Evidence Synthesis/Technology Assessment
Number 87

Common Syndromes in Older Adults Related to Primary and Secondary Prevention

Prepared for:
Agency for Healthcare Research and Quality
U.S. Department of Health and Human Services
540 Gaither Road
Rockville, MD 20850
www.ahrq.gov

Contract No. HHSA 290-2007-10064-1

Prepared by:
Minnesota Evidence-Based Practice Center
Minneapolis, Minnesota

Investigators:
Robert L. Kane, MD
Kristine M.C. Talley, PhD, GNP-BC, RN
Tatyana Shamliyan, MD, MS
James T. Pacala, MD, MS

AHRQ Publication No. 11-05157-EF-1
July 2011

None of the investigators have any affiliations or financial involvement (e.g., employment, consultancies, honoraria, stock options, expert testimony, grants or patents received or pending, or royalties) that conflict with material presented in this report.

Suggested Citation:
Kane RL, Talley KM, Shamliyan T, Pacala JT. Common Syndromes in Older Adults Related to Primary and Secondary Prevention. Evidence Report/Technology Assessment No. 87. AHRQ Publication No. 11-05157-EF-1. Rockville, MD: Agency for Healthcare Research and Quality; July 2011.

Acknowledgments:
The authors thank Dorothee Aeppli, PhD, for her calculations of life expectancy among populations with increased risk of death; Christopher A. Warlick, MD, PhD, for his recommendation about models that report mortality in elderly patients; librarian Judith Stanke, MA, for her contributions to the literature search; Rema Ramakrishnan, MD, MPH candidate, Shiyi Wang, MD, PhD candidate, Jing Du, PhD candidate, Warren Manyara, MD, MHA candidate, and Molly Moor, PhD candidate, for their assistance with the literature search and data abstraction; Jeannine Ouellette for her help in writing the report; Marilyn Eells for editing and formatting the report; and Karen Rashke, Yaminah Oliver, and Christa Prodzinski for assistance with data entry and formatting tables.

The authors also thank Kathleen Buckwalter, PhD, RN, Thomas Gill, MD, Jack Guralnik, MD, PhD, Rosanne Leipzig, MD, PhD, Joseph Ouslander, MD, Barbara Resnick, PhD, Albert L. Siu, MD, MSPH, and Gregg Warshaw, MD, for serving on the Technical Expert Panel; and Linda Fried, MD, MPH, and Linda Kinsinger, MD, for reviewing the draft of this report and providing helpful recommendations for revisions and clarifications.

Structured Abstract

Objectives: To create a systematic synthesis of the published evidence about the prevalence of eight geriatric syndromes and their association with survival and institutionalization, and to provide a review of models that report survival in elderly populations.

Data Sources: Original epidemiologic studies were sought from several databases to identify articles published in English from January 1, 1990 to April 25, 2010.

Review Methods: We identified studies of multiple morbidities, mild cognitive impairment, frailty, disability, sarcopenia, malnutrition, homeostenosis (i.e., impaired homeostasis), and chronic inflammation in the general elderly population and age, race, and sex subgroups. We developed standardized forms using different definitions of these syndromes and abstracted prevalence of the syndromes. Multivariate adjusted risks of mortality and institutionalization for elderly patients with syndromes were abstracted to calculate remaining life expectancy. Pooled analyses were conducted with random effects models. Statistical and decisionmaking models were appraised for content, simplicity, and validation.

Results: Of the 2,377 publications retrieved, 509 publications of 123 studies were eligible for review. Definitions varied within each syndrome and overlapped across all syndromes. Prevalence estimates increased with age. African Americans had higher prevalence of multiple morbidities, frailty, malnutrition, and disability when compared to Caucasians. Evidence on other minority subgroups was sparse. All syndromes were associated with increased risk of death and institutionalization. A negative association between prevalence of a syndrome and its effect on survival was evident across all syndromes. Impaired homeostasis and dementia were associated with the lowest survival among elderly persons when compared to the general population. In the young-old, ages 65–74 years, those with homeostenosis, poor health, or advanced dementia suffered significant decreases in predicted life expectancy. The syndromes affected the likelihood of death more among the young-old. In those older than age 90 years, the added value of factoring in conditions and syndromes to evaluate the link to mortality beyond 1 year was minimal. Complexity was not associated with better mortality models in elderly persons.

Conclusions: Syndromes are not independent; definitions and prevalence estimates overlap substantially. Some minority subpopulations had higher prevalence of the syndromes. Less inclusive definitions had lower prevalence but were better predictors of outcomes. Complex mortality models added less benefit to simpler models that included age, specific diseases, and impact on overall health and functioning. For younger old persons, syndromes most strongly linked to mortality were homeostenosis, poor health, and dementia.

Contents

Tables

Figures

Appendixes

Executive Summary

Geriatric syndromes can lead to age-related decline in well-being among elderly adults.[1,2] The signs and symptoms encompassed by geriatric syndromes span multiple physiological systems related to functional dependency.[3,4] A number of syndromes identified by longitudinal studies are associated with reduced function, quality of life and survival, and an increased risk of institutionalization.[5-8] However, variations in syndrome definitions make systematic discussion of their effects difficult.

Routine clinical practice includes assessment of age-related chronic diseases based on accepted diagnostic criteria. In contrast, comprehensive geriatric assessment goes beyond examination for chronic diseases and focuses on functional independence in daily activities and optimal interventions to improve functional status and quality of life.[9] Indeed, comprehensive geriatric assessment emphasizes functional status as a major quality of life factor for older adults.[10]

Quality of life improvements for older adults require addressing geriatric syndromes in addition to managing chronic disease.[11] A geriatric syndrome's definition, along with its combination with any chronic disease, affects the syndrome's association with patient-centered outcomes, including quality of life, institutionalization, and survival.[12-14] Certain factors are long known to affect patient-centered outcomes. For example, the persistently strong association between self-assessed health status and patient-centered outcomes remains a marvel.[15] Similarly, dependency, defined as deficiencies in activities of daily living (ADLs), also associates strongly with patient-centered outcomes.[16] Systematic reviews have yet to examine other syndromes such as cognitive impairment, frailty, poor nutrition status, or chronic inflammation for prevalence or association with institutionalization and survival.

This review examines what is known about common geriatric syndromes and their effect on the clinical course of older patients. Our analysis examines the extent to which varying definitions of each syndrome can affect determination of its prevalence and its association with patient-centered outcomes. In general, we anticipate a reciprocal relationship; the more inclusive the definition, the higher the prevalence. However, inclusivity should make the variable less predictive of adverse outcomes. More encompassing definitions or those with lower thresholds will inevitably raise prevalence estimates and be less precise in their predictive power than more stringent definitions with higher cut scores. For example, Manton applied ADL- and instrumental activities of daily living (IADL)-related measures for disability to describe a pattern of decline in prevalence over two decades.[17] Systematic criteria to define multisystem complex geriatric syndromes are needed.[1]

Meanwhile, multiple operational definitions of the syndromes presented a challenge to summarizing the research on their prevalence and predictive power. Frailty, especially, persists as an elusive concept, despite efforts at consensus conferences on the topic.[18-21] Frailty may be viewed as a specific phenotype or as an index of deficit accumulations.[22,23] However, despite problems of definition and measurement, frailty demonstrates a potent association with outcomes. Different indices derived from frailty measures have shown associations with adverse events.[24] Likewise, increasing frailty is typically associated with adverse events.[25] Frailty and related components (such as ADL dependency, delirium, malnutrition risk, and comorbidity) are linked to increased mortality risk.[26] More deficit accumulation is associated with worse outcomes.[13] Frailty predicts mortality even after consideration of the effects of clinical and subclinical disease.[27] Frailty's predictive capacity also seems to hold up among various populations in different countries.[28]

Syndromes are also not independent; definitions and prevalence estimates overlap considerably. For example, sarcopenia is associated with frailty, but some view the former as a dimension of the latter.[29-31] Frailty is associated with comorbidity and disability, although efforts to distinguish the latter emphasize frailty's multisystem dysfunction and instability.[32,33] Various geriatric conditions (such as cognitive impairment, falls, and ADL dependency) are associated with disability.[34] Polypharmacy may indicate multiple morbidities, but overzealous prescription may also be a factor.[35] Research suggests that inflammatory cytokines play a substantial role in age-related disease.[36] Thus, separating the syndromes presents another challenge.

This report was commissioned by the U.S. Preventive Services Task Force (USPSTF) as background material to help them understand the impact of geriatric syndromes on well-being. The USPSTF opted not to consider disease as a risk factor for the purposes of this review. Our review does not address the suitability of preventing the examined syndromes or altering their courses.

The Technical Expert Panel selected geriatric syndromes (but not diseases) for this review according to how much each syndrome would affect the enthusiasm of clinicians for recommending prevention strategies. We addressed the eight syndromes that were most highly rated.

We included original epidemiologic studies that examined prevalence of the eligible syndromes in adults older than age 65 years. We defined young-old as ages 65–80 years, elderly as ages 80–90 years, and very old as ages 90 years and older. We defined age categories the same as they were defined in the original studies.

We retrieved 2,377 publications and excluded 1,865 that were not eligible for review. We included 509 publications of 123 studies. The majority of the studies were well designed prospective cohorts or national surveys conducted in the United States, including the National Health and Nutrition Examination Survey (NHANES), the National Health Interview Survey, and the National Survey of Self-Care and Aging (76 studies, 62 percent).

Key Question 1. What is the Definition and Prevalence of Common Syndromes/Conditions in Older Adults?

Definitions of a given syndrome vary, and the concepts underlying various syndromes overlap. For example, frailty measures often include disability and comorbidity.

Multiple Morbidities

The studies used a variety of definitions for multiple morbidities, including number of chronic diseases or conditions, high comorbidity score, polypharmacy, or self-perceived poor health. Prevalence estimates varied depending on definitions, with more than 20 percent of older adults suffering from multiple chronic conditions. One-third to one-half of older adults take more than five drugs. One-third of older adults reported fair or poor health.

Cognitive Impairment

Definitions of cognitive impairment varied. The most common definition required subjective complaint of memory impairment with objective memory impairment, normal general cognitive function, and intact cognitive ADLs/IADLs.[37,38] Depending on diagnostic method, prevalence (defined as a score of <24 on the Mini-Mental State Examination [MMSE]) varied from 10.6 to 33.1 percent.[14,39-45] Studies of the Established Populations for Epidemiologic Studies of the Elderly demonstrated that 7.1 percent of the tested elderly had cognitive impairment detected with the 10-item Short Portable Mental Status Questionnaire.[46-48] Prevalence of self-reported cognitive impairment varied from 2.8 to 13.2 percent.[49]

Prevalence estimates varied substantially in the same study, from 42 percent having self-reported memory complaint to less than 1 percent with mild or moderate cognitive impairment or questionable dementia.[50] The variation in prevalence estimates (concordance from 0 to 24 percent) indicates that each definition identified a unique group, and total prevalence of mild cognitive impairment without dementia may exceed 50 percent of community-dwelling older adults.[50]

Prevalence of dementia did not exceed 8 percent in persons older than age 65 years, but this estimate can be misleading because of substantial variation in prevalence across age subgroups.

Frailty

Wide variances in frailty definitions affects prevalence estimates. Using the framework from the Interventions on Frailty Working Group, we categorized frailty definitions into two groups: phenotype and accumulation of deficits. When the studies accepted the biologic syndrome model of frailty with five major criteria, including weight loss, fatigue and exhaustion, weakness, low physical activity and slowness, and mobility impairment, we categorized the estimates into phenotype definitions.[23] When the studies accepted the burden model of frailty, including symptoms, diseases, conditions, and disability, we categorized the estimates into the accumulation of deficits definition.[22] Accumulation deficit indices included up to 75 components.[12,51,52] Separation of these two definition types and estimation of disability in frail persons were somewhat artificial. Prevalence was higher when using accumulation of deficits (24 percent) than phenotype definitions, such as low physical activity or fatigue (14 percent). The overlap in prevalence estimates using different definitions was small. The Health and Retirement Study examined prevalence of frailty using different definitions, including phenotype and accumulation deficit, and found that 30 percent of elderly people were frail according to at least one definition, but only 3 percent according to all three definitions.

Disability

The most common definitions of disability included having difficulty with or needing assistance with basic activities of daily living (BADLs) or with IADLs. Disability was defined as having "any" (limitations with one or more activities), "moderate" (limitations with one to two activities), or "severe" (three or more activity limitations) disability or having a limitation with an individual activity. Definitions were based on self-reported inability and need for assistance to perform particular tasks. IADL disabilities were more common than BADL disabilities. Reporting of IADL disability ranged in prevalence from 12 to 46.7 percent[53-57] compared to 5[58] to 25.6 percent for BADL disability.[41,53,55-64]

In general, disability prevalence decreased as severity increased. For example, the prevalence of severe BADL and severe IADL disability was lower than the prevalence for moderate disability, which was lower than having any disability. The order of individual IADLs from most to least common was having limitations with driving, housekeeping, personal finances, shopping, meal preparation, using the telephone, and medication management. For individual BADL disabilities, the hierarchy of most to least common disability was walking, bathing, dressing, transferring, toileting, and eating.[65]

Sarcopenia

Sarcopenia was defined as a loss of skeletal muscle mass owing to any disease or condition.[66] Operational definitions were based on lean body mass relative to skeletal size and total body mass. Sarcopenia was defined based on index values within the sex-specific distribution in a healthy, younger population[67,68] or based on a linear regression modeling the relationship between lean mass with fat mass and height. Recently published recommendations from the European Working Group on Sarcopenia in Older People defined sarcopenia as the presence of both low muscle mass and low muscle function (strength or performance).[69] Prevalence estimates varied depending on definition from 14 to 60 percent among age, sex, and ethnicity categories. Simple relative skeletal muscle index underestimated sarcopenia in obese older persons. Residual methods adjusting for fat mass may be a better method to identify sarcopenia in overweight and obese older adults.

Malnutrition

Studies defined malnutrition as unintended weight loss[70-72] or low body mass index (BMI).[46,72-76] Among biochemical markers, low blood albumin levels,[73,75,77] anemia,[77,78] and deficit of micronutrients[79-81] may identify older persons with poor nutritional status. Several studies used composite nutritional scores based on self-reported dietary intake and habits to identify elderly persons with malnutrition.[70,72,82-85] Prevalence estimates varied across definitions and were less than 3 percent when defined with low BMI, 6–10 percent with vitamin and micronutrient deficit, and 1–5 percent with a low composite nutritional score. The prevalence of low BMI and blood albumin level was highest in older American veterans (15 percent).

Homeostenosis (Impaired Homeostasis)

Very few studies examined the prevalence of impaired homeostasis in elderly persons. Several studies that examined impaired homeostenosis used allostatic load defined by elevated markers of chronic inflammation, low albumin levels, impaired creatinine clearance, increased blood pressure, hemoglobin A_{1C}, homocysteine, total cholesterol, and triglycerides.[86] NHANES defined impaired homeostasis using an allostatic load score and found that 1.4 percent of older adults in the United States had an allostatic load score of more than 4.[86] The Duke Established Populations for Epidemiologic Studies of the Elderly defined plasma tonicity as a marker of impaired homeostasis[46] and found that 10 percent of older adults had increased plasma tonicity.

Chronic Inflammation

Few studies provided information on the prevalence of unspecified chronic inflammation in older adults. Elevated C-reactive protein (CRP) was found in 24.4 percent of older adults,[87] while 5 percent had elevated interleukin 6 (IL6), and 5 percent had elevated tumor necrosis factor-alpha.[88]

Key Question 2. What is the Prevalence of Common Syndromes/Conditions in Older Adults in Sex, Age, Race, Ethnicity, and Other Subgroups?

Multiple Morbidities

Prevalence of multimorbid conditions increased with age from 28 percent in adults ages 65 to 74 years to 37 percent in adults older than age 75 years. Women tended to have a higher prevalence than men of having more than three comorbidities (16 to 18.4 percent), polypharmacy (43 percent), and poor health (7 percent). Prevalence of more than three chronic diseases was higher in African American women (13.4 percent) than in Caucasian women (9.5 percent).[89] Inconsistent definitions of outcomes across the studies made comparison of the estimates difficult.

Cognitive Impairment

Prevalence of cognitive impairment without dementia increased with age across all definitions and studies, from 18.8 percent in adults older than age 75 years[90] to 44.1 percent among those older than age 90 years.[91] Prevalence of dementia also increased with age across all definitions. Prevalence of senile dementia increased from 1.6 percent in those age 67.5 years to 36.7 percent in those older than age 95 years. Prevalence of Alzheimer's disease increased from 0.4 percent in those age 67.5 years to 37.4 percent in those older than age 95 years.[92,93]

Older men and women had comparable prevalence of cognitive impairment. Prevalence of cognitive impairment in older men varied from 16 percent to 36 percent.[59,94] No age associated increase was evident. Prevalence of cognitive impairment in older women varied from 10 to 12 percent using the Modified Mini-Mental State Examination (3MSE) questionnaire.[59,95]

Prevalence was higher (24 percent) when the authors defined cognitive impairment using an MMSE score of <24.[42,90,94,96] Prevalence of dementia in older women was consistent across different countries, with an evident increase with age, from 0.25 percent in those ages 65–69 years to 5 percent in those older than age 80 years.[97]

About 20 to 40 percent of older persons with cognitive impairment developed dementia within 2 to 5 years of followup.[98-100] Several studies demonstrated that older persons with cognitive impairment were at higher risk of developing dementia.

Frailty

Prevalence of frailty increased with age but differed within age subgroups depending on definitions. Prevalence of frailty in those ages 65 to 70 years ranged from 3 to 6 percent, using a phenotype definition, to 5 to 15 percent using an accumulation deficit definition.[23,101-104] Prevalence among those ages 70 to 80 years varied from 5 to 12 percent, according to a phenotype definition, to 8 to 17 percent according to accumulated deficits.[22,23,101,104,105] Prevalence was more than 16 percent in those older than age 80 years according to any definition.[23,101-104]

Among race groups, African Americans had the highest prevalence of frailty across different definitions. More than half of older African Americans were frail according to two studies.[23,104,106,107] Two studies examined the prevalence of frailty in older Hispanics and reported that 8 to 20 percent met different frailty criteria.[104,108] Prevalence of frailty in older Caucasians varied from 6 to 12 percent, using a phenotype definition, to 15 to 40 percent using an accumulation deficit definition.[23,104,107,109] The large cohort studies of predominantly older Caucasians in the Survey of Health, Aging and Retirement in Europe demonstrated that 17 percent were frail according to phenotype criteria.[110]

Among sex groups, prevalence of frailty was somewhat higher in women than in men, and increased with age in both sexes. Prevalence of phenotype frailty was 7 percent in older men, and accumulation deficit frailty was 24 percent.[23,103-105,107,109,111-115]

Prevalence was higher in aging African American and Hispanic men compared to Asian or Caucasian men.[23,113,116] Prevalence of phenotype frailty in older women was 13 percent, and accumulation deficit frailty was 26 percent.[23,24,103-105,107,109,111,115-117] African American women had the highest prevalence of frailty, with 60 percent of adults older than age 85 years being frail.[23,116]

Disability

In general, women had higher rates of BADL disability than men. However, as the severity of disability increased, the prevalence for women and men became similar (i.e., 7.0 percent for severe BADL disability[118] and 1.2 percent for eating disability[119,120]). Few studies reported sex differences in IADL disabilities. The prevalence of any IADL disability was higher in women than men.[121] One study described changes in the prevalence of any IADL disability over 6 years between men and women.[121] More women reported an IADL disability than men at any time period, but showed less change over time. In terms of individual IADL disabilities, more women had difficulty with housekeeping and meal preparation than men but less difficulty with shopping.[119,122]

Only two studies reported the prevalence of any BADL disability by ethnic group, and one study enrolled only older Hispanic Americans.[41,60,62] The prevalence of any BADL disability, in order of highest to lowest, was African Americans (13.6 percent), American Indians (11.6 percent), Hispanic Americans (11 percent),[41] and Caucasians (8.1 percent).[62] Racial differences persisted after accounting for sex. Older African American women had the highest prevalence of having any BADL disability (10.7 percent), followed by African American men (7.5 percent), Caucasian women (5.2 percent), and Caucasian men (4.7 percent).[60] There were no racial differences in eating disabilities.[119]

Two studies reported age differences in the prevalence of BADL disability.[59,118] Reporting any disability and moderate disability was more prevalent in the oldest age groups and in older women. The prevalence of severe BADL disability ranged from 10 to 11 percent in people ages 80 years and older, was 6 percent in those ages 65 to 74 years, and did not differ significantly by sex.[118]

Sarcopenia

Prevalence of sarcopenia increased with age.[68,123] Older African Americans had significantly lower odds of sarcopenia when compared to older Caucasian Americans.[123] Odds of sarcopenia did not differ between Hispanic and non-Hispanic whites.[68]

Malnutrition

Age and sex differences in malnutrition were not consistent across the studies. Pooled prevalence of poor nutritional score was 18.3 percent in older men and 24 percent in older women. Women had a lower prevalence of decreased albumin levels[77] but higher prevalence of low BMI.

Older African Americans had a significantly higher risk of malnutrition, defined as unintentional weight loss, compared to older Caucasian persons.[71] Prevalence of anemia did not differ among Caucasians and non-Caucasians.[78] Prevalence of unintentional weight loss did not differ in Hispanics and non-Hispanics.[72] Older Hispanic women had a higher prevalence of poor nutritional scores compared to non-Hispanic women (30 percent vs. 17 percent, respectively).[72]

The studies did not report prevalence of homeostenosis and chronic inflammation in older subpopulations.

Key Question 3. What is the Association Between These Common Syndromes/Conditions and Mortality, Institutionalization, Hospitalization, and Activities of Daily Living?

We analyzed the association between outcomes and each syndrome and across all syndromes to identify links to mortality. Estimates of association varied depending on definitions of comorbidities, population subgroups, definitions of outcomes, and adjustment for correlated contributing factors. Not all analyses addressed the multifactorial nature of geriatric syndromes and the role of baseline diseases. For example, disability was an outcome but also a part of the definition of frailty. Adjustment for correlated multifactorial syndromes that ignored definitive primary cause of disability or death may give invalid estimation of the association between syndromes and mortality. No studies separately examined age and specific disease contributions.

Multiple Morbidities

We observed a consistent and significant positive association between multiple morbidities and mortality across the studies. Older persons with multiple morbidities had a 32 to 112 percent relative increase in death compared to those without multiple morbidities.[39,124-129] The magnitude of the association was dose responsive, with an 85 percent relative increase in mortality for those with four to five diseases and 112 percent among those with six or more chronic conditions.[39,124-129] The magnitude of the association decreased with time of followup, from a 100 percent relative increase at 10 years (odds ratio [OR], 2 [95% confidence interval (CI), 1.4–2.8]) to a 59 percent increase at 15 years of followup (OR, 1.6 [95% CI, 1.1–2.3]).[125] However, this may be a statistical reflection of a greater denominator as outcomes accrue over time.

Polypharmacy was significantly associated with mortality in two studies, with evidence of a dose response.[54,130] Those with poor health had an increased risk of death in all studies that examined the association.[27,103,131]

The Longitudinal Study of Aging demonstrated a positive significant association between multiple morbidities and institutionalization.[128] Those with poor health had a 10 to 80 percent relative increase in institutionalization.[8,103,132]

Older adults with multiple morbidities had increased odds of hospitalization (OR, 1.7 [95% CI, 1.1–2.9]).[133] The association with hospitalization was dose responsive.[126] The relative increase in odds of hospitalization was 37 percent in those with morbidity scores of 3 versus ≤2, 46 percent in those with scores of 4–5 versus ≤2, and 94 percent in those with scores of ≥6 versus ≤2.[126]

Polypharmacy was significantly associated with hospitalization.[133,134] The Medicare Risk Demonstration cohort reported a 190 percent increase (OR, 2.9 [95% CI, 2.2–4.1) in odds of hospitalization among those with more than five prescriptions compared to those with fewer than five concurrent drugs.[133] The Longitudinal Study of Aging reported a significant increase in risk of hospitalization among older adults with poor health.[135-140]

We concluded that multimorbid conditions and poor perceived health demonstrated a strong association with mortality. Poor perceived health was a strong predictor of institutionalization. The number of chronic conditions, polypharmacy, and poor perceived health was associated with hospitalization.

Cognitive Impairment

Cognitive impairment was associated with a significantly higher risk of mortality in all studies that examined this association. The largest relative increase of 250 percent in women and 280 percent in men was found in the Canadian Study of Health and Aging, which defined cognitive impairment as a score of <78 on the 3MSE scale.[141,142] There was dose response association, with a 4 percent relative increase in mortality for each decrease by 1 point on the MMSE.[39,44,54,143-148] The studies that estimated relative risk ratio (RR) or hazard rate ratio (HR) found a 37 percent[39,54] and a 61 percent[44,147] relative increase in risk of death, respectively.

Older women (pooled RR, 1.4 [95% CI, 1.11–1.7]) but not men (pooled RR, 1.2 [95% CI, 0.8–1.8]) with MMSE scores of <24 had a significant risk of death.[39,94] Both men and women with severe cognitive impairment, defined as an MMSE score of <18, were at higher risk of death.

Dementia was associated with a significantly higher risk of mortality in the majority of the studies that examined this association.[149] Overall, dementia was associated with a 163 percent relative increase in odds of death (pooled OR, 2.6 [95% CI, 2.2–3.2]).

Cognitive impairment was associated with a significant risk of institutionalization in the majority of the studies that examined this association. For cognitive function measured with MMSE, the association was dose responsive and significant even within the normal ranges of the scale. Older persons had a higher relative increase in institutionalization of 9 percent per each 1-point decrease on the MMSE.[145] Those with dementia were at a significant risk of institutionalization in several large studies, including the Medicare Current Beneficiary Survey (OR, 34.9),[150] the Canadian Study of Health and Aging (OR, 36.3),[151] and the Marshfield Epidemiologic Study Area (HR, 5.1).[152]

We concluded that older persons with cognitive impairment had a higher risk of mortality and institutionalization. Magnitude of the association varied depending on the country, age, and sex of the participants, definitions of the cognitive impairment, and statistical estimates.

Frailty

Frailty was associated with mortality across a number of studies with varying definitions.[14,23,111,115,148,153-156] The strength of the association was cumulative[157] and dose responsive,[14,156] with a greater risk among those with increasing numbers of frailty components.[14,156] The association generally persisted over longer followup periods.[23,156]

The association was significant in men and women. Frail men had a relatively greater risk of death of 105 to 251 percent according to phenotype definitions and of 65 to 356 percent according to accumulation deficit definitions.[113,114,158,159] Frail women had increased mortality across different studies and definitions of frailty.[158-160]

Frailty was associated with an increased risk of institutionalization[155,160] and hospitalization.[14,28,161] The studies demonstrated a 29 percent relative increase in risk[161] and a 41 to 345 percent relative risk[14,161] in odds of hospitalization.

Disability

Disability and hospitalization. The statistically significant association between disability and hospitalization was demonstrated in four studies (adjusted relative measures of association ranged from 1.8 to 16.0).[136,137,162,163] Risk of hospitalization depended on the definition of disability, and, in general, risk increased along with the severity of disability. Older people who had any BADL (defined as having one or more BADL dependencies) had the lowest risk of hospitalization. Those with severe BADL disability (defined as having three or more BADL dependencies) had the highest risk. The risk for women was also greater than the risk for men. The manner in which BADL disability develops appears to influence the risk for hospitalization. Older people who experienced catastrophic severe disability (defined as the sudden onset of three or more BADL disabilities when no BADL disabilities existed before) were 16 times more likely to be hospitalized than those who had moderate BADL disability.[163] When ADL disability was measured on a continuous scale, the risk for hospitalization was not statistically significant, nor was it significant when measured as having any BADL or IADL dependencies.

Disability and risk of death. In general, older people with BADL disabilities were at higher risk for death (OR range, 1.9–86.8) than those with IADL disabilities (OR range, 1.5–6.6) when compared to those without disability. Those with more BADL disabilities had a higher risk of death than those with fewer BADL disabilities. Severe BADL disabilities were associated with the highest risk of death,[128,164] followed by moderate BADL disabilities.[128,164] The lowest risk of death occurred when any BADL disability was reported.[162] The risk of death associated with individual BADL disabilities was not reported in the studies, with one exception. The risk for death at 48 months doubled for older people with bathing disabilities.[53] The risk of death associated with IADL disabilities was highest when any IADL disability was reported.[128,164] Those with severe IADL disability had slightly higher risks of death (OR range, 1.6–2.2) than those with moderate IADL disabilities (OR range, 1.5–1.7). Those with difficulty managing personal finances were twice as likely to die as those without this disability.[53] When disability was measured on a continuous scale, the per one-point increase in the disability score and the risk of death were the same whether the scale measured BADL, IADL, or BADL/IADL disability. Men with BADL disabilities had slightly higher risks of death than women.[64] Caucasian men and women who were unable to prepare a meal had higher risks of death than African American men and women.[119] Women suffer greater discrepancies in years of expected active life remaining than men if they have a BADL/IADL disability.[40] In summary, older people with the most severe BADL disabilities had the highest risks of death. No studies examined how individual BADL and IADL disabilities increase the risk of death. Women fared worse than men in terms of expected active life remaining, but men with BADL disabilities had slightly higher death rates than women with BADL disabilities. Older Caucasian people were more likely to die than older African American people if they reported difficulty with preparing meals. Few studies reported differences in death rates between men and women or between older people of different ethnicities who have disabilities.

Sarcopenia

Limited evidence indicates that sarcopenia was associated with significantly higher odds of multiple disabilities[68] but not mortality.[165]

Malnutrition

The association between malnutrition and mortality was consistent across the studies and different definitions of malnutrition.[70,71,83,166-169] Low BMI[166,167] and malnutrition identified using the Mini Nutritional Assessment[70] were the strongest predictors for mortality.

Among biological markers that may be related to malnutrition, red cell distribution width (RDW) demonstrated strong and significant association with mortality in all examined age, sex, and race subgroups in a meta-analysis of individual subject data from seven community-based studies of 11,827 older adults.[79] Red cell distribution was associated with mortality, however, in those with iron, folate, and/or vitamin B12 deficiencies (adjusted HR for 1 percent increment in RDW, 1.2 [95% CI, 1.1–1.2]), as well as in those without these deficiencies (adjusted HR for 1 percent increment in RDW, 1.2 [95% CI, 1.2–1.3]).[79] Routinely measured as a part of the complete blood count, a red cell distribution width of >15 percent was associated with a 151 percent relative increase in risk of death (HR, 2.5 [95% CI, 2.2–2.9]).[79] Very low albumin levels and very high pre-albumin levels (transthyretin >316mg/L or <258mg/L) were associated with increased mortality.[167,170]

Several studies analyzing composite measures of malnutrition and chronic inflammation found a significant positive association with mortality. Those with the highest levels of alpha-1-acid glycoprotein and the lowest levels of transthyretin had the highest risk of death, with a 364 percent relative increase in women and a 586 percent relative increase in men.[170] Elevated composite measure of chronic inflammation and poor nutritional status was associated with an increased risk of death in older men but not women.[170]

Homeostenosis (Impaired Homeostasis)

Individual studies demonstrated a significant association between disability, mortality, and indicators of impaired homeostasis. The association of impaired homeostasis with clinical outcomes varied depending on the definitions of the exposure and population studied. Unstable BMI (HR, 1.3 [95% CI, 1.0–1.8]), pulse pressure (HR, 1.3 [95% CI, 1.0–1.7]), and fasting plasma glucose (HR, 1.6 [95% CI, 1.2–2.1]) were associated with a greater risk of mortality in an Italian cohort.[171] The MacArthur Studies of Successful Aging demonstrated a significant association between increased allostatic load and mortality.[124,172,173] The same study found a 27 percent relative increase in the odds of death (OR, 1.3 [95% CI, 1.0–1.5]) in those with an elevated stress hormone index.[124] Consensus around the operational definition of homeostenosis and its biomarkers is necessary for a better interpretation of the results.

Chronic Inflammation

Studies consistently found positive significant associations between chronic inflammation and mortality. Among common definitions of chronic inflammation, elevated IL6 and CRP were associated with higher mortality. Those with elevated IL6 levels had a 42 percent relative increase in death (pooled RR, 1.4 [95% CI, 1.2–1.7]).[124,174-177] Those with elevated CRP had a 42 percent relative increase in death (pooled RR, 1.4 [95% CI,1.3–1.6]).[87,124,129,166,167,170,174,177-179]

Among other individual markers of chronic inflammation, the strongest association with mortality was demonstrated for a combination of elevated CRP with low albumin (HR, 5.0 [95% CI, 2.3–11.0])[170] or with elevated fibrinogen levels (HR, 9.56 [95% CI, 4.34–21.1]).[178]

We found no studies that examined the association between chronic inflammation and institutionalization or hospitalization.

Key Question 4. What Statistical and Decisionmaking Models Report Mortality Based on These Common Geriatric Syndromes/Conditions?

Models reporting mortality vary by complexity, by selection of predictors, and by time course. We found 28 studies that described prognostic indices for mortality in older adults. Previous indices are complex, time consuming, or have a lack of clinical applicability. However, recent studies have been designed to develop and validate easy-to-use indices using information readily available from administrative data, laboratory data, diagnoses, or self-reported health status data. Some indices were created for certain segments of the population (e.g., hospitalized elderly,[26,180-183] community dwellers,[4,23,27,148,155,184-188] or older individuals with acquired mental disorders).[189] Others have been developed with the use of nationally representative samples.[53,186,187,190] While the majority of studies have been conducted in the U.S. population ages 50 years and older, a few have been done in European countries[14,134,180,189,191,192] and Canada.[155,193,194]

To examine overall effects of different syndromes on mortality in adults older than age 65 years, we estimated numbers of deaths per 1,000 from individual studies that provided death rates among persons with and without different syndromes (Table 1).[195] We estimated that among frail older persons, 459 per 1,000 died within 1–2 years of followup.[182,187] Disability in basic ADLs and IADLs were the strongest predictor of mortality.[196]

Within 3 years, 500–600 older persons with malnutrition, 351 with cognitive impairment, and 534 with severe dementia died per 1,000 older persons.[189,197,198]

Within 5 years, 490 elderly persons with malnutrition, 513 with frailty, 530 with elevated CRP, and 827–941 with vascular dementia died per 1,000 older persons.[70,91,141,186] Frailty and cognitive impairment were associated with 400–800 deaths per 1,000 during more than 5 years of followup.[23,148,199] Such estimations may not reflect mortality in age, sex, or race subgroups but demonstrate a burden of geriatric syndromes.

We also estimated population risk of mortality attributable to geriatric syndromes (Table 2). When population prevalence and multivariate adjusted relative risks were taken into account, more than 7 percent of deaths were attributable to multiple morbidities and elevated CRP. We estimated that 3 to 5 percent of deaths among older persons could be delayed by preventing frailty; prevention of mild cognitive impairment could delay 5 to 6 percent of deaths. Overall, around 26 percent of deaths in older persons can be attributed to geriatric syndromes. Conversely, having these syndromes affects the likelihood of benefitting from preventive interventions.

The prevalence and risk of mortality and institutionalization were almost inversely related. The prevalence of accumulation deficit frailty (which uses many components) was higher than phenotype frailty (which uses only a few components). The relative risk of mortality and institutionalization was higher for phenotype frailty (Figure 1). The same negative association was seen for more severe forms of the same syndrome. Prevalence of severe cognitive impairment and dementia were lower, but risk of mortality was higher when compared to mild cognitive impairment (Figure 2). A negative association between the prevalence of a syndrome and its effect on mortality was evident across those syndromes in which the more restricted definition defines a more severe state (Figure 3).

We estimated remaining life expectancy in individuals with syndromes using Centers for Disease Control and Prevention United States Life Tables and the relative risk of death from pooled analyses and individual studies. Increased levels of allostatic load (impaired homeostasis) and dementia were associated with the lowest survival among older persons when compared to the general U.S. population. The data shown in Figure 4 represent a merger of several data sets to yield general trends. The influence on survival of some factors is much greater than others. Poor health, malnutrition, and allostatic load (poor homeostasis) exert twice the influence of factors such as comorbidity and frailty. The size of the effect differs by age (and thus expected life expectancy) (Table 3). Relative risk is likely more useful than population attributable risk. In the young-old, ages 65–74 years, only the very few who are very ill (e.g., homeostenosis, poor health, or advanced dementia) or frail suffer significant alterations in predicted life expectancy. From ages 75–90 years, maximal heterogeneity of disease and geriatric syndromic states result in larger mortality deviations from unafflicted individuals than seen in other age groups. In the old-old, particularly past age 90 years, the added value of factoring in conditions and syndromes to predict mortality beyond 1 year is minimal.

Models reporting mortality vary by complexity, by selection of predictors, and by time course. Some models strive for simplicity, with few predictors that are easily measured, much or all of which could be gained by culling administrative data. Other much more complex models rely on data gathered from clinician and/or patient assessments. For purposes of anticipating the benefit of preventive services, a simpler approach, based on some crude classifications around average life expectancy (based on age and sex), serves better than more complex models.

Geriatrics teaches that age is a good general predictor, but great care is needed to look within older people to distinguish other risk factors. In this case, the evidence for added benefit from factoring in syndromic information is mixed; syndromic information is helpful for younger old persons, but adds little insight for the very old. The most potent predictors are the rarest syndromes. Absolute risk differences and remaining life expectancy in comparison groups should be taken into consideration when analyzing predictive value of syndromes in different age subgroups.

Some basic relationships hold regardless of the measure used. They can be summarized as follows:

- Simple disease-based measures, such as number of comorbid illnesses or measures of inflammation, add modestly to the relative risk of mortality provided by age and sex alone but account for a more population-based mortality burden due to their high prevalence.

- Advanced dementia is one specific condition that confers significantly added mortality risk.
- More complex syndromic measures, such as those assessing frailty or incorporating functional status (e.g., allostatic load and dementia), better capture increased mortality risk (indicated by higher relative risk) than simpler measures, as they more selectively identify the relatively few (indicated by lower population attributable risk) sickest patients most likely to experience deterioration in health and death.
- Simpler measures that reflect the *severity* of individual diseases, such as indicators of advanced dementia, or the overall *impact* of multiple conditions, such as assessments of overall health, also identify the fewer and sicker patients at higher risk of mortality.

In conclusion, complex mortality models add comparatively little understanding to more simply measured and calculated models. Measures of the *impact* of conditions and syndromes on overall health and functioning provide greater discrimination among individual patients for assessing mortality risk. Mortality predictors appear to be relatively consistent across short- and long-range models. The greatest added advantage of mortality models over simple remaining life expectancy was observed among patients ages 75 to 90 years. No models considered psychosocial factors, such as resilience, or the role and quality of health care for elderly patients with syndromes. Decisionmaking models are based on various assumptions and simulation techniques that need careful sensitivity analysis and validation.

Our review does not address the extent to which the presence of a syndrome adds predictive power over and above the presence of specific diseases. It seems likely that the syndromes represent intermediate states between the disease and mortality, but their specific additive explanatory power remains unknown. For clinicians, the syndromes offer summative approaches that can help in some instances to improve the estimate of the risk of mortality.

Ideally, we would consider other outcomes besides mortality, but the measures used present large problems of endogeneity. Measures of frailty and disability contain elements central to quality of life. They also frequently provide the basis for institutionalization.

All syndromes had overlapping definitions or closely related pathophysiology. The multifactorial interactive nature of syndromes should be analyzed with interaction models rather than adjustment. The majority of the studies, however, provided multivariate adjustment for known confounding factors, causes of death, and presence of other syndromes. The models that analyzed the association between syndromes and mortality grouped primary causes of death into larger categories of cancer or cardiovascular diseases to adjust for them. The syndromes associated with decompensated chronic diseases, including inability to maintain homeostasis, poor general health, or low BMI, had the strongest association with mortality and institutionalization.

Evidence suggests that, despite differences in definitions, common geriatric syndromes can be examined and constructed from a variety of different measures. By almost all definitions used, evidence suggests a considerable disease burden as population age increases. Evidence about how geriatric syndromes may modify the efficacy of preventive or other interventions is needed but was outside of our scope. Future research should examine effectiveness of screening, preventive treatment, and disease management strategies in elderly adults with common geriatric syndromes.

Chapter 1. Introduction

Geriatric syndromes can lead to age-related decline in well-being among elderly adults.[1,2] The signs and symptoms encompassed by geriatric syndromes span multiple physiological systems related to functional dependency.[3,4] A number of syndromes identified by longitudinal studies are associated with reduced function and quality of life and increased risk of institutionalization and mortality.[5-8] However, variations in syndrome definitions make systematic discussion of their effects difficult.

Routine clinical practice includes assessment of age-related chronic diseases based on accepted diagnostic criteria. In contrast, comprehensive geriatric assessment goes beyond examination for chronic diseases and focuses on functional independence in daily activities and optimal interventions to improve functional status and quality of life.[9] Indeed, comprehensive geriatric assessment emphasizes functional status as a major quality of life factor for older adults.[10]

Quality of life improvements for older adults require addressing geriatric syndromes in addition to managing chronic disease.[11] A geriatric syndrome's definition, along with its combination with any chronic disease, affects the syndrome's association with patient-centered outcomes, including quality of life, institutionalization, and mortality.[12-14] Certain factors are long known to affect patient-centered outcomes. For example, the persistently strong association between self-assessed health status and patient-centered outcomes remains a marvel.[15] Similarly, dependency, defined as deficiencies in activities of daily living (ADLs), also associates strongly with patient-centered outcomes.[16] Systematic reviews have yet to examine other syndromes, such as cognitive impairment, frailty, poor nutrition status, or chronic inflammation for prevalence or association with institutionalization and mortality.

This review examines what is known about common geriatric syndromes and their effect on the clinical course of older patients. Our analysis examines the extent to which varying definitions of each syndrome can affect determination of its prevalence and its association with patient-centered outcomes. In general, we anticipate a reciprocal relationship; the more inclusive the definition, the higher the prevalence. More encompassing definitions or those with lower thresholds will inevitably raise prevalence estimates and be less precise in their predictive power than more stringent definitions with higher cut scores. For example, Manton applied ADL- and instrumental activities of daily living (IADL)-related measures for disability to describe a pattern of decline in prevalence over two decades.[17] Our review synthesizes the evidence for the following research questions.

Key Questions

Key Question 1. What is the definition and prevalence of common syndromes/conditions in older adults?

- Multiple morbidities (using polypharmacy as a proxy)
- Cognitive impairment
- Frailty
- Disability
- Sarcopenia

- Malnutrition
- Homeostenosis
- Chronic inflammation

Key Question 2. What is the prevalence of common syndromes/conditions in older adults in sex, age, race, ethnicity, and other subgroups?

- Sex subgroups (men, women)
- Age subgroups (>65 years, >85 years)
- Race subgroups (European, African, Asian, American Native)
- Ethnicity subgroups (white Hispanic, white non-Hispanic, African American, Asian, Arab, Oceanic, Jewish)
- Comorbidity profile defined as a composite comorbidity measure rather than the presence of the specific disease

Key Question 3. What is the association between these common syndromes/conditions and mortality, institutionalization, hospitalization, and activities of daily living?

Key Question 4. What statistical and decisionmaking models report mortality based on these common geriatric syndromes/conditions?

Focus of the Review

This review examines selected geriatric syndromes for prevalence and potential impact on various outcomes. We do not address the suitability of preventing these syndromes or altering their courses.

Multiple operational definitions of the syndromes presented a challenge to summarizing the research on their prevalence and predictive power. Frailty, especially, persists as an elusive concept, despite efforts at consensus conferences on the topic.[18-21] Frailty may be viewed as a specific phenotype or as an index of deficit accumulations.[22,23] However, despite problems of definition and measurement, frailty demonstrates a potent association with outcomes. Different indices derived from frailty measures have shown association with adverse events.[24] Likewise, increasing frailty is typically associated with adverse events.[25] Frailty and related components (such as ADL dependency, delirium, malnutrition risk, and comorbidity) are linked to increased mortality risk.[26] More deficit accumulation is associated with worse outcomes.[13] Frailty predicts mortality even after consideration of the effects of clinical and subclinical disease.[27] Frailty's predictive capacity also seems to hold up among various populations in different countries.[28]

Syndromes are also not independent; definitions and prevalence estimates overlap considerably. For example, sarcopenia is associated with frailty, but some view the former as a dimension of the latter.[29-31] Frailty is associated with comorbidity and disability, although efforts to distinguish the latter emphasize frailty's multisystem dysfunction and instability.[32,33] Various geriatric conditions (such as cognitive impairment, falls, and ADL dependency) are associated with disability.[34] Polypharmacy may indicate multiple morbidities, but overzealous prescription may also be a factor.[35] Research suggests that inflammatory cytokines play a substantial role in age-related disease.[36] Thus, separating the syndromes presents another challenge.

This report was commissioned by the U.S. Preventive Services Task Force (USPSTF) as background material to help them understand the impact of geriatric syndromes on well-being. The USPSTF opted not to consider disease as a risk factor. Our review does not address the suitability of preventing the examined syndromes or altering their courses.

The Technical Expert Panel (TEP) selected geriatric syndromes (but not diseases) for this review according to how much each syndrome would affect the enthusiasm of clinicians for recommending prevention strategies. We addressed the eight syndromes that were most highly rated.

We included original epidemiologic studies that examined prevalence of the eligible syndromes in adults older than age 65 years. We defined young-old as ages 65–80 years, elderly as ages 80–90 years, and very old as ages 90 years and older. We defined age categories the same as they were defined in the original studies.

We retrieved 2,377 publications and excluded 1,865 that were not eligible for review. We included 509 publications of 123 studies. The majority of the studies were well designed prospective cohorts or national surveys conducted in the United States, including the National Health and Nutrition Examination Survey (NHANES), the National Health Interview Survey, and the National Survey of Self-Care and Aging (76 studies, 62 percent).

Chapter 2. Methods

Our analytical framework includes target population, syndromes, and patient mortality, morbidity, disability, and institutionalization. Our conceptual model (Figure 5) outlines the pathways from the development of the syndromes to patient outcomes, including health care interventions related to screening and prevention. However, health care interventions were beyond the scope of this project.

Figure 5 also provides information about the following research questions:

Key Question 1. What is the prevalence of syndromes?
Key Question 2. What is the epidemiology of syndromes?
Key Question 3. What is the association between syndromes and patient outcomes?
Key Question 4. What models report mortality and morbidity in association with the syndromes?

Selection of Eligible Syndromes

The TEP selected geriatric syndromes for this review. We sent a list of 21 syndromes to nine TEP members, asking them to indicate the extent to which the presence of each syndrome in an older person would affect their enthusiasm for recommending each of four prevention strategies. Prevention strategies included simple (e.g., immunization) and complex (e.g., weight loss program) primary prevention or simple (e.g., visual screening) and complex (e.g., colonoscopy) secondary prevention. The TEP used 0 to indicate no effect, 1 to indicate a very mild effect, and 9 to indicate a very strong effect. We collected responses and calculated the mean score for each syndrome. For this review we selected syndromes with a mean score >4. The TEP members responded (eight responses) that presence of each syndrome in an older person would not greatly affect their enthusiasm for recommending simple primary or secondary prevention (mean scores were <4). TEP members responded that eight syndromes would affect their decision about complex primary and secondary prevention in an elderly population (Figure 6). We defined these eight syndromes as eligible for this review.

Search Strategy

We sought studies from a wide variety of sources, including MEDLINE via Ovid and PubMed, Cochrane databases, manual searches of reference lists from systematic reviews and other relevant publications, and the Centers for Disease Control and Prevention (CDC) Web site that lists all publications from the Longitudinal Study of Aging. The search strategies for the three research questions are described in Appendix A. Exact search strategies were developed through consultation with qualified librarians. We developed a priori search strategies based on relevant medical subject headings terms, text words, and weighted word frequency algorithms to identify related articles. We documented each recommended, included, and excluded study in the reference library. We limited our search to studies published in English from January 1, 1990 to April 25, 2010.

Excluded references are shown in Appendix B. All work was conducted under the guidance of a

TEP, whose members are identified in Appendix C.

Eligibility

We included studies that were original epidemiologic population-based surveys and cohorts and well designed systematic reviews and meta-analyses published in English from January 1, 1990 to April 25, 2010. The studies had to report the prevalence or incidence of the eligible geriatric syndromes or the association geriatric syndromes had with frailty, disability, or mortality. The study sample had to include community-dwelling adults ages 65 years or older. We defined young-old as ages 65–80 years, elderly as ages 80–90 years, and very old as ages 90 years and older. We also used the same definitions of age categories used in the original studies. We reviewed results from the Survey of Income and Program Participation, the National Long-Term Care Survey, and the Medicare Current Beneficiary Survey.

Exclusion Criteria

Studies were excluded from the review if any of the following conditions were met:

- Study participants are in a hospital or long-term care facility setting.
- Study participants were recruited in hospital settings and followed after discharge.
- Study participants are a disease-specific population (i.e., all participants have congestive heart failure).
- Study does not report prevalence of the syndromes or the relative measures of the association with outcomes.
- Study reports the mean value of a continuous measure of the geriatric syndrome (i.e., muscle strength, blood levels of biomarkers, scores of cognitive function or functional decline) rather than prevalence of the syndromes.
- Study is an intervention to prevent eligible syndromes and/or progression of such.
- Study is a screening intervention to reduce morbidity and mortality.
- Study assesses the cost-effectiveness of screening and prevention strategies.
- Study reports diagnostic values and psychometric evaluations of geriatric assessment tools.

For key question 3, we included statistical and decisionmaking models that report mortality based on geriatric syndromes. We used the Social Security Administration's 2007 Period Life Table (available at http://www.ssa.gov/OACT/STATS/table4c6.html) to estimate life expectancy for participants with eligible syndromes when compared to the general population. We excluded articles that described methods for quantifying frailty, calibration of depression symptoms, and methods differing in handling survival data.

Data Extraction

Evaluations of the studies and data extraction were performed manually and independently by five researchers. The data abstraction forms are shown in Appendix D. We abstracted the information relevant to the PICOTS (population, intervention, comparator, outcomes, time, and settings) framework for each question (Table 4). Errors in data extractions were assessed by comparison with the established ranges for each variable and the data charts from the original articles. Any discrepancies were detected and discussed without formal double entry or statistical evaluation of inter-rater reliability. We abstracted exact definitions of the outcomes from the studies. We analyzed sampling strategies and inclusion of disabled or institutionalized participants in the primary studies. We abstracted the sample size and prevalence of the syndromes to calculate 95 percent confidence intervals of the prevalence using Meta-Analyst software (Tufts Medical Center, Boston, MA).[200] We abstracted adjusted relative measures of the association between syndromes and outcomes with 95 percent confidence intervals, descriptive information about populations, definitions of the syndromes, outcomes, and time to measure outcomes. We abstracted all variables that were included in multivariate adjusted models.

Data Synthesis

For key question 1, results of individual studies (expressed as crude and age-adjusted prevalence estimates) were summarized in evidence tables to analyze prevalence, depending on the definitions of the syndrome. We categorized operational definitions of the syndromes as:

- Abnormal categories of individual biomarkers or diagnostic tests.
- Composite measures of the same syndrome.
- Composite measures of more than one syndrome (e.g., malnutrition and chronic inflammation).

We synthesized the evidence regarding homeostenosis, chronic inflammation, and malnutrition following definitions from the guidelines (Table 5) and from the original studies. We defined homeostenosis as homeostatic dysregulation.[201] We categorized generally similar cutoffs of anthropometric and diagnostic tests as well as biomarkers into the same groups. For example, we categorized the studies with increased C-reactive protein (CRP) levels of >2.8mg/L,[174] >3 mg/L,[87,177] or in the highest quartile[124,202] into one group of chronic inflammation.

We defined comorbidity and multimorbidity according to the National Institute on Aging Task Force on Comorbidity.[203] Comorbidity was defined as co-occurrence of preexisting age-related health conditions or diseases *in reference to an index disease*. Multimorbidity was defined as the co-occurrence of two or more diseases or active health conditions (e.g., *aggregate of coequals*) that may or may not be linked by a causal relationship or with no consistent dominant index disorder. Both definitions ignore severity of the diseases or conditions and quality of health care managing the diseases. We analyzed previously validated composite comorbidity weighted indices that take into account the number and seriousness of comorbid diseases.[204] We analyzed the prevalence of polypharmacy because it reflects comorbidity and treatment utilization.[205,206] We analyzed poor self-perceived health in relation to mortality because it reflects morbidity and well-being.[15,207] We focused on poor self-reported health because this category has been associated with health problems and physical functioning in older individuals.[208]

We used the framework proposed by the Interventions on Frailty Working Group to identify criteria of frailty in epidemiologic studies (Table 6).[209] We categorized the definitions of frailty into two groups: phenotype and accumulation of deficits. When the studies accepted the biologic syndrome model of frailty, with five major criteria, including weight loss, fatigue and exhaustion, weakness, low physical activity and slowness, and mobility impairment, we categorized the estimates into phenotype definitions of frailty.[23] When the studies accepted the burden model of frailty, including symptoms, diseases, conditions, and disability, we categorized the estimates into the accumulation of deficits definition of frailty.[22]

We synthesized the evidence about disability using two operational definitions: measures of basic activities of daily living (BADLs) and instrumental activities of daily living (IADLs). We defined BADL disability as difficulty with or requiring help with any number of the following activities: dressing/hygiene, bathing, toileting, transferring, ambulating, feeding, and grooming. We defined IADL disability as having difficulty with or needing help with using the telephone, shopping, preparing meals, housekeeping, transportation, medication management, and financial management. Since each study used a different combination of items or scoring system to define BADL or ADL disability, a new set of categorical definitions was created to organize and compare the study findings on disability prevalence and incidence. The new categorical definitions represent a hierarchy of disability; for example, BADL disabilities are more life limiting than IADL disabilities. For categorical operational definitions of IADLs, the indicators "any," "moderate," or "severe" represent severity of a given type of IADL disability. For example, studies that used a cutoff score of one or more BADL present were labeled as "any BADL disability." Moderate IADL disability was designated when the study indicated that one or two items were used to define disability. Severe disability was designated if three or more items were used to define disability. Some studies used a continuous measure of IADL disability, and these study results are reported separately from categorical definitions. A few studies used a measure that combined BADL and IADL disability, which are also reported separately. Table 7 summarizes how ADL disability definitions were recategorized.

Results from studies with the same operational definition of the geriatric syndrome were pooled to estimate prevalence and incidence.[210] Meta-analysis was used to assess the consistency of the association between syndromes and outcomes with random effects models.[200] Chi-square tests were used to assess consistency in study results.[211,212] Significant heterogeneity means that estimates of prevalence and association were not consistent in the studies (not replicable results). We used Stata 10.1 software (StataCorp, College Station, TX) to calculate pooled prevalence and association estimates with random effects models. All calculations were conducted at a 95 percent confidence level.

We synthesized the evidence in the total samples and then in age, race, and gender categories when possible. We synthesized the evidence answering the research question about prevalence of all syndromes and then the association with morbidity, mortality, and health care utilization.

For key question 3, we used published criteria to appraise cost-effectiveness models[213] and criteria from the *British Medical Journal* economic submissions checklist.[214] We also estimated the number of deaths among 1,000 older persons with each syndrome using calculations based on the simulation algorithm.[195] We calculated population attributable risk of mortality or institutionalization using prevalence and risk estimates from pooled analyses when available or from individual studies.[215] We estimated remaining life expectancy for those with each syndrome from CDC United States Life Tables (available at http://www.cdc.gov/nchs/data/nvsr/nvsr56/nvsr56_09.pdf) and relative risks of all cause mortality in older populations with each syndrome. Life expectancy was estimated as the area under the survival curve. In such estimations we could not address the length of having syndromes, interaction with other syndromes, and health care interventions. We used the mortality rates of the general population, which also contains people at risk of the syndromes. When available in the studies, sex and race specific regression coefficients were applied.

Quality Assessment

We included original epidemiologic studies that employed strategies to reduce bias in observational research. We evaluated quality of individual studies and level of evidence using the following USPSTF criteria.[216]

1. Do the studies have the appropriate research design to answer the key question(s)?
2. To what extent are the existing studies of high quality (i.e., what is the internal validity)?
3. To what extent are the results of the studies generalizable to the general U.S. primary care population and situation (i.e., what is the external validity)?
4. How many studies have been conducted that address the key question(s)? How large are the studies (i.e., what is the precision of the evidence)?
5. How consistent are the results across the studies?
6. Are there additional factors that assist in drawing conclusions (e.g., presence or absence of dose-response effects, fit within a biologic model)?

We defined the nationally representative population based surveys and prospective cohort studies having the highest applicability.

Rating the Body of Evidence

We assessed study quality and strength of evidence using guidelines from the Agency for Healthcare Research and Quality.[217] The strength of evidence was judged according to the domains of risk of bias, consistency, and precision for each major outcome.[217] When appropriate, presence of confounders that would diminish an observed effect and strength of association were also included. We graded the quality of evidence as follows:

Grade	Definition
High	**High confidence that the evidence reflects the true effect.** Further research is very unlikely to change confidence in the estimate of effect.
Moderate	**Moderate confidence that the evidence reflects the true effect.** Further research may change confidence in the estimate of effect and may change the estimate.
Low	**Low confidence that the evidence reflects the true effect.** Further research is likely to change confidence in the estimate of effect and is likely to change the estimate.
Insufficient	Evidence either is unavailable or does not permit a conclusion.

Chapter 3. Results

We retrieved 2,377 publications and excluded 1,865 that were ineligible for review (Figure 7). We included 509 publications of 123 studies. Results from the same studies have been published in more than one article. The articles could provide slightly different information about included and excluded subjects. For key questions 2 through 4 we identified four meta-analyses[79,93,97,233] and 119 original studies (Appendix E Table 1). The majority of the studies were conducted in the United States (76 studies, 62 percent). The studies included 5,420,254 subjects. The majority of the subjects resided in the United States (5,287,278 or 98 percent of the total subjects). The majority of the studies were prospective cohorts, nationally representative surveys, or Medicare analyses. Retrospective analyses of the administrative data were presented in two studies.[101,127] Randomized controlled clinical trials (RCTs) provided information relevant to our research questions and were included in the review.[42,153] The majority of eligible studies enrolled adults older than age 65 years. Several cohorts enrolled centenarians, including the Danish Centenarian Study,[176] the Vitality 90+ Study,[179] and the 90+ Study.[91] Two cohort studies, including the Baltimore Epidemiologic Catchment Area Program[40] and the Framingham Offspring Study,[234] did not enroll exclusively older individuals but reported the outcomes in age categories eligible for our review. Three studies enrolled men exclusively, including the Osteoporotic Fractures in Men Study,[113] the Honolulu-Asia Aging Study of the Honolulu Heart Program,[235] and the University of Connecticut Center on Aging Osteoporosis in Men Study.[112] Some studies enrolled women exclusively, including the Nun Study,[236] the Study of Osteoporotic Fractures,[237] and the Women's Health and Aging Studies.[89,117,160,166,169,238-246]

Almost all studies enrolled some race and ethnic subgroups, but very few reported the outcomes among them. NHANES III,[247] the National Health Interview Survey,[121] and the Cardiovascular Health Study (CHS)[87] reported oversampling of minority populations. The Frailty Study of African Americans in South Central Los Angeles enrolled only African Americans.[106] The National Survey of Self-Care and Aging[248,249] oversampled the oldest old. The Precipitating Events Project[107] oversampled persons who were physically frail. The majority of the eligible studies enrolled community-residing older persons. Several studies included residents of long-term care facilities.[44,58,61,93,97,106,154,176,179,219,250-253]

Internal validity of the majority of the studies was good. The studies provided multivariate adjusted estimates of the association between syndromes and outcomes. Adjustment varied across the studies. The majority of the studies adjusted for age, sex, socioeconomic status, comorbidities, and behavioral factors. Some studies adjusted for correlated syndromes, thus underestimating the strength of the association. Adjustment for components of the definition of frailty may also underestimate the association between frailty and mortality. Adjustment for a disability that is an outcome of several syndromes may also underestimate the association between syndromes and mortality. Therefore, we judged crude but not overadjusted estimates as poor quality.

Key Question 1. What is the Definition and Prevalence of Common Syndromes/Conditions in Older Adults?

Multiple Morbidities

The studies used a variety of definitions for multiple morbidities, including number of chronic diseases or conditions, high comorbidity score, polypharmacy, and self-perceived poor health. Prevalence estimates varied depending on definitions (Table 8).

A majority of older people suffered from chronic diseases;[254] 28 to 37 percent had more than three chronic conditions (Figure 8). Prevalence did not decrease in association with a greater number of diagnoses. More than 20 percent of older persons suffered from five or more chronic diseases, and the same number suffered from 11 or more (Appendix E Table 2).[152] Population-based studies relied on self-reported medical diagnoses to define older people with multiple morbidities. The simple number of the self-reported diseases, however, may not reflect severity of the conditions.

Studies of community-dwelling older adults in clinical settings defined multimorbid conditions using medical examinations and documentation. Such studies were able to address clinical importance of multiple morbidities. Some analyzed severity and seriousness of multiple morbidities by analyzing major diagnoses among all listed; others calculated the weighted Charlson comorbidity index (Appendix E Table 2). Prevalence estimates differ depending on the population studied. A prospective cohort study of community-dwelling older adults attending a large primary care clinic reported that 9.3 percent had two or more serious diagnoses among six to nine listed.[255] A prospective study that aimed to develop the Burden of Illness Score for Elderly Persons reported that 61 to 71 percent of patients had a Charlson comorbidity index score of ≥2.[4] The Swedish Prescribed Drug Register analysis reported that 25 percent of older adults had a Charlson comorbidity index score of 1–2, 3 percent had a score of 3–4, and 0.4 percent had a score of >5.[205]

Several studies defined multiple comorbidity as polypharmacy because it reflected prevalence of diseases that required treatments.[205,206] The prevalence of polypharmacy (defined as concurrent use of five or more drugs) varied from 22 percent in the United States[152] to 29 percent in Europe[256] and 57 percent in Sweden[205] (Appendix E Table 3). Polypharmacy was also defined as the number of doctor visits in which at least one drug was prescribed on the patient record. Annual drug visits increased from an average of three per older patient in 1995–1996 to five per older patient in 2004–2005 (Figure 9). The number of drugs per patient increased from nine to 12 in 1995–1996 to 19–22 in 2004–2005 (Figure 10). The annual number of drug visits increased by 25–29 percent during the analyzed 10 years from 1995–2005 (Figure 11). During the same time period, the number of drugs per patient increased by 85–89 percent (Figure 11). Almost 18 percent of older people have taken more than 11 drugs.[205] Prevalence of inappropriate polypharmacy, defined according to the Physicians' Desk Reference, was as high as 34.6 percent in a study of more than 60,000 older patients.[205]

Poor self-perceived health reflected a person's morbidity, physical functioning, and well-being.[15,207,208] The prevalence of fair health in older people was 28.24 percent (Figure 12).[14,103,109,250] Poor health was reported by 3 percent of older persons.[14,103,109,250]

In conclusion, more than 20 percent of older persons suffer from multiple chronic conditions. One-third to one-half take more than five drugs, with inappropriate polypharmacy in 35 percent of cases. One-third of older people report fair or poor health.

Cognitive Impairment

Definitions of cognitive impairment varied in the studies categorizing pathophysiological classification of the condition, prevalence, or association estimates (Table 9).[50] Some studies defined age-associated cognitive decline[257] as part of the normal aging process.[50,258] Several studies defined it as memory impairment and absence of dementia[259] or absence of neurological, psychiatric, or systemic illnesses that could explain the presence of cognitive deficits.[90] The definitions can also be categorized as self-reported memory complaints[50] or memory impairment diagnosed with validated tools.[37,38,90] Operational definitions varied depending on inclusion of impaired ADLs and social functions. Some studies defined cognitive decline as objective memory deficit resulting in decreased performance in employment or social situations.[38,260] The most common definition of cognitive impairment required subjective complaint of memory impairment with objective memory impairment, normal general cognitive function, and intact cognitive ADLs and IADLs.[37,38] Prevalence estimates varied substantially depending on the definitions.

The Medical Research Council Cognitive Function and Aging Study used 17 different definitions of cognitive impairment in the same sample of 2,053 older people (Appendix E Table 4).[50] Prevalence estimates varied from 42 percent having self-reported memory complaints to less than 1 percent having mild or moderate cognitive impairment or questionable dementia.[50] Interestingly, the authors found little overlap (concordance from 0 to 24 percent) in different definitions of cognitive impairment. First, this means that each definition identified a unique group of older people. Therefore, prevalence estimation of cognitive impairment in the population requires using several definitions to distinguish different types of impairment. Second, overall prevalence of cognitive impairment without dementia may exceed half of older individuals residing in the community.[50]

Prevalence of cognitive impairment in other studies was lower, probably because the studies used fewer definitions (Appendix E Table 5).From the individual studies, the Canadian Study of Health and Aging reported the highest prevalence of positivity on the Modified Mini-Mental State Examination (3MSE) for cognitive functioning (41.0[250] to 46.3 percent[95] had a 3MSE score of <78). The CHS Cognition Study demonstrated a much lower prevalence of amnestic cognitive impairment (Figure 13).[90] Prevalence of probable mild cognitive impairment-amnestic type was less than 3 percent.[90] Prevalence of probable mild cognitive impairment-multiple cognitive deficit type was slightly higher but still less than 6 percent.[90] NHANES III found prevalence of amnestic cognitive impairment (6.6 percent) similar to that found in CHS.[247]

Prevalence varied depending on the diagnostic methods used to identify cognitive impairment. Prevalence of cognitive impairment (defined as a score of <24 on the Mini-Mental State

Examination [MMSE]) varied from 10.6 to 33.1 percent (Figure 14).[14,39-45] Prevalence of severe cognitive impairment (defined as an MMSE score of <15) was lower and varied between 1.3 and 9.3 percent (Figure 15).[39,44,261] The second Longitudinal Study of Aging obtained self-reported responses to the Telephone Interview of Cognitive Status (TICS) instrument.[49] This study found cognitive impairment in 2.8 to 13.2 percent of older individuals (Figure 16).[49] Studies of the Established Populations for Epidemiologic Studies of the Elderly used the 10-item Short Portable Mental Status Questionnaire and demonstrated that, on average, 7.1 percent of those tested met criteria of cognitive impairment (Figure 17).[46-48]

Prevalence of dementia was less variable across the studies because of standardized consensus definitions (Figure 18).[262] Prevalence of senile dementia diagnosed using *Diagnostic and Statistical Manual of Mental Disorders, Third Edition* criteria varied from 3.6 percent in France to 6.7 percent in Finland.[262] Prevalence of senile dementia diagnosed using the Geriatric Mental Status Examination in England was 4.6 to 5.2 percent.[262] Prevalence of probable Alzheimer's disease in older people was 14 percent (Figure 19).[92,93] Prevalence of definitive Alzheimer's disease was much less at 3.1 percent.[92,93] The Canadian Study of Health and Aging reported the highest prevalence, with 31.6 percent scoring positive for dementia on the 3MSE (Appendix E Table 6).[95] The same study identified 5.1 percent of older patients with Alzheimer's disease and 8 percent with all types of dementia combined.[95] Prevalence of severe dementia was 2.6 percent[95] or 42 percent of all dementia cases.[263]

In conclusion, prevalence of cognitive impairment is estimated at around 30 percent in older people across different studies and definitions. Prevalence of amnestic cognitive impairment was around 7 percent. Prevalence of dementia did not exceed 8 percent in elderly persons older than age 65 years, but this estimate can be misleading because of substantial variation in prevalence across age subgroups.

Frailty

Definitions of frailty vary widely, and the nature of the definition affects the prevalence of reported frailty. Table 10 arrays a number of studies on frailty in order of the reported prevalence and shows the components used to determine frailty. There is no clear relationship between the number or type of components and the prevalence of frailty. Accumulation deficit indices included up to 75 components. Phenotype indices typically included five criteria. Self-reported mobility limitations were included in the phenotype definition. Disability in ADLs was included in the accumulation deficit definition. Separation of the two types of definitions and estimation of disability in frail persons was somewhat artificial.

Table 11 summarizes these arrays slightly differently, by showing the effect of including a specific component on the prevalence of frailty. Lung function, chronic or terminal illness, visual or cognitive impairment, and incontinence are all strong influences.

Another way of synthesizing this complex array is to contrast the measures that use various phenotypic measures, such as low physical activity or fatigue, as compared to specific deficits. Figure 20 shows the odds of having a frailty prevalence higher than 20 percent for these two types of indicators. The studies that used accumulation deficit components reported higher prevalence estimates more often. Figure 21 graphs the prevalence of frailty from various studies according to the type of measure used; again, the prevalence is higher when using accumulation of deficits.[23,101,103,104,107,109,111,115,229,264]

The initial manifestations of frailty criteria in association to the development of frailty was examined in the Women's Health and Aging Study II.[265] Weakness was the most common first manifestation that could predict development of frailty during 7.5 years of followup.[265] Other studies did not analyze temporality in different frailty criteria.

Variability in prevalence estimates was substantial within the same study and across different studies. The Health and Retirement Study examined prevalence of frailty using different definitions, including phenotype and accumulation deficit, and found that 30 percent of older people were frail according to at least one definition, but only 3 percent according to all three definitions (Figure 22).[104] Such a small overlap indicates that each definition distinguished unique groups, and population-based studies should use all definitions to detect frailty.

Appendix E Table 7 summarizes the prevalence rates from various studies, showing the measure used. The same study may generate a different prevalence depending on the measure used or severity of the condition (Appendix E Table 8).

In conclusion, prevalence of frailty varied depending on definitions. Prevalence of frailty, defined as accumulation deficit, was 24 percent. Prevalence of frailty, defined as phenotype, was 14 percent. The overlap in definitions was small. Thus, according to at least one definition, around 30 percent of older people were frail.

Disability

Definition and prevalence of BADL disability in older people.

Any BADL disability. The prevalence of any BADL disability was reported in 12 studies (Table 12).[41,53,55-64] The percentage of older people with any BADL disability ranged from 5.0 to 25.6 percent (Appendix E Table 9). The prevalence was lowest (5.0 to 9.1 percent) in national surveys that included people of all ages, but reported those aged 65 years and older separately (i.e., the National Health Interview Survey,[58] the American Community Survey,[60] the Survey on Income and Program Participation,[58] and the Census Public Use Microdata Files[62]), higher (11.0 to 18.3 percent) in studies exclusively targeting older adults (i.e., Established Populations for Epidemiologic Studies of the Elderly,[41,57,64] Longitudinal Studies of Aging[56,63]), and highest (13.9 to 25.6 percent) in studies targeting the oldest of the old (i.e., Survey of Assets and Health Dynamics of the Oldest Old,[55] CHS All Stars[59]) (Figure 23).

Moderate BADL disability. The prevalence of moderate BADL disability (defined as having one to two BADL disabilities) was reported in two studies, and ranged from 16.1 to 20.5 percent (Figure 24).[5,118]

Severe BADL disability. The lowest rates were reported for severe BADL disability, which ranged from 6.0 to 7.8 percent[5,118] when it was measured as having three to four BADL disabilities and 4.8 percent[5] when it was measured as having five to seven BADL disabilities (Figure 24).

Bathing disability. The percentage of older people with bathing disabilities ranged from 3.9 to 9.0 percent (Figure 25).[53,55,65,122,248] In the Massachusetts Health Care Panel Study, the percentage of older adults who had a bathing disability increased from 3.9 to 14.7 percent over 5 years.[65]

Dressing/hygiene disability. The percentage of older people with dressing or hygiene disabilities ranged from 0.8 to 11.0 percent (Figure 26).[53,55,65,120,248] In the Massachusetts Health Care Panel Study, the percentage of older adults who had a dressing disability increased from 0.8 to 9.3 percent over 5 years.[65]

Eating disability. The percentage of older people with eating disabilities ranged from 0.4 to 4.5 percent (Figure 27).[53,55,58,65,119,120,248] In the Massachusetts Health Care Panel Study, the percentage of older adults who had an eating disability increased from 0.4 to 2.2 percent over 5 years.[65]

Toileting disability. The percentage of older people with toileting disabilities ranged from 2.4 to 6.0 percent (Figure 28).[53,55,58]

Transferring disability. The percentage of older people with transferring disabilities ranged from 0.4 to 21.1 percent (Figure 28).[53,55,58,65,120] In the Massachusetts Health Care Panel Study, the percentage of older adults who had a transferring disability increased from 0.4 to 5.8 percent over 5 years.[65]

Walking disability. Between 0.8 and 27.3 percent of older people reported walking disabilities (Figure 28).[53,55,65,120] In the Massachusetts Health Care Panel Study, the percentage of older adults who had a walking disability increased from 0.8 to 7.7 percent over 5 years.[65]

Summary. The prevalence of any BADL disability was quite variable and depended on the target population of the study. It was lower in national surveys and highest in studies targeting the oldest old. Moderate BADL disability was the most common, and severe BADL disability was the least common. In terms of individual BADL disabilities, the hierarchy of most to least common disability was walking, bathing, dressing, transferring, toileting, and eating (Table 12). Over a period of 5 years, more older people developed individual BADL disabilities (Table 13).

Definition and prevalence of IADL disability in older people.

Any IADL disability. The percentage of older people reporting any IADL disability ranged from 12.0 to 46.7 percent (Figure 29 and Table 14).[53-57,266]

Moderate IADL disability. The percentage of older people reporting a moderate IADL disability ranged from 7.2 to 31.0 percent (Figure 29).[5,248,267]

Severe IADL disability. The percentage of older people reporting a severe IADL disability ranged from 4.5 to 21.2 percent (Figure 29).[5,54,267] The prevalence was lowest when severe IADL disability was defined as having difficulty with four or more IADLs (4.5 to 5.7 percent)[5,54] and higher when it was defined as having difficulty with three or more IADLs (6.2 to 21.2 percent) (Appendix E Table 10).[5,267]

Financial disability. The percentage of older people reporting a financial disability ranged from 8.0 to 19.3 percent (Figure 30).[53,55,65] The percentage of older people with difficulty managing finances increased from 19.3 to 36.7 percent over a 5-year period in the Massachusetts Health Care Panel Study.[65]

Housekeeping disability. The percentage of older people reporting a housekeeping disability ranged from 7.5 to 35.8 percent (Figure 30).[65,122] The percentage of older people with difficulty doing housework increased from 35.8 to 48.0 percent over a 5-year period in the Massachusetts Health Care Panel Study.[65]

Meal preparation disability. The percentage of older people reporting difficulty with meal preparation ranged from 7.1 to 32.4 percent (Figure 30).[53,65,119] The percentage of older people with difficulty preparing meals increased from 32.4 to 34.1 percent over a 5-year period in the Massachusetts Health Care Panel Study.[65]

Medication management disability. The percentage of older people reporting difficulty with medication management ranged from 3.0 to 4.7 percent (Figure 30).[53,55]

Shopping disability. The percentage of older people reporting difficulty with shopping ranged from 11.0 to 32.9 percent (Figure 30).[53,65,119] The percentage of older people with difficulty shopping increased from 32.9 to 41.3 percent over a 5-year period in the Massachusetts Health Care Panel Study.[65]

Telephone disability. The percentage of older people reporting difficulty using the telephone ranged from 4 to 6 percent (Figure 31).[53,55]

Transportation disability. The percentage of older people requiring assistance with transportation increased from 54.3 to 67.6 percent over a 5-year period in the Massachusetts Health Care Panel Study (Figure 31).[65]

Summary. Prevalence was highest when any IADL disability was reported, lower when moderate IADL disability was reported, and lowest for severe IADL disability. The order of individual IADL disabilities from most to least common was needing assistance with or having difficulty with driving, housekeeping, personal finances, shopping, meal preparation, using the telephone, and medication management. Over a 5-year period the percentage of older people with IADL disabilities increased (Table 15).

Sarcopenia

Sarcopenia was defined as a loss of skeletal muscle mass owing to any disease or condition.[66] Operational definitions were based on lean body mass relative to skeletal size and total body mass.[66] Relative indices were calculated using dual energy x-ray absorptiometry. Sarcopenia was defined as index values of less than 2 standard deviations below the sex-specific mean in a healthy, younger population.[67,68] Using this definition, sarcopenia was identified when relative skeletal muscle index or appendicular skeletal muscle mass index (kg/m^2) was less than 7.3 kg/m^2 for men and 5.5 kg/m^2 for women.[67,68] The recently published recommendations from the European Working Group on Sarcopenia in Older People defined sarcopenia as the presence of both low muscle mass and low muscle function (strength or performance).[69]

The Rosseta study,[67] Aging Process Study,[268] and the New Mexico Elder Health Survey[68] defined sarcopenia using a relative skeletal muscle index. This definition, however, does not take into account individuals with increased fat mass who will not be diagnosed with sarcopenia despite inadequate low muscle mass. The investigators of the Health Aging and Body Composition (Health ABC) Study proposed adjusting relative skeletal muscle indices for body fat mass and height to determine the expected total lean mass.[123] Total lean mass was measured relative to height squared and relative to height and total fat mass.[123] Sarcopenia was defined as lean mass/height^2 in the lowest 20 percent of the sex-specific distribution of the index using cut-off points of 7.2 kg/m^2 (men) and 5.7 kg/m^2 (women).[123] A second definition of sarcopenia was based on linear regression modeling the relationship between lean mass and height (meters) and fat mass (kilograms). Individuals below the 20th percentile of the distribution of residuals were diagnosed with sarcopenia.[123]

Prevalence estimates varied depending on definitions. The studies provided sex-specific estimates only. The New Mexico Elder Health Survey[68] reported sarcopenia in 13.5 percent of non-Hispanic white men younger than age 70 years and in 53 percent of Caucasian men older than age 80 years.[68] Prevalence of sarcopenia was slightly higher in Hispanic men, ranging from 17 percent in men younger than age 70 years to 58 percent in those older than age 80 years.[68] Prevalence of sarcopenia was greater in older women and varied from 23.1 percent in non-Hispanic white women to 24 percent in Hispanic women younger than age 70 years.[68] Hispanic women older than age 80 years had the highest prevalence of sarcopenia (60 percent).[68] The Health ABC Study found sarcopenia in 50.4 percent of men with a body mass index (BMI) of <25 kg/m^2 using a lean mass index and in 32.8 percent of men using definitions adjusted for fat mass (Figure 32).[123] The same study found sarcopenia in 51.9 percent of women with a BMI of <25 kg/m^2 using a lean mass index and in 23 percent of women using definitions adjusted for fat mass. Prevalence of sarcopenia using the residual method was identified in 11.5 percent of obese older men and in 21 percent of obese older women.[123] Using the unadjusted lean mass index, no obese individuals with relatively low lean mass were found to have sarcopenia.[123]

In conclusion, prevalence of sarcopenia in older individuals varied from 14 to 60 percent, depending on age, sex, and ethnicity. Simple relative skeletal muscle index can underestimate sarcopenia in obese patients. Residual methods adjusting for fat mass may more effectively identify sarcopenia in overweight and obese patients.

Malnutrition

The studies defined malnutrition as abnormal categories of individual biomarkers or composite measures of poor nutritional status. Among individual anthropometric markers, unintended weight loss[70-72] and low BMI[46,72-76] defined individuals with malnutrition. Among biochemical markers, low blood albumin levels,[73,75,77] anemia,[77,78] and deficit of micronutrients[79-81] identified people with poor nutritional status. Several studies used composite nutritional scores based on self-reported dietary intake and habits to identify people with malnutrition.[70,72,82-85] Prevalence estimates varied across the definitions.

Anthropometric definitions of malnutrition. Unexpected weight loss of more than 5 percent of baseline body weight was reported by 21 percent of individuals in the Danish part of a large survey of European older adults (Appendix E Table 11).[70] Low BMI was defined as <18.5 kg/m^2,[46,73,76,121] <19 kg/m^2,[75] or <22 kg/m^2.[72] The highest prevalence of malnutrition according to low BMI (15 percent) was found among older American veterans.[75] A European study found that 5.8 percent of older individuals had low BMI.[73] The prevalence of low BMI in older people from the general American population was as low as 2.3 percent.[46] The Geisinger Rural Aging Study did not find any rural older Americans with a BMI of <18.5 kg/m^2 (0 percent prevalence) (Appendix E Table 11).[76]

Biochemical definitions of malnutrition. Low albumin levels were found in 3.1 percent of American veterans (Appendix E Table 11).[75] Prevalence was remarkably higher in studies that recruited older people in clinical settings. The Italian Group of Pharmacoepidemiology in the Elderly study found that 38.1 percent of individuals had albumin levels <35 g/L.[73] American studies developing the High-Risk Diagnoses for the Elderly Scale found that 24 to 49 percent of older patients in clinical settings had albumin levels <3.5 mg/dL.[4]

A micronutrient deficit was more common in older Europeans (18.2 percent) than in older Americans (6.4 percent) (Appendix E Table 12).[79] On average, 5.3 percent of older people had a folate deficit (Figure 33).[80,81] Older Europeans also had a higher prevalence of vitamin B12 deficiency (11.7 percent) compared to Americans (5.4 percent).[79] On average, 7.5 percent had a vitamin B12 deficiency (Figure 33). Prevalence of iron deficiency was similar in older Europeans (6.1 percent) and Americans (5.6 percent) (Appendix E Table 12).[79] On average, 4.7 percent of older adults had an iron deficiency (Figure 33). Prevalence of vitamin D insufficiency was the same (36.7 percent) in older Europeans[80] and Americans.[81] On average, 9.9 percent of older adults had a vitamin D deficiency (Figure 33).

Composite nutritional score. Prevalence of malnutrition in older adults varied from 1 percent[82] in eight European countries to 5 percent in Australia (Appendix E Table 13).[83] According to the Nutrition Screening Initiative, 21 percent of older adults in the United States had a high nutritional risk.[84] Half of the American older adults with poor perceived health were at high risk of malnutrition.[84] Overall, 33 percent of older individuals had a high nutritional risk (Figure 34).[70,72,82-85]

In conclusion, the prevalence of malnutrition depended on definitions. The chance of having low BMI was less than 3 percent, around 6 to 10 percent for having a vitamin and micronutrient deficit, and 1 to 5 percent for having a low composite nutritional score. The prevalence of low BMI and blood albumin level was highest in older American veterans.[75]

Homeostenosis (Impaired Homeostasis)

Very few studies examined the prevalence of impaired homeostasis (Appendix E Table 14). NHANES I and II defined impaired homeostasis in older persons using an allostatic load score.[86] The total score was based on elevated CRP level of >0.5 mg/dL, low albumin level of <4.5 g/dL, creatinine clearance of <78.5 mL/min/1.73 m^2, and increased blood pressure, hemoglobin A_{1C}, homocysteine, total cholesterol, and triglycerides. The surveys found that 1.4 percent of the elderly population in the United States had an allostatic load score of >4.[86] The Duke Established Populations for Epidemiologic Studies of the Elderly analyzed plasma tonicity as a marker of impaired homeostasis that can predict frailty and disability.[46] Plasma tonicity was estimated from plasma glucose, sodium, and potassium measures and was used to classify subjects as normotonic (285–294 mOsm/L) or hypertonic (>300 mOsm/L). This study found that 10 percent of individuals had increased plasma tonicity.

In conclusion, existing evidence was insufficient to estimate the prevalence of homeostenosis.

Chronic Inflammation

Few studies provided prevalence of unspecified chronic inflammation (Appendix E Figure 1).[87,88,146] CHS found that 24.4 percent of older adults had elevated CRP.[87] The Health ABC Study reported that 5 percent of older adults had elevated IL6 and 5 percent had elevated tumor necrosis factor-alpha.[88] The Swedish NONA Immune Study demonstrated that 15.3 percent of all older adults and 18.4 percent of frail older persons had an inverted CD4/CD8 ratio.[146]

In conclusion, existing evidence was insufficient to estimate a prevalence of chronic inflammation.

Key Question 2. What is the Prevalence of Common Syndromes/Conditions in Older Adults in Sex, Age, Race, Ethnicity, and Other Subgroups?

Multiple Morbidities

Prevalence of three or more chronic diseases increased from 28 percent in adults ages 65–74 years to 37 percent in adults older than age 75 years (Figure 8). Older persons living below the poverty level had a higher prevalence of multiple morbidities. The prevalence of polypharmacy also increased from 50 percent in adults ages 75–79 years to 63 percent in those older than age 85 years (Table 16).[205]

Prevalence of comorbidities in older men varied from 16 percent having two chronic diseases to 5 percent having four to six chronic diseases (Appendix E Table 2).[125] More than one-third of older men took more than five drugs,[94] while 16 percent took more than 11 drugs (Appendix E Table 3).[205] On average, an older man took 9.6 to 12 drugs in 1995–1996 but 18 to 21 drugs in 2004–2005 (Figure 10). The increase in annual drug visits (35 percent) and drugs taken (102 percent) in men ages 65–74 years during the decade from 1996 to 2005 was largest when compared to other sex and age categories (Figure 11). Poor health was reported by 7 percent of older men (Figure 35).[94,103,280]

The prevalence of more than three comorbidities in older women varied from 16.0 to 18.4 percent (Table 16).[89,117] The prevalence of five, six, or more diseases was lower among older women who participated in the Women's Health and Aging Studies.[117,242] Thus, the majority of older women reported three or four comorbidities.

The prevalence of polypharmacy was greater in older women than in men; 43 percent had taken more than five drugs[94] and 19 percent took more than 11 drugs.[205] From 1996–2005, women older than age 75 years experienced a 32 percent increase in annual drug visits and a 94 percent increase in the number of prescribed drugs (Figure 11). Poor health was reported by 7 percent of older women (Figure 36).[94,103,280]

Prevalence of more than three chronic diseases was higher in African American women (13.4 percent) than in Caucasian women (9.5 percent).[89] A comparison of the estimates was difficult because there were inconsistent definitions of the outcomes and older subgroups across the studies.

In conclusion, prevalence of multimorbid conditions increased with age. Women tended to have a higher prevalence of comorbidities, polypharmacy, and poor health. African American women had a higher prevalence of comorbidities than Caucasian women.

Cognitive Impairment

Age. Prevalence of cognitive impairment increased with age across all definitions and studies. Prevalence of mild cognitive impairment identified using the 3MSE increased from 18.8 percent in individuals older than age 75 years to 44.1 percent among those older than age 90 years (Figure 37).[90,91,146,281] Prevalence of cognitive impairment in elderly persons defined as an MMSE score of <24 increased from 16.9 percent among those older than age 65 years to 22.9 percent in centenarians older than age 90 years (Figure 14).[14,39-45] The prevalence of cognitive impairment identified through the TICS instrument increased from 3.38 percent in persons ages 70–74 years to 19.6 percent among those older than age 85 years (Figure 16).[49]

Prevalence of dementia increased with age in all studies. Prevalence of senile dementia increased from 1.6 percent in individuals age 67.5 years to 36.7 percent in those older than age 95 years (Figure 19).[92,93] The prevalence of Alzheimer's disease increased from 0.4 percent in individuals age 67.5 years to 37.4 percent in those older than age 95 years.[92,93] Prevalence of severe dementia increased dramatically from 3.2 percent in individuals ages 75–84 years to 14.6 percent in those older than age 85 years.[95] A meta-analysis of nine studies concluded that the highest prevalence of dementia was among individuals ages 80–85 years, with a minimal increase after age 90 years.[93]

Race. Limited evidence from the CHS Cognition Study indicates that older individuals of African American descent had a higher prevalence of mild cognitive impairment (45.5 percent) compared to Caucasians (14 percent) (Figure 37).[90]

Sex. Prevalence of cognitive impairment in men varied from 16 percent in the Canadian Study of Health and Aging[250] and PAQUID (Personnes Agées QUID) Research Program[94] to 36 percent in the CHS All Stars Study (Appendix E Table 15).[59] No age-associated increase was evident. For instance, the Survey in Europe on Nutrition and the Elderly reported that 14 percent of men ages 80–85 years had cognitive impairment.[96] The prevalence was 10.3[42] to 14.9 percent[59] in men older than age 89 years.

Prevalence of dementia in older men was consistent across different countries, with an evident increase with age (Figure 38).[97] The EURODEM-Prevalence Research Group reported that 3.25 percent of older men had vascular or mixed dementia.[97] Prevalence increased from 1.04 percent in men ages 65–69 years to 5.8 percent in those older than age 85 years.[97] CHS identified dementia in 9 percent of men younger than age 75 years and in 43 percent of those older than age 85 years (Figure 39).[282] The Canadian Study of Health and Aging demonstrated an evident increase in severe dementia in aging men, from 0.4 percent in those ages 65–74 years to 8.8 percent in those older than age 85 years.[95]

The prevalence of cognitive impairment in women varied depending on definitions and age. Cognitive impairment detected with the 3MSE questionnaire varied from 10.4 to 11.5 percent in older women (Figure 40).[59,95] Functional cognitive impairment was identified with the 3MSE questionnaire in 35 to 59 percent of older women.[59] Cognitive and physical impairment were identified with the same instrument in 6.3 to 24.3 percent of older women.[59] The prevalence of cognitive impairment defined as an MMSE score of <24 was 24 percent in women older than age 65 years (Figure 41).[42,90,94,96]

Prevalence did not increase substantially with age. Pooled prevalence of cognitive impairment in women ages 80 to 85 years was 31.8 percent but was reduced to 14.2 percent in those older than age 90 years.[42,90,94,96] Since prevalence of dementia increases with age, a decrease in prevalence of cognitive impairment may reflect a competing risk issue.

The prevalence of cognitive impairment was lower in the Longitudinal Study of Aging that used the TICS instrument (Figure 42).[49] The Longitudinal Study of Aging found an increase in prevalence with age, from 8.6 percent in women ages 70–74 years to 33 percent in those older than age 85 years.[49]

The prevalence of dementia in older women was consistent across different countries, with evident increases with age (Figure 43).[97] The EURODEM-Prevalence Research Group found vascular or mixed dementia in 2.3 percent of older women.[97] Prevalence increased from 0.3 percent in those ages 65–69 years to 5.4 percent in those older than age 80 years.[97] Prevalence of any dementia increased from 8.8 percent in women younger than age 75 years to 51 percent in those older than age 85 years, and to 56 percent in centenarians (Figure 44).[95,176,236,282] Severe dementia increased from 0.6 percent in women ages 65–74 years to 17.2 percent in those older than age 85 years.[95,176,236,282]

Other factors. Several factors have been associated with the development of cognitive impairment and dementia in healthy aging people (Appendix E Table 16).[283,284] Sedentary lifestyle was associated with dementia in several studies.[285-292] Several cohort studies demonstrated an increased risk of dementia among smokers (Appendix E Table 16).[284,285,293-295] The association with alcohol intake was not linear, with an increased risk of dementia among both nondrinkers and heavy drinkers.[285,288,296-300] Obesity[301-304] and increased saturated fat intake in older adults was also associated with a higher risk of cognitive impairment.[285,305]

Several studies showed that cognitive impairment was associated with a greater risk of dementia. More than 20 percent of older people with cognitive impairment developed dementia during 2 to 5 years of followup (Appendix E Table 17).[98] The Cache County Study on Memory, Health, and Aging demonstrated that 46 percent of older individuals with mild cognitive impairment developed dementia during 3 years of followup.[306] The Religious Orders Study[99] and the German Study on Aging, Cognition, and Dementia in Primary Care Patients Study Group[100] demonstrated a significant risk of any dementia and Alzheimer's disease in older individuals with cognitive impairment (Appendix E Table 18). Several cognitive tests have been shown to predict dementia in older people with cognitive impairment, including the Selective Reminding Test, Benton Visual Retention Test, Wechsler Memory Scale, Paired Associate Learning, Mattis Dementia Rating Scale, Rey Auditory Verbal Learning Test, Cambridge Mental Disorders in the Elderly Examination, Wechsler Adult Intelligence, Fuld Object Memory Test, Boston Naming Test, and California Verbal Learning Test (Appendix E Table 19).[98,283] The differences in the magnitude of the association between different definitions of cognitive impairment and dementia have not been documented in large population-based studies.

In conclusion, prevalence of cognitive impairment and dementia increased with age, with the highest prevalence among community-dwelling persons ages 80–85 years. Older African Americans had a higher prevalence of cognitive impairment. Older men and women had comparable prevalence of cognitive impairment and dementia. Older persons with cognitive impairment were at a higher risk of developing dementia.

Frailty

Prevalence of frailty increased with age but differed within age subgroups, depending on definitions (Appendix E Table 20). Prevalence in those between the ages of 65 and 70 years ranged from 3–6 percent, using the phenotype definition, to 5–15 percent using the accumulation deficit definition (Figure 45).[23,101-104] Prevalence of frailty in adults between the ages of 70 and 80 years varied from 5–12 percent, according to the phenotype definition, to 8–17 percent according to the accumulation deficit definition (Figure 46).[22,23,101,104,105] Prevalence of frailty according to any definition was more than 16 percent in those older than age 80 years (Figure 47).[23,101-104] Prevalence according to the phenotype definition increased from 16 percent in those ages 80–84 years to 26 percent in those ages 85–89 years, without further increase with age. Prevalence of frailty according to the accumulation deficit definition continued increasing with age. More than half (50 to 56 percent) of people older than age 85 years were frail according to the accumulation deficit definition.

Among race groups, older African Americans had the highest prevalence of frailty across different definitions (Appendix E Table 21). More than half of older African Americans were frail according to two studies (Precipitating Events Project and Frailty Study of African Americans in South Central Los Angeles) (Figure 48).[23,104,106,107] Two studies examined prevalence of frailty in older Hispanics and reported that 8–20 percent met different frailty criteria (Figure 49).[104,108] Prevalence of frailty in older Caucasians varied from 6–12 percent, using the phenotype definition, to 15–40 percent using the accumulation deficit definition (Figure 50).[23,104,107,109] The large cohort studies of predominantly Caucasian participants in the Survey of Health, Aging and Retirement in Europe demonstrated that, according to phenotype criteria, 17 percent of older people were frail.[110]

Among sex groups, prevalence of frailty was somewhat higher in women than in men. Estimates varied depending on studies, definitions, and age subgroups. In older men, prevalence of phenotype frailty was 7 percent, and accumulation deficit frailty was 24 percent (Figure 51).[23,103-105,107,109,111-115] Prevalence of phenotype frailty increased from 2–37 percent in higher age subgroups (Figure 52).[23,101,111,113,115] Prevalence of accumulation deficit frailty increased from 3 percent in men ages 65–69 years to 55 percent in those older than age 90 years. Prevalence was higher in aging African American and Hispanic men compared to Asian or Caucasian men (Figure 53).[23,113,116] Prevalence of phenotype frailty was 13 percent in women, and accumulation deficit frailty was 26 percent (Figure 54).[23,24,103-105,107,109,111,115-117] Prevalence of phenotype frailty increased from 3–13 percent in higher age subgroups (Figure 55).[23,101,104,111,115] Prevalence of accumulation deficit frailty increased from 6–57 percent in higher age subgroups. African American women had the highest prevalence of frailty, with 60 percent of those older than age 85 years being frail (Figure 56).[23,116]

In conclusion, prevalence of frailty varied depending on studies, definitions, and age subgroups. Prevalence increased with age and was higher when accumulation deficit definitions were used. Older African Americans and Hispanics had a higher prevalence of frailty.

Disability

Prevalence of BADL disability by sex.

Any BADL disability. Four studies reported prevalence for any BADL disability by sex, and women had a higher prevalence of any BADL disability (8.1–14.0 percent) than men (6.5–10.3 percent) (Figures 57–60).[61,63,64,121]

Moderate BADL disability. Women (21.7 percent) had a higher prevalence of moderate BADL disability than men (19.1 percent) in the one study that reported this outcome (Figure 61).[118]

Severe BADL disability. The prevalence of severe BADL disability was the same in older men and women (6 percent) (Figure 62).[118]

Individual BADL disabilities. Women had a higher prevalence of disabilities in bathing, dressing/hygiene, transferring, and walking than men (Table 17). The prevalence was equal between men and women for eating disabilities, and no study reported on differences in toileting disabilities.

Summary. In general, women had higher rates for all types of BADL disabilities, except for eating disabilities, which had an equal prevalence. The highest prevalence reported for BADL disability occurred when it was measured as moderate BADL disability, then as any BADL disability, and finally as severe BADL disability.

Prevalence of IADL disability by sex. Few studies reported differences by sex in IADL disabilities (Table 18).

The prevalence of any IADL disability was higher in women than men (Table 18).[121] One study described changes in the prevalence of any IADL disability over 6 years between men and women.[121] More women reported an IADL disability than men at any time period, but showed less change over time (Figure 63). In terms of individual IADL disabilities, more women had more difficulty with housekeeping and meal preparation than men, but less difficulty with shopping (Figures 64 and 65).[119,122]

Prevalence of BADL disability by ethnicity.

Any BADL disability. Two studies reported prevalence of any BADL disability by ethnic group and one study enrolled only older Hispanic Americans (Table 19).[41,60,62] Prevalence of any BADL disability, in order of highest to lowest, was African Americans (13.6 percent), American Indians (11.6 percent), Hispanic Americans (11.0 percent),[41] and Caucasian Americans (8.1 percent) (Figure 66).[62] Racial differences persisted after accounting for sex. Older African American women had the highest prevalence of having any BADL disability (10.7 percent), followed by African American men (7.5 percent), Caucasian women (5.2 percent), and Caucasian men (4.7 percent) (Figure 67).[60]

Eating disability. One study reported the prevalence of eating disabilities by ethnic group and found that African American and Caucasian older adults had the same prevalence (1.2 percent) (Figure 68).[119]

Summary. The prevalence of BADL disabilities was highest in African American older people, followed by American Indian older people and Hispanic older people, and was lowest in Caucasian older Americans. African American women had the highest prevalence of BADL disability, followed by African American men, Caucasian women, and Caucasian men. There were no racial differences in eating disabilities.

Prevalence of IADL disability by ethnicity. Only one study reported differences in the prevalence of IADL disabilities by race.[119] Older African Americans had a higher percentage of individuals having difficulty with meal preparation and shopping than Caucasian older adults. Older African American women had the highest prevalence (Figures 69 and 70).

Summary. Very little is known about racial differences in the prevalence of IADL disability in older people. African American women appear to have more IADL disability.

Prevalence of BADL disability by age groups.

Any BADL disability. One study reported differences in the prevalence of any BADL disability by sex and age group.[59] In general, the prevalence of any BADL disability increased with age and was higher in women (Table 20).

Moderate BADL disability. One study reported differences in the prevalence of moderate BADL disability by sex and age group.[118] In general, prevalence of moderate BADL disability was higher in women and in the oldest age groups. Women older than age 80 years had the highest prevalence of moderate BADL disability.

Severe BADL disability. One study reported differences in the prevalence of severe BADL disability by sex and age group.[118] Prevalence of severe BADL disability ranged from 10–11 percent in people ages 80 years and older, was 6 percent in those ages 65–74 years, and did not differ significantly by sex (Table 21).

Summary. BADL disability was highest in the oldest age groups, and in older women.

Sarcopenia

Prevalence of sarcopenia increased with age.[68,123] However, the association was strong and consistent only in men.[68,123] The association was significant in women in the New Mexico Elder Health Survey[68] but random in female participants in the Health Aging and Body Composition Study.[123]

Older African Americans had significantly lower odds of sarcopenia when compared to Caucasians (OR, 0.2 [95% CI, 0.1–0.3]).[123] The odds of sarcopenia did not differ among Hispanic and non-Hispanic whites.[68]

Prevalence of sarcopenia did not demonstrate a consistent association with comorbidity across the studies. Older men with more than three diseases had significantly higher odds of sarcopenia in the Health Aging and Body Composition Study[123] but not in the New Mexico Elder Health Survey.[68] Sarcopenia was not associated with multimorbid conditions in women in both studies.[68,123]

Malnutrition

Prevalence of poor nutritional scores did not demonstrate a linear association with age in the Nutrition Screening Initiative.[84] Prevalence was highest in those ages 65–74 years (46 percent) but decreased to 31 percent in those older than age 85 years.[84] Sex differences in prevalence of malnutrition were evident for some but not all definitions of malnutrition (Appendix E Figure 2).[96]

Prevalence of poor nutritional scores was the same in men and women in the Nutrition Screening Initiative (Figure 71).[84] The pooled prevalence of poor nutritional scores was 18.27 percent in older men and 24 percent in older women (Figure 34). Prevalence of unintentional weight loss also did not differ by sex (Figure 72).[71,72] Women, however, had a lower prevalence of decreased albumin levels[77] but a higher prevalence of low BMI (Appendix E Table 10).[72]

Older African Americans had a significantly higher risk of malnutrition defined as unintentional weight loss when compared to Caucasians (Figure 71).[71] According to NHANES II, prevalence of anemia did not differ among older Caucasians and non-Caucasians (Appendix E Table 11).[78]

Prevalence of unintentional weight loss did not differ in older Hispanics and non-Hispanics.[72] Older Hispanic women had a higher prevalence of poor nutritional scores when compared to non-Hispanic women (30 percent vs. 17 percent, respectively).[72]

In conclusion, age and sex differences in malnutrition were not consistent across the studies. Older African Americans had a higher prevalence of unintentional weight loss. Older Hispanic women had a higher prevalence of poor nutritional scores.

Homeostenosis (Impaired Homeostasis)

We could not identify studies that reported prevalence of homeostenosis in age subgroups.

Chronic Inflammation

We could not identify studies that reported prevalence of chronic inflammation in age, sex, or race subgroups. Older women with higher blood levels of carotene, lycopene, lutein, b-cryptoxanthin, and selenium had a lower prevalence of elevated IL6 (Appendix E Table 22).[240]

In conclusion, evidence was insufficient about prevalence of unspecified chronic inflammation in older subpopulations.

Key Question 3. What is the Association Between These Common Syndromes/Conditions and Mortality, Institutionalization, Hospitalization, and Activities of Daily Living?

We analyzed the association of outcomes with each syndrome and across all syndromes. The estimates of the association varied depending on definitions of comorbidities, population subgroups, definitions of the outcomes, and adjustment for correlated contributing factors. Some analyses did not address the multifactorial nature of geriatric syndromes and the role of baseline diseases. For example, disability was an outcome but also a part of the definition of frailty. Adjustment for correlated multifactorial syndromes that ignored definitive primary cause of disability or death may give invalid estimation of the association between syndromes and mortality. Age and specific disease contributions were not separately examined in the studies.

Multiple Morbidities

The estimates of the association varied depending on definitions of comorbidities, population subgroups, definitions of the outcomes, and adjustment for correlated contributing factors. The Women's Health and Aging Studies I and II demonstrated increased odds of frailty in women with more than three chronic diseases (OR, 1.5 [95% CI, 1.3–1.7])[89] or more than eight inflammatory diseases (OR, 1.8 [95% CI, 1.5–2.3]) (Appendix E Table 23).[117] The Health ABC Study found an increased risk of sarcopenia in older men (RR, 2.8 [95% CI, 1.7–4.8]) but not in women.[123]

The positive significant association between multiple morbidities and mortality was consistent across the studies. Older persons with comorbidities had a 32–112 percent relative increase in death (Table 22).[39,124-129] The magnitude of the association decreased during the time of followup, from a 100 percent relative increase at 10 years (OR, 2 [95% CI, 1.4–2.8)] to a 59 percent increase at 15 years (OR, 1.59 [95% CI, 1.1–2.3]).[125] The association between comorbidity and mortality attenuated dramatically during the longer time of followup in another cohort, from a 471 percent relative increase at 1 year to a 120 percent increase at 10 years.[129] Attenuation in association may be a statistical reflection of a greater denominator as outcomes accrue over time. The magnitude of the association was dose responsive, with an 85 percent relative increase in mortality for older persons with four to five diseases and a 112 percent relative increase among those with six or more chronic conditions.[126]

A prospective cohort from a large health maintenance organization demonstrated a significant increase in mortality in older women (OR, 2.5 [95% CI, 1.1–6.0]) and men (OR, 2.3 [95% CI, 1.3–4.1]) who had a Charlson comorbidity index score of 2–4 versus 0.[308]

Polypharmacy was significantly associated with mortality in two studies with evidence of a dose response.[54,130] One European cohort, the PAQUID study, did not find a significant association between polypharmacy and death in older men and women.[94]

Older persons with poor health had an increased risk of death in all studies that examined the association (Figure 73).[27,103,131] Older women with poor health had a 235 percent relative increase in mortality[94,280] and older men had a 233 percent increase.[94,280] The magnitude of the association decreased over the time of followup in women (Appendix E Table 24). Women with poor health had a 280 percent increase in risk of death at 5 months of followup in the Longitudinal Study of Aging (HR, 3.8 [95% CI, 2.0–7.1]), a 100 percent increase at 23 months (HR, 2.0 [95% CI, 1.3–3.0]), but no significant association at 32 months.[309] Among other population subgroups, older Medicare beneficiaries with functional dependency and poor health had an increased risk of death of 99–124 percent.[310]

The Longitudinal Study of Aging demonstrated a positive significant association between multiple morbidities and institutionalization (Appendix E Table 25).[128] Older persons with poor health had a 10–80 percent relative increase in institutionalization (Appendix E Table 26).[8,103,132] The Longitudinal Study of Aging reported a significant risk of first admission ever to a nursing home (HR, 1.2 [95% CI, 1.1–1.2]) and overall nursing home placement (HR, 1.1 [95% CI, 1.1–1.2]) in older Caucasians with poor health.[132,311] The association was not significant among older African Americans.

Older persons with multiple morbidities had increased odds of hospitalization (OR, 1.7 [95% CI, 1.1–2.9]) (Appendix E Table 27).[133] The association with hospitalization was dose responsive.[126] The relative increase in odds of hospitalization was 37 percent in persons with comorbidity scores of 3 versus ≤2, 46 percent in those with scores of 4–5 versus ≤5, and 94 percent in those with scores of ≥6 versus ≤2.[126]

Polypharmacy was significantly associated with hospitalization.[133,134] The Medicare Risk Demonstration cohort reported a 190 percent increase (OR, 2.9 [95% CI, 2.2–4.1]) in odds of hospitalization among older persons with more than five prescriptions when compared to those with less than five concurrent drugs.[133] The Assistenza Socio-Sanitaria Italian cohort found a 124 percent relative increase in odds of hospitalization among older persons with more than five prescription medications (OR, 2.2 [95% CI, 1.8–2.8]).[134]

The Longitudinal Study of Aging reported a significant increase in the risk of hospitalization among older persons with poor health (Appendix E Table 28).[135-140] Older persons with poor health had increased odds of any hospital admission (OR, 2.8),[136] any Medicare-reimbursed hospital episode (OR, 2.1),[135] hospitalization for ambulatory care-sensitive conditions (OR, 1.5),[137] and repeated admissions (OR, 2.2).[140]

In conclusion, among different definitions of multimorbid conditions, comorbidity scores and poor perceived health demonstrated a strong association with mortality in older people. Poor perceived health was a strong predictor for institutionalization. The number of chronic conditions, comorbidity scores, polypharmacy, and poor perceived health were associated with hospitalization.

Cognitive Impairment

Cognitive impairment was associated with a significantly higher risk of mortality in all studies that examined this association (Appendix E Table 29).[149] The magnitude of the association varied depending on the definition of cognitive impairment, country of study, and adjustment for other contributing factors (Appendix E Table 30). The largest relative increase of 250 percent in women and 280 percent in men was found in the Canadian Study of Health and Aging, which defined cognitive impairment as a score of <78 on the 3MSE scale.[141,142] The association was dose responsive, with a 4 percent relative increase in mortality for each one-point decrease in MMSE score (Figure 74).[39,44,54,143-148] The magnitude of the association was highest in studies that estimated the association with odds ratios (pooled OR, 4.2 [95% CI, 2.6–6.8]).[144,146] The studies that estimated relative risk of hazard rate ratios found a 37 percent[39,54] and a 61 percent[44,147] relative increase in risk of death, respectively (Figure 74). Odds ratios may overestimate relative risk when baseline event rates are higher than 30 percent.[312] Estimation of relative risk from the reported odds ratio was not feasible because of inconsistent reporting of baseline rates.

Fewer studies analyzed the association between different definitions of cognitive impairment. The Canadian Study of Health and Aging examined different case definitions of mild cognitive impairment[313] and did not demonstrate a significant increase in risk of mortality (Figure 75).[39,94,313]

Among sex groups, older women (pooled RR, 1.37 [95% CI, 1.11–1.69]) but not men (pooled RR, 1.2 [95% CI, 0.8–1.8]) with an MMSE score of <24 had a significant risk of mortality (Figure 75).[39,94] Both men and women with severe cognitive impairment, defined as an MMSE score of <18, were at a higher risk of death.

Dementia was associated with a significantly higher risk of mortality in the majority of the studies that examined this association (Appendix E Table 31).[149] Overall, dementia was associated with a 163 percent relative increase in the odds of death (pooled OR, 2.6 [95% CI, 2.2–3.2]).[149] The highest risk of death was found in the North Manhattan Aging Project, among three ethnoracial groups (Latinos, African Americans, and non-Latino whites) with dementia. Several European cohorts, including the Helsinki Aging Study,[314] the Longitudinal Gerontological and Geriatric Population Studies in Gothenburg,[315] the Swedish Kungsholmen Study,[316] the Italian Longitudinal Study on Aging,[317] and the Appignano Study[318] demonstrated more than a 100 percent relative increase in mortality in older individuals with dementia.

Cognitive impairment was associated with a significant risk of institutionalization in the majority of the studies that examined this association (Appendix E Table 32). For cognitive function measured with MMSE, the association was dose responsive and significant even within the normal ranges of the scale. Older individuals had a higher relative increase in institutionalization of 9 percent per each one-point decrease in MMSE score.[145] The magnitude of the association varied substantially across the studies. Studies that reported odds ratios tended to overestimate the magnitude of the association. The Canadian Study of Health and Aging demonstrated that older persons with age-associated memory impairment (OR, 17.5 [95% CI, 14.0–22.0]) or mild cognitive impairment with an MMSE score of <23 (OR, 29.1 [95% CI, 25.1–33.8]) had a substantial increase in the odds of nursing home placement.[151] The Asset and Health Dynamics Among the Oldest Old Study demonstrated a smaller but still highly significant risk of institutionalization in older people with mild/moderate (HR, 2.3 [95% CI, 1.8–2.8]) or severe cognitive impairment.[319] Older persons with dementia had a significant risk of institutionalization in several large studies, including the Medicare Current Beneficiary Survey (OR, 34.9),[150] the Canadian Study of Health and Aging (OR, 36.3),[151] and the Marshfield Epidemiologic Study Area (HR, 5.1) (Appendix E Table 32).[152] The magnitude of the association was higher in the studies that reported odds ratios rather than relative risk.

Cognitive impairment was associated with a significant risk of hospitalization in one study of three that examined this association (Appendix E Table 33). The MacArthur Research Network on Successful Aging Community Study demonstrated 680 percent higher odds of hospitalization in older people with a decline in the Short Portable Mental Status Questionnaire (OR, 7.8 [95% CI, 2.0–30.8]).[320] The Longitudinal Study of Aging[137,140] and the Medicare Current Beneficiary Survey[321] did not find a significant association between cognitive impairment and dementia.

In conclusion, older individuals with cognitive impairment had a higher risk of mortality and institutionalization. The magnitude of the association varied depending on the country, age, and sex of the participants, definitions of the cognitive impairment, and statistical estimates.

Frailty

Frailty was associated with cognitive impairment, comorbidities, and disability. The prevalence of frailty demonstrated a dose response association with a larger number of comorbidities or ADL disability (Appendix E Table 34).[23,104]

Frailty was associated with mortality (Appendix E Table 35). Figure 76 summarizes the overall association between frailty and mortality across a number of varying studies, organized by the general definitional approach to frailty.[14,23,111,115,148,153-156] Although there is substantial heterogeneity across the studies, there is a positive relationship. The relationship is stronger when accumulated deficits are employed as the basis for the definition.

The strength of the association was cumulative. Figure 77 uses data from an analysis of the Medicare Current Beneficiary Survey to show that more deficits were associated with a higher risk of bad events.[157] Figure 78 shows how increasing numbers of phenotypic frailty components were associated with a greater risk of mortality.[14,156] As shown in Figure 79, this effect generally persisted over longer followup periods.[23,156] The strongest association between frailty and mortality was demonstrated at 4 years of followup. The relative increase in mortality was less at 11 years but remained significant.

The association was significant in men and women. Older frail men had a relatively greater risk of death of 105 to 251 percent, according to the phenotype definition, and 65 to 356 percent according to the accumulation deficit definition (Appendix E Figure 3).[113,114,158,159] The dose response association between the increasing value of the frailty accumulation deficit index and mortality was significant in Chinese men ages 80–99 years but random in those ages 65–80 years or older than age 100 years (Appendix E Figure 4).[159] Frail older women had increased mortality across different studies and definitions of frailty (Appendix E Figure 5).[158-160] The dose response association between the increasing value of the frailty accumulation deficit index and mortality was significant in all age categories of Chinese women (Appendix E Figure 6).[159]

Frailty was associated with an increased risk of institutionalization (Appendix E Table 36). The magnitude of association was higher in studies of disabled older persons, including the Women's Health and Aging Studies[160] and the Canadian Study of Health and Aging.[155] Different frailty criteria were also associated with increased risk of institutionalization in the Precipitating Events Project.[147] Slow gait speed and cognitive impairment were the strongest predictors. Frailty was also associated with an increased risk of hospitalization (Appendix E Table 37).[14,28,161] The studies demonstrated a 29 percent relative increase in risk[161] and a 41–345 percent relative increase in odds of hospitalization.[14,161]

Two studies examined the association between frailty and emergency department (ED) visits (Appendix E Table 38). The MOBILIZE Boston Study found that the relative increase in odds of ED visits was 210–254 percent in frail older persons compared to nonfrail older persons.[109] Secondary analysis of data from the Medicare Current Beneficiary Survey that adjusted for previous ED visits and previous hospitalizations did not find a significant association between frailty and ED visits.[157]

In conclusion, frail older adults had an increased risk of disability, mortality, and institutionalization. The association was consistent across the studies, persisted with more years of followup, and demonstrated a dose response association with the number of criteria met.

Disability

Disability and hospitalization. The results of studies examining the association between disability and risk of hospitalization are summarized in Table 23. A more detailed accounting of the results appears in Appendix E Table 39. The statistically significant association between disability and hospitalization was demonstrated in four studies (adjusted relative measures of association ranged from 1.8 to 16.0).[136,137,162,163] The risk of hospitalization depended on the definition of disability, and in general this risk increased with the severity of disability. Older people who had any BADL disability (defined as having one or more BADL dependencies) had the lowest risk of hospitalization. Older individuals with severe BADL disability (defined as having three or more BADL dependencies) had the highest risk. The risk for women was also greater than the risk for men. The manner in which BADL disability develops appears to influence the risk for hospitalization. Older people who experienced catastrophic severe disability (defined as the sudden onset of three or more BADL disabilities when none existed before) were 16 times more likely to be hospitalized than those who had moderate ADL disability.[163] When ADL disability was measured on a continuous scale, the risk for hospitalization was not statistically significant, nor was it significant when it was measured as having any ADL or IADL dependencies.

Disability measures not measured as ADLs also predicted hospitalization. The greatest risk was a two-fold increase for older people who were not physically able (difficulty in walking 1/4 of a mile; stooping, crouching, or kneeling; lifting 10 pounds; or walking up 10 steps without resting).[162]

The majority of the studies that examined the association between disability and institutionalization found that disabled elderly adults had a significantly higher risk of placement in nursing homes (Appendix E Table 40).

Disability and mortality.

Risk of death for older people with BADL disabilities. Several studies reported the odds ratio or hazard ratio associated with different definitions of disability and the risk of death during different time periods (Appendix E Table 41).

Table 24 summarizes the studies that reported these relationships. In general, older people with BADL disabilities were at higher risk for death (OR range, 1.9–86.8) than those with IADL disabilities (OR range, 1.5–6.6) compared to elderly adults without disabilities (Figures 80 and 81). Those with more BADL disabilities had a higher risk of death than those with fewer BADL disabilities (Figure 80). Severe BADL disabilities were associated with the highest risk of death at 72 months (OR, 30.0 [95% CI, 18.0–51.0])[128] and 24 months (OR, 86.8 [95% CI, 39.4–190.8]).[164] Moderate BADL disabilities were associated with greater odds of death at 72 months (OR, 8.6 [95% CI, 6.6–11.0])[128] and 24 months (OR, 14.1 [95% CI, 9.2–21.6]).[164] The lowest risk of death occurred when any BADL disability was reported (OR, 1.9 [95% CI, 1.2–2.7]).[162] The risk of death associated with individual BADL disabilities was not reported in the studies, with one exception. The risk for death at 48 months doubled for older people with bathing disabilities.[53]

Risk of death for older people with IADL disabilities. The risk of death associated with IADL disabilities was highest when any IADL disability was reported. Older adults reporting any IADL disability were 6.6 times more likely to die at 72 months[128] and 4.1 times more likely to die at 24 months.[164] Those with severe IADL disability had slightly higher odds of death (OR range, 1.6–2.2) than those with moderate IADL disabilities (OR range, 1.5–1.7) (Figure 81). The risk of death associated with individual IADL disabilities was only reported in one study. Those with difficulty managing personal finances were twice as likely to die as those without this disability.[53]

When disability was measured on a continuous scale, the per one-point increase in disability score and the risk of death were the same whether the scale measured BADL, IADL, or BADL/IADL disability (Figure 82).

Difference in risk of death and disability by sex and race. Men with BADL disabilities had slightly higher risks of death than women.[64] One study looked at risk disparities in race subgroups of older people with IADL disabilities.[119] White men and women who were unable to prepare a meal had higher risks of death than African American men and women with this disability (Figure 83).

Life expectancy. One study reported differences in life expectancy by age and sex for older people with and without BADL/IADL disabilities (Figure 84).[40] Women suffered greater discrepancies in years of expected active life remaining if they had a BADL/IADL disability. Women age 78 years who have a disability had a 49 percent reduction in expected active life remaining compared to women the same age without a disability; this reduction was 34 percent for women age 65 years, 38 percent for men age 78 years, and 25 percent for men age 65 years.[40]

Summary. In general, older people with the most severe BADL disabilities had the highest risks of death. There is basically no research on how individual BADL and IADL disabilities increase the risk of death. Men with BADL disabilities had slightly higher death rates than women with BADL disabilities. There are few studies reporting race or ethnic differences in death rates among disabled older men and women.

Sarcopenia

Sarcopenia was associated with significantly higher odds of multiple disabilities.[68] The relative increase in odds of having more than three disabilities was 266 percent in older men with sarcopenia and 308 percent in women with sarcopenia.[68] The association with impaired lower extremity function depended on the definitions of sarcopenia. A significant increase in the odds of mobility disability was demonstrated among older patients with sarcopenia who were diagnosed using a lean mass index adjusted for fat mass (Appendix E Table 42).[123] The unadjusted relative lean mass index was positively associated with mobility disability in men but not in women.[123]

The association between sarcopenia and mortality was examined in one study (the Invecchiare in Chianti Study).[165] Even though older people with greater muscle density had a lower risk of death, sarcopenia was not associated with mortality.[165]

The association between sarcopenia and hospitalization was examined in one study, the Health ABC Study.[322] The study demonstrated a significant positive association between low muscle density (RR, 1.5 [95% CI, 1.2–1.7]) or weak grip strength (RR, 1.5 [95% CI, 1.3–1.8]) and hospitalization. Lean mass or sarcopenia was not associated with hospitalization.[322] The authors concluded that poor function and low muscle density are better predictors for treatment utilization in older individuals and should be measured in population-based studies.

In conclusion, limited evidence suggests that sarcopenia was associated with disability but not mortality in older people. Mobility disability and low muscle density may predict hospitalization better than simple lean mass index.

Malnutrition

The association between mortality and malnutrition was consistent across the studies and different definitions of malnutrition (Figure 85).[70,71,83,166-169]

Low BMI[166,167] and malnutrition identified using the Mini Nutritional Assessment[70] were the strongest predictors for mortality.

In addition, several biological markers related to malnutrition have been shown to be strong and significant predictors of mortality (Appendix E Table 43). Red cell distribution width is typically elevated in older persons with malnutrition, iron deficiency, or vitamin B12 or folate deficiency.[79] Meta-analysis of individual subject data from seven community-based studies of 11,827 older adults demonstrated a strong and significant association with mortality in all examined age, sex, and race subgroups.[79] Red cell distribution width was associated with mortality in older adults with and without iron, folate, and/or vitamin B12 deficiencies (adjusted HR for a 1 percent increment in RDW, 1.2 [95% CI, 1.1–1.2]), as well as in those without these deficiencies (adjusted HR for a 1 percent increment in RDW, 1.2 [95% CI, 1.2–1.3]).[79] Routinely measured as a part of the complete blood count, red cell distribution width >15 percent was associated with a 151 percent relative increase in risk of death (HR, 2.5 [95% CI, 2.2–2.9]).[79] Very low albumin levels and very high prealbumin levels (transthyretin >316mg/L or <258mg/L) were associated with increased mortality (Figure 86).[167,170] Low albumin level predicted a higher risk of early death in older men but not women (Appendix E Table 44).[170] Low vitamin D levels were associated with higher mortality in older women participating in the Women's Health and Aging Studies[241] but not in the Longitudinal Aging Study Amsterdam when men and women were combined in one model.[80]

Several studies analyzed composite measures of malnutrition and chronic inflammation in older people and found a significant positive association with mortality. For instance, elevated levels of inflammatory globulin, orosomucoid (alpha-1-acid glycoprotein), was associated with increased mortality.[167] The relative increase in mortality was 126 percent in older men and 161 percent in women (Appendix E Table 44).[170] Elevated alpha-1-acid glycoprotein levels predicted followup mortality of 5 years, but not longer (Figure 86).[170] Older people with the highest levels of alpha-1-acid glycoprotein and the lowest levels of transthyretin had the highest risk of death, with a 364 percent relative increase in women and 586 percent relative increase in men (Appendix E Table 44).[170] An elevated composite measure of chronic inflammation and poor nutrition was associated with increased risk of death in older men but not women (Figure 87).[170]

Women with nutritional deficit or multiple definitions of malnutrition, however, had a higher prevalence of frailty (Figure 88).[238] The evidence about treatment utilization in older people with malnutrition is limited to one study of domiciliary care services for older people with moderate or severe functional limitations that found an increased risk of ED admissions and hospitalizations in those with undernutrition and malnutrition (Appendix E Table 43).[83]

In conclusion, low BMI, nutritional risk identified with the Mini Nutritional Assessment, and increased red cell distribution width were strong and consistent predictors of mortality in older individuals. Other biomarkers and their combinations need further examination.

Homeostenosis (Impaired Homeostasis)

The association of impaired homeostasis with clinical outcomes varied depending on the definitions of the exposure and study populations (Appendix E Table 44). Older women with increased allostatic load had significantly greater odds of frailty (OR, 1.2 [95% CI, 1.0–1.3]), with a 16 percent relative increase per each one-point increase in score in the Women's Health and Aging Studies.[89] Older persons with high plasma tonicity had a significantly higher risk of impaired ADLs (RR, 2.7 [95% CI, 1.3–5.6]), impaired IADLs (RR, 2.3 [95% CI, 1.2–4.3]), and overall disability (RR, 2.1 [95% CI, 1.2–3.6]) in the Duke Established Populations for Epidemiologic Studies of the Elderly.[46]

The association between mortality and homeostenosis was examined in several studies that used different definitions of homeostenosis (Appendix E Table 44). Unstable BMI (HR, 1.3 [95% CI, 1.0–1.8]), pulse pressure (HR, 1.3 [95% CI, 1.0–1.7]), and fasting plasma glucose (HR, 1.6 [95% CI, 1.2–2.1]) were associated with greater risk of mortality in an older Italian cohort.[171] The MacArthur Studies of Successful Aging demonstrated a significant association between increased allostatic load and mortality.[124,172,173] The same study found a 27 percent relative increase in odds of death (OR, 1.3 [95% CI, 1.0–1.5]) in older people with an elevated stress hormone index.[124] The Invecchiare in Chianti Study demonstrated a relative increase of death of 472 percent in older people with elevated free estrogen levels (OR, 5.7 [95% CI, 1.7–19.4]).[323]

In conclusion, individual studies demonstrated a significant association between disability, mortality, and indicators of impaired homeostasis in elderly people. Consensus operational definition of homeostenosis and its biomarkers is necessary for better interpretation of the results.

Chronic Inflammation

The studies consistently found positive significant association between chronic inflammation and disability and mortality, despite different markers of inflammation and study populations. Older people with three elevated markers of chronic inflammation had increased odds of cognitive decline (OR, 1.5 [95% CI, 1.0–2.3]) (Appendix E Figure 7).[324] The Framingham study demonstrated decreasing brain volume among elderly individuals with elevated markers of chronic inflammation.[234] Older individuals with increased levels of IL6 (OR, 3.7 [95% CI, 1.9–6.9]) or CRP (OR, 1.9 [95% CI, 1.1–3.4]) had significantly higher odds of sarcopenia (Appendix E Figure 8).[325] The highest relative increase in odds of sarcopenia of 627 percent was demonstrated among those with elevated IL6 and alpha 1-antichymotrypsin.[325] Older women with elevated IL6 and decreased insulin-like growth factor had increased odds of disability in ADLs (OR, 2.5 [95% CI, 1.0–6.3]) and IADLs (OR, 3.7 [95% CI, 1.1–12.2]) (Appendix E Figure 9).[239] Older women with elevated IL6 had increased odds of frailty (OR, 2.0 [95% CI, 1.1–3.6]) (Appendix E Figure 10).[238,244]

The association between chronic inflammation and mortality differed across the studies depending on the markers and populations. Older women with elevated levels of two markers, IL6 and CRP, did not have a higher risk of death in a pooled analysis among women (Appendix E Figure 11).[124,174,219,220] However, older men with chronic inflammation had a higher risk of death (RR, 2.8 [95% CI, 1.4–5.5]).[174] A composite inflammatory index was not associated with mortality in the MacArthur Studies of Successful Aging and in the Leiden 85-Plus Study (Appendix E Figure 12).[124,219] Only older people with low levels of proinflammatory markers (IL-1Ra) and anti-inflammatory markers (IL10) had higher risk of death (RR, 2.2 [95% CI, 1.3–3.8]).[219]

Among common definitions of chronic inflammation, elevated IL6 and CRP were associated with higher mortality in older people. Elderly individuals with elevated IL6 levels had a 42 percent relative increase in death (pooled RR, 1.4 [95% CI, 1.2–1.7]) (Figure 89).[124,174-177] Older people with elevated CRP had a 42 percent relative increase in death (pooled RR, 1.4 [95% CI, 1.3–1.6]) (Figure 90).[87,124,129,166,167,170,174,177-179]

The association differed among men and women. Elevated IL6 was associated with increased mortality in women but not men (Appendix E Figure 13).[166,174,239] In contrast, elevated CRP was associated with increased mortality in men (pooled RR, 1.6 [95% CI, 1.2–2.2]) but not women (pooled RR, 1.1 [95% CI, 0.8–1.7]) (Figure 90).[87,124,166,167,170,174,176,177,202]

The studies reported different times of followup to analyze the association between mortality and different cut-off points for elevated CRP (Appendix E Table 45). The association attenuated with longer time of followup in CHS.[178] Older men with elevated CRP had a 300 percent relative increase in early 3-year mortality (HR, 4.1 [95% CI, 2.7–6.3]) but only a 42 percent relative increase in 8-year mortality (HR, 1.4 [95% CI, 1.1–1.8]).[178] Older women with elevated CRP had a 134 percent relative increase in 3-year mortality (HR, 2.3 [95% CI, 1.4–3.9]) and no significant association at 8 years of followup (HR, 1.2 [95% CI, 0.9–1.7]). The attenuation during longer followup was not evident when the association was compared at 5 and 9 years of followup in the Pathologies Oculaires Liées à l'Age Study.[170] Older men with elevated CRP had a significantly higher risk of death at 5 and 9 years while women did not.[170] One cohort (the Invecchiare in Chianti Study) demonstrated that an increase in CRP during the time of followup was the best predictor of mortality when compared to baseline or followup absolute CRP levels.[177] In a study in which CRP increased during followup, older subjects had a 210 percent relative increase in mortality (HR, 3.1 [95% CI, 1.3–7.7]).[177] Meta-regression analyses did not find a significant modification in association by the time of followup across all studies.

The studies reported different cut-off points for elevated CRP (Appendix E Table 45). The studies categorized older people by a single cut-off point for CRP, ranging from 3 mg/L[87,174,177] to 15 mg/L.[167] CHS[178] and the Iowa 65+ Rural Health Study[174] analyzed mortality in quartiles, while the Vitality 90+ Study[179] and the Women's Health and Aging Study[166] analyzed mortality in tertiles of CRP levels. All studies reported a greater risk of death in larger categories of CRP. Few studies analyzed the dose response association between CRP levels and mortality. The Helsinki Ageing Study found a 20 percent increase in death per 10 mg/L increase in CRP.[326] The Danish Centenarian Study found a significant 26 percent increase in mortality (crude HR, 1.3 [95% CI, 1.0–1.5]) per increase in 1 standard deviation of CRP levels in logarithmic scales.[176] Meta-regression analyses did not find a significant modification in association by cut-off point of CRP across all studies.

Individual studies reported other markers of chronic inflammation. Among them, elevated levels of tumor necrosis factor-alpha,[176] D-dimer,[175] fibrinogen,[178] and IL1 receptor antagonist[179] levels were associated with mortality (Appendix E Table 46). The strongest association with mortality was demonstrated for elevated CRP combined with low albumin (HR, 5.0 [95% CI, 2.3–11.0])[170] or elevated fibrinogen levels (HR, 9.6 [95% CI, 4.3–21.1]).[178] Significant association was found for early mortality and in men.

We could not find studies that examined the association between chronic inflammation and institutionalization or hospitalization.

In conclusion, chronic inflammation was associated with increased risk of frailty, disability, and mortality in older people. The risk was higher for early mortality and attenuated during longer time of followup. The risk was dose responsive for IL6 and CRP. The association was consistent for men but not for women. The strongest predictor of early mortality was elevated CRP combined with low albumin or increased fibrinogen.

Key Question 4. What Statistical and Decisionmaking Models Report Mortality Based on These Common Geriatric Syndromes/Conditions?

Models reporting mortality vary by complexity, by selection of predictors, and by time course. Some models strive for simplicity, with few predictors that are easily measured, much or all of which could be gained by culling administrative data. Others are much more complex, with data gathered from clinician and/or patient assessments. While a simpler approach is more appealing from a cost and operational perspective, the question remains as to the marginal benefit of more complex models. The basic relationship holds regardless of the measure used.

To provide an overview of overall effects of different syndromes on mortality in adults older than age 65 years, we estimated the number of deaths per 1,000 older persons from individual studies that provided death rates among those with and without different syndromes (Table 1). We estimated that among frail older persons, 459 older persons per 1,000 died within 1–2 years of followup.[182,187]

Within 3 years, 500–600 older persons with malnutrition, 351 with cognitive impairment, and 534 with severe dementia died per 1,000.[189,197,198] Disability in basic ADLs and IADLs were associated with the highest risk of mortality.[196]

Within 5 years, 490 older persons with malnutrition, 513 with frailty, 530 with elevated CRP, and 827–941 with vascular dementia died per 1,000.[70,91,141,186] Frailty and cognitive impairment were associated with 400–800 deaths per 1,000 during more than 5 years of followup.[23,148,199] Such estimations may not reflect mortality in age, sex, or race subgroups but demonstrate a burden of geriatric syndromes.

We also estimated population risk of mortality attributable to geriatric syndromes (Table 2). When population prevalence and multivariate adjusted relative risks were taken into account, more than 7 percent of deaths were attributable to multiple morbidities and elevated CRP. We estimated that 3–5 percent of deaths among elderly persons could be delayed if frailty was prevented. Prevention of mild cognitive impairment could result in delaying 5–6 percent of deaths among elderly persons. Overall, around 26 percent of deaths in elderly persons can be attributed to geriatric syndromes. Conversely, having the syndrome may affect the likelihood of benefitting from other interventions, such as prevention.

The prevalence and risk of mortality and institutionalization were almost inversely related. The prevalence of accumulation deficit frailty (which uses many components) was higher than phenotype frailty (which uses only a few components). The relative risk of mortality and institutionalization was higher for phenotype frailty (Figure 1). The same negative association was seen for more severe forms of the same syndrome. Prevalence of severe cognitive impairment and dementia were lower, but risk of mortality was higher when compared to mild cognitive impairment (Figure 2). A negative association between the prevalence of a syndrome and its effect on mortality was evident across those syndromes in which the more restricted definition defines a more severe state (Figure 3).

The remaining life expectancy of individuals with syndromes was estimated using the CDC United States Life Tables and the relative risk of death from pooled analyses and individual studies. Increased levels of allostatic load (impaired homeostasis) and dementia were associated with the lowest survival among older persons when compared to the general population in the United States. The data shown in Figure 4 represent a merger of several data sets to yield general trends. The influence on survival of some factors was much greater than others when we compared them across studies. Poor health, malnutrition, and allostatic load (impaired homeostasis) exerted twice the influence of factors such as comorbidity and frailty. Since not a single study measured and compared all syndromes in association with mortality, indirect comparisons may be erroneous. The size of the effect differed by age (and thus expected life expectancy) (Table 3). For the purposes of informing prevention decisions, relative risk is likely more useful than population attributable risk. In the young-old, ages 65–74 years, only the very few who were very ill or frail (e.g., homeostenosis, poor health, or advanced dementia) suffered significant alterations in predicted life expectancy. From ages 75–90 years there was maximal heterogeneity of disease and geriatric syndromic states, resulting in larger mortality deviations from unafflicted individuals than in other age groups. In the old-old, particularly past age 90 years, the added value of factoring in conditions and syndromes to predict mortality beyond 1 year was minimal.

Statistical Models

We found 28 studies that described prognostic indices that report mortality in elderly people.

Since previous indices are complex, time consuming, or have a lack of clinical applicability, recent studies have been designed to develop and validate easy-to-use indices using information readily available from administrative data, laboratory data, diagnoses, or self-reported health status data (Appendix E Table 47). Some indices were created for certain segments of the population (e.g., hospitalized elderly,[26,180-183] community dwellers,[4,23,27,148,155,184-188] or older people with acquired mental disorders).[189] Others have been developed with the use of nationally representative samples.[53,186,187,190] Most studies have been conducted in the U.S. population ages 50 years and older, but a few have been done in European countries[14,134,180,189,191,192] and Canada.[155,193,194]

To assess the predictive accuracy of the final logistic model used to derive the frailty index, calibration (i.e., the degree of similarity between predicted and actual risk) and discrimination (i.e., the ability of a risk score to correctly assign a higher mortality risk value to a person who died than to one who survived) were largely evaluated in many models (Appendix E Table 48).[4,24,26,27,53,114,134,155,181,182,184,187,193] The point scoring system created in the development (or derivation) cohort was applied to the validation cohort to determine risk scores for all of the population in the validation cohort. Then, the mean predicted mortality from the development cohort and the observed mortality in the validation cohort were compared in each quartile, quintile, or other groups of risk score. To determine the discrimination of the index, the area under the receiver operating characteristic curve (AUC) was calculated in both cohorts and compared. In general, studies chose to report number of deaths versus number at risk and AUC for both cohorts.[4,26,27,53,134,181,182,184,187] Validation procedures and results were not reported in the articles in a consistent manner. Variability in design, validation, and reporting of the models hampered comparison to conclude which models are better than others. The studies did not validate predictive models against actual life expectancies in the general population of older adults.

We believe that there are at least four areas to consider when evaluating prognostic instruments: simplicity, geriatric syndromes or disease approach, frailty or mortality indices, and short- or long-term estimate of the risk of mortality. We recognize an overlap between different categories of models.

Simplicity of the models. In simple models, all the variables should be either readily available or straightforward to measure (without the aid of any instrument) or found in medical records (Appendix E Table 49). The scoring system should be easy to follow and reproduce in clinical settings. Unless complex indices can be hard-wired into an electronic medical record, clinicians are unlikely to use them.

Some of the models were complex in terms of the number of index components, measurement of each component, weight method, and design of risk scoring systems.[27,180,186,190,191,193] These indices are time consuming and rely heavily on availability of clinical data or the clinician's experience. Therefore, they are not easy to use and are of limited clinical use, but they can be useful for research purposes (Appendix E Table 50).

Diseases versus geriatric syndromes. In an attempt to evaluate the added benefit of incorporating more functional and multidimensional predictors, we calculated the relative risk and attributable risk of different syndromes on mortality (Table 2). Some of the indices were oriented toward diseases as predictors, and some incorporated more geriatric principles such as geriatric syndromes and functionality. While disease-oriented methods are more pragmatic and easy to capture with administrative data, more gerocentric indices are more conceptually appealing and do appear to add predictive value.

Frailty or mortality indices. Among geriatric syndromes, frailty was examined to predict mortality with different composite indices. Fried et al[23] considers frailty as a unique clinical syndrome that differs from comorbidity or disability. According to Fried, an individual who is frail presents three of the following criteria: unintentional weight loss (10 pounds in past year), self-reported exhaustion, weakness (grip strength), slow walking speed, and low physical activity. Quite a few studies followed this approach, either adopting or improving their indices based upon Fried's model (Appendix E Table 51).[14,23,24,109,114,148,183,188]

The other widely accepted approach considers frailty as the accumulation of symptoms, diseases, and disabilities and combines all of them in one frailty index score (Appendix E Table 52).[4,26,27,53,155,180-182,184,186,187,189-191,193,194,332]

Short- or long-term mortality risk. Some of the indices were validated using a continuous mortality outcome variable, while others used categorical variables. Published models offer a range of 1–10 years for mortality prediction. Selection of how far one wants to assess mortality risk varies by clinical and policy considerations. A 1-year mortality risk would be important for revisiting patient preferences for care at the end of life (Appendix E Table 53). An assessment of 3-year mortality could be useful for health care providers in heightening awareness of the transition from a chronic disease to a frail state, and for patients in estate planning and putting other affairs in order. Five-year mortality risk is an important consideration for decisions regarding cancer screening, given that many cancer screening tests require 5 or more years to realize a benefit (Appendix E Table 54).[181] Whereas 6- to 10-year mortality risk might be useful for policy issues, shorter time spans are much more useful for individual patient care.

A few summary statements are possible:

- Simple disease-based measures, such as number of comorbid illnesses or measures of inflammation, add modestly to the relative risk of mortality but account for more population-based mortality burden due to their high prevalence.
- Advanced dementia is one specific condition that confers significantly added mortality risk.
- More complex syndromic measures, such as those assessing frailty or incorporating functional status (e.g., allostatic load), better capture increased mortality risk (indicated by higher relative risk) than simpler measures, as they more selectively identify the relatively few (indicated by lower population attributable risk) sickest patients most likely to experience deterioration in health and death.
- Simpler measures that reflect the *severity* of individual diseases, such as indicators of advanced dementia, or the overall *impact* of multiple conditions, such as assessments of overall health, also identify the fewer and sicker patients at higher risk of mortality.

In conclusion, complex mortality models added comparatively little understanding to more simply measured and calculated models. Measures of the impact of conditions and syndromes on overall health and functioning provided greater discrimination among individual patients for assessing mortality risk. Mortality predictors appeared to be relatively consistent across short- and long-range models. The greatest added advantage of mortality models over simple remaining life expectancy was observed among patients ages 75–90 years. Decisionmaking models that are based on various assumptions and simulation techniques need careful sensitivity analysis and validation.

Chapter 4. Discussion

This review examines the prevalence of common geriatric syndromes and their association with patient-centered outcomes. Syndrome definitions varied and overlapped. Prevalence estimates increased with age. Women had higher rates of frailty and all types of disabilities; African Americans had higher prevalence of multiple morbidities, frailty, malnutrition, and disability compared to Caucasians; and evidence on other minority subgroups was sparse.

All syndromes were associated with increased risk of death and institutionalization. Age and sex were strongly associated with mortality, and the additional presence of one or more conditions increased the effect. Using relative risk, several conditions strongly influenced mortality, including poor health, severe BADL disability, low BMI, dementia, and impaired homeostenosis. The syndromes increased the likelihood of death more among the young-old. For those older than age 90 years, factoring in conditions and syndromes in relation to survival added minimal value. Complexity was not associated with better mortality models in older persons.

Our review offers several insights. Previous studies have inconsistently defined the conditions we considered. Two factors influence the structure of the measure: composition (i.e., its combination of elements) and the cut-off score used to determine severity levels. The definition's nature, or operationalization, affects both the measure's prevalence and its predictive power—usually in opposite directions. Across all syndromes, we observed a negative association between syndrome prevalence and its effect on mortality, and more severe forms of the same syndrome demonstrated the same negative association. Also across all syndromes, more inclusive definitions led to higher prevalence but lower predictive value. Lower prevalence of severe cognitive impairment and dementia were associated with higher risk of mortality and institutionalization compared to more common mild cognitive impairment. Figure 1 shows how the measure's composition can affect its prevalence and strength of association with outcomes, while Figure 2 shows how different cut-off scores for the same measure affect its prevalence and strength of association.

Estimates of association varied depending on syndrome definitions, population subgroups, outcome definitions, and adjustment for correlated contributing factors. Some analyses addressed neither the multifactorial nature of geriatric syndromes nor the role of baseline diseases. For example, disability was an outcome of frailty but also part of frailty's definition. Adjustment for correlated multifactorial syndromes that ignored the definitive primary cause of disability or death may give invalid estimation of the association between syndromes and mortality. Not all studies separately examined age and specific disease contributions.

Geriatric syndromes had overlapping definitions or interacting pathophysiology.[1] For example, multimorbidity increased risk of frailty,[89,117] which in turn was associated with cognitive impairment, comorbidities, and disability. The prevalence of frailty demonstrated a dose response association with a larger number of comorbidities or ADL disabilities.[23,104] Sarcopenia was associated with significantly higher odds of multiple disabilities.[68,123] Elderly adults with impaired homeostasis had significantly greater odds of frailty[89] and disabilities.[46]

Interaction models are better suited than adjustment models for analyzing the multifactorial interactive nature of syndromes. Linear models that separately examine risk factors for chronic disease and patient outcomes are commonly accepted in disease epidemiology but fail to adequately address the multifactorial nature of geriatric syndromes.[1] The majority of studies, however, provided multivariate adjustment for known confounding factors, causes of death, and the presence of other syndromes. Models that analyzed the association between syndromes and mortality grouped primary causes of death into larger categories of cancer or cardiovascular diseases and adjusted for them. Using multivariate adjustment, the studies demonstrated significant association between each syndrome and outcomes, and concluded that syndromes contributed to the outcome independent of specific diseases included in the models. Concentric models include multiple etiological pathways contributing to the same clinical outcomes. Concentric models evaluate various pathways in developing and treating malignant tumors,[1] but like linear models, concentric models fail to capture the interacting nature of syndromes. Some authors have proposed interactive concentric models that address synergisms in how syndromes develop, and their association with outcomes.[1] However, published studies have provided insufficient evidence for better accuracy of interactive concentric models or of new measurement technologies.

Geriatric wisdom holds that age is a good predictor of average change but not of individual change because health status varies increasingly with age. The question then is whether a more complex approach that assigns varying weights to different syndromes/conditions is more useful than a more general approach that assigns older persons to general risk categories (e.g., high, medium, and low) and applies the 25th, 50th, and 75th percentiles of expected institutionalization or survival accordingly. When adjusted for age, the predictive value of the syndromes diminished by the time of followup to death. Few studies addressed syndrome length or used informative censoring when evaluating survival.[333] Few studies analyzed the order in which components of the syndromes manifested.

Ideally we would consider outcomes other than mortality, but the measures used present large problems of endogeneity. Measures of frailty and disability, already closely linked, contain elements central to quality of life. They are also the basis for institutionalization. Comparative effectiveness of outpatient management strategies for prevention of disability and institutionalization fell beyond our scope.

Increased knowledge of prevalence, epidemiology, and the relationship between syndromes and health status illuminates the environment in which patients and physicians make decisions about preventive services. At the population level, the relevant measure is population attributable risk, which includes prevalence and risk of death. However, clinicians' concerns are with individual prognosis. In that light, we based our estimation of life expectancy on the CDC United States Life Tables that incorporate average survival of older adults with different diseases and syndromes. Life expectancy was calculated assuming the same relative risk across the remaining life span. About 26 percent of the risk of death was attributable to the syndromes. Modifiable syndromes, including elevated CRP and allostatic load, were associated with 8.3 percent of all deaths in older persons. The effectiveness of preventive interventions in older persons would depend on their age and the nature of the syndromes. To be effective, preventive interventions targeting multimorbidity and geriatric syndromes in older persons may need to have multiple distinct components and must improve functional status.[334]

Our report has limitations. Several factors may affect interpretation of our results, including the metric chosen and population versus individual risks. We could not explain heterogeneity in prevalence estimates using available information about study participants or methodology. We analyzed the differences between self-reported syndromes and objectively assessed syndromes when possible. However, the studies used different methods to measure several syndromes, including disability. We could not address three-way interaction in prevalence estimates by age, sex, and race because the studies inconsistently analyzed these differences. We could not evaluate nonlinearity in the association between age and syndromes because the primary studies did not test the hypothesis of nonlinearity. We were not able to evaluate predictive value for all possible definitions of syndromes because no studies examined risk of death for different definitions of the same syndrome. We found limited evidence with which to examine race and ethnic differences in mortality and institutionalization in older persons with geriatric syndromes.

Future Research

Future research should address temporal associations between components of syndromes as well as the order in which various diagnostic criteria manifest. Individual patient data analysis from large cohort studies can provide a precise powered estimation of risk of death and institutionalization for age, race, and ethnic subgroups. Future research should also investigate how geriatric syndromes may modify utility and effectiveness of preventive and treatment interventions in older adults with geriatric syndromes.

Future research should address how prevention of modifiable geriatric syndromes may delay mortality and institutionalization. Future research should also examine how optimal outpatient management for older adults may prevent development of disability and institutionalization. An analytic framework for comparative effectiveness of different preventive interventions in aging populations should be developed. Such a framework should recognize the multifactorial nature of the syndromes and the importance of improved functional status.[334]

Evidence-based guidelines across disciplines should include assessment of geriatric syndromes for disease management in older adults, emphasizing functional independence as a central patient outcome. Knowledge of common geriatric syndromes should be translated into routine clinical practice.

References and Included Studies

(Note: This set of references is different from those in Appendix E.)

1. Inouye SK, Studenski S, Tinetti ME, et al. Geriatric syndromes: clinical, research, and policy implications of a core geriatric concept. *J Am Geriatr Soc*. 2007;55(5):780-91.
2. Fried LP, Walston JD, Ferrucci L. Frailty. In: Halter JB, Ouslander JG, Tinetti ME, Studenski S, High KP, Asthana S, eds. *Hazzard's Geriatric Medicine and Gerontology*. 6th ed. New York: McGraw Hill; 2009:631-45.
3. Tinetti ME, Inouye SK, Gill TM, Doucette JT. Shared risk factors for falls, incontinence, and functional dependence: unifying the approach to geriatric syndromes. *JAMA*. 1995;273(17):1348-53.
4. Inouye SK, Bogardus ST Jr, Vitagliano G, et al. Burden of illness score for elderly persons: risk adjustment incorporating the cumulative impact of diseases, physiologic abnormalities, and functional impairments. *Med Care*. 2003;41(1):70-83.
5. Rakowski W, Fleishman JA, Mor V, Bryant SA. Self-assessments of health and mortality among older persons: do questions other then global self-rated health predict mortality? *Res Aging*. 1993;15(1):92-116.
6. Wolinsky FD, Johnson RJ. Perceived health status and mortality among older men and women. *J Gerontol*. 1992;47(6):S304-12.
7. Wolinsky FD, Callahan CM, Fitzgerald JF, et al. Changes in functional status and the risks of subsequent nursing home placement and death. *J Gerontol*. 1993;48(3):S94-101.
8. Steinbach U. Social networks, institutionalization, and mortality among elderly people in the United States. *J Gerontol*. 1992;47(4):S183-90.
9. Johnston CB, Harper GM, Landefeld CS. Geriatric disorders. In: McPhee SJ, Papadakis MA, eds. *Current Medical Diagnosis & Treatment 2011*. 50th ed. New York: McGraw Hill; 2011:61-75.
10. Reuben DB, Rosen S. Principles of geriatric assessment. In: Halter JB, Ouslander JG, Tinetti ME, Studenski S, High KP, Asthana S, eds. *Hazzard's Geriatric Medicine and Gerontology*. 6th ed. New York: McGraw Hill; 2009:141-52.
11. Bourdel-Marchasson I, Berrut G. Caring the elderly diabetic patient with respect to concepts of successful aging and frailty. *Diabetes Metab*. 2005;31(2):5S13-9.
12. Rockwood K, Song X, MacKnight C, et al. A global clinical measure of fitness and frailty in elderly people. *CMAJ*. 2005;173(5):489-95.
13. Rockwood K, Mitnitski A, Song X, et al. Long-term risks of death and institutionalization of elderly people in relation to deficit accumulation at age 70. *J Am Geriatr Soc*. 2006;54(6):975-9.
14. Avila-Funes JA, Amieva H, Barberger-Gateau P, et al. Cognitive impairment improves the predictive validity of the phenotype of frailty for adverse health outcomes: the three-city study. *J Am Geriatr Soc*. 2009;57(3):453-61.
15. Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. *J Health Soc Behav*. 1997;38(1):21-37.
16. Branch LG, Katz S, Kniepmann K, et al. A prospective study of functional status among community elders. *Am J Public Health*. 1984;74(3):266-8.
17. Manton KG. Recent declines in chronic disability in the elderly U.S. population: risk factors and future dynamics. *Annu Rev Public Health*. 2008;29:91-113.

18. Fried LP, Ferrucci L, Darer J, et al. Untangling the concepts of disability, frailty, and comorbidity: implications for improved targeting and care. *J Gerontol A Biol Sci Med Sci*. 2004;59(3):255-63.
19. Markle-Reid M, Browne G. Conceptualizations of frailty in relation to older adults. *J Adv Nurs*. 2003;44(1):58-68.
20. Brown I, Renwick R, Raphael D. Frailty: constructing a common meaning, definition, and conceptual framework. *Int J Rehabil Res*. 1995;18(2):93-102.
21. Bortz WM 2nd. A conceptual framework of frailty: a review. *J Gerontol A Biol Sci Med Sci*. 2002;57(5):M283-8.
22. Rockwood K, Andrew M, Mitnitski A. A comparison of two approaches to measuring frailty in elderly people. *J Gerontol A Biol Sci Med Sci*. 2007;62(7):738-43.
23. Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: evidence for a phenotype. *J Gerontol A Biol Sci Med Sci*. 2001;56(3):M146-56.
24. Ensrud KE, Ewing SK, Taylor BC, et al. Comparison of 2 frailty indexes for prediction of falls, disability, fractures, and death in older women. *Arch Intern Med*. 2008;168(4):382-9.
25. Winograd CH, Gerety MB, Chung M, et al. Screening for frailty: criteria and predictors of outcomes. *J Am Geriatr Soc*. 1991;39(8):778-84.
26. Drame M, Novella JL, Lang PO, et al. Derivation and validation of a mortality-risk index from a cohort of frail elderly patients hospitalised in medical wards via emergencies: the SAFES study. *Eur J Epidemiol*. 2008;23(12):783-91.
27. Fried LP, Kronmal RA, Newman AB, et al. Risk factors for 5-year mortality in older adults: the Cardiovascular Health Study. *JAMA*. 1998;279(8):585-92.
28. Avila-Funes JA, Helmer C, Amieva H, et al. Frailty among community-dwelling elderly people in France: the three-city study. *J Gerontol A Biol Sci Med Sci*. 2008;63(10):1089-96.
29. Vanitallie TB. Frailty in the elderly: contributions of sarcopenia and visceral protein depletion. *Metabolism*. 2003;52(10 Suppl 2):22-6.
30. Kinney JM. Nutritional frailty, sarcopenia and falls in the elderly. *Curr Opin Clin Nutr Metab Care*. 2004;7(1):15-20.
31. Bauer JM, Sieber CC. Sarcopenia and frailty: a clinician's controversial point of view. *Exp Gerontol*. 2008;43(7):674-8.
32. Rockwood K, Hogan DB, MacKnight C. Conceptualisation and measurement of frailty in elderly people. *Drugs Aging*. 2000;17(4):295-302.
33. Topinkova E. Aging, disability and frailty. *Ann Nutr Metab*. 2008;52(Suppl 1):6-11.
34. Cigolle CT, Langa KM, Kabeto MU, et al. Geriatric conditions and disability: the Health and Retirement Study. *Ann Intern Med*. 2007;147(3):156-64.
35. Murray MD, Callahan CM. Improving medication use for older adults: an integrated research agenda. *Ann Intern Med*. 2003;139(5 Pt 2):425-9.
36. Bruunsgaard H, Pedersen BK. Age-related inflammatory cytokines and disease. *Immunol Allergy Clin North Am*. 2003;23(1):15-39.
37. Petersen RC, Smith GE, Waring SC, et al. Mild cognitive impairment: clinical characterization and outcome. *Arch Neurol*. 1999;56(3):303-8.
38. Petersen RC, Stevens JC, Ganguli M, et al. Practice parameter: early detection of dementia: mild cognitive impairment (an evidence-based review). Report of the Quality Standards Subcommittee of the American Academy of Neurology. *Neurology*. 2001;56(9):1133-42.
39. Kelman HR, Thomas C, Kennedy GJ, et al. Cognitive impairment and mortality in older community residents. *Am J Pub Health*. 1994;84(8):1255-60.

40. Gallo JJ, Schoen R, Jones R. Cognitive impairment and syndromal depression in estimates of active life expectancy: the 13-year follow-up of the Baltimore Epidemiologic Catchment Area sample. *Acta Psychiatra Scand*. 2000;101(4):265-73.
41. Raji MA, Al Snih S, Ray LA, et al. Cognitive status and incident disability in older Mexican Americans: findings from the Hispanic Established Population for the Epidemiological Study of the Elderly. *Ethn Dis*. 2004;14(1):26-31.
42. Rait G, Fletcher A, Smeeth L, et al. Prevalence of cognitive impairment: results from the MRC trial of assessment and management of older people in the community. *Age Ageing*. 2005;34(3):242-8.
43. Zanetti M, Ballabio C, Abbate C, et al. Mild cognitive impairment subtypes and vascular dementia in community-dwelling elderly people: a 3-year follow-up study. *J Am Geriatr Soc*. 2006;54(4):580-6.
44. Guehne U, Luck T, Busse A, et al. Mortality in individuals with mild cognitive impairment: results of the Leipzig Longitudinal Study of the Aged (LEILA75+). *Neuroepidemiology*. 2007;29(3-4):226-34.
45. Plassman BL, Langa KM, Fisher GG, et al. Prevalence of cognitive impairment without dementia in the United States. *Ann Intern Med*. 2008;148(6):427-34.
46. Stookey JD, Purser JL, Pieper CF, et al. Plasma hypertonicity: another marker of frailty? *J Am Geriatr Soc*. 2004;52(8):1313-20.
47. Bassuk SS, Berkman LF, Wypij D. Depressive symptomatology and incident cognitive decline in an elderly community sample. *Arch Gen Psychiatry*. 1998;55(12):1073-81.
48. Purser JL, Fillenbaum GG, Pieper CF, et al. Mild cognitive impairment and 10-year trajectories of disability in the Iowa Established Population for Epidemiologic Studies of the Elderly cohort. *J Am Geriatr Soc*. 2005;53(11):1966-72.
49. Pratt LA, Weeks JD, Goulding MR. Measures of cognitive functioning in the 1994–2000 Second Longitudinal Study of Aging. *Natl Health Stat Report*. 2008;(2):1-15.
50. Stephan BC, Matthews FE, McKeith IG, et al. Early cognitive change in the general population: how do different definitions work? *J Am Geriatr Soc*. 2007;55(10):1534-40.
51. Goggins WB, Woo J, Sham A, et al. Frailty index as a measure of biological age in a Chinese population. *J Gerontol A Biol Sci Med Sci*. 2005;60(8):1046-51.
52. Searle SD, Mitnitski A, Gahbauer EA, et al. A standard procedure for creating a frailty index. *BMC Geriatr*. 2008;8:24.
53. Lee SJ, Lindquist K, Segal MR, et al. Development and validation of a prognostic index for 4-year mortality in older adults. *JAMA*. 2006;295(7):801-8.
54. Ganguli M, Dodge HH, Mulsant BH. Rates and predictors of mortality in an aging, rural, community-based cohort: the role of depression. *Arch Gen Psychiatry*. 2002;59(11):1046-52.
55. Tabbarah M, Mihelic A, Crimmins E. Disability: the demographics of physical functioning and home environments of older Americans. *J Archit Plann Res*. 2001;18(3):183-93.
56. Chen PC, Wilmoth JM. The effects of residential mobility on ADL and IADL limitations among the very old living in the community. *J Gerontol B Psychol Sci Soc Sci*. 2004;59(3):S164-72.
57. Hanlon JT, Fillenbaum GG, Kuchibhatla M, et al. Impact of inappropriate drug use on mortality and functional status in representative community dwelling elders. *Med Care*. 2002;40(2):166-76.

58. Wiener JM, Hanley RJ, Clark R, et al. Measuring the activities of daily living: comparisons across national surveys. *J Gerontol*. 1990;45(6):S229-37.
59. Newman AB, Arnold AM, Sachs MC, et al. Long-term function in an older cohort—the Cardiovascular Health Study All Stars Study. *J Am Geriatr Soc*. 2009;57(3):432-40.
60. Fuller-Thomson E, Nuru-Jeter A, Minkler M, et al. Black-white disparities in disability among older Americans: further untangling the role of race and socioeconomic status. *J Aging Health*. 2009;21(5):677-98.
61. Fuller-Thomson E, Yu B, Nuru-Jeter A, et al. Basic ADL disability and functional limitation rates among older Americans from 2000–2005: the end of the decline? *J Gerontol A Biol Sci Med Sci*. 2009;64(12):1333-6.
62. Goins RT, Moss M, Buchwald D, et al. Disability among older American Indians and Alaska Natives: an analysis of the 2000 Census Public Use Microdata Sample. *Gerontologist*. 2007;47(5):690-6.
63. Bannerman E, Miller MD, Daniels LA, et al. Anthropometric indices predict physical function and mobility in older Australians: the Australian Longitudinal Study of Ageing. *Public Health Nutr*. 2002;5(5):655-62.
64. Corti MC, Guralnik JM, Salive ME, et al. Serum albumin level and physical disability as predictors of mortality in older persons. *JAMA*. 1994;272(13):1036-42.
65. Jette AM, Branch LG, Berlin J. Musculoskeletal impairments and physical disablement among the aged. *J Gerontol*. 1990;45(6):M203-8.
66. Nakasato YR, Carnes BA. Myopathy, polymyalgia rheumatica, and temporal arteritis. In: Halter JB, Ouslander JG, Tinetti ME, Studenski S, High KP, Asthana S, eds. *Hazzard's Geriatric Medicine and Gerontology*. 6th ed. New York: McGraw Hill; 2009:1445-52.
67. Gallagher D, Visser M, De Meersman RE, et al. Appendicular skeletal muscle mass: effects of age, gender, and ethnicity. *J Appl Physiol*. 1997;83(1):229-39.
68. Baumgartner RN, Koehler KM, Gallagher D, et al. Epidemiology of sarcopenia among the elderly in New Mexico. *Am J Epidemiol*. 1998;147(8):755-63.
69. Cruz-Jentoft AJ, Baeyens JP, Bauer JM, et al. Sarcopenia: European consensus on definition and diagnosis. Report of the European Working Group on Sarcopenia in Older People. *Age Ageing*. 2010;39(4):412-23.
70. Beck AM, Ovesen L, Osler M. The 'Mini Nutritional Assessment' (MNA) and the 'Determine Your Nutritional Health' checklist (NSI checklist) as predictors of morbidity and mortality in an elderly Danish population. *Br J Nutr*. 1999;81(1):31-6.
71. Newman AB, Yanez D, Harris T, et al. Weight change in old age and its association with mortality. *J Am Geriatr Soc*. 2001;49(10):1309-18.
72. Marshall JA, Lopez TK, Shetterly SM, et al. Indicators of nutritional risk in a rural elderly Hispanic and non-Hispanic white population: San Luis Valley Health and Aging Study. *J Am Diet Assoc*. 1999;99(3):315-22.
73. Onder G, Landi F, Volpato S, et al. Serum cholesterol levels and in-hospital mortality in the elderly. *Am J Med*. 2003;115(4):265-71.
74. Shannon J, Shikany JM, Barrett-Connor E, et al. Demographic factors associated with the diet quality of older US men: baseline data from the Osteoporotic Fractures in Men (MrOS) Study. *Public Health Nutr*. 2007;10(8):810-8.
75. Martin CT, Kayser-Jones J, Stotts NA, et al. Risk for low weight in community-dwelling, older adults. *Clin Nurse Spec*. 2007;21(4):203-11.

76. Ledikwe JH, Smiciklas-Wright H, Mitchell DC, et al. Dietary patterns of rural older adults are associated with weight and nutritional status. *J Am Geriatr Soc*. 2004;52(4):589-95.
77. Lesourd B, Decarli B, Dirren H. Longitudinal changes in iron and protein status of elderly Europeans. *Eur J Clin Nutr*. 1996;50(Suppl 2):S16-24.
78. Dallman PR, Yip R, Johnson C. Prevalence and causes of anemia in the United States, 1976 to 1980. *Am J Clin Nutr*. 1984;39(3):437-45.
79. Patel KV, Semba RD, Ferrucci L, et al. Red cell distribution width and mortality in older adults: a meta-analysis. *J Gerontol A Biol Sci Med Sci*. 2010;65(3):258-65.
80. Visser M, Deeg DJ, Puts MT, et al. Low serum concentrations of 25-hydroxyvitamin D in older persons and the risk of nursing home admission. *Am J Clin Nutr*. 2006;84(3):616-22.
81. Johnson MA, Fischer JG, Park S. Vitamin D deficiency and insufficiency in the Georgia Older Americans Nutrition Program. *J Nutr Elder*. 2008;27(1-2):29-46.
82. de Groot LC, Beck AM, Schroll M, et al. Evaluating the Determine Your Nutritional Health Checklist and the Mini Nutritional Assessment as tools to identify nutritional problems in elderly Europeans. *Eur J Clin Nutr*. 1998;52(12):877-83.
83. Visvanathan R, Macintosh C, Callary M, et al. The nutritional status of 250 older Australian recipients of domiciliary care services and its association with outcomes at 12 months. *J Am Geriatr Soc*. 2003;51(7):1007-11.
84. Weatherspoon LJ, Worthen HD, Handu D. Nutrition risk and associated factors in congregate meal participants in northern Florida: role of Elder Care Services (ECS). *J Nutr Elder*. 2004;24(2):37-54.
85. Yap KB, Niti M, Ng TP. Nutrition screening among community-dwelling older adults in Singapore. *Singapore Med J*. 2007;48(10):911-6.
86. Nelson KM, Reiber G, Kohler T, et al. Peripheral arterial disease in a multiethnic national sample: the role of conventional risk factors and allostatic load. *Ethn Dis*. 2007;17(4):669-75.
87. Cao JJ, Arnold AM, Manolio TA, et al. Association of carotid artery intima-media thickness, plaques, and C-reactive protein with future cardiovascular disease and all-cause mortality: the Cardiovascular Health Study. *Circulation*. 2007;116(1):32-8.
88. Visser M, Pahor M, Taaffe DR, et al. Relationship of interleukin-6 and tumor necrosis factor-alpha with muscle mass and muscle strength in elderly men and women: the Health ABC Study. *J Gerontol A Biol Sci Med Sci*. 2002;57(5):M326-32.
89. Szanton SL, Allen JK, Seplaki CL, et al. Allostatic load and frailty in the Women's Health and Aging Studies. *Biol Res Nurs*. 2009;10(3):248-56.
90. Lopez OL, Jagust WJ, DeKosky ST, et al. Prevalence and classification of mild cognitive impairment in the Cardiovascular Health Study Cognition Study: part 1. Arch Neurol. 2003;60(10):1385-9.
91. Kravitz BA, Corrada MM, Kawas CH. High levels of serum C-reactive protein are associated with greater risk of all-cause mortality, but not dementia, in the oldest-old: results from the 90+ Study. *J Am Geriatr Soc*. 2009;57(4):641-6.
92. Evans DA, Funkenstein HH, Albert MS, et al. Prevalence of Alzheimer's disease in a community population of older persons: higher than previously reported. *JAMA*. 1989;262(18):2551-6.
93. Ritchie K, Kildea D. Is senile dementia "age-related" or "ageing-related"?—evidence from meta-analysis of dementia prevalence in the oldest old. *Lancet*. 1995;346(8980):931-4.

94. Helmer C, Barberger-Gateau P, Letenneur L, et al. Subjective health and mortality in French elderly women and men. *J Gerontol B Psychol Sci Soc Sci*. 1999;54(2):S84-92.
95. Graham JE, Rockwood K, Beattie BL, et al. Prevalence and severity of cognitive impairment with and without dementia in an elderly population. *Lancet*. 1997;349:1793-6.
96. Pearson JM, Schlettwein-Gsell D, Brzozowska A, et al. Life style characteristics associated with nutritional risk in elderly subjects aged 80–85 years. *J Nutr Health Aging*. 2001;5(4):278-83.
97. Rocca WA, Hofman A, Brayne C, et al. The prevalence of vascular dementia in Europe: facts and fragments from 1980–1990 studies. *Ann Neurol*. 1991;30(6):817-24.
98. Tuokko H, Frerichs RJ. Cognitive impairment with no dementia (CIND): longitudinal studies, the findings, and the issues. *Clin Neuropsychol*. 2000;14(4):504-25.
99. Aggarwal NT, Wilson RS, Beck TL, et al. Mild cognitive impairment in different functional domains and incident Alzheimer's disease. *J Neurol Neurosurg Psychiatry*. 2005;76(11):1479-84.
100. Jessen F, Wiese B, Bachmann C, et al. Prediction of dementia by subjective memory impairment: effects of severity and temporal association with cognitive impairment. *Arch Gen Psychiatry*. 2010;67(4):414-22.
101. Brody KK, Johnson RE, Douglas Ried L. Evaluation of a self-report screening instrument to predict frailty outcomes in aging populations. *Gerontologist*. 1997;37(2):182-91.
102. Kang HG, Costa MD, Priplata AA, et al. Frailty and the degradation of complex balance dynamics during a dual-task protocol. *J Gerontol A Biol Sci Med Sci*. 2009;64(12):1304-11.
103. Gutman GM, Stark A, Donald A, et al. Contribution of self-reported health ratings to predicting frailty, institutionalization, and death over a 5-year period. *Int Psychogeriatr*. 2001;13(Supp 1):223-31.
104. Cigolle CT, Ofstedal MB, Tian Z, et al. Comparing models of frailty: the Health and Retirement Study. *J Am Geriatr Soc*. 2009;57(5):830-9.
105. Peterson MJ, Giuliani C, Morey MC, et al. Physical activity as a preventative factor for frailty: the Health, Aging, and Body Composition Study. *J Gerontol A Biol Sci Med Sci*. 2009;64(1):61-8.
106. Bowles J, Brooks T, Hayes-Reams P, et al. Frailty, family, and church support among urban African American elderly. *J Health Care Poor Underserved*. 2000;11(1):87-99.
107. Hardy SE, Dubin JA, Holford TR, et al. Transitions between states of disability and independence among older persons. *Am J Epidemiol*. 2005;161(6):575-84.
108. Ottenbacher KJ, Graham JE, Al Snih S, et al. Mexican Americans and frailty: findings from the Hispanic Established Populations Epidemiologic Studies of the Elderly. *Am J Public Health*. 2009;99(4):673-9.
109. Kiely DK, Cupples LA, Lipsitz LA. Validation and comparison of two frailty indexes: the MOBILIZE Boston Study. *J Am Geriatr Soc*. 2009;57(9):1532-9.
110. Santos-Eggimann B, Cuenoud P, Spagnoli J, et al. Prevalence of frailty in middle-aged and older community-dwelling Europeans living in 10 countries. *J Gerontol A Biol Sci Med Sci*. 2009;64(6):675-81.
111. Klein BE, Klein R, Knudtson MD, et al. Frailty, morbidity and survival. *Arch Gerontol Geriatr*. 2005;41(2):141-9.
112. Kenny AM, Waynik IY, Smith J, et al. Association between level of frailty and bone mineral density in community-dwelling men. *J Clin Densitom*. 2006;9(3):309-14.

113. Cawthon PM, Marshall LM, Michael Y, et al. Frailty in older men: prevalence, progression, and relationship with mortality. *J Am Geriatr Soc*. 2007;55(8):1216-23.
114. Ensrud KE, Ewing SK, Cawthon PM, et al. A comparison of frailty indexes for the prediction of falls, disability, fractures, and mortality in older men. *J Am Geriatr Soc*. 2009;57(3):492-8.
115. Song X, Mitnitski A, Rockwood K. Prevalence and 10-year outcomes of frailty in older adults in relation to deficit accumulation. *J Am Geriatr Soc*. 2010;58(4):681-7.
116. Ottenbacher KJ, Ostir GV, Peek MK, et al. Frailty in older Mexican Americans. *J Am Geriatr Soc*. 2005;53(9):1524-31.
117. Chang SS, Weiss CO, Xue QL, et al. Patterns of comorbid inflammatory diseases in frail older women: the Women's Health and Aging Studies I and II. *J Gerontol A Biol Sci Med Sci*. 2010;65(4):407-13.
118. Gardener EA, Huppert FA, Guralnik JM, et al. Middle-aged and mobility-limited: prevalence of disability and symptom attributions in a national survey. *J Gen Intern Med*. 2006;21(10):1091-6.
119. Hays JC, Keller HH, Ostbye T. The effects of nutrition-related factors on four-year mortality among a biracial sample of community-dwelling elders in the North Carolina Piedmont. *J Nutr Elder*. 2005;25(2):41-67.
120. Murtagh KN, Hubert HB. Gender differences in physical disability among an elderly cohort. *Am J Public Health*. 2004;94(8):1406-11.
121. Crimmins EM, Saito Y, Reynolds SL. Further evidence on recent trends in the prevalence and incidence of disability among older Americans from two sources: the LSOA and the NHIS. *J Gerontol B Psychol Sci Soc Sci*. 1997;52(2):S59-71.
122. Albert SM, Alam M, Nizamuddin M, et al. Comparative study of functional limitation and disability in old age: Delhi and New York City. *J Cross Cult Gerontol*. 2005;20(3):231-41.
123. Newman AB, Kupelian V, Visser M, et al. Sarcopenia: alternative definitions and associations with lower extremity function. *J Am Geriatr Soc*. 2003;51(11):1602-9.
124. Seeman TE, Crimmins E, Huang MH, et al. Cumulative biological risk and socio-economic differences in mortality: MacArthur Studies of Successful Aging. *Soc Sci Med*. 2004;58(10):1985-97.
125. Schultz-Larsen K, Avlund K. Tiredness in daily activities: a subjective measure for the identification of frailty among non-disabled community-living older adults. *Arch Gerontol Geriatr*. 2007;44(1):83-93.
126. Dorr DA, Jones SS, Burns L, et al. Use of health-related, quality-of-life metrics to predict mortality and hospitalizations in community-dwelling seniors. *J Am Geriatr Soc*. 2006;54(4):667-73.
127. Long SK, Liu K, Black K, et al. Getting by in the community: lessons from frail elders. *J Aging Soc Policy*. 2005;17(1):19-44.
128. Mor V, Wilcox V, Rakowski W, et al. Functional transitions among the elderly: patterns, predictors, and related hospital use. *Am J Public Health*. 1994;84(8):1274-80.
129. Tilvis RS, Kahonen-Vare MH, Jolkkonen J, et al. Predictors of cognitive decline and mortality of aged people over a 10-year period. *J Gerontol A Biol Sci Med Sci*. 2004;59(3):268-74.
130. Ahmad R, Bath PA. Identification of risk factors for 15-year mortality among community-dwelling older people using Cox regression and a genetic algorithm. *J Gerontol A Biol Sci Med Sci*. 2005;60(8):1052-8.

131. Onawola RS, LaVeist TA. Subjective health status as a determinant of mortality among African-American elders. *J Natl Med Assoc*. 1998;90(12):754-8.
132. Kersting RC. Impact of social support, diversity, and poverty on nursing home utilization in a nationally representative sample of older Americans. *Soc Work Health Care*. 2001;33(2):67-87.
133. Shelton P, Sager MA, Schraeder C. The Community Assessment Risk Screen (CARS): identifying elderly persons at risk for hospitalization or emergency department visit. *Am J Manag Care*. 2000;6(8):925-33.
134. Mazzaglia G, Roti L, Corsini G, et al. Screening of older community-dwelling people at risk for death and hospitalization: the Assistenza Socio-Sanitaria in Italia project. *J Am Geriatr Soc*. 2007;55(12):1955-60.
135. Wolinsky FD, Culler SD, Callahan CM, et al. Hospital resource consumption among older adults: a prospective analysis of episodes, length of stay, and charges over a seven-year period. *J Gerontol*. 1994;49(5):S240-52.
136. Aliyu MH, Adediran AS, Obisesan TO. Predictors of hospital admissions in the elderly: analysis of data from the Longitudinal Study on Aging. *J Natl Med Assoc*. 2003;95(12):1158-67.
137. Laditka JN. Hazards of hospitalization for ambulatory care sensitive conditions among older women: evidence of greater risks for African Americans and Hispanics. *Med Care Res Rev*. 2003;60(4):468-95.
138. Wolinsky FD, Stump TE, Johnson RJ. Hospital utilization profiles among older adults over time: consistency and volume among survivors and decedents. *J Gerontol B Psychol Sci Soc Sci*. 1995;50(2):S88-100.
139. Stearns SC, Kovar MG, Hayes K, et al. Risk indicators for hospitalization during the last year of life. *Health Serv Res*. 1996;31(1):49-69.
140. Boult C, Dowd B, McCaffrey D, et al. Screening elders for risk of hospital admission. *J Am Geriatr Soc*. 1993;41(8):811-7.
141. Ostbye T, Hill G, Steenhuis R. Mortality in elderly Canadians with and without dementia: a 5-year follow-up. *Neurology*. 1999;53(3):521-6.
142. Ostbye T, Steenhuis R, Wolfson C, et al. Predictors of five-year mortality in older Canadians: the Canadian Study of Health and Aging. *J Am Geriatr Soc*. 1999;47(10):1249-54.
143. Royall DR, Chiodo LK, Mouton C, et al. Cognitive predictors of mortality in elderly retirees: results from the Freedom House Study. *Am J Geriatr Psychiatry*. 2007;15(3):243-51.
144. Keller BK, Potter JF. Predictors of mortality in outpatient geriatric evaluation and management clinic patients. *J Gerontol*. 1994;49(6):M246-51.
145. St John PD, Montgomery PR, Kristjansson B, et al. Cognitive scores, even within the normal range, predict death and institutionalization. *Age Ageing*. 2002;31(5):373-8.
146. Wikby A, Ferguson F, Forsey R, et al. An immune risk phenotype, cognitive impairment, and survival in very late life: impact of allostatic load in Swedish octogenarian and nonagenarian humans. *J Gerontol A Biol Sci Med Sci*. 2005;60(5):556-65.
147. Rothman MD, Leo-Summers L, Gill TM. Prognostic significance of potential frailty criteria. *J Am Geriatr Soc*. 2008;56(12):2211-6.
148. Graham JE, Snih SA, Berges IM, et al. Frailty and 10-year mortality in community-living Mexican American older adults. *Gerontology*. 2009;55(6):644-51.

149. Dewey ME, Saz P. Dementia, cognitive impairment and mortality in persons aged 65 and over living in the community: a systematic review of the literature. *Int J Geriatr Psychiatry*. 2001;16(8):751-61.
150. Goodlin S, Boult C, Bubolz T, et al. Who will need long-term care? Creation and validation of an instrument that identifies older people at risk. *Dis Manag*. 2004;7(4):267-74.
151. Rockwood K, Stolee P, McDowell I. Factors associated with institutionalization of older people in Canada: testing a multifactorial definition of frailty. *J Am Geriatr Soc*. 1996;44(5):578-82.
152. Eaker ED, Vierkant RA, Mickel SF. Predictors of nursing home admission and/or death in incident Alzheimer's disease and other dementia cases compared to controls: a population-based study. *J Clin Epidemiol*. 2002;55(5):462-8.
153. Jones DM, Song X, Rockwood K. Operationalizing a frailty index from a standardized comprehensive geriatric assessment. *J Am Geriatr Soc*. 2004;52(11):1929-33.
154. Mitnitski A, Song X, Skoog I, et al. Relative fitness and frailty of elderly men and women in developed countries and their relationship with mortality. *J Am Geriatr Soc*. 2005;53(12):2184-9.
155. Jones D, Song X, Mitnitski A, et al. Evaluation of a frailty index based on a comprehensive geriatric assessment in a population based study of elderly Canadians. *Aging Clin Exp Res*. 2005;17(6):465-71.
156. Kulminski AM, Ukraintseva SV, Kulminskaya IV, et al. Cumulative deficits better characterize susceptibility to death in elderly people than phenotypic frailty: lessons from the Cardiovascular Health Study. *J Am Geriatr Soc*. 2008;56(5):898-903.
157. Hastings SN, Purser JL, Johnson KS, et al. Frailty predicts some but not all adverse outcomes in older adults discharged from the emergency department. *J Am Geriatr Soc.* 2008;56(9):1651-7.
158. Puts MT, Lips P, Deeg DJ. Sex differences in the risk of frailty for mortality independent of disability and chronic diseases. *J Am Geriatr Soc*. 2005;53(1):40-7.
159. Gu D, Dupre ME, Sautter J, et al. Frailty and mortality among Chinese at advanced ages. *J Gerontol B Psychol Sci Soc Sci*. 2009;64(2):279-89.
160. Bandeen-Roche K, Xue QL, Ferrucci L, et al. Phenotype of frailty: characterization in the Women's Health and Aging Studies. *J Gerontol A Biol Sci Med Sci*. 2006;61(3):262-6.
161. Dukers DF, Vermeer MH, Jaspars LH, et al. Expression of killer cell inhibitory receptors is restricted to true NK cell lymphomas and a subset of intestinal enteropathy-type T cell lymphomas with a cytotoxic phenotype. *J Clin Pathol*. 2001;54(3):224-8.
162. Harris T, Kovar MG, Suzman R, et al. Longitudinal study of physical ability in the oldest-old. *Am J Public Health*. 1989;79(6):698-702.
163. Ferrucci L, Guralnik JM, Pahor M, et al. Hospital diagnoses, Medicare charges, and nursing home admissions in the year when older persons become severely disabled. *JAMA*. 1997;277(9):728-34.
164. Anderson RT, James MK, Miller ME, et al. The timing of change: patterns in transitions in functional status among elderly persons. *J Gerontol B Psychol Sci Soc Sci*. 1998;53:S17-27.
165. Cesari M, Pahor M, Lauretani F, et al. Skeletal muscle and mortality results from the InCHIANTI Study. *J Gerontol A Biol Sci Med Sci*. 2009;64(3):377-84.
166. Volpato S, Guralnik JM, Ferrucci L, et al. Cardiovascular disease, interleukin-6, and risk of mortality in older women: the Women's Health and Aging Study. *Circulation*. 2001;103(7):947-53.

167. Raynaud-Simon A, Lafont S, Berr C, et al. Orosomucoid: a mortality risk factor in elderly people living in the community? *Clin Nutr*. 2002;21(1):45-50.
168. Zakai NA, Katz R, Hirsch C, et al. A prospective study of anemia status, hemoglobin concentration, and mortality in an elderly cohort: the Cardiovascular Health Study. *Arch Intern Med*. 2005;165(19):2214-20.
169. Semba RD, Ricks MO, Ferrucci L, et al. Types of anemia and mortality among older disabled women living in the community: the Women's Health and Aging Study I. *Aging Clin Exp Res*. 2007;19(4):259-64.
170. Carriere I, Dupuy AM, Lacroux A, et al. Biomarkers of inflammation and malnutrition associated with early death in healthy elderly people. *J Am Geriatr Soc*. 2008;56(5):840-6.
171. Zoppini G, Verlato G, Targher G, et al. Variability of body weight, pulse pressure and glycaemia strongly predict total mortality in elderly type 2 diabetic patients: the Verona Diabetes Study. *Diabetes Metab Res Rev*. 2008;24(8):624-8.
172. Seeman TE, McEwen BS, Rowe JW, et al. Allostatic load as a marker of cumulative biological risk: MacArthur Studies of Successful Aging. *Proc Natl Acad Sci U S A*. 2001;98(8):4770-5.
173. Karlamangla AS, Singer BH, Seeman TE. Reduction in allostatic load in older adults is associated with lower all-cause mortality risk: MacArthur Studies of Successful Aging. *Psychosom Med*. 2006;68(3):500-7.
174. Harris TB, Ferrucci L, Tracy RP, et al. Associations of elevated interleukin-6 and C-reactive protein levels with mortality in the elderly. *Am J Med*. 1999;106(5):506-12.
175. Cohen HJ, Harris T, Pieper CF. Coagulation and activation of inflammatory pathways in the development of functional decline and mortality in the elderly. *Am J Med*. 2003;114(3):180-7.
176. Bruunsgaard H, Andersen-Ranberg K, Hjelmborg JB, et al. Elevated levels of tumor necrosis factor alpha and mortality in centenarians. *Am J Med*. 2003;115(4):278-83.
177. Alley DE, Crimmins E, Bandeen-Roche K, et al. Three-year change in inflammatory markers in elderly people and mortality: the Invecchiare in Chianti Study. *J Am Geriatr Soc*. 2007;55(11):1801-7.
178. Jenny NS, Yanez ND, Psaty BM, et al. Inflammation biomarkers and near-term death in older men. *Am J Epidemiol*. 2007;165(6):684-95.
179. Jylha M, Paavilainen P, Lehtimaki T, et al. Interleukin-1 receptor antagonist, interleukin-6, and C-reactive protein as predictors of mortality in nonagenarians: the Vitality 90+ Study. *J Gerontol A Biol Sci Med Sci*. 2007;62(9):1016-21.
180. Pilotto A, Ferrucci L, Franceschi M, et al. Development and validation of a multidimensional prognostic index for one-year mortality from comprehensive geriatric assessment in hospitalized older patients. *Rejuvenation Res*. 2008;11(1):151-61.
181. Walter LC, Brand RJ, Counsell SR, et al. Development and validation of a prognostic index for 1-year mortality in older adults after hospitalization. *JAMA*. 2001;285(23):2987-94.
182. Levine SK, Sachs GA, Jin L, et al. A prognostic model for 1-year mortality in older adults after hospital discharge. *Am J Med*. 2007;120(5):455-60.
183. Purser JL, Kuchibhatla MN, Fillenbaum GG, et al. Identifying frailty in hospitalized older adults with significant coronary artery disease. *J Am Geriatr Soc*. 2006;54(11):1674-81.
184. Carey EC, Covinsky KE, Lui LY, et al. Prediction of mortality in community-living frail elderly people with long-term care needs. *J Am Geriatr Soc*. 2008;56(1):68-75.

185. Melzer D, Lan TY, Guralnik JM. The predictive validity for mortality of the index of mobility-related limitation—results from the EPESE Study. *Age Ageing*. 2003;32(6):619-25.
186. Schonberg MA, Davis RB, McCarthy EP, et al. Index to predict 5-year mortality of community-dwelling adults aged 65 and older using data from the National Health Interview Survey. *J Gen Intern Med*. 2009;24(10):1115-22.
187. Carey EC, Walter LC, Lindquist K, et al. Development and validation of a functional morbidity index to predict mortality in community-dwelling elders. *J Gen Intern Med*. 2004;19(10):1027-33.
188. Gill TM, Gahbauer EA, Allore HG, et al. Transitions between frailty states among community-living older persons. *Arch Intern Med*. 2006;166(4):418-23.
189. Pijpers E, Ferreira I, van de Laar RJ, et al. Predicting mortality of psychogeriatric patients: a simple prognostic frailty risk score. *Postgrad Med J*. 2009;85(1007):464-9.
190. Garcia-González JJ, Garcia-Peña C, Franco-Marina F, Gutiérrez-Robledo LM. A frailty index to predict the mortality risk in a population of senior Mexican adults. *BMC Geriatr*. 2009;9:47.
191. Ravaglia G, Forti P, Lucicesare A, et al. Development of an easy prognostic score for frailty outcomes in the aged. *Age Ageing*. 2008;37(2):161-6.
192. Albertsson DM, Mellstrom D, Petersson C, et al. Validation of a 4-item score predicting hip fracture and mortality risk among elderly women. *Ann Fam Med*. 2007;5(1):48-56.
193. Song X, Mitnitski A, MacKnight C, et al. Assessment of individual risk of death using self-report data: an artificial neural network compared with a frailty index. *J Am Geriatr Soc*. 2004;52(7):1180-4.
194. Mitnitski AB, Graham JE, Mogilner AJ, Rockwood K. Frailty, fitness and late-life mortality in relation to chronological and biological age. *BMC Geriatr*. 2002;2:1.
195. Woloshin S, Schwartz LM, Welch HG. The risk of death by age, sex, and smoking status in the United States: putting health risks in context. *J Natl Cancer Inst*. 2008;100(12):845-53.
196. Fried LP, Kronmal RA, Newman AB, et al. Risk factors for 5-year mortality in older adults: the Cardiovascular Health Study. *JAMA*. 1998;279(8):585-92.
197. Lee HB, Kasper JD, Shore AD, et al. Level of cognitive impairment predicts mortality in high-risk community samples: the Memory and Medical Care Study. *J Neuropsychiatry Clin Neurosci*. 2006;18(4):543-6.
198. Saletti A, Johansson L, Yifter-Lindgren E, et al. Nutritional status and a 3-year follow-up in elderly receiving support at home. *Gerontology*. 2005;51(3):192-8.
199. Stump TE, Callahan CM, Hendrie HC. Cognitive impairment and mortality in older primary care patients. *J Am Geriatr Soc*. 2001;49(7):934-40.
200. Wallace BC, Schmid CH, Lau J, Trikalinos TA. Meta-Analyst: software for meta-analysis of binary, continuous and diagnostic data. *BMC Med Res Methodol*. 2009;9:80.
201. Kuchel GA. Aging and homeostatic regulation. In: Halter JB, Ouslander JG, Tinetti ME, Studenski S, High KP, Asthana S, eds. *Hazzard's Geriatric Medicine and Gerontology*. 6th ed. New York: McGraw Hill; 2009:621-31.
202. Pizzarelli F, Lauretani F, Bandinelli S, et al. Predictivity of survival according to different equations for estimating renal function in community-dwelling elderly subjects. *Nephrol Dial Transplant*. 2009;24(4):1197-205.
203. Yancik R, Ershler W, Satariano W, et al. Report of the National Institute on Aging Task Force on Comorbidity. *J Gerontol A Biol Sci Med Sci*. 2007;62(3):275-80.

204. Charlson ME, Pompei P, Ales KL, et al. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis*. 1987;40(5):373-83.
205. Haider SI, Johnell K, Weitoft GR, et al. The influence of educational level on polypharmacy and inappropriate drug use: a register-based study of more than 600,000 older people. *J Am Geriatr Soc*. 2009;57(1):62-9.
206. Haider SI, Johnell K, Thorslund M, et al. Trends in polypharmacy and potential drug-drug interactions across educational groups in elderly patients in Sweden for the period 1992–2002. *Int J Clin Pharmacol Ther*. 2007;45(12):643-53.
207. Idler EL, Russell LB, Davis D. Survival, functional limitations, and self-rated health in the NHANES I Epidemiologic Follow-up Study, 1992. *Am J Epidemiol*. 2000;152(9):874-83.
208. Krause NM, Jay GM. What do global self-rated health items measure? *Med Care*. 1994;32(9):930-42.
209. Ferrucci L, Guralnik JM, Studenski S, et al. Designing randomized, controlled trials aimed at preventing or delaying functional decline and disability in frail, older persons: a consensus report. *J Am Geriatr Soc*. 2004;52(4):625-34.
210. Higgins JP, Green S, eds. Cochrane Handbook for Systematic Reviews of Interventions. Chichester, England: Wiley-Blackwell; 2008.
211. Viechtbauer W. Confidence intervals for the amount of heterogeneity in meta-analysis. *Stat Med*. 2007;26(1):37-52.
212. Knapp G, Biggerstaff BJ, Hartung J. Assessing the amount of heterogeneity in random-effects meta-analysis. *Biom J*. 2006;48(2):271-85.
213. Drummond MF. Methods for the Economic Evaluation of Health Care Programmes. 2nd ed. Oxford, England: Oxford University Press; 1997.
214. Gerard K, Seymour J, Smoker I. A tool to improve quality of reporting published economic analyses. *Int J Technol Assess Health Care*. 2000;16(1):100-10.
215. Aschengrau A, Seage GR III. Essentials of Epidemiology in Public Health. Sudbury, MA: Jones and Bartlett; 2003.
216. Sawaya GF, Guirguis-Blake J, LeFevre M, et al. Update on the methods of the U.S. Preventive Services Task Force: estimating certainty and magnitude of net benefit. *Ann Intern Med*. 2007;147(12):871-5.
217. Methods Guide for Comparative Effectiveness Reviews. AHRQ Publication No. 10(11)-EHC063-EF. Rockville, MD: Agency for Healthcare Research and Quality; 2011. Accessed at http://www.effectivehealthcare.ahrq.gov/healthInfo.cfm?infotype=rr&ProcessID=60 on 2 June 2011.
218. Bartali B, Frongillo EA, Guralnik JM, et al. Serum micronutrient concentrations and decline in physical function among older persons. *JAMA*. 2008;299(3):308-15.
219. van den Biggelaar AH, Huizinga TW, de Craen AJ, et al. Impaired innate immunity predicts frailty in old age: the Leiden 85-Plus Study. *Exp Gerontol*. 2004;39(9):1407-14.
220. Sarkisian CA, Gruenewald TL, John Boscardin W, et al. Preliminary evidence for subdimensions of geriatric frailty: the MacArthur Study of Successful Aging. *J Am Geriatr Soc*. 2008;56(12):2292-7.
221. Ory MG, Schechtman KB, Miller JP, et al. Frailty and injuries in later life: the FICSIT trials. *J Am Geriatr Soc*. 1993;41(3):283-96.
222. Brown M, Sinacore DR, Binder EF, et al. Physical and performance measures for the identification of mild to moderate frailty. *J Gerontol A Biol Sci Med Sci*. 2000;55(6): 350-5.

223. Gill TM, Williams CS, Richardson ED, et al. Impairments in physical performance and cognitive status as predisposing factors for functional dependence among nondisabled older persons. *J Gerontol A Biol Sci Med Sci*. 1996;51(6):M283-8.
224. Winograd CH, Gerety MB, Brown E, et al. Targeting the hospitalized elderly for geriatric consultation. *J Am Geriatr Soc*. 1988;36(12):1113-9.
225. Strawbridge WJ, Shema SJ, Balfour JL, et al. Antecedents of frailty over three decades in an older cohort. *J Gerontol B Psychol Sci Soc Sci*. 1998;53(1):S9-16.
226. Saliba D, Elliott M, Rubenstein LZ, et al. The Vulnerable Elders Survey: a tool for identifying vulnerable older people in the community. *J Am Geriatr Soc*. 2001;49(12):1691-9.
227. Pendergast DR, Fisher NM, Calkins E. Cardiovascular, neuromuscular, and metabolic alterations with age leading to frailty. *J Gerontol*. 1993;48:61-7.
228. Campbell AJ, Buchner DM. Unstable disability and the fluctuations of frailty. *Age Ageing*. 1997;26(4):315-8.
229. Dayhoff NE, Suhrheinrich J, Wigglesworth J, et al. Balance and muscle strength as predictors of frailty among older adults. *J Gerontol Nurs*. 1998;24(7):18-27.
230. Vellas B, Gillette-Guyonnet S, Nourhashémi F, et al. Falls, frailty and osteoporosis in the elderly: a public health problem [in French]. *Rev Med Interne*. 2000;21(7):608-13.
231. Rockwood K, Fox RA, Stolee P, et al. Frailty in elderly people: an evolving concept. *CMAJ*. 1994;150(4):489-95.
232. Chin AP, Dekker JM, Feskens EJ, et al. How to select a frail elderly population? A comparison of three working definitions. *J Clin Epidemiol*. 1999;52(11):1015-21.
233. Friedman DS, Wolfs RC, O'Colmain BJ, et al. Prevalence of open-angle glaucoma among adults in the United States. *Arch Ophthalmol*. 2004;122(4):532-8.
234. Jefferson AL, Massaro JM, Wolf PA, et al. Inflammatory biomarkers are associated with total brain volume: the Framingham Heart Study. *Neurology*. 2007;68(13):1032-8.
235. Stewart R, Masaki K, Xue QL, et al. A 32-year prospective study of change in body weight and incident dementia: the Honolulu-Asia Aging Study. *Arch Neurol*. 2005;62(1):55-60.
236. Tyas SL, Salazar JC, Snowdon DA, et al. Transitions to mild cognitive impairments, dementia, and death: findings from the Nun Study. *Am J Epidemiol*. 2007;165(11):1231-8.
237. Ensrud KE, Ewing SK, Taylor BC, et al. Frailty and risk of falls, fracture, and mortality in older women: the study of osteoporotic fractures. *J Gerontol A Biol Sci Med Sci*. 2007;62(7):744-51.
238. Fried LP, Xue QL, Cappola AR, et al. Nonlinear multisystem physiological dysregulation associated with frailty in older women: implications for etiology and treatment. *J Gerontol A Biol Sci Med Sci*. 2009;64(10):1049-57.
239. Cappola AR, Xue QL, Ferrucci L, et al. Insulin-like growth factor I and interleukin-6 contribute synergistically to disability and mortality in older women. J Clin Endocrinol Metab. 2003;88(5):2019-25.
240. Walston J, Xue Q, Semba RD, et al. Serum antioxidants, inflammation, and total mortality in older women. *Am J Epidemiol*. 2006;163(1):18-26.
241. Semba RD, Houston DK, Ferrucci L, et al. Low serum 25-hydroxyvitamin D concentrations are associated with greater all-cause mortality in older community-dwelling women. *Nutr Res*. 2009;29(8):525-30.
242. Fried LP, Bandeen-Roche K, Kasper JD, et al. Association of comorbidity with disability in older women: the Women's Health and Aging Study. *J Clin Epidemiol*. 1999;52(1):27-37.

243. Xue QL, Fried LP, Glass TA, et al. Life-space constriction, development of frailty, and the competing risk of mortality: the Women's Health and Aging Study I. *Am J Epidemiol*. 2008;167(2):240-8.
244. Schmaltz HN, Fried LP, Xue QL, et al. Chronic cytomegalovirus infection and inflammation are associated with prevalent frailty in community-dwelling older women. *J Am Geriatr Soc*. 2005;53(5):747-54.
245. Boyd CM, Xue QL, Simpson CF, et al. Frailty, hospitalization, and progression of disability in a cohort of disabled older women. *Am J Med*. 2005;118(11):1225-31.
246. Blaum CS, Xue QL, Tian J, et al. Is hyperglycemia associated with frailty status in older women? *J Am Geriatr Soc*. 2009;57(5):840-7.
247. Takahashi PY, Dyrbye LN, Thomas KG, et al. The association of transient ischemic attack symptoms with memory impairment among elderly participants of the third US National Health and Nutrition Examination Survey. *J Geriatr Psychiatry Neurol*. 2009;22(1):46-51.
248. Johnson TM 2nd, Bernard SL, Kincade JE, et al. Urinary incontinence and risk of death among community-living elderly people: results from the National Survey on Self-Care and Aging. *J Aging Health*. 2000;12(1):25-46.
249. Mathieson KM, Kronenfeld JJ, Keith VM. Maintaining functional independence in elderly adults: the roles of health status and financial resources in predicting home modifications and use of mobility equipment. *Gerontologist*. 2002;42(1):24-31.
250. Disability and frailty among elderly Canadians: a comparison of six surveys. *Int Psychogeriatr*. 2001;13(Supp 1):159-67.
251. Buurman BM, van Munster BC, Korevaar JC, et al. Prognostication in acutely admitted older patients by nurses and physicians. *J Gen Intern Med*. 2008;23(11):1883-9.
252. Solfrizzi V, Scafato E, Capurso C, et al. Metabolic syndrome, mild cognitive impairment, and progression to dementia: the Italian Longitudinal Study on Aging. *Neurobiol Aging*. 2009; Dec 30 [Epub ahead of print].
253. Wieland D, Lamb VL, Sutton SR, et al. Hospitalization in the Program of All-Inclusive Care for the Elderly (PACE): rates, concomitants, and predictors. *J Am Geriatr Soc*. 2000;48(11):1373-80.
254. de Groot LC, Verheijden MW, de Henauw S, et al. Lifestyle, nutritional status, health, and mortality in elderly people across Europe: a review of the longitudinal results of the SENECA study. *J Gerontol A Biol Sci Med Sci*. 2004;59(12):1277-84.
255. Perkins AJ, Kroenke K, Unutzer J, et al. Common comorbidity scales were similar in their ability to predict health care costs and mortality. *J Clin Epidemiol*. 2004;57(10):1040-8.
256. Zarowitz BJ, Stebelsky LA, Muma BK, et al. Reduction of high-risk polypharmacy drug combinations in patients in a managed care setting. *Pharmacotherapy*. 2005;25(11):1636-45.
257. Levy R. Aging-associated cognitive decline. *Int Psychogeriatr*. 1994;6(1):63-8.
258. Kral VA. Senescent memory decline and senile amnestic syndrome. *Am J Psychiatry*. 1958;115(4):361-2.
259. Ebly EM, Hogan DB, Parhad IM. Cognitive impairment in the nondemented elderly: results from the Canadian Study of Health and Aging. *Arch Neurol*. 1995;52(6):612-9.
260. Reisberg B, Ferris SH, de Leon MJ, et al. The Global Deterioration Scale for assessment of primary degenerative dementia. *Am J Psychiatry*. 1982;139(9):1136-9.
261. Raji MA, Kuo YF, Snih SA, et al. Cognitive status, muscle strength, and subsequent disability in older Mexican Americans. *J Am Geriatr Soc*. 2005;53(9):1462-8.

262. Ritchie K, Kildea D, Robine JM. The relationship between age and the prevalence of senile dementia: a meta-analysis of recent data. *Int J Epidemiol*. 1992;21(4):763-9.
263. Wolfson C, Wolfson DB, Asgharian M, et al. A reevaluation of the duration of survival after the onset of dementia. *N Engl J Med*. 2001;344(15):1111-6.
264. Tennstedt S, Cafferata GL, Sullivan L. Depression among caregivers of impaired elders. *J Aging Health*. 1992;4(1):58-76.
265. Xue QL, Bandeen-Roche K, Varadhan R, et al. Initial manifestations of frailty criteria and the development of frailty phenotype in the Women's Health and Aging Study II. *J Gerontol A Biol Sci Med Sci*. 2008;63(9):984-90.
266. Espino DV, Bazaldua OV, Palmer RF, et al. Suboptimal medication use and mortality in an older adult community-based cohort: results from the Hispanic EPESE Study. *J Gerontol A Biol Sci Med Sci*. 2006;61(2):170-5.
267. Rolland Y, Lauwers-Cances V, Cesari M, et al. Physical performance measures as predictors of mortality in a cohort of community-dwelling older French women. *Eur J Epidemiol*. 2006;21(2):113-22.
268. Baumgartner RN, Stauber PM, McHugh D, et al. Cross-sectional age differences in body composition in persons 60+ years of age. *J Gerontol A Biol Sci Med Sci*. 1995;50(6):M307-16.
269. Veehof L, Stewart R, Haaijer-Ruskamp F, et al. The development of polypharmacy: a longitudinal study. *Fam Pract*. 2000;17(3):261-7.
270. Pressley JC, Patrick CH. Frailty bias in comorbidity risk adjustments of community-dwelling elderly populations. *J Clin Epidemiol*. 1999;52(8):753-60.
271. National Center for Health Statistics. Health, United States, 2007. DHHS Publication No. 2007-1232. Hyattsville, MD: National Center for Health Statistics, Centers for Disease Control and Prevention; 2007. Accessed at http://www.cdc.gov/nchs/data/hus/hus07.pdf on 2 June 2011.
272. Gurland BJ, Dean LL, Copeland J, et al. Criteria for the diagnosis of dementia in the community elderly. *Gerontologist*. 1982;22(2):180-6.
273. Hughes CP, Berg L, Danziger WL, et al. A new clinical scale for the staging of dementia. *Br J Psychiatry*. 1982;140:566-72.
274. Morris JC, Edland S, Clark C, et al. The Consortium to Establish a Registry for Alzheimer's Disease (CERAD), part IV: rates of cognitive change in the longitudinal assessment of probable Alzheimer's disease. *Neurology*. 1993;43(12):2457-65.
275. Lichtman JH, Krumholz HM, Wang Y, et al. Risk and predictors of stroke after myocardial infarction among the elderly: results from the Cooperative Cardiovascular Project. *Circulation*. 2002;105(9):1082-7.
276. Lupon J, Gonzalez B, Santaeugenia S, et al. Prognostic implication of frailty and depressive symptoms in an outpatient population with heart failure. *Rev Esp Cardiol*. 2008;61(8):835-42.
277. Puts MT, Lips P, Deeg DJ. Static and dynamic measures of frailty predicted decline in performance-based and self-reported physical functioning. *J Clin Epidemiol*. 2005;58(11):1188-98.
278. Woo J, Tang NL, Suen E, et al. Telomeres and frailty. *Mech Ageing Dev*. 2008;129(11):642-8.

279. Boyle PA, Buchman AS, Wilson RS, et al. Physical frailty is associated with incident mild cognitive impairment in community-based older persons. *J Am Geriatr Soc*. 2010;58(2):248-55.
280. Grant MD, Piotrowski ZH, Chappell R. Self-reported health and survival in the Longitudinal Study of Aging, 1984–1986. *J Clin Epidemiol*. 1995;48(3):375-87.
281. Artero S, Ancelin ML, Portet F, et al. Risk profiles for mild cognitive impairment and progression to dementia are gender specific. *J Neurol Neurosurg Psychiatry*. 2008;79(9):979-84.
282. Fitzpatrick AL, Kuller LH, Ives DG, et al. Incidence and prevalence of dementia in the Cardiovascular Health Study. *J Am Geriatr Soc*. 2004;52(2):195-204.
283. Tuokko HA, Frerichs RJ, Kristjansson B. Cognitive impairment, no dementia: concepts and issues. *Int Psychogeriatr*. 2001;13(Supp 1):183-202.
284. Lee Y, Back JH, Kim J, et al. Systematic review of health behavioral risks and cognitive health in older adults. *Int Psychogeriatr*. 2010;22(2):174-87.
285. Kivipelto M, Rovio S, Ngandu T, et al. Apolipoprotein E ε4 magnifies lifestyle risks for dementia: a population-based study. *J Cell Mol Med*. 2008;12(6B):2762-71.
286. Taaffe DR, Irie F, Masaki KH, et al. Physical activity, physical function, and incident dementia in elderly men: the Honolulu-Asia Aging Study. *J Gerontol A Biol Sci Med Sci*. 2008;63(5):529-35.
287. Larson EB, Wang L, Bowen JD, et al. Exercise is associated with reduced risk for incident dementia among persons 65 years of age and older. *Ann Intern Med*. 2006;144(2):73-81.
288. Simons LA, Simons J, McCallum J, et al. Lifestyle factors and risk of dementia: Dubbo Study of the elderly. *Med J Aust*. 2006;184(2):68-70.
289. Podewils LJ, Guallar E, Kuller LH, et al. Physical activity, APOE genotype, and dementia risk: findings from the Cardiovascular Health Cognition Study. *Am J Epidemiol*. 2005;161(7):639-51.
290. Singh-Manoux A, Hillsdon M, Brunner E, et al. Effects of physical activity on cognitive functioning in middle age: evidence from the Whitehall II prospective cohort study. *Am J Public Health.* 2005;95(12):2252-8.
291. Abbott RD, White LR, Ross GW, et al. Walking and dementia in physically capable elderly men. *JAMA*. 2004;292(12):1447-53.
292. Weuve J, Kang JH, Manson JE, et al. Physical activity, including walking, and cognitive function in older women. *JAMA*. 2004;292(12):1454-61.
293. Reitz C, den Heijer T, van Duijn C, et al. Relation between smoking and risk of dementia and Alzheimer disease: the Rotterdam Study. *Neurology*. 2007;69(10):998-1005.
294. Tyas SL, White LR, Petrovitch H, et al. Mid-life smoking and late-life dementia: the Honolulu-Asia Aging Study. *Neurobiol Aging*. 2003;24(4):589-96.
295. Ott A, Slooter AJ, Hofman A, et al. Smoking and risk of dementia and Alzheimer's disease in a population-based cohort study: the Rotterdam Study. *Lancet*. 1998;351(9119):1840-3.
296. Ngandu T, Helkala EL, Soininen H, et al. Alcohol drinking and cognitive functions: findings from the Cardiovascular Risk Factors Aging and Dementia (CAIDE) Study. *Dement Geriatr Cogn Disord*. 2007;23(3):140-9.
297. Ganguli M, Vander Bilt J, Saxton JA, et al. Alcohol consumption and cognitive function in late life: a longitudinal community study. *Neurology*. 2005;65(8):1210-7.

298. Anttila T, Helkala EL, Viitanen M, et al. Alcohol drinking in middle age and subsequent risk of mild cognitive impairment and dementia in old age: a prospective population based study. *BMJ*. 2004;329(7465):539.
299. Luchsinger JA, Tang MX, Siddiqui M, et al. Alcohol intake and risk of dementia. *J Am Geriatr Soc*. 2004;52(4):540-6.
300. Elias PK, Elias MF, D'Agostino RB, et al. Alcohol consumption and cognitive performance in the Framingham Heart Study. *Am J Epidemiol*. 1999;150(6):580-9.
301. Whitmer RA, Gunderson EP, Quesenberry CP Jr, et al. Body mass index in midlife and risk of Alzheimer disease and vascular dementia. *Curr Alzheimer Res*. 2007;4(2):103-9.
302. Elias MF, Elias PK, Sullivan LM, et al. Obesity, diabetes and cognitive deficit: the Framingham Heart Study. *Neurobiol Aging*. 2005;26(Suppl 1):11-6.
303. Rosengren A, Skoog I, Gustafson D, et al. Body mass index, other cardiovascular risk factors, and hospitalization for dementia. *Arch Intern Med*. 2005;165(3):321-6.
304. Gustafson D, Rothenberg E, Blennow K, et al. An 18-year follow-up of overweight and risk of Alzheimer disease. *Arch Intern Med*. 2003;163(13):1524-8.
305. Eskelinen MH, Ngandu T, Helkala EL, et al. Fat intake at midlife and cognitive impairment later in life: a population-based CAIDE study. *Int J Geriatr Psychiatry*. 2008;23(7):741-7.
306. Tschanz JT, Welsh-Bohmer KA, Lyketsos CG, et al. Conversion to dementia from mild cognitive disorder: the Cache County Study. *Neurology*. 2006;67(2):229-34.
307. Schoenborn CA, Marano M. Current estimates from the National Health Interview Survey. *Vital Health Stat 10*. 1988;(166):1-233.
308. Malmgren JA, Koepsell TD, Martin DP, et al. Mortality, health services use, and health behavior in a cohort of well older adults. *J Am Geriatr Soc*. 1999;47(1):51-9.
309. Wolinsky FD, Johnson RL, Stump TE. The risk of mortality among older adults over an eight-year period. *Gerontologist*. 1995;35(2):150-61.
310. Porell FW, Miltiades HB. Disability outcomes of older Medicare HMO enrollees and fee-for-service Medicare beneficiaries. *J Am Geriatr Soc*. 2001;49(5):615-31.
311. Belgrave LL, Bradsher JE. Health as a factor in institutionalization. *Res Aging*. 1994;16(2):115-41.
312. Davies HT, Crombie IK, Tavakoli M. When can odds ratios mislead? *BMJ*. 1998;316(7136):989-91.
313. Fisk JD, Merry HR, Rockwood K. Variations in case definition affect prevalence but not outcomes of mild cognitive impairment. *Neurology*. 2003;61(9):1179-84.
314. Juva K, Sulkava R, Erkinjuntti T, et al. The prognosis of demented patients: one-year follow-up study of a population sample. *Int J Geriatr Psychiatry*. 1994;9:537-41.
315. Aevarsson O, Svanborg A, Skoog I. Seven-year survival rate after age 85 years: relation to Alzheimer disease and vascular dementia. *Arch Neurol*. 1998;55(9):1226-32.
316. Aguero-Torres H, Fratiglioni L, Winblad B. Natural history of Alzheimer's disease and other dementias: review of the literature in the light of the findings from the Kungsholmen Project. *Int J Geriatr Psychiatry*. 1998;13(11):755-66.
317. Baldereschi M, Di Carlo A, Maggi S, et al. Dementia is a major predictor of death among the Italian elderly. *Neurology*. 1999;52(4):709-13.
318. Bonaiuto S, Mele M, Galluzzo L, et al. Survival and dementia: a 7-year follow-up of an Italian elderly population. *Arch Gerontol Geriatr*.1995;20(1):105-13.

319. Banaszak-Holl J, Fendrick AM, Foster NL, et al. Predicting nursing home admission: estimates from a 7-year follow-up of a nationally representative sample of older Americans. *Alzheimer Dis Assoc Disord*. 2004;18(2):83-9.
320. Chodosh J, Seeman TE, Keeler E, et al. Cognitive decline in high-functioning older persons is associated with an increased risk of hospitalization. *J Am Geriatr Soc*. 2004;52(9):1456-62.
321. Weiner M, Powe NR, Weller WE, et al. Alzheimer's disease under managed care: implications from Medicare utilization and expenditure patterns. *J Am Geriatr Soc*. 1998;46(6):762-70.
322. Cawthon PM, Fox KM, Gandra SR, et al. Do muscle mass, muscle density, strength, and physical function similarly influence risk of hospitalization in older adults? *J Am Geriatr Soc*. 2009;57(8):1411-9.
323. Maggio M, Ceda GP, Lauretani F, et al. Relationship between higher estradiol levels and 9-year mortality in older women: the Invecchiare in Chianti study. *J Am Geriatr Soc*. 2009;57(10):1810-5.
324. Yaffe K, Lindquist K, Penninx BW, et al. Inflammatory markers and cognition in well-functioning African-American and white elders. *Neurology*. 2003;61(1):76-80.
325. Schaap LA, Pluijm SM, Deeg DJ, et al. Inflammatory markers and loss of muscle mass (sarcopenia) and strength. *Am J Med*. 2006;119(6):526.
326. Strandberg TE, Tilvis RS. C-reactive protein, cardiovascular risk factors, and mortality in a prospective study in the elderly. *Arterioscler Thromb Vasc Biol*. 2000;20(4):1057-60.
327. Speare A Jr, Avery R, Lawton L. Disability, residential mobility, and changes in living arrangements. *J Gerontol*. 1991;46(3):S133-42.
328. Kersting RC. Predictors of nursing home admission for older black Americans. *J Gerontol Soc Work*. 2001;35(3):33-50.
329. Naeim A, Keeler EB, Reuben D. Perceived causes of disability added prognostic value beyond medical conditions and functional status. *J Clin Epidemiol*. 2007;60(1):79-85.
330. Grabowski DC, Ellis JE. High body mass index does not predict mortality in older people: analysis of the Longitudinal Study of Aging. *J Am Geriatr Soc*. 2001;49(7):968-79.
331. Rakowski W, Hickey T. Mortality and the attribution of health problems to aging among older adults. *Am J Public Health*. 1992;82(8):1139-41.
332. Markides KS, Black SA, Ostir GV, et al. Lower body function and mortality in Mexican American elderly people. *J Gerontol A Biol Sci Med Sci*. 2001;56(4):M243-7.
333. Murphy TE, Han L, Allore HG, et al. Treatment of death in the analysis of longitudinal studies of gerontological outcomes. *J Gerontol A Biol Sci Med Sci*. 2011;66(1):109-14.
334. Leipzig RM, Whitlock EP, Wolff TA, et al. Reconsidering the approach to prevention recommendations for older adults. *Ann Intern Med*. 2010;153(12):809-14.

Acronyms/Abbreviations

3MSE	Modified Mini-Mental State Examination
ADLs	Activities of daily living
AHEAD	Asset and Health Dynamics Among the Oldest Old
AHRQ	Agency for Healthcare Research and Quality
AUC	Area under the receiver operating characteristic curve
BADLs	Basic activities of daily living
BISEP	Burden of Illness Score for Elderly Persons
BMI	Body mass index
CDC	Centers for Disease Control and Prevention
CHS	Cardiovascular Health Study
CI	Confidence interval
COL	Colonoscopy
CRP	C-reactive protein
DCBE	Double-contrast barium enema
DSM	Diagnostic and Statistical Manual of Mental Disorders
ED	Emergency department
EWGSOP	European Working Group on Sarcopenia in Older People
F-DNA	Fecal DNA testing
FOBT	Fecal occult blood testing
GMS	Geriatric Mental Status Examination
Health ABC	Health Aging and Body Composition
HR	Hazard ratio
IADLs	Instrumental activities of daily living
IL	Interleukin
LSOA	Longitudinal Study of Aging
MHCPS	Massachusetts Health Care Panel Study
MeSH	Medical subject headings
MMSE	Mini-Mental State Examination
MNA	Mini Nutritional Assessment
NHANES	National Health and Nutrition Examination Survey
OR	Odds ratio
PAQUID	Personnes Agées QUID
PAR	Population attributable risk
PICOTS	Population, Intervention, Comparator, Outcomes, Time, and Settings
PEP	Precipitating Events Project
RCT	Randomized controlled trial
RDW	Red cell distribution width
RR	Relative risk
SHARE	Survey of Health, Aging, and Retirement in Europe
SIG	Flexible sigmoidoscopy
SPMSQ	Short Portable Mental Status Questionnaire
TEP	Technical expert panel
TICS	Telephone Interview of Cognitive Status
USPSTF	U.S. Preventive Services Task Force

Table 1. Mortality Among Older Persons With Geriatric Syndromes

Reference	Syndrome	Deaths per 1,000 Elderly Persons With Different Definitions of the Syndrome				
3-Year Mortality						
	Dependent in ADLs or IADLs					
Carey, 2008[184]	Preparing meals	Shopping	Housework	Laundry	Managing finances	Taking medications
	424	416	418	411	424	**439**
	Bathing	Toileting	Transferring	Eating	Dressing	Walking across a room
	418	470	**476**	463	434	450
	Cognitive impairment					
Lee, 2006[197]	No cognitive disorder	Mild cognitive impairment	Mild dementia	Moderate dementia	Severe dementia	
	63	180	260	280	**534**	
Pijpers, 2009[189]	MMSE score >24	MMSE score ≤24				
	192	**351**				
	Frailty					
Fried, 2001[23]	Not frail	Intermediate	Frail			
	30	70	180			
	Frailty phenotype					
Ensrud, 2009[114]	Not Frail	Intermediate	Frail			
	29	62	166			
Fried, 2001[23]	Not Frail	Intermediate	Frail			
	30	70	180			
	Malnutrition					
Saletti, 2005[198]	Well Nourished	At risk of malnutrition	Malnutrition			
	279	400	**500**			
	BMI 20-23	BMI 23-28	BMI <20			
	348	353	**500**			
Pijpers, 2009[189]	BMI ≥8.5	BMI <18.5				
	274	**611**				
5-Year Mortality						
	Self-perceived health					
Gutman, 2001[103]	Very good	Pretty good	Not too good	Poor/very poor		
	146	225	359	339		

	Cognitive impairment									
	Cognitively normal		Alzheimer's disease		Vascular dementia		Other dementia and cognitive impairment			
Ostbye, 1999[141]	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*		
65-74 yrs	156	200	579	684	600	739	342	422		
75-84 yrs	237	359	643	725	776	769	468	577		
85+ yrs	448	500	**820**	**911**	**827**	**941**	**613**	**680**		

	Disability					
Schonberg, 2009[186]	**Quintile of Risk** (Age, sex, smoking, BMI, perceived health, ADL or IADL disability, emotional health, comorbidity, hospitalization, emergency room and clinic visits)					
	1	2	3	4	5	
	60	100	140	270	520	
	50	100	170	310	500	
	57	100	151	284	**513**	

Table 1. Mortality Among Older Persons With Geriatric Syndromes

Reference	Syndrome	Deaths per 1,000 Elderly Persons With Different Definitions of the Syndrome					
	Disability (cont'd)						
	Mortality Index, Points (Age, sex, smoking, BMI, perceived health, ADL or IADL disability, emotional health, comorbidity, hospitalization, emergency room and clinic visits)						
Schonberg, 2009[186]	0-1	2-3	4-5	6-7	8-9	10-11	
	20	70	80	110	150	250	
	30	50	80	120	190	290	
	24	63	80	114	164	264	
Lee, 2006[53]	Difficulty bathing	Difficulty preparing meals	Difficulty using telephone	Difficulty managing finances	Difficulty walking several blocks	Difficulty pushing heavy objects	
	431	334	**454**	364	257	224	
	Malnutrition						
Beck, 1999[70]	NSI checklist	NSI checklist	MNA	MNA			
	0-5	≥6	≥24	17-23.5			
	230	360	170	**490**			
	Chronic inflammation						
Kravitz, 2009[91]	CRP						
	Undetectable (<0.5)	Detectable (0.5-0.7)	Elevated (≥0.8)				
	375	531	**530**				
5- to 7-Year Mortality							
	Cognitive impairment						
Stump, 2001[199]	None	Mild	Moderate to severe				
	214	215	**408**				
	Frailty						
Fried, 2001[23]	Not frail	Intermediate	Frail				
	120	230	**430**				
10-Year Mortality							
	Disability						
Graham, 2009[148]	**ADL limitation**	**IADL limitation**					
	805	555					
	Frailty						
Graham, 2009[148]	Not Frail	Intermediate	Frail				
	336	487	**840**				

Bold indicates the best predictors of mortality.

Table 2. Population Risk of Mortality Attributable to Geriatric Syndromes, Sorted in Descending Order of Population Attributable Risk

Syndrome	Definition	Prevalence (%)	Relative Risk	PAR (%)
Multiple comorbidity*	>3 diseases	31	1.32-2.12	7.52-16.38
BADL disability	Moderate	16.1-20.5	14.1	15.8
Chronic inflammation*	Elevated CRP	24.4	1.42	7.22
BADL disability	Severe	6.0-7.8	86.8	6.9
Frailty*	Phenotype	14.35	1.5	4.78
Cognitive impairment*	MMSE score <24	16.86	1.37-1.61	4.55-6.39
Cognitive impairment	MMSE score <18	7.5	2.2	4.09
Multiple comorbidity	Poor health, men	6.94	2.33	3.96
Multiple comorbidity	Poor health, women	6.71	2.35	3.85
Cognitive impairment	Dementia	6.28	2.2-2.69	3.43-3.95
Frailty	Accumulation deficit	23.57	1.15	3.07
Multiple comorbidity	Poor health	2.93	2.04	1.49
Malnutrition*	Low BMI	2.3	2.03	1.17
Homeostenosis*	Allostatic load score 6 vs. 1	1.4	4.45	1.09

*Combining PAR, 26% of mortality in elderly persons was attributable to geriatric syndromes.

Table 3. Differences in Remaining Life Expectancy Between Older Persons From the General Population and Older Persons With Geriatric Syndromes

Age	Remaining Life Expectancy in General Population	Multiple Morbidity (>3 Diseases)	Elevated CRP	Frailty (Phenotype)	MMSE Score <24	MMSE Score <18	Accumulation Deficit	Poor Health	Low BMI	Allostatic Load	ADL Disability
65	18.4	-2.2	-2.8	-3.2	-2.5	-6.0	-1.1	-5.6	-5.4	-10.3	-3.85
70	14.9	-2.0	-2.5	-2.8	-2.2	-5.3	-1.0	-5.0	-4.8	-8.9	-3.43
75	11.7	-1.7	-2.1	-2.5	-1.9	-4.5	-0.9	-4.3	-4.1	-7.5	-2.97
80	8.9	-1.4	-1.8	-2.1	-1.6	-3.7	-0.7	-3.6	-3.4	-6.0	-2.48
85	6.5	-1.1	-1.4	-1.6	-1.3	-3.0	-0.6	-2.8	-2.7	-4.7	-1.98
90	4.6	-0.8	-1.1	-1.2	-1.0	-2.2	-0.4	-2.1	-2.0	-3.5	-1.45
95	2.8	-0.5	-0.6	-0.7	-0.6	-1.3	-0.2	-1.3	-1.2	-2.2	-0.86
100	0.4	-0.1	-0.1	-0.1	-0.1	-0.3	-0.1	-0.2	-0.2	-0.4	-0.17

Table 4. Population, Intervention, Comparator, Outcomes, Time, and Settings for Each Research Question (PICOTS Framework)

Question	Population	Intervention (Independent Variable)	Comparator	Outcomes	Time, Setting
1. What is the definition and prevalence of common syndromes/conditions in older adults?	Elderly: >65 years ≥80 years in community	Definitions of the outcomes Measurements of the outcomes Socioeconomic groups Race groups	Definitions of the outcomes Measurements of the outcomes Socioeconomic groups Race groups	Prevalence of cognitive impairment -Frailty -Malnutrition -Multiple morbidities (using polypharmacy as a proxy) -Homeostenosis -Disability -Sarcopenia -Chronic inflammation	1990-2009 General population
2. What is the prevalence of common syndromes/ conditions in older adults in sex, age, race, ethnicity, and other subgroups?	Elderly: >65 years ≥80 years in community	Sex: male Age: age categories Comorbidity	Sex: female Age: age categories No comorbidity	Prevalence of cognitive impairment -Frailty -Malnutrition -Multiple morbidities (using polypharmacy as a proxy) -Homeostenosis -Disability -Sarcopenia -Chronic inflammation	1990-2009 General population
3. What is the association between these common syndromes/conditions and mortality, institutionalization, hospitalization, and activities of daily living?	Elderly : >65 years ≥80 years in community	Prevalence and degree of cognitive impairment -Frailty -Malnutrition -Multiple morbidities (using polypharmacy as a proxy) -Homeostenosis -Disability -Sarcopenia -Chronic inflammation	Absence or low degree of cognitive impairment -Frailty -Malnutrition -Multiple morbidities (using polypharmacy as a proxy) -Homeostenosis -Disability -Sarcopenia -Chronic inflammation	Morbidity Mortality Disability Institutionalization	1990-2009 General population
4. What statistical and decisionmaking models predict mortality based on these common geriatric syndromes/conditions?	Elderly: >65 years ≥80 years in community	Prevalence and degree of cognitive impairment -Frailty -Malnutrition -Multiple morbidities (using polypharmacy as a proxy) -Homeostenosis -Disability -Sarcopenia -Chronic inflammation	Statistical modeling of the association between interacting syndromes and conditions and patient outcomes	Morbidity Mortality	1990-2009 General population

Table 5. Definitions of Homeostatic Dysregulation in Older Persons, Modified From Kuchel[201]

Syndrome	Operational Definition
Impaired Homeostasis	
Homeostenosis	Diminished capacity to respond to varied homeostatic challenges, such as changes in ambient temperature, orthostasis, fluid load, or dehydration. High plasma tonicity (>300 mOsm/L[46]) Greater intraindividual variability in fasting glucose, pulse pressure, and BMI[171]
Abnormal allostatic load[86,89,124]	Increased biological burden in terms of estimates of cumulative exposure exacted by attempts to adapt to life's demands predicts future mortality, as well as declines in cognitive and physical function: • High-sensitivity CRP (>5.0 mg/L) • Albumin (<3.6 g/dL) • IL-6 (>2.76 pg/ml) • Aldosterone (<4.5 ng/dL) • Urinary cortisol • Males (<25.0 or >72.0 mg/24 hours) • Females (<8.0 or >37.0 mg/24 hours) • Dehydroepiandrosterone sulfate • Males (<79.5 mg/dL) • Females (<15.5 mg/dL) • Epinephrine (>24.0 pg/mL) • Norepinephrine (>433.0 pg/mL)
Excessive response to stressors	Sympathetic responses to common challenges are excessively large and prolonged.[124] High urinary epinephrine High urinary free cortisol High urinary norepinephrine Stress hormone index
Malnutrition	
Poor nutritional status	Significant weight change: a) 10% of body weight in 6 months or b) involuntary loss of >10 lb in 6 months[70-72] Anthropometric data: body mass index <20[46,72-76,166,167] Laboratory data: serum prealbumin <15 mg/dl,[167,170] serum transferrin <200 mg/dl, or serum albumin <3.5 g/dl[73,75,124,167,170] Anemia with nutritional deficiencies[169] Red cell distribution width[79] Transthyretin (mg/L)[167,170] Micronutrients deficit[79-81,218]
Composite nutritional score	Risk of malnutrition accoridng to the Mini Nutritional Assessment; maximum score is 30, with cut-off values of 24 points (well nourished), 17 points (risk of malnutrition), <17 (malnourished).[70,82,83] Nutritional risk using the "Determine Your Nutritional Health Checklist": low nutritional risk (0-2), moderate risk (3-5), and high risk (6+)[70,72,82,84,85]
Chronic Inflammation	
Increased levels of individual biomarkers	Elevated high-sensitivity CRP[87,124,166,167,170,174,176,177,202] Increased levels of Interleukin-6[124,174-177] CD4/CD8 ratio[146] High fibrinogen[124] High D-dimer levels[175] Increased levels of tumor necrosis factor-alpha[176]
Inflammatory indices	Balance between pro-inflammatory and anti-inflammatory markers[124,219] Elevated levels of several biomarkers[124,174,219,220]
Prognostic inflammatory and nutritional indices	Prognostic Inflammatory and Nutritional Index (PINI) defined as (CRP * alpha 1-acid glycoprotein)/(albumin * transthyretin)[170]

Table 6. Reported Components of Frailty Syndrome By the Interventions on Frailty Working Group[209]

Reference	Mobility	Strength	Balance	Motor Processing	Cognition	Nutrition	Endurance	Physical Activity
Ory 1993[221]	X	X	X		X		X	
Brown 2000[222]	X	X	X	X				
Tinetti 1995[3]	X	X						
Fried 2001[23]	X	X				X	X	X
Gill 1996[223]	X		X					
Winograd 1988[224]	X				X	X		X
Strawbridge 1998[225]	X				X	X		
Saliba 2001[226]	X							
Pendergast 1993[227]		X	X	X			X	
Campbell 1997[228]		X	X	X	X	X	X	
Dayhoff 1998[229]		X	X					
Vellas 2000[230]		X				X	X	X
Rockwood 1994[231]					X			X
Chin 1999[232]						X		X

Table 7. Summary of Basic and Instrumental ADL Disability Definitions

Disability Definition	Operational Definition of Disability
Any BADL disability	1 or more BADL items present
Moderate BADL disability	1 to 2 BADL items
Severe BADL disability	3 or more BADL items
BADL disability continuous	BADLs measured on a continuous scale
Individual BADL disability items	Measure only contains 1 BADL item (bathing, dressing/hygiene, eating, toileting, transferring, walking)
Any IADL disability	1 or more IADL items present
Moderate IADL disability	1 to 2 IADL items
Severe IADL disability	3 or more IADL items
IADL disability continuous	IADLs measured on a continuous scale
Individual IADL disability items	Measure only contains 1 IADL item (finances, housekeeping, meal preparation, shopping, medication management, telephone, transportation)
Any BADL/IADL disability	
BADL/IADL disability continuous	

Table 8. Prevalence of Multiple Morbidities in Older Persons

Number of Chronic Conditions (high level of evidence)	Polypharmacy (low level of evidence)	Self-Perceived Health (high level of evidence)
Suffer from chronic diseases: 77.4%[254]	2-3 drugs: 40.7%[269]	Fair/poor: Pooled 28.24% (95% CI, 20.98-38.00)[14,103,109,250]
3-4: 18.7-30.7%[250,270]	4-5 drugs: 0.09%[269]	Poor: Pooled 2.93% (95% CI, 1.90-4.51)[14,103,109,250]
≥3: 27.80-36.60%*	5-9 drugs: 21.8%[152]	
≥4: 10.8%[270]	>5 drugs: 29.0%[256] to 56.6%[205] >11 drugs: 17.7%[205]	
5-6: 8.2-18.3%[250]		
>5: 23%[176]		
≥7: 1.9-13.9%[250]		
8-10: 20.1%[152]		
≥11: 23.7%[152]		

*From the National Health Interview Survey.

Table 9. Components of Systems Classifying Cognitive Impairment in Older Persons[50]

System, Reference	Criteria
Age-associated cognitive decline[257]	Impairments (below age- and education-matched norms) in memory, learning, attention, thinking, language, or visuospatial functioning. Onset of decline is described as gradual and has been present for at least 6 months, which is confirmed by an informant.
Age-associated memory impairment[50]	Gradual decline in memory (below young healthy norms), with other cognitive functions unimpaired. Adequate intellectual functioning.
Age-consistent memory impairment[50]	Decline in memory is observed as expected for age. Performance ±1 SD of the mean established for age on 75% or more of memory tests administered.
Age-related cognitive decline	Objective decline from premorbid level (within normal limits for the person's age) in cognitive function on a comprehensive neuropsychological assessment, not otherwise specified.
Benign senescent forgetfulness[258]	Inability to recall relatively unimportant data and parts of experiences belonging to remote rather than the recent past; use of compensatory strategies.
Cognitive impairment, no dementia[259]	Cognitively impaired but no evidence of dementia, as diagnosed according to the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*; cognitive impairment can be in one or multiple domains and have a variety of aetiologies. This category is therefore more inclusive than age-associated memory impairment and age-related cognitive decline.
Limited cognitive disturbance[272]	Referred to in the Comprehensive Assessment and Referral Evaluation and contrasts with pervasive cognitive disturbance and dementia.
Mild cognitive decline[260]	Stage 3 of the Global Deterioration Scale, the earliest stage of clinical decline. Objective evidence of a memory deficit resulting in decreased performance in demanding employment and social situations.
Moderate cognitive decline[260]	Stage 4 of the Global Deterioration Scale, a late confusional phase in which a clear cut deficit is apparent. Patients almost always make three or more errors on the Mental Status Questionnaire.
Mild cognitive disorder[50]	Decline in cognitive performance, including memory impairment and learning or concentration difficulties. Cognitive tests must corroborate complaint. The disorder may precede, accompany, or follow a wide variety of infections.
Mild cognitive impairment (amnestic)[37,38]	Subjective complaint of memory impairment with objective memory impairment adjusted for age. Normal general cognitive function. Intact activities of daily living/instrumental activities of daily living.
Mild cognitive impairment[37] (multiple)[38]	Deterioration in at least one nonmemory cognitive domain in addition to memory impairment without sufficiently severe functional impairment or loss of instrumental activities of daily living to constitute dementia. Normal general cognitive function.
Mild cognitive impairment (nonamnestic) [50]	Objective impairment in one or more nonmemory domains. Memory performance is not impaired. No functional impairment or loss of instrumental activities of daily living. Normal general cognitive function.
Probable mild cognitive impairment[90]	Meeting the following criteria: 1) participants or their families reported cognitive problems and 2) there were no neurological, psychiatric, or systemic illnesses that could explain the presence of cognitive deficits.
Possible mild cognitive impairment[90]	Meeting the following criteria: 1) neither participants nor their families reported cognitive problems; or 2) there were neurological, psychiatric, or systemic illnesses that might explain the presence of cognitive deficits; or 3) there was an incomplete evaluation.
Minimal dementia[50]	Corresponds closely to ''questionable dementia'' (CDR score of 0.5).[16] Deficits in memory and minor and variable errors in orientation. No evident impairment in occupational functioning.
Mild neurocognitive disorder[50]	Impairment arising as a consequence of a general medical condition.
Self-reported memory complaint[50]	Complaints of memory loss in the absence of formal testing. When formal testing indicates no impairment, an individual would be classified as ''worried well.''
Questionable dementia[273,274]	The worst end of the mild cognitive impairment spectrum; associated with a CDR score of 0.5, indicative of cognitive impairment 2 SDs below the mean in one cognitive domain. Objective evidence of cognitive impairment not satisfying criteria for dementia.

Table 10. Definitions and Prevalence of Frailty

Study	Prevalence (%)	Mobility impairment	Weakness	Weight loss /poor nutritional status	Low Physical Activity	Fatigue	Bowel and Bladder Incontinence	Cognitive impairment	Visual impairment	ADL/IADL impairment	Lung Function	Chronic/ Terminal Illness
Cardiovascular Health Study Fried, 2001[23]	6.9	✓	✓	✓	✓	✓						
Canadian Study of Health and Aging Gutman, 2001[103]	21.2	✓					✓	✓		✓		
Women's Health and Aging Studies Bandeen-Roche, 2006[160]	11.3	✓	✓	✓	✓	✓						
PAVAMC Frailty Study Winograd, 1991[25] (hospital based)	27	✓		✓			✓	✓		✓		✓
Cooperative Cardiovascular Project Lichtman, 2009[275] (hospital based)	27.5	✓					✓	✓				
Heart Failure Cohort Lupon, 2008[276] (among diseases)	39.9							✓			✓	
Beaver Dam Eye Study Cohort Klein et al, 2005[111]	44.7	✓	✓						✓	✓		
Precipitating Events Project Hardy, 2005[107]	42.7	✓										
Chinese Longitudinal Healthy Longevity Survey Gu, 2009[159]	NR							✓	✓		✓	✓
Study of Osteoporotic Fractures Ensrud, 2008[24]	17	✓		✓		✓						
Osteoporotic Fractures in Men Cawthon, 2007[113]	4	✓	✓	✓	✓	✓						
Longitudinal Aging Study Amsterdam Puts, 2005[277]	5.8			✓	✓		✓	✓	✓	✓		
Three-City Study Avila-Funes, 2008[28]	7	✓	✓	✓	✓	✓						
MacArthur Study Sarkisian, 2008[220]	6.7	✓	✓	✓	✓	✓		✓				
Depression Among Caregivers of Impaired Elders Study Tennstedt, 1992[264]	18.9	✓			✓			✓			✓	
Hispanic Established Populations for Epidemiologic Studies of the Elderly Ottenbacher, 2009[108]	7.6	✓	✓	✓	✓	✓						
Chinese University of Hong Kong Aging Study Woo, 2008[278]	NR	✓						✓			✓	
Rush Memory and Aging Project Boyle, 2010[279]	NR	✓	✓	✓		✓						
Health and Retirement Study Cigolle, 2009[104]	21.3		✓	✓				✓	✓			
National Population Health Survey of Canada Song, 2010[115]	22.7	✓		✓	✓	✓	✓		✓		✓	
Health, Aging and Body Composition Study Peterson, 2009[105]	2.7	✓										

NR=prevalence estimate not reported; study defined frailty and examined association between frailty and outcome.

Table 11. Number of Studies and Prevalence Estimates By Each Criterion of the Definition of Frailty

Prevalence Category	Mobility Impairment	Weakness	Weight Loss/Poor Nutritional Status	Low Physical Activity	Fatigue	Bowel and Bladder Incontinence	Cognitive Impairment	Visual Impairment	ADL/IADL Impairment	Lung Function	Chronic/ Terminal Illness
0-5%	2	1	1	1	1	0	0	0	0	0	0
10-20%	3	1	2	2	2	0	1	0	0	1	0
20-30%	4	1	3	1	1	4	4	2	2	1	1
5-10%	4	4	5	5	4	1	2	1	1	0	0
>30%	2	1	0	0	0	0	1	1	1	1	0
Total	15	8	11	9	8	5	8	4	4	3	1
Average prevalence of frailty in studies when component is included in the definition of frailty											
Mean	17.9	13.7	12.5	10.1	10.4	20.8	21.0	23.6	24.7	27.2	27.0
Standard deviation	13.3	13.6	8.1	6.4	6.3	8.8	11.2	16.0	16.1	11.2	

Table 12. Prevalence of Basic ADL Disability (Evidence From Good-Quality Studies)

Disability Definition	Range of Older Persons With Disability (%)
Any BADL disability	5.0-18.3[41,53,55-64] 25.6 (CHS All Stars)[59]
Moderate BADL disability	16.1-20.5[5,118]
Severe BADL disability	6.0-7.8 (3-4 BADLs)[5,118] 4.8 (5-7 BADLs)[5]
Bathing disability	3.9-9.0[53,55,65,122,248]
Dressing/hygiene disability	0.8-11.0[53,55,65,120,248] 9.2 (Alumni Health Study)[120]
Eating disability	0.4-4.5[53,55,58,65,119,120,248] 7.3 (Alumni Health Study)[120]
Toileting disability	2.4-6.0[53,55,58]
Transferring disability	0.4-9.0[53,55,58,65] 21.1 (Alumni Health Study)[120]
Walking disability	0.8-13.0[53,55,65,120] 20.6 (Alumni Health Study)[120]

Table 13. Increase in Individual Basic ADL Disability Over 5 Years[65]

Individual BADL Disability	Year	
	1980	1985
Bathing disability	3.9	14.7
Dressing/hygiene disability	0.8	11.0
Eating disability	0.4	2.2
Transferring disability	0.4	5.8
Walking disability	0.8	7.7

Table 14. Prevalence of Instrumental ADL Disability (Moderate to High Level of Evidence)

Disability Definition	Range of Older Persons With Disability (%)
Any IADL disability	12.0-46.7[53-57]
Moderate IADL disability	7.2-31.0[5,248,267]
Severe IADL disability	4.5-21.2[5,54,267]
Finance disability	8.0-19.3[53,55,65]
Housekeeping disability	7.5-35.8[65,122]
Meal preparation disability	7.1-32.4[53,65,119]
Medication management disability	3.0-4.7[53,55]
Shopping disability	11.0-32.9[53,65,119]
Telephone disability	4.0-6.0[53,55]
Transportation disability	54.3[65]

Table 15. Increase in Individual Instrumental ADL Disability Over 5 Years (Good-Quality Study)[65]

Individual IADL Disability	Year	
	1980	1985
Finance disability	19.3	36.7
Housekeeping disability	35.8	48.0
Meal preparation disability	32.4	34.1
Shopping disability	32.9	41.3
Transportation disability	54.3	67.6

Table 16. Prevalence of Multiple Morbidities in Older Subgroups

Subgroup	Number of Chronic Conditions (low to moderate level of evidence)	Polypharmacy (insufficient level of evidence)	Self-Perceived Health (high level of evidence)
65-74 years	≥3 diseases: 27.80%[307]		
>75 years >100 years	≥3 diseases: 36.60%[307] >5 diseases: 23%[176]	75-79 years: 50.3% 80-84 years: 57.2% 85-89 years: 63.1%[205]	
Men	2 diseases: 16%[125] 4-6 diseases: 5%[125]	≥5 drugs: 35.6%[94] >11 drugs: 15.5%[205]	Fair Pooled: 27.61% (95% CI,16.77-45.47)[94,280] Fair/poor 14.20% (95% CI,13.30-15.10)[74] Poor Pooled: 6.94% (95% CI, 3.00-16.10)[94,103,280]
Women	2 diseases: 16%[125] 3 diseases: 23.0%[242] ≥3 diseases: 16-18.4%[89,117] 4 diseases: 16.0%[242] >4 diseases: 8.6%[117] 5 diseases: 9.0%[242] >5 diseases: 1.6%[117] 6 diseases: 4.5%[242] 7 diseases: 2.0%[242] 8 diseases: 0.5%[242]	≥5 drugs: 43.0%[94] >11 drugs: 19.1%[205]	Fair Pooled: 31.64% (95% CI, 14.31-69.93) Poor Pooled: 6.71% (95% CI, 3.04-14.81)[94,103,280]
African Americans	≥3 diseases in women: 13.4%[89]		
Caucasians	≥3 diseases in women: 9.5%[89]		

Table 17. Prevalence of Basic ADL Disability in Women and Men

Disability Definition	Range of Older Persons With Disability (%)	
	Women	Men
Any BADL disability	8.1-14.0[61,63,64,121] (high level of evidence)	6.1-10.3[61,63,64,121] (high level of evidence)
Moderate BADL disability	21.7[118]	19.1[118]
Severe BADL disability	7.0[118]	7.0[118]
Bathing disability	7.7[122]	4.4[122]
Dressing/hygiene disability	17.1 (Alumni Health Study)[120]	13.2 (Alumni Health Study)[120]
Eating disability	1.2[119] to 11.8 (Alumni Health Study)[120]	1.2[119] to 6.0 (Alumni Health Study)[120]
Toileting disability	None	None
Transferring disability	27.6 (Alumni Health Study)[120]	19.2 (Alumni Health Study)[120]
Walking disability	27.3 (Alumni Health Study)[120]	18.6 (Alumni Health Study)[120]

Table 18. Differences in Instrumental ADL Disability Prevalence By Sex (Good-Quality Individual Studies)

IADL Disability	Men	Women
Any IADL	9.2[121]	12.7[121]
Housekeeping	23.6[120]	40.1[120]
Meal Preparation	9.8[119]	10.2[119]
Shopping	20.5[119]	10.4[119]

Table 19. Prevalence of Basic ADL Disability By Ethnic Group (Good-Quality Individual Studies)

Disability Definition	Prevalence (%)		
	African American Older Persons With Disability	American Indian Older Persons With Disability	White Older Persons With Disability
Any BADL disability	13.6[62] Men: 7.5[60] Women:10.7[60]	11.6[62]	8.7[62] Men: 4.7[60] Women: 5.2[60]
Moderate BADL disability			
Severe BADL disability			
Bathing disability			
Dressing/hygiene disability			
Eating disability	1.2[119]		1.2[119]
Toileting disability			
Transferring disability			
Walking disability			

Table 20. Differences in Prevalence of Moderate Basic ADL Disability By Age and Sex Groups (Good-Quality Study)[118]

	Ages 65-74	Ages 80+
Women	18.0%	33.0%
Men	17.0%	28.0%

Table 21. Differences in Prevalence of Severe Basic ADL Disability By Age and Sex Groups (Good-Quality Study)[118]

	Ages 65-74	Ages 80+
Women	6.0%	10.0%
Men	6.0%	11.0%

Table 22. Association Between Multiple Morbidities and Clinical Outcomes

Population	Number of Chronic Diseases	Charlson Score	Polypharmacy	Poor Health
Relative increase in risk of death				
	High level of evidence	Good-quality individual study	Moderate level of evidence	High level of evidence
All sexes	32-112%[39,124,125-129]		13-16% per drug[54,130]	Pooled: 104%[27,103,131]
Women	18%[243]	89-154%[308]	Not significant[94]	Pooled: 235%[94,280]
Men		127%[308]	Not significant[94]	Pooled: 233%[94,280]
Relative increase in risk of institutionalization				
	Low-quality individual study			Moderate level of evidence
All sexes	20%[128]			10-80%[8,103,132] Dose response: 20% per score (0-5)[327]
African Americans				Not significant[311,328]
Caucasians				10-12%[311,328]
Relative increase in risk of hospitalization				
	Low-quality individual study	Low-quality individual study	Moderate level of evidence	Low level of evidence
All sexes	70%[133]	37-94%[126]	124-190%[133,134]	7-179%[135-140]

Table 23. Association Between Disability and Risk of Hospitalization (Moderate-Quality Individual Studies)

Disability Definition	Estimate (95% CI)
Any BADL disability	1.8 (1.6-2.0)[136] 2.0 (1.1-3.4)[162] 3.3 (1.9-5.5)[162]
Severe BADL disability	Progressive disability* Men: 2.8 (1.6-5.2)[163] Women: 3.8 (2.2-4.9)[163]
	Catastrophic disability** Men: 15.8 (9.1-27.5)[163] Women: 16.0 (11.1-23)[163]
BADL disability, continuous variable	1.31[137] (NS)
Any IADL disability	2.5 (1.4-4.5)[162]
Any IADL/BADL disability	1.2 (0.8-1.8)[140]
Other disability definitions	Not physically able*** 2.1 (1.2-3.5)[162]
	Number of restricted-activity bed days 1.7 (0.86-2.9)[133] (NS)
	Uses cane, walker, wheelchair 1.16[253] (p=0.006)

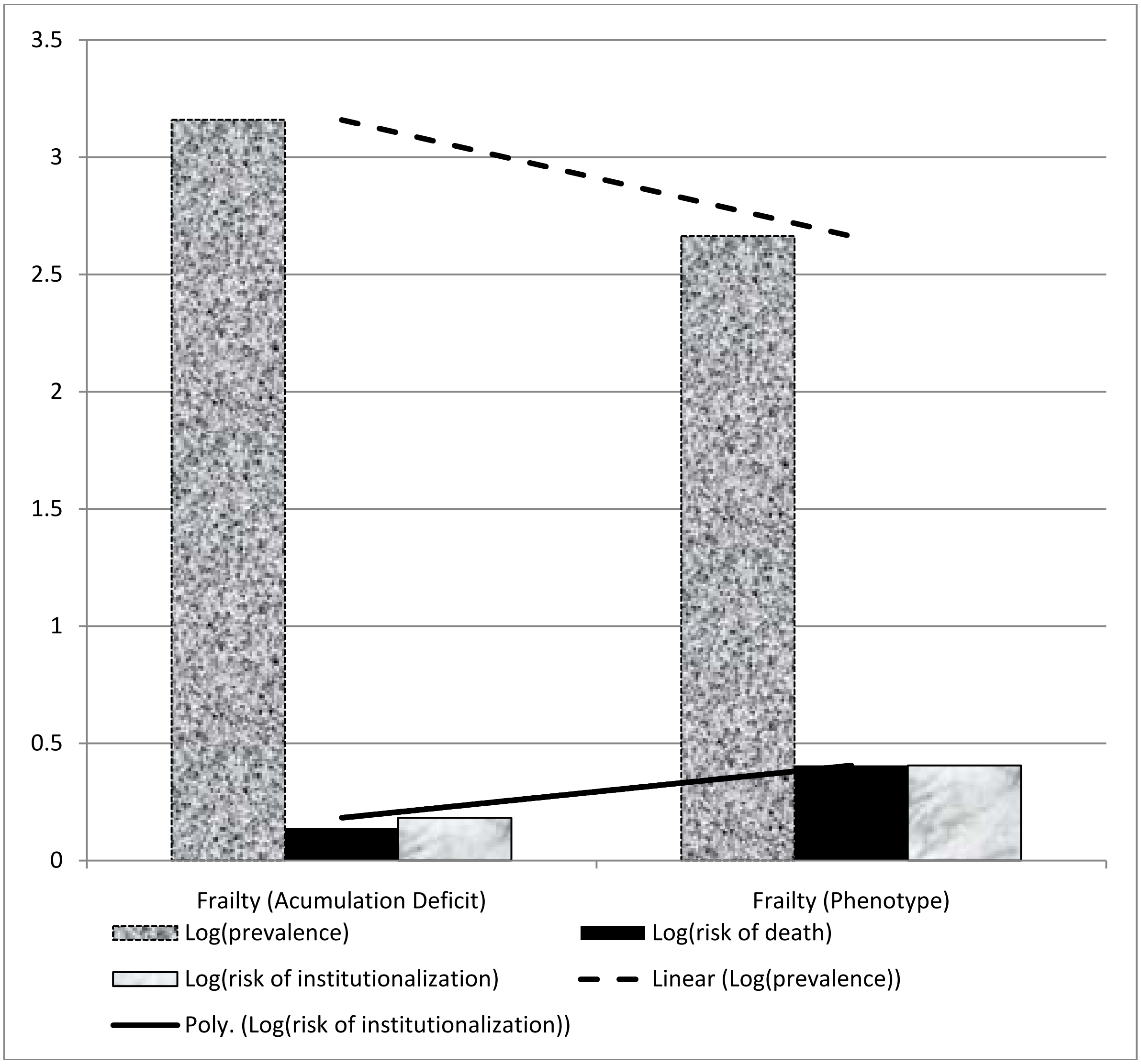
NS=statistically nonsignificant result.
*Progressive disability is defined as the development of an additional ADL dependency after having 1-2 ADL disabilities.
**Catastrophic disability is defined as the onset of 3 or more ADL dependencies when none existed before.
***Physically able is defined as having no difficulty in walking 1/4 of a mile, stooping, crouching or kneeling, lifting 10 pounds, or walking up 10 steps without resting.

Table 24. Association Between Disability and Risk of Death (Good-Quality Individual Studies)

Disability Definition	Time to Mortality (Months)	Estimated Subpopulation (95% CI)
BADL disability continuous	48	1.1 (1.04-1.16)[329]
	6	1.4 (NR); p<0.01[127] – Frail
	1.5	1.11 (1.06-1.15)[251] – Hospitalized
Any BADL disability	24	1.9 (1.3-2.7)[162]
Moderate BADL disability	24	14.1 (9.2-21.6)[164]
	48	2.0 (1.2-3.3)[164]
	72	8.6 (6.6-11.0)[128]
	12	2.1 (1.6-2.8)[181] – Hospitalized
Severe BADL disability	24	86.8 (39.4-190.8)[164]
	48	3.4 (1.6-7.5)[164]
	72	30.0 (18.0-51.0)[128]
	96	1.13 (1.07-1.19) Hispanic elders[266]
Dressing	30 ±19.2	1.6 (1.3-2.1) fully dependent[184] – Frail
	30 ±19.2	1.2 (1.0-1.4) partially dependent[184] – Frail
Toileting	30 ±19.2	1.3 (1.1-1.5) fully dependent[184] – Frail
Walking	6	1.7 (NS)[127] – Frail
Bathing	48	2.0 (1.6-2.4)[53]
IADL continuous	48	1.12 (1.08-1.17)[53]
	6	0.88 (NS)[127] – Frail
Any IADL disability	24	4.14 (3.20-5.36)[164]
	48	1.86 (1.4-2.46)[164]
	72	6.6 (5.0-8.6)[128]
Moderate IADL disability	36	1.54 (NR); p=0.05[54]
	60	1.72 (NR); p=0.001[54]
	120	1.62 (NR); p<0.001[54]
	60	1.46 (1.20-1.78)[27]
Severe IADL disability	36	2.49 (NR); p=0.02[54]
	60	1.64 (1.26-2.14)[27]
	60	2.09 (NR); p=0.03[54]
	120	2.2 (NR); p=0.001[54]
Meal preparation	6	2.42 (NS)[127] – Frail
Medication management	6	1.15 (NS)[127]
Financial management	48	1.9 (1.6-2.3)[53]
BADL/IADL continuous	96	1.10 (1.08-1.12)[330]
Any BADL/IADL disability	Variable death or institutionalization	1.84 (1.04-3.24)[153] – Frail

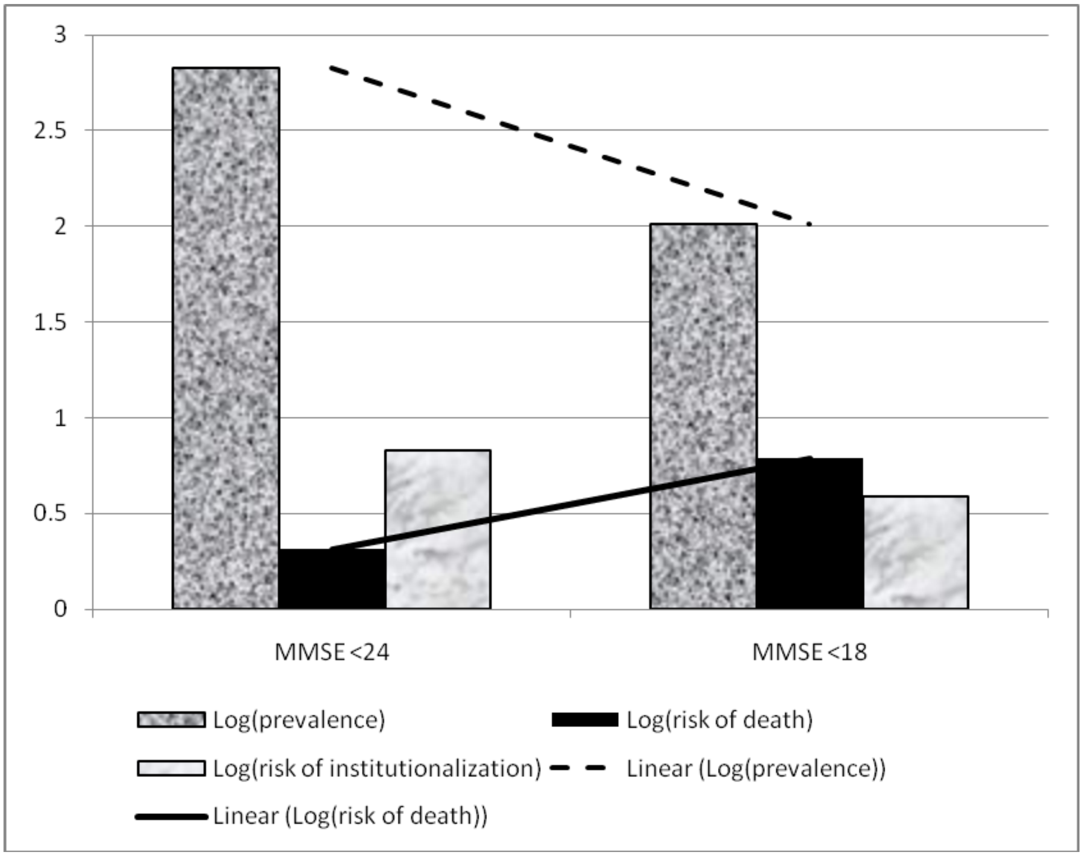
NS=not significant; NR=not reported.

Figure 1. Negative Association Between Prevalence of Frailty and Relative Risk of Mortality and Institutionalization Among Different Definitions of Frailty: Measurement Effect



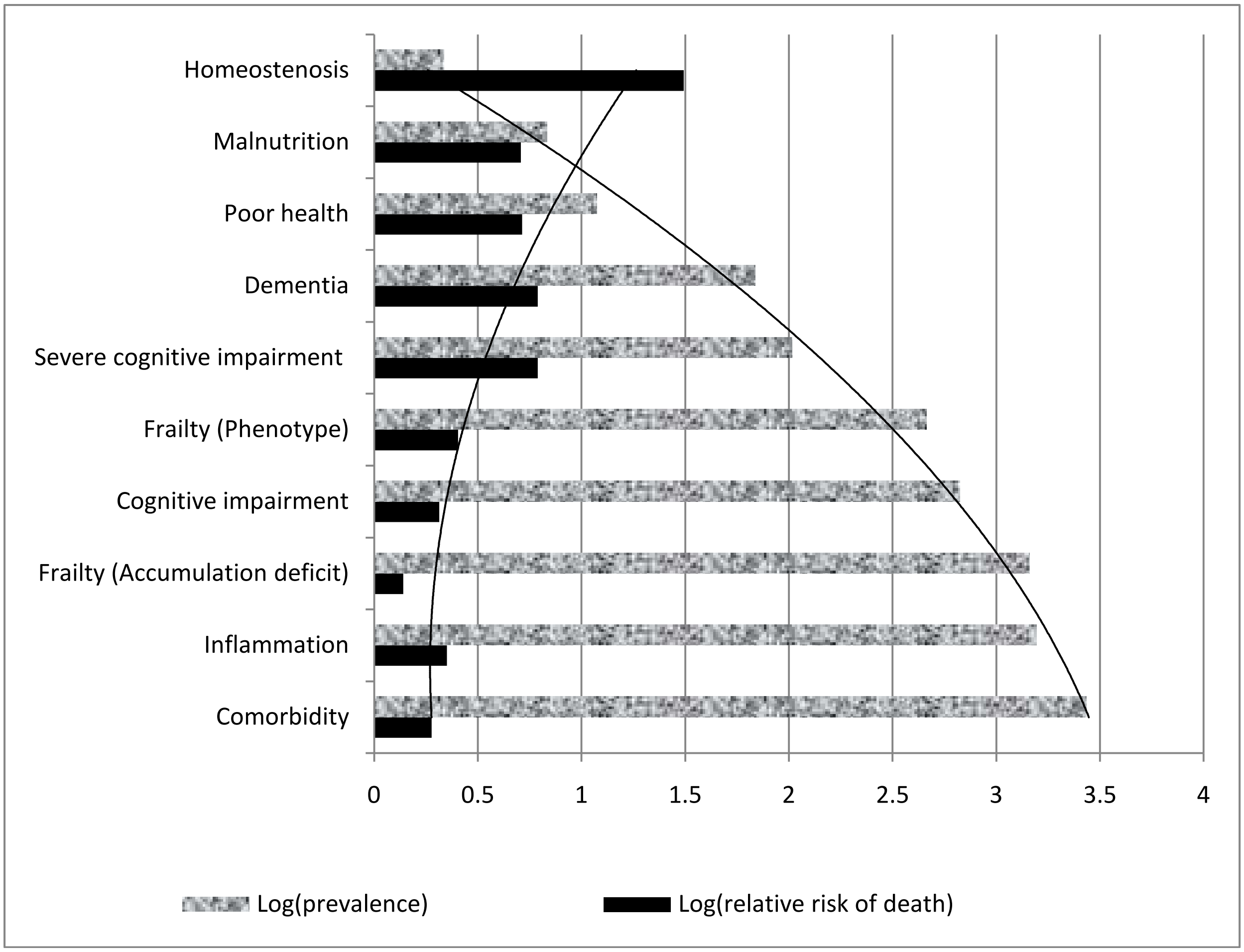
Vertical axis=logarithmic value of prevalence or relative risk; poly=polynomial trend; linear=linear trend.

Figure 2. Negative Association Between Prevalence of Cognitive Impairment and Relative Risk of Mortality and Institutionalization Among Different Definitions of Cognitive Impairment: Severity Effect



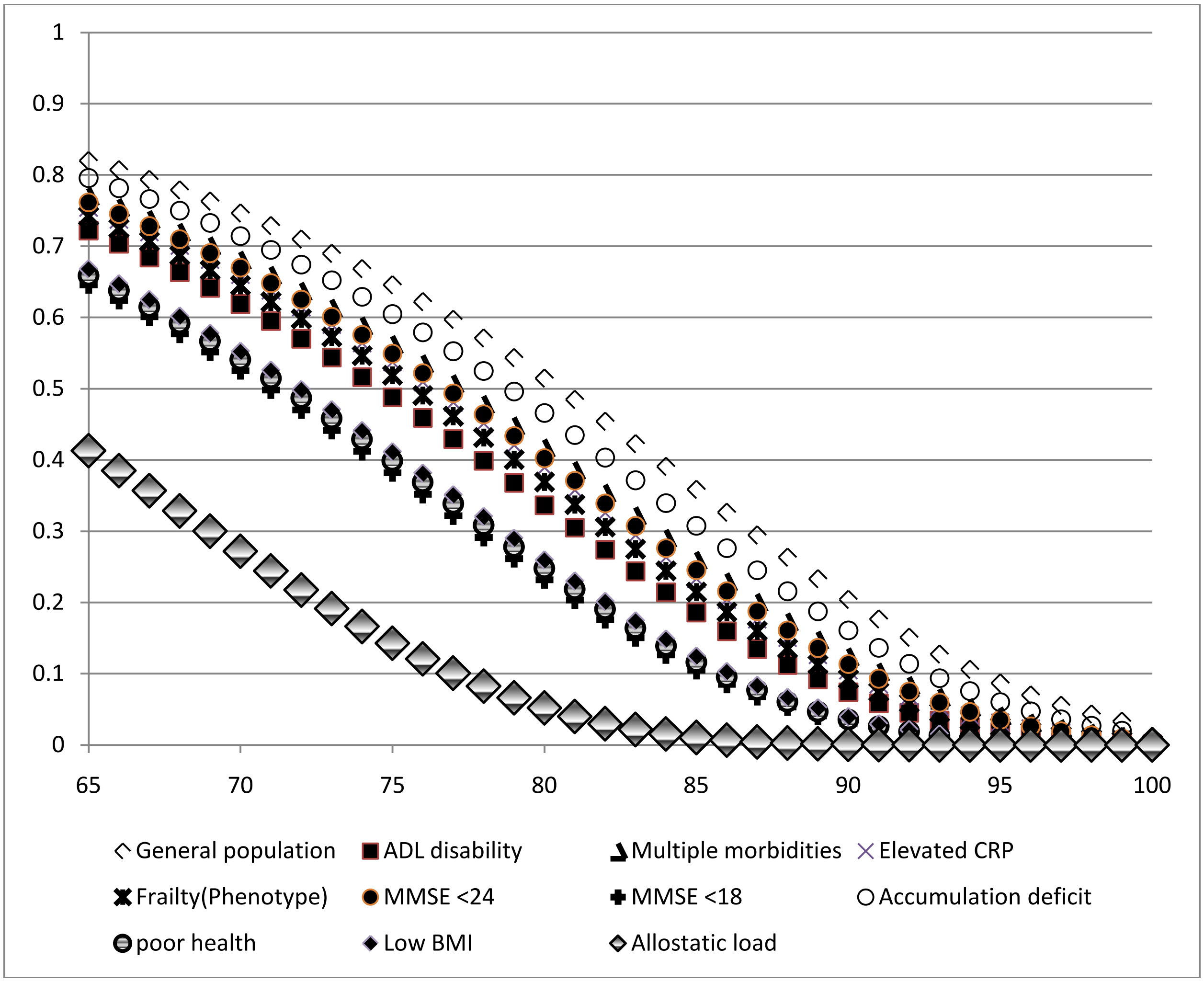
Vertical axis=logarithmic value of prevalence or relative risk; linear=linear trend.

Figure 3. Negative Association Between Prevalence of Geriatric Syndromes and Relative Risk of Mortality: Tendency of Lower Risk for Higher Prevalence Across All Syndromes



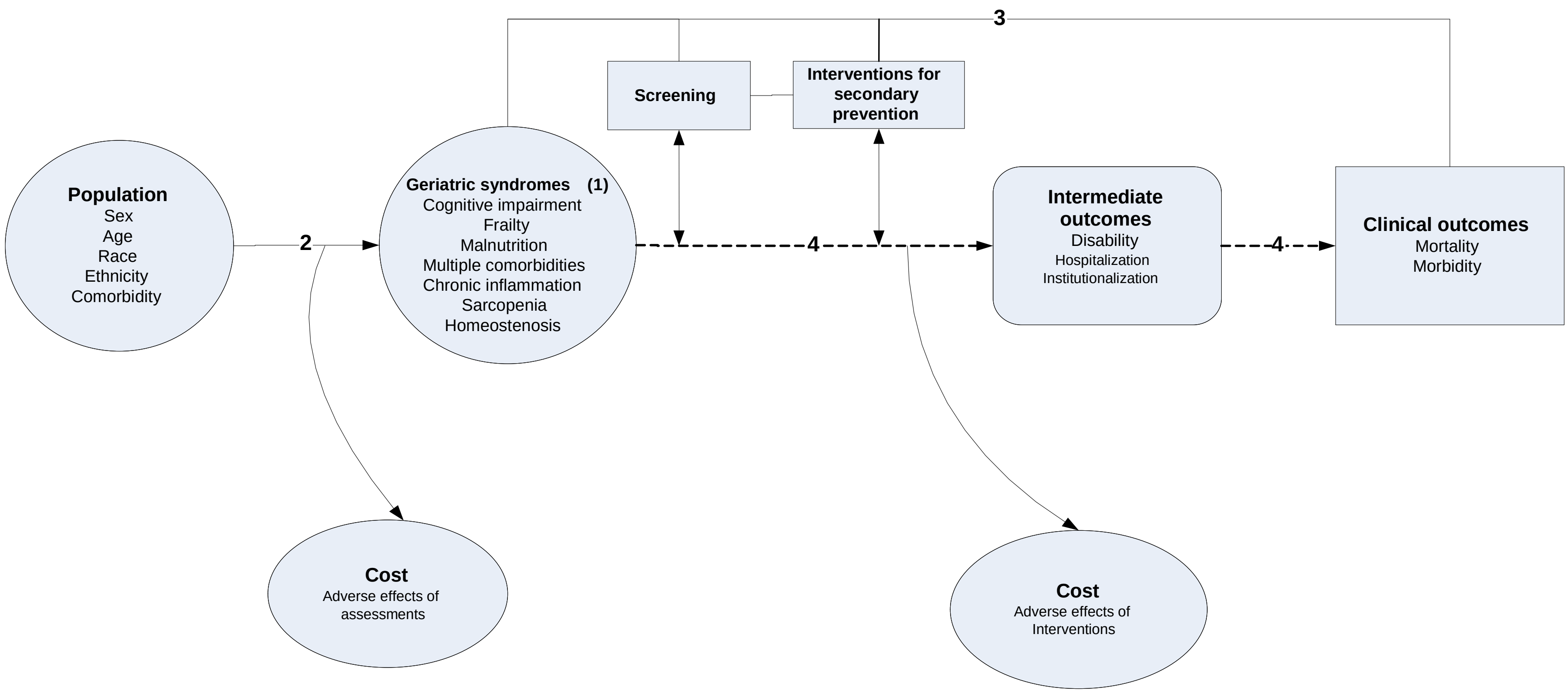
Horizontal axis=logarithmic value of prevalence or relative risk; poly=polynomial trend.

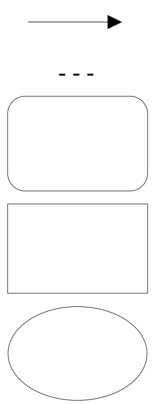
Figure 4. Survival in Older Persons in the General Population and With Geriatric Syndromes: Effect of Relative Risk of Mortality



Vertical axis=probability of survival; horizontal axis=years of age; dots=probability of surviving until the next year for adults older than age 65 years from the general population and with geriatric syndromes.

Figure 5. Conceptual Model





Arrows describe screening, primary prevention of the syndromes, and secondary prevention of the progression of the syndromes. However, health care interventions are beyond the scope of the project.

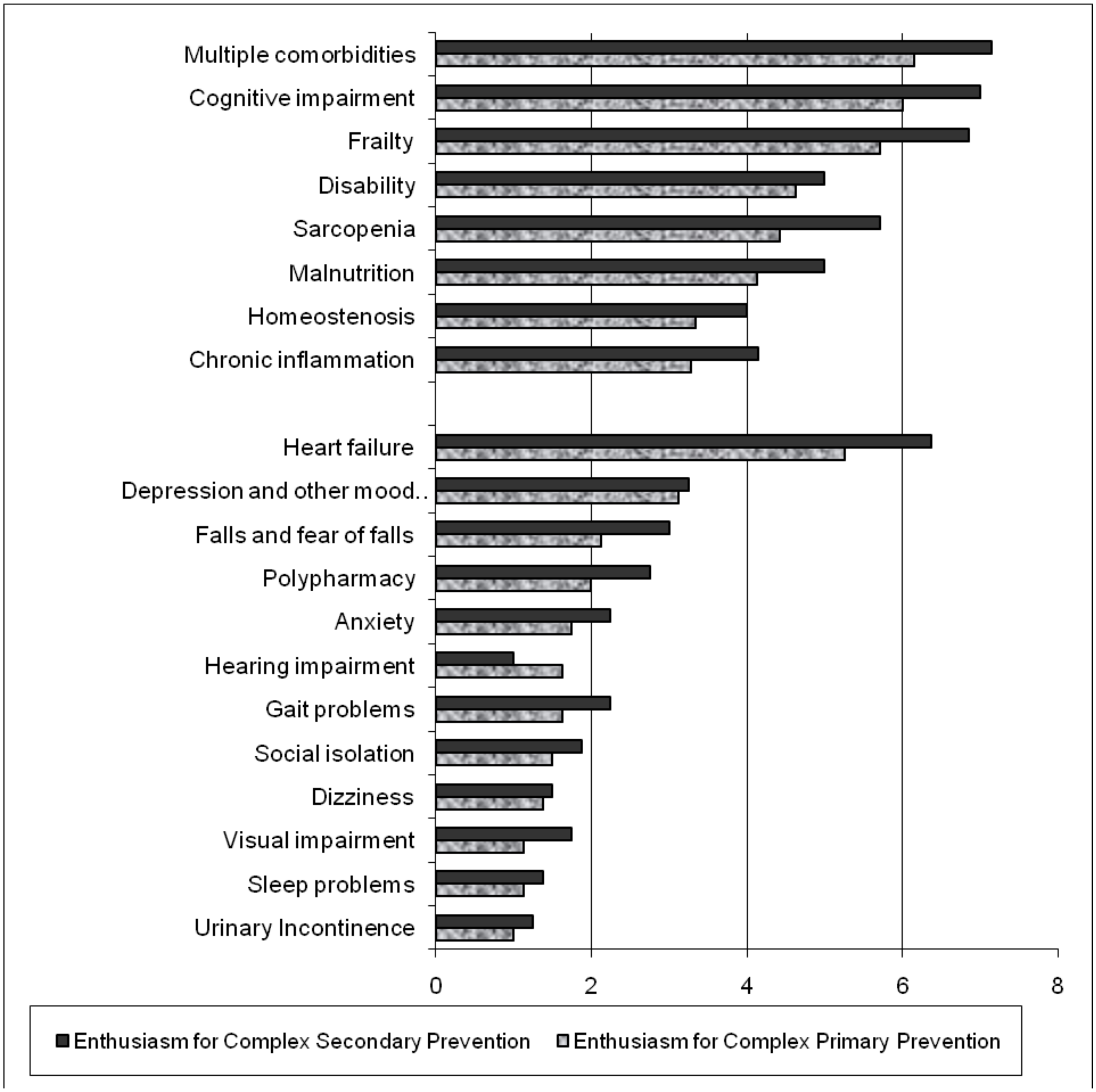
\- - - Dotted line describes the association between syndromes and outcomes.

Rounded corner rectangles provide information about intermediate outcomes (disability, hospitalization, and institutionalization).

Squared corner rectangles contain patient important clinical outcomes (mortality and morbidity).

Ovals represent cost and adverse events of the assessments and preventive interventions.

Figure 6. Results of Ranking Exercise



Bars represent mean scores, based on ranking of each syndrome on a scale of 0 to 9 by eight TEP members. Horizontal axis shows the mean score for each syndrome.

Figure 7. Study Flow

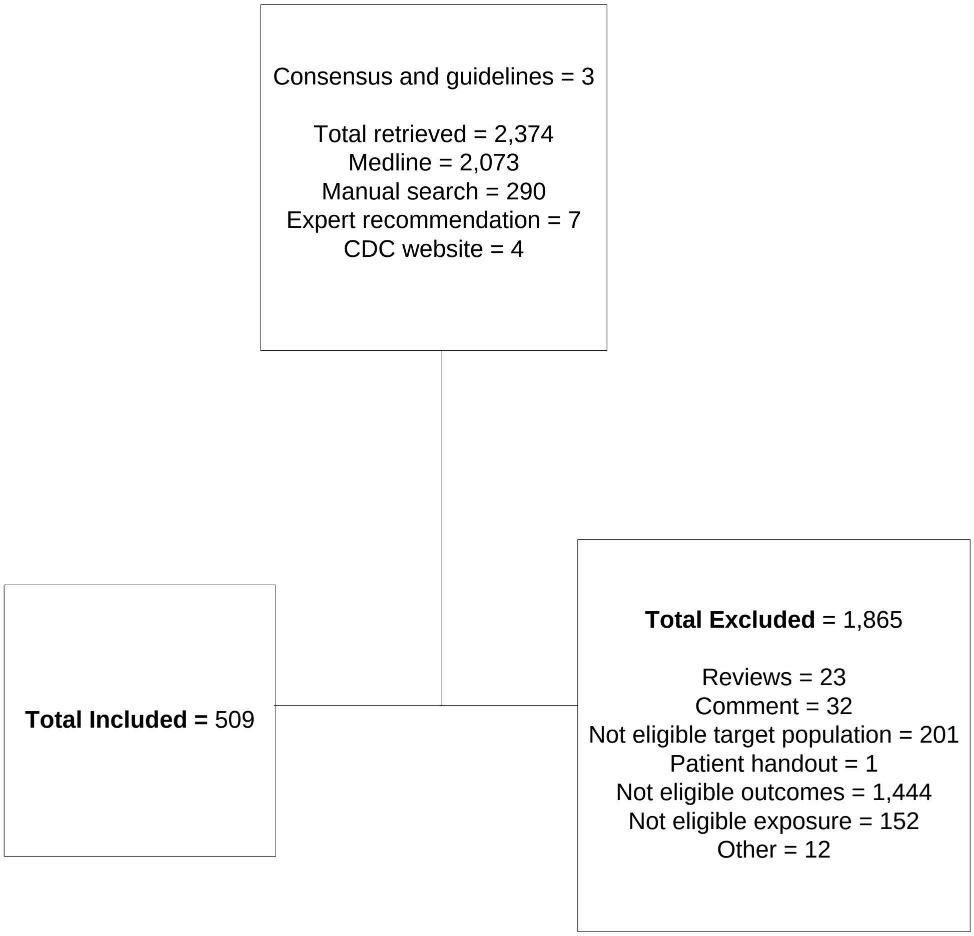
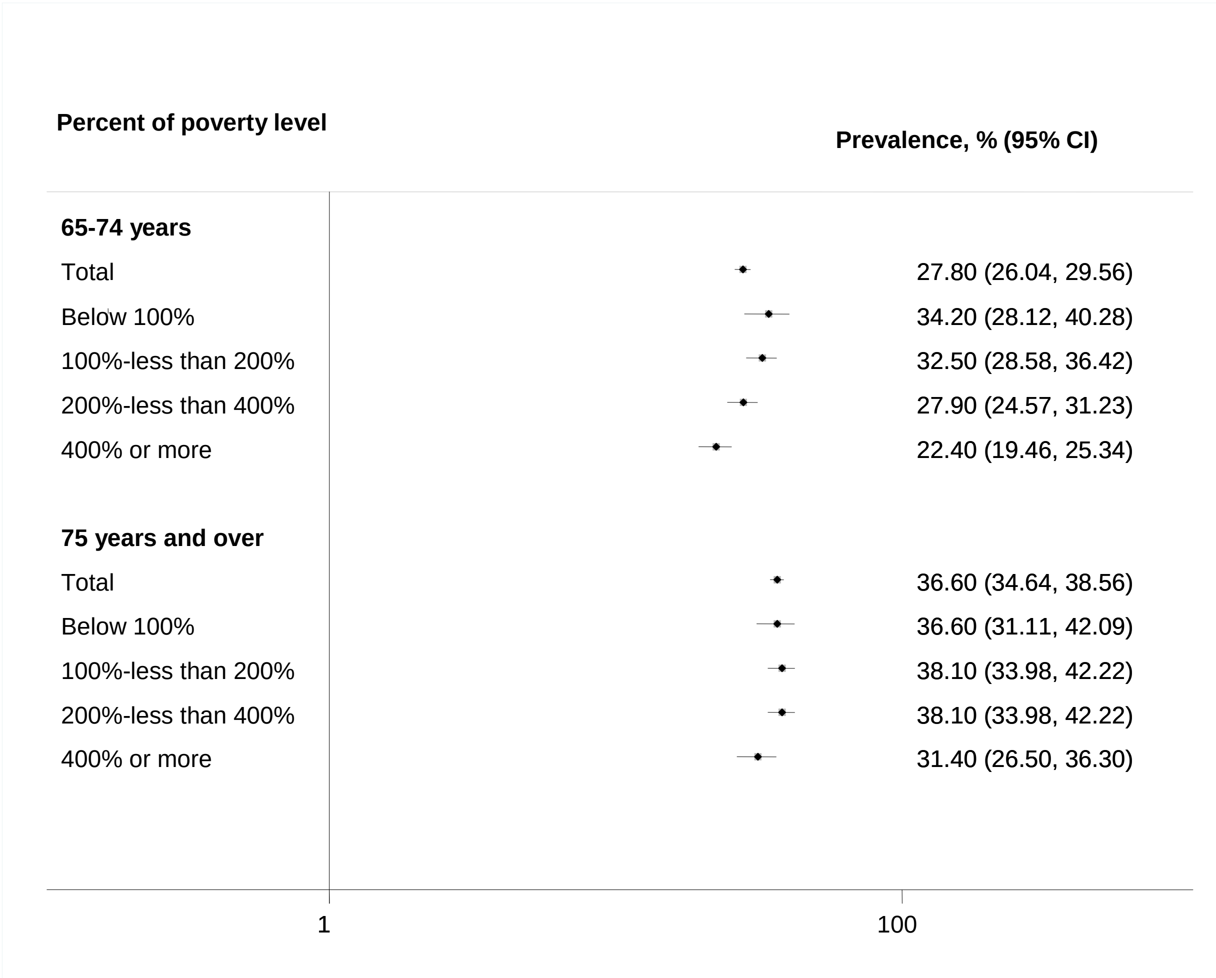
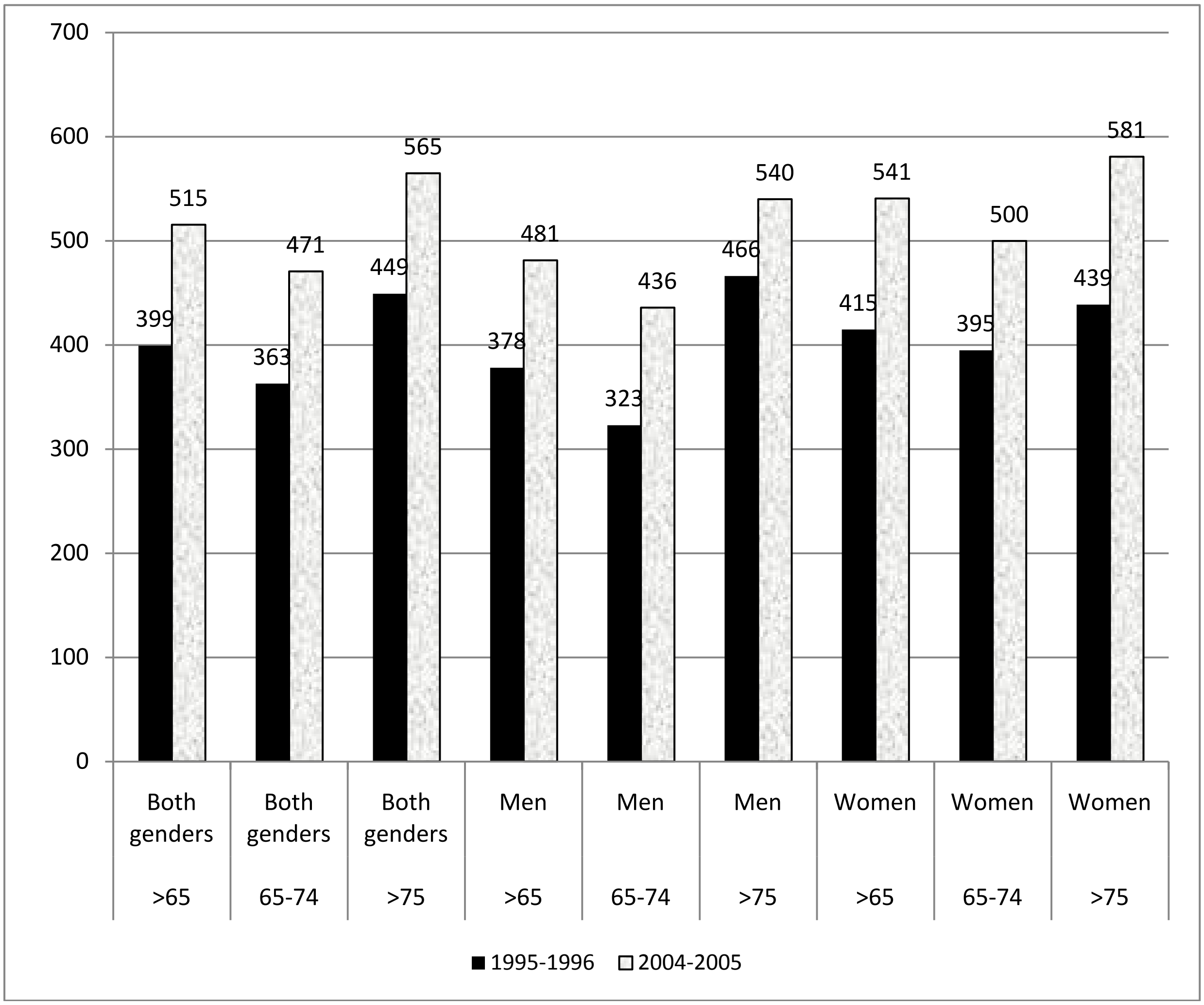


Figure 8. Prevalence of Three or More Chronic Conditions Among Older Persons By Percent of Poverty Level: United States, 2005 (Good-Quality National Survey*)



* National Health Interview Survey.[271]

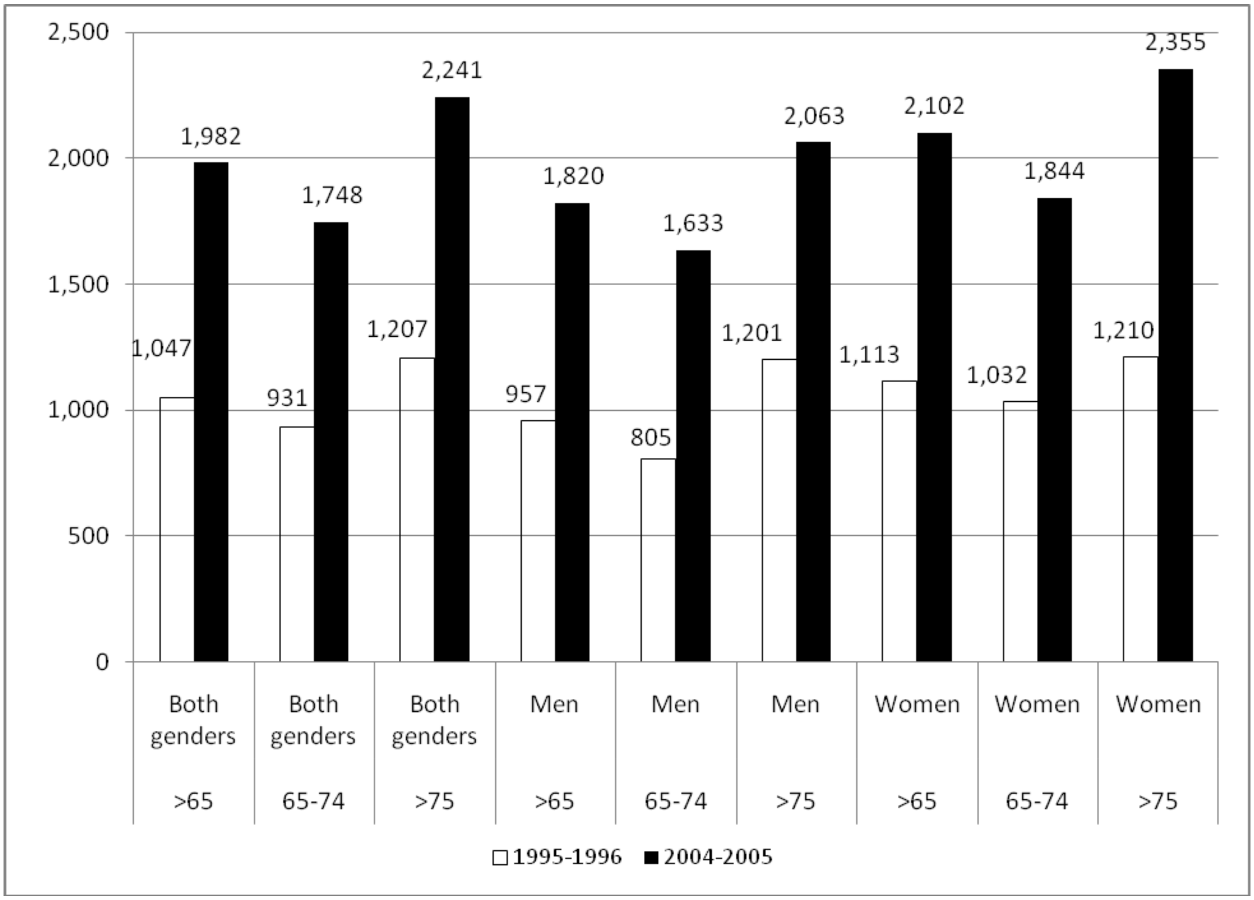
Figure 9. Increase in Drug Visits in Which at Least One Prescription or Nonprescription Drug Was Recorded on the Patient Record Form, per 100 Older Persons (Good-Quality National Surveys*)



Vertical axis=number of drug visits.

*National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey.[271]

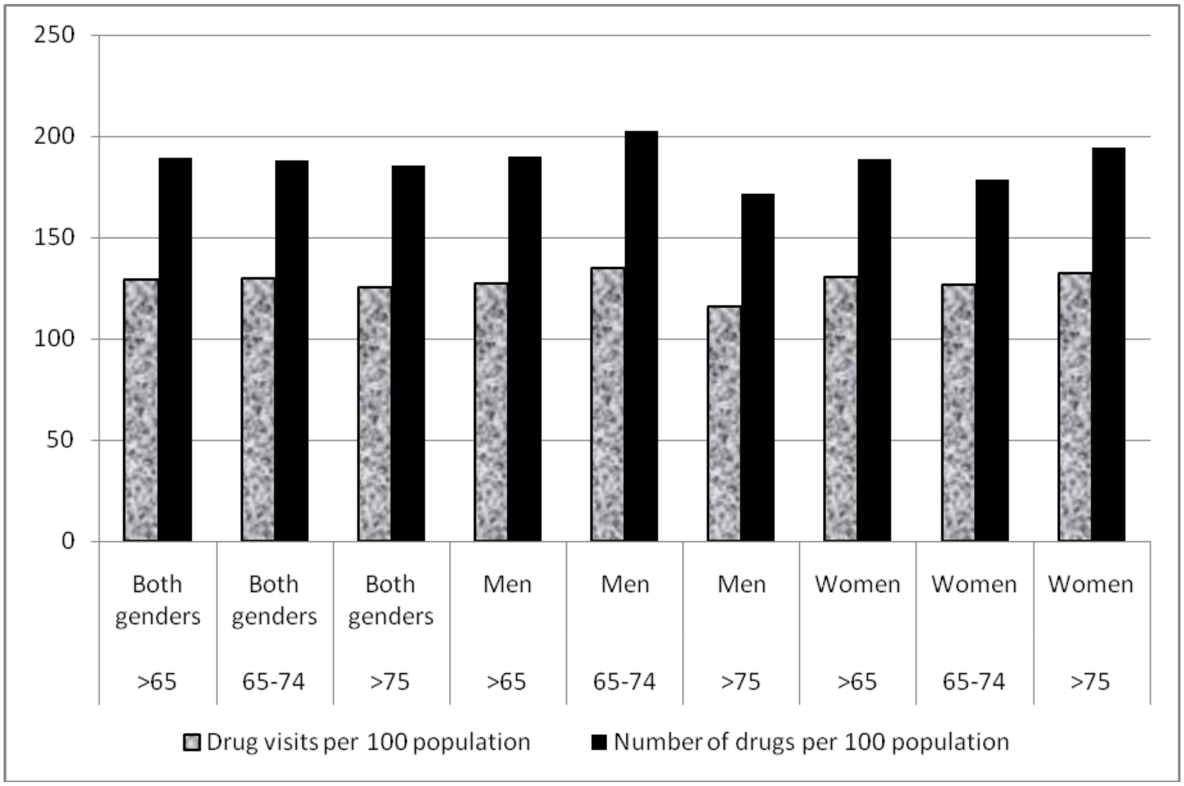
Figure 10. Increase in the Number of Drugs per 100 Older Persons (Good-Quality National Surveys*)



Vertical axis=total number of drugs.

*National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey.[271]

Figure 11. Percentage Increase in Drug Visits and the Number of Drugs per 100 Older Persons From 1994–1996 to 2004–2005 (Good-Quality National Surveys*)



Vertical axis=percent increase in drug visits and the number of drugs.

*National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey.[271]

Figure 12. Prevalence of Fair/Poor Health Status in Older Persons (High Level of Evidence)[14,103,109,250]

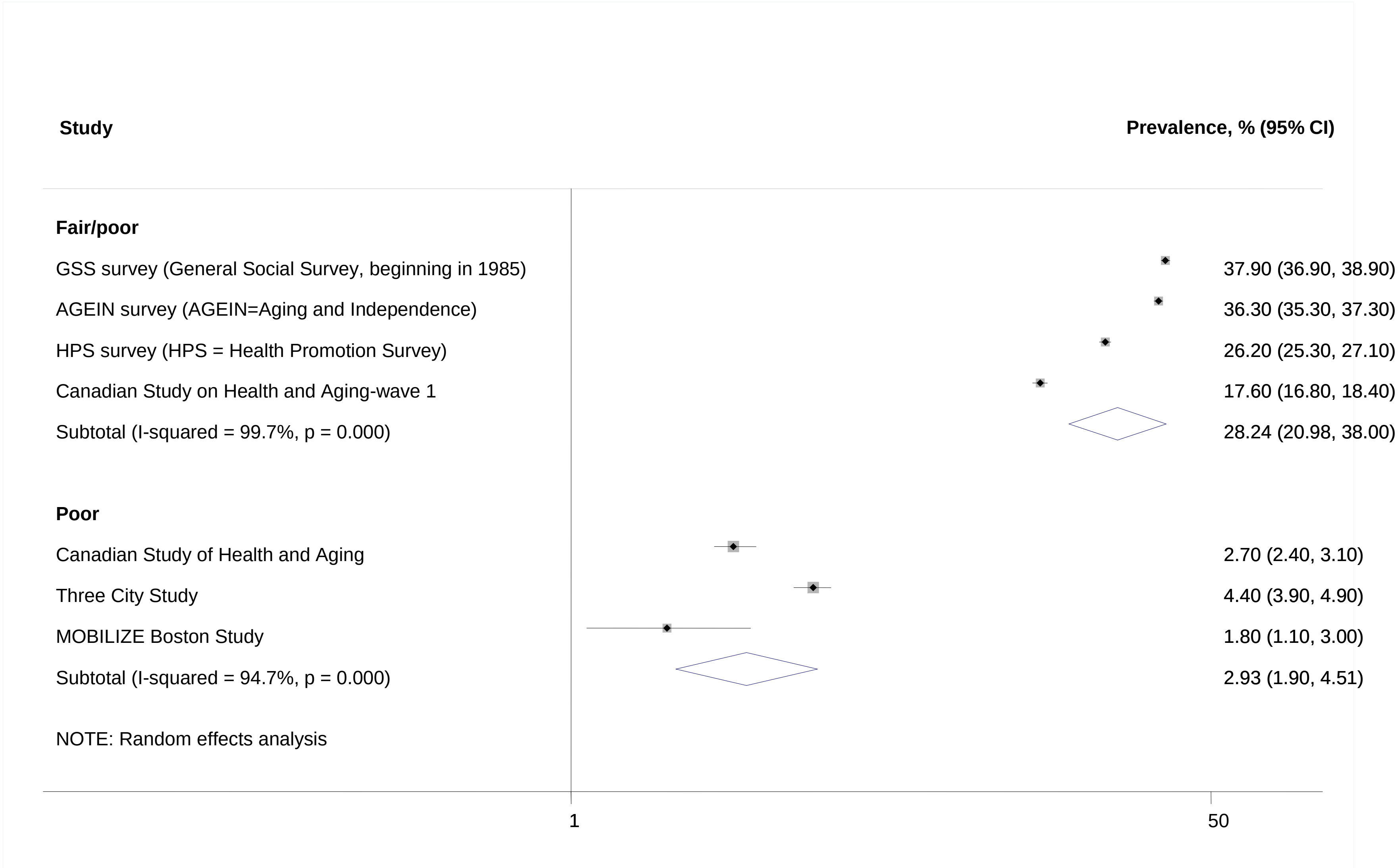
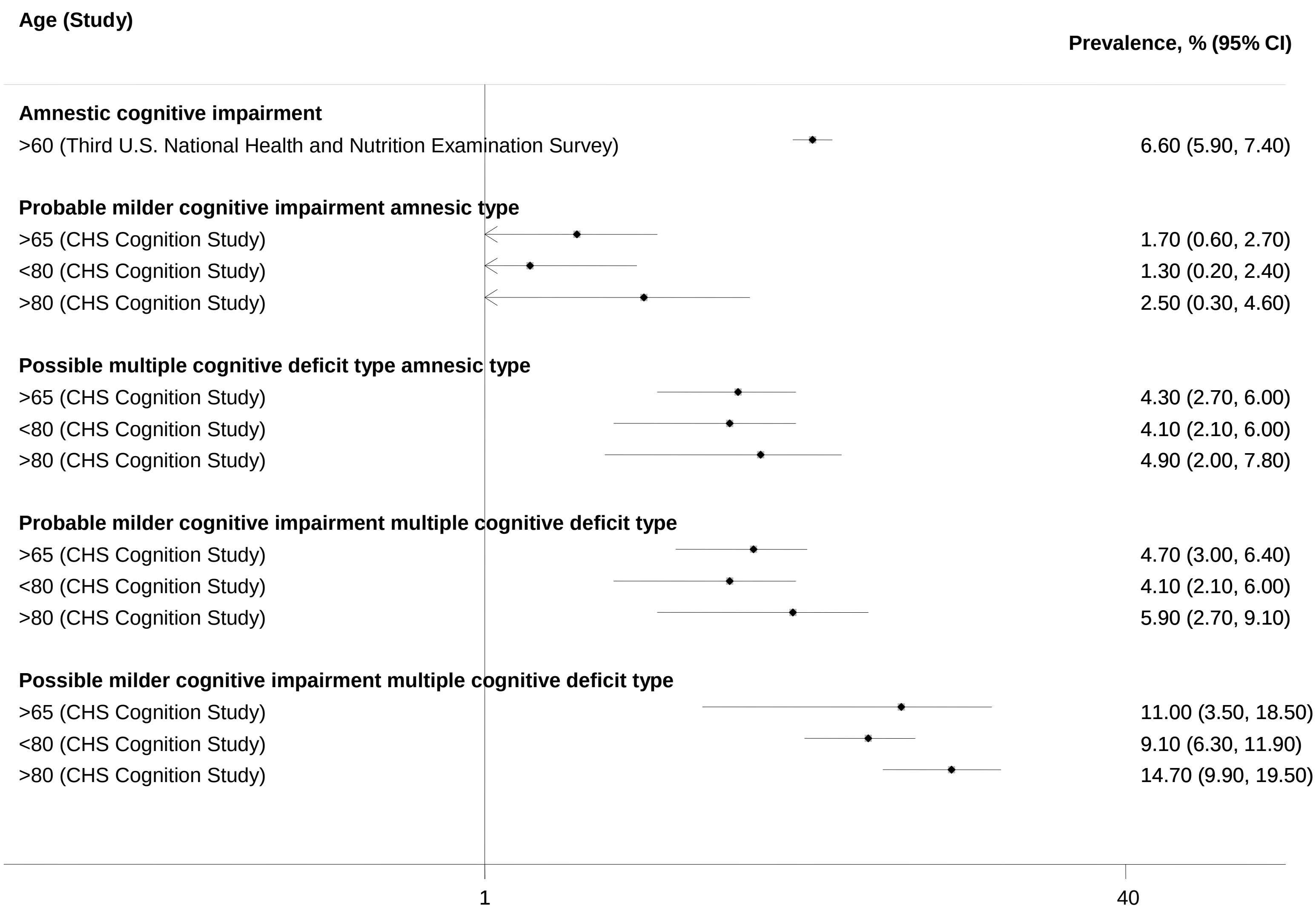


Figure 13. Prevalence of Amnestic or Multiple-Deficit Mild Cognitive Impairment in Age Categories (Low Level of Evidence)[90,247]



CHS=Cardiovascular Health Study (CHS) Cognition Study.

Figure 14. Prevalence of Cognitive Impairment in Older Persons Defined as an MMSE Score of <24 (Moderate Level of Evidence)[14,39-45]

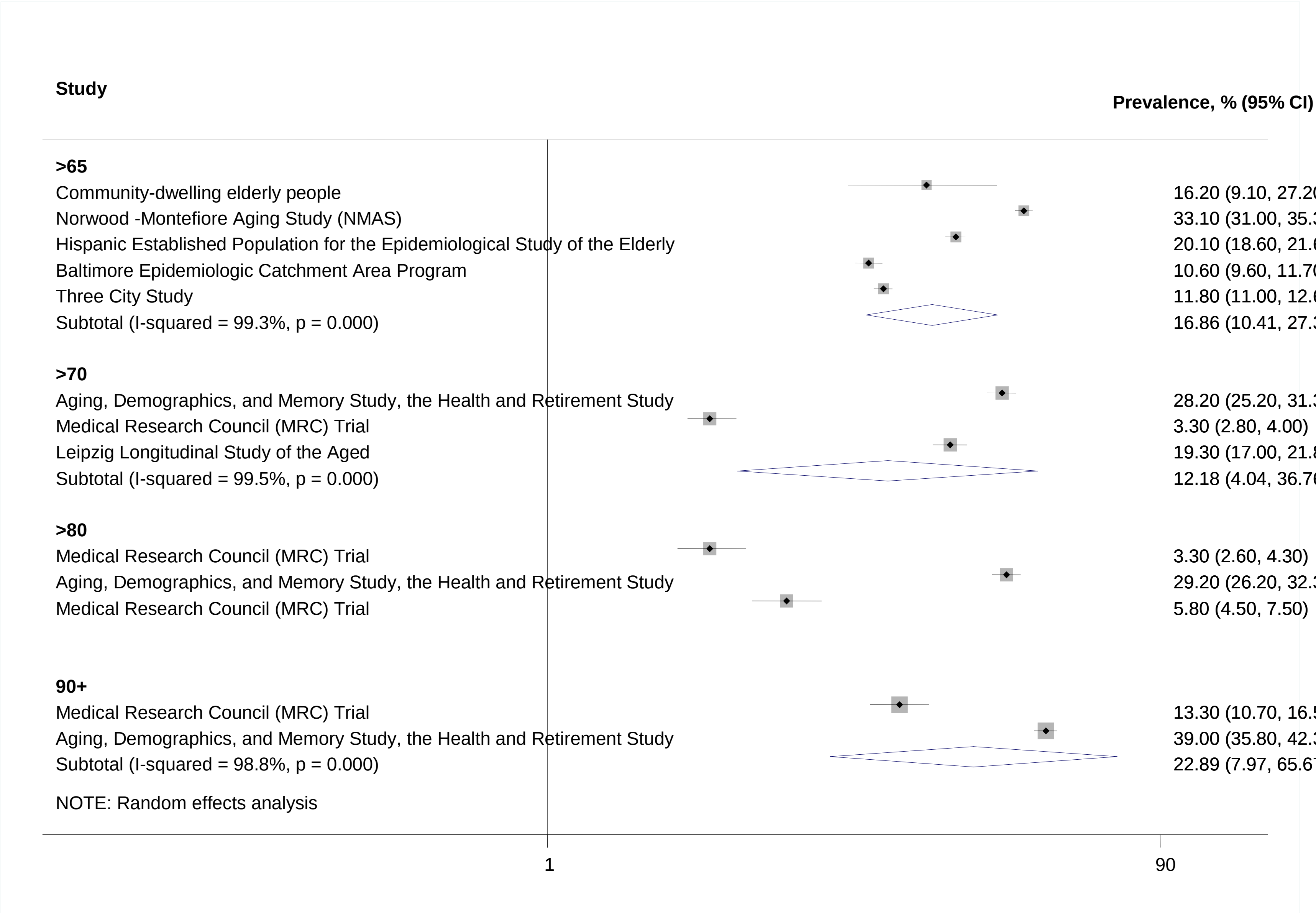


Figure 15. Prevalence of Severe Cognitive Impairment in Older Persons Defined as an MMSE Score of <15 (Low Level of Evidence)[39,44,261]

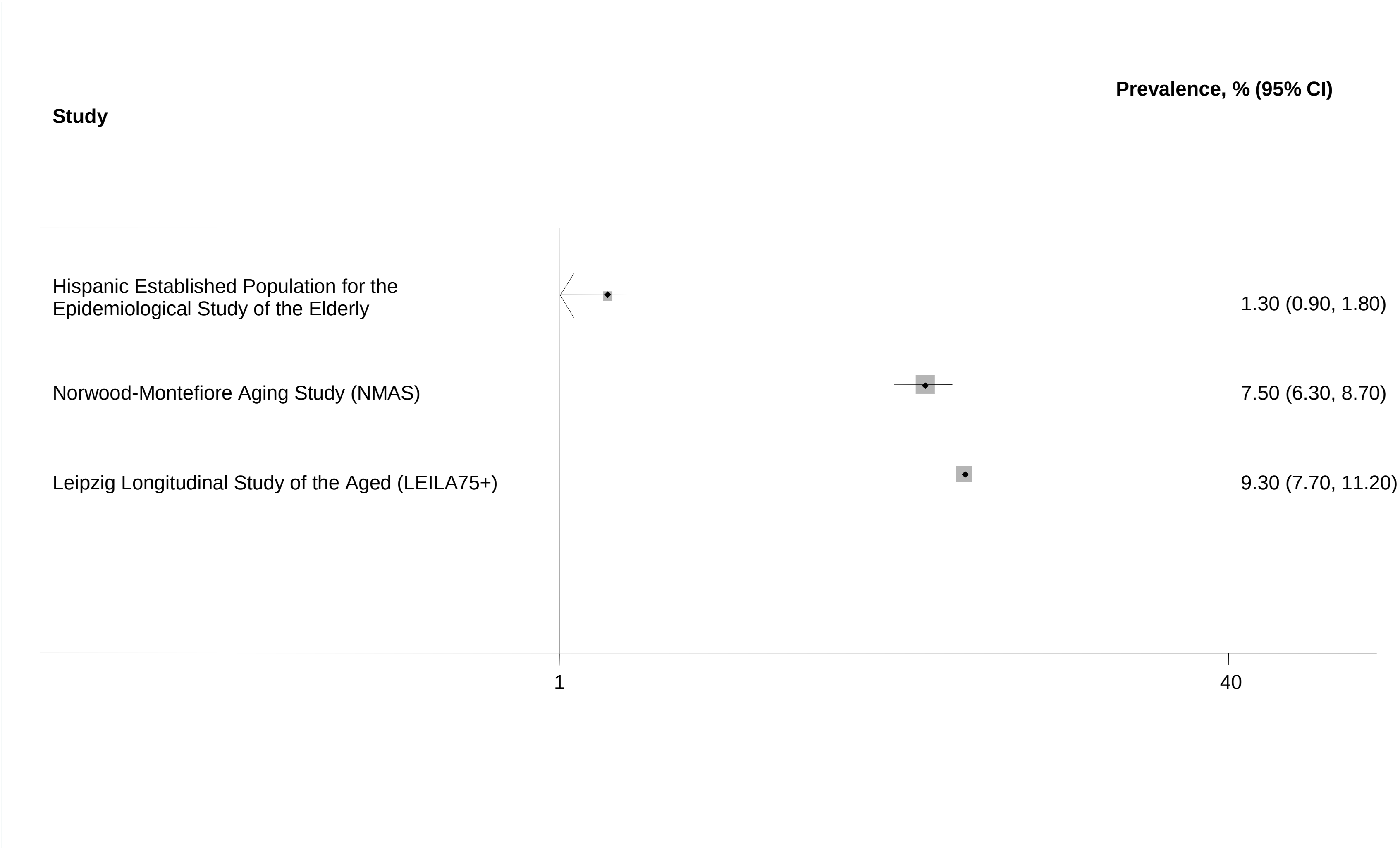


Figure 16. Prevalence of Cognitive Impairment in Age Categories of Self-Respondents (High Level of Evidence)[49]

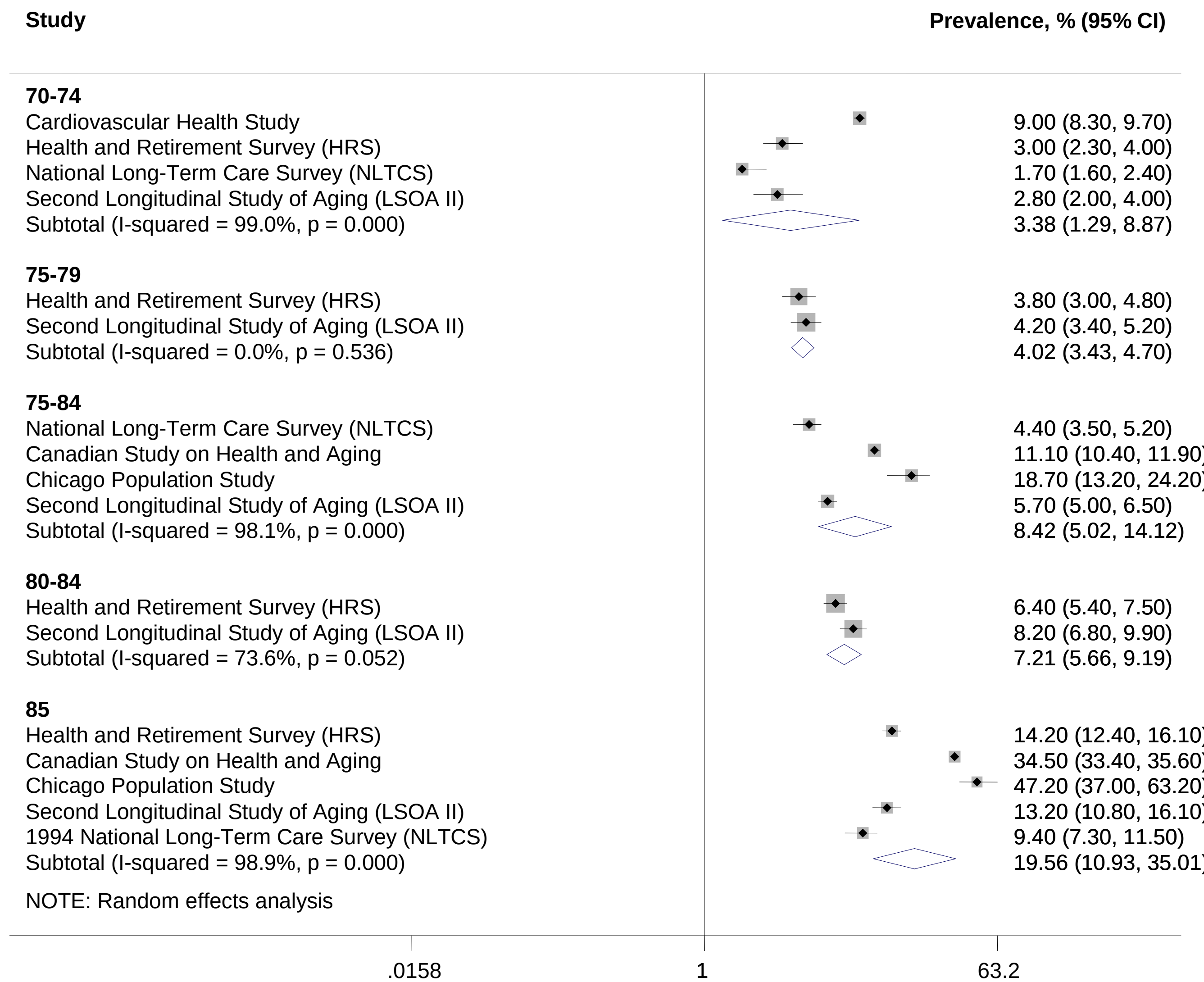


Figure 17. Prevalence of Cognitive Impairment Using the 10-Item Short Portable Mental Status Questionnaire (High Level of Evidence)[46-48]

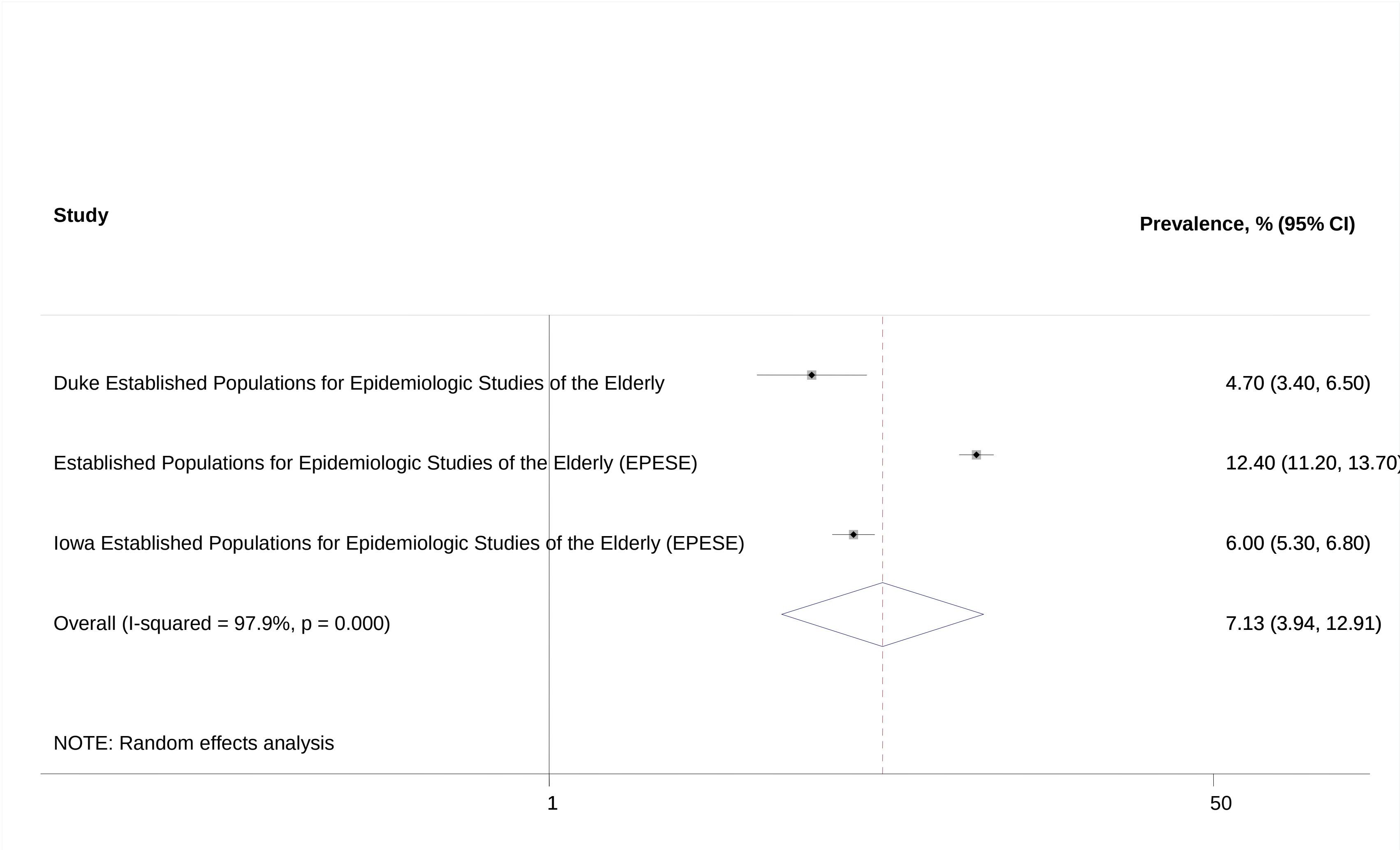


Figure 18. Prevalence of Senile Dementia in Older Persons According to Definition (High Level of Evidence)[262]

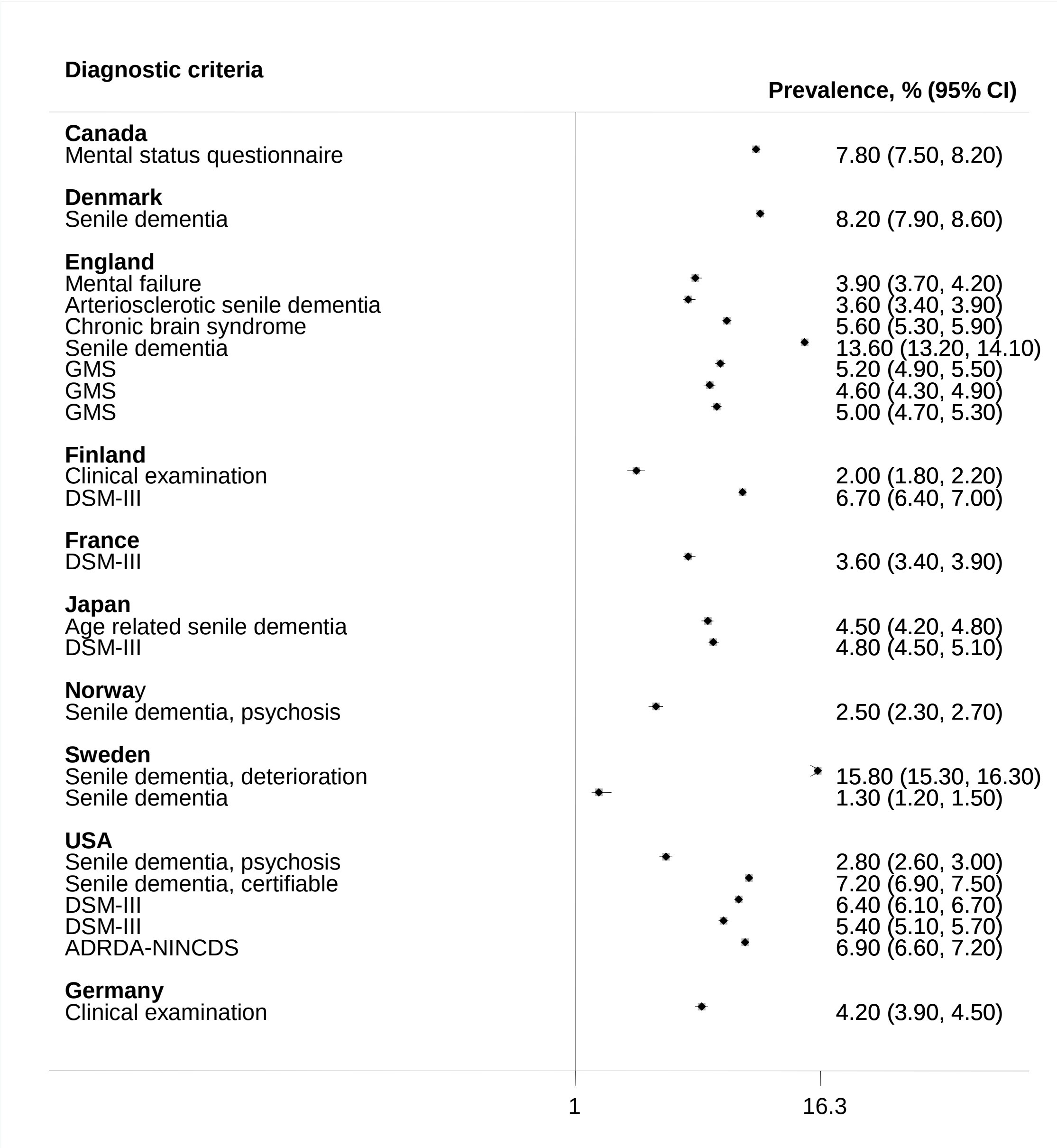


Figure 19. Prevalence of Dementia in Age Groups: Results From the East Boston Study and Meta-Analysis of 13 Epidemiological Studies of Senile Dementia (High Level of Evidence)[92,262]

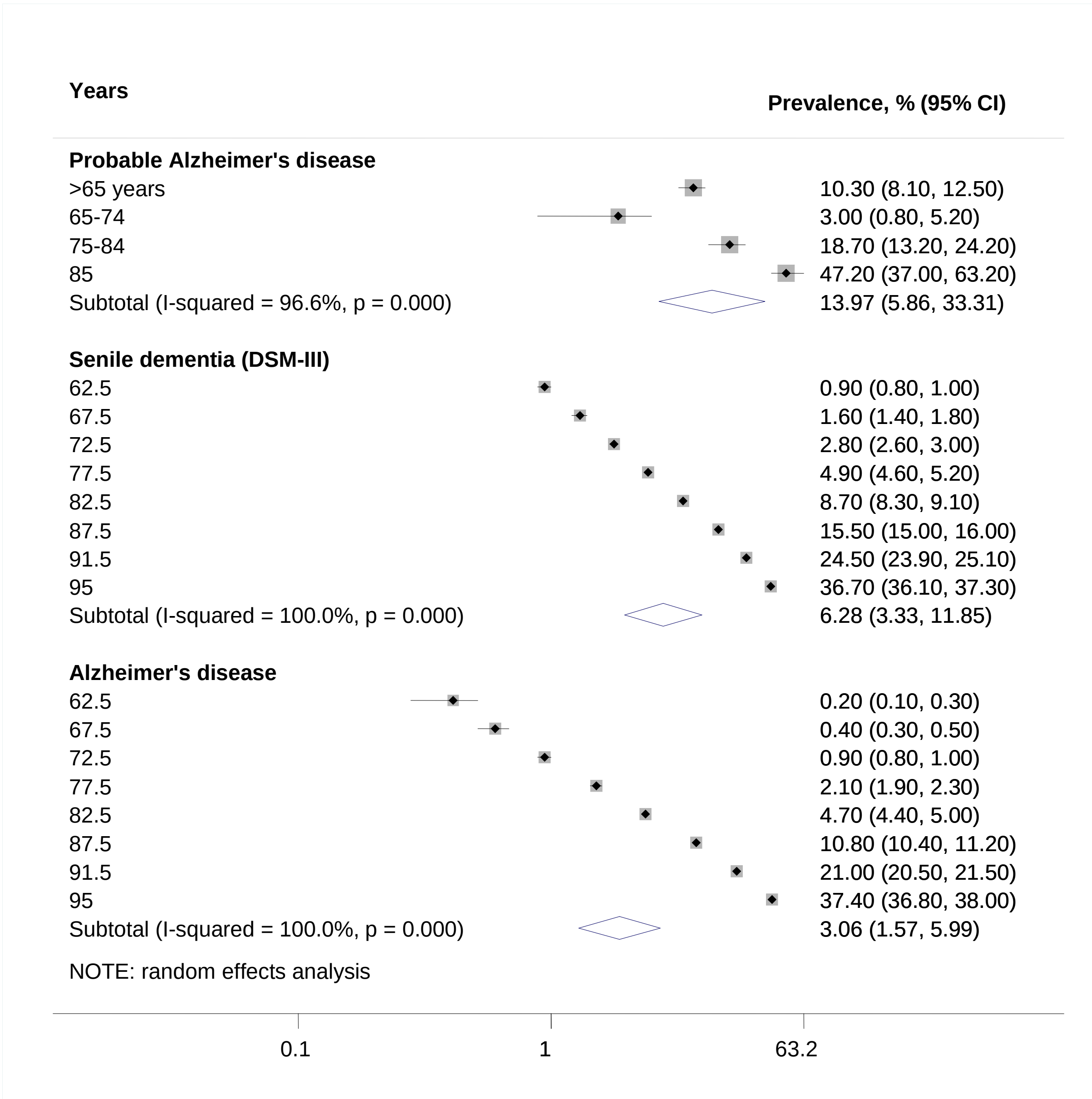


Figure 20. Odds of Higher Frailty Prevalence Estimates (>20%) in Studies That Included Components in the Definition of Frailty Compared to Those That Did Not

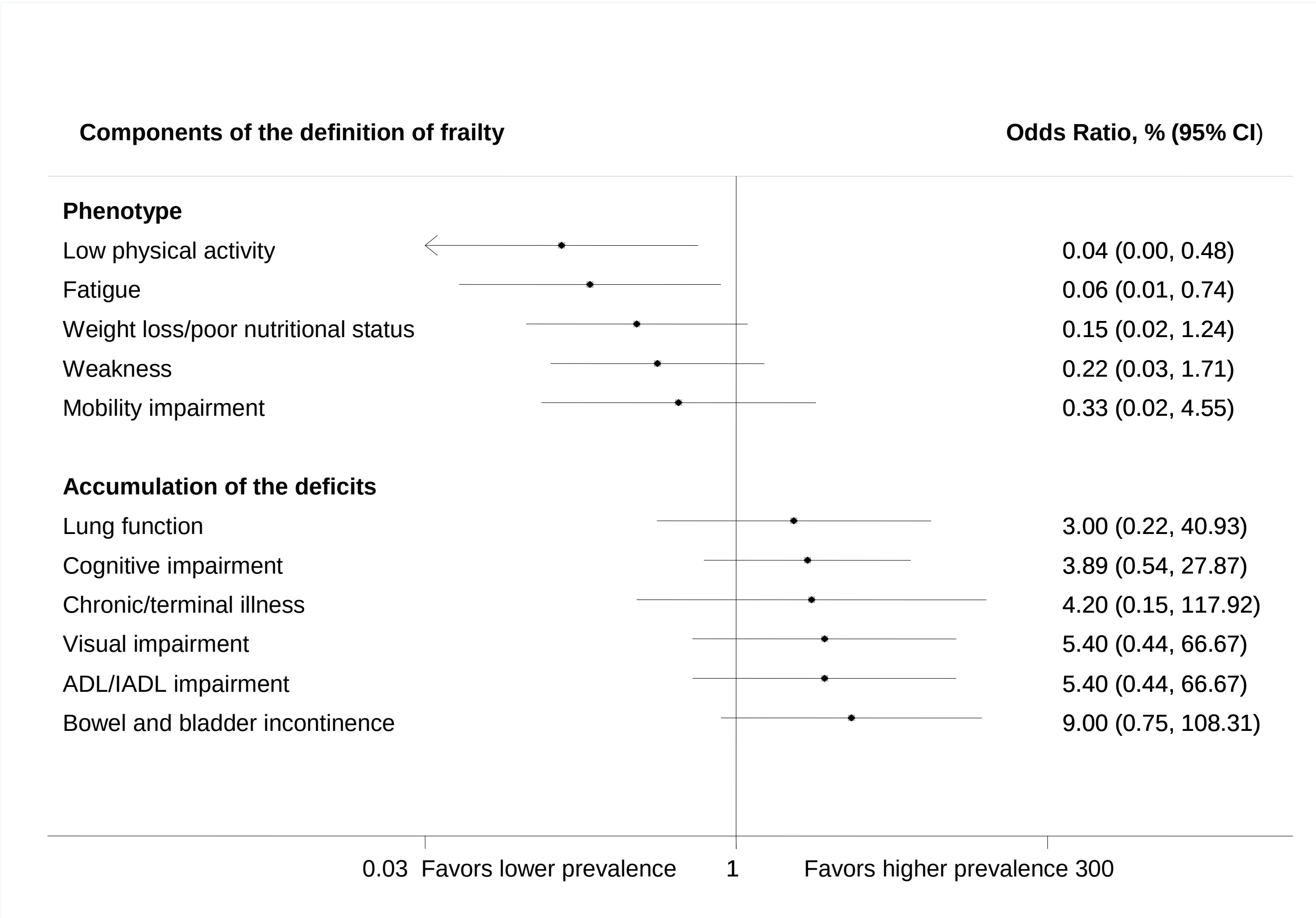


Figure 21. Prevalence of Frailty in Older Persons (High Level of Evidence)[23,101,103,104,107,109,111,115,229,264]

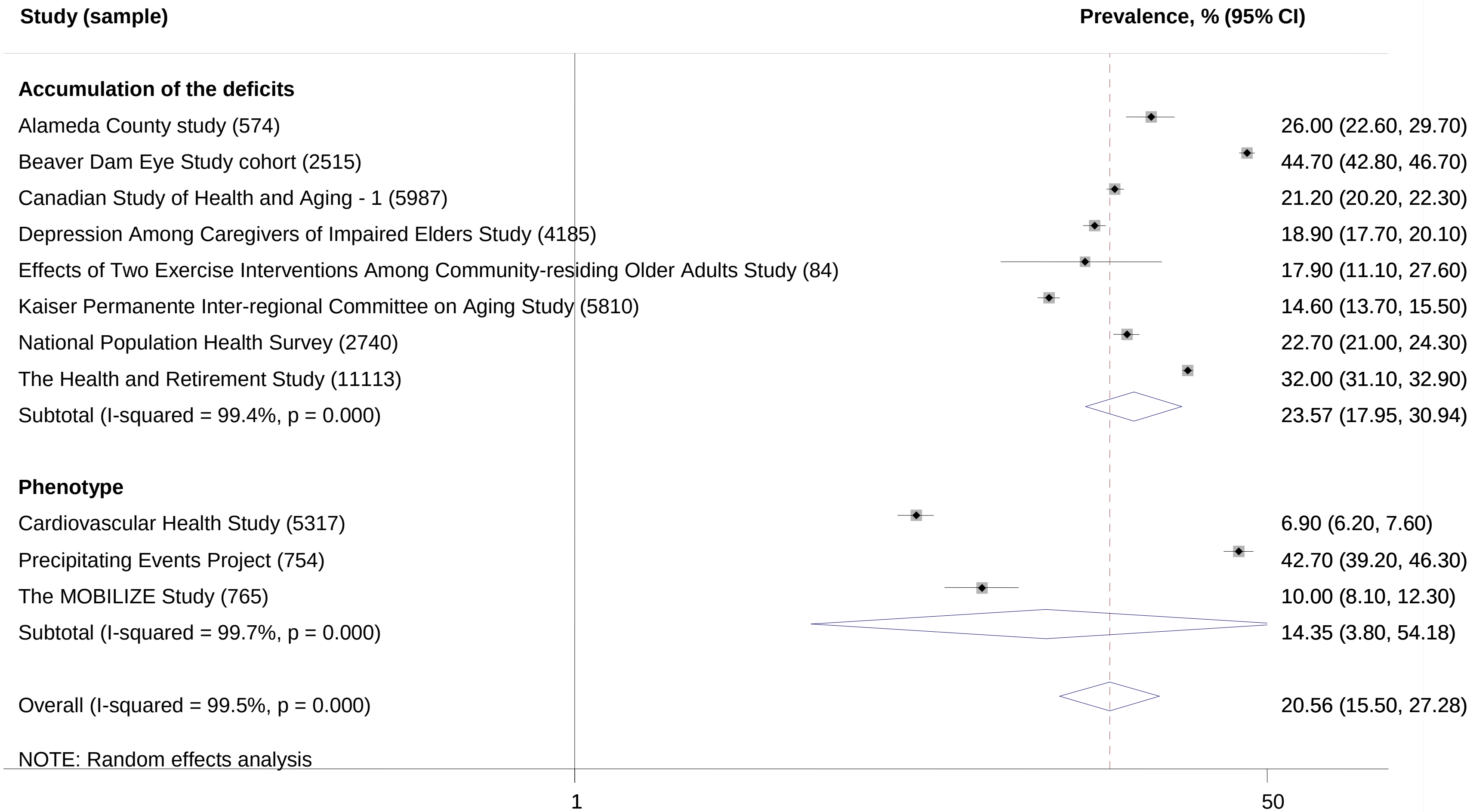


Figure 22. Differences in Prevalence of Frailty in the Same Population According to Definition: Results From the Health and Retirement Study (Good-Quality Study)[104]

Frailty according to different models	Prevalence, % (95% CI)
Crude prevalence	
At least one model (Functional Domains, Burden, or Phenotype)	30.20 (29.40, 31.10)
All three models (Functional Domains, Burden, Phenotype)	3.10 (2.80, 3.40)
>2 domains with deficiencies	29.00 (28.20, 29.90)
Burden model	15.40 (14.70, 16.10)
Functional domain model	20.30 (19.60, 21.10)
Phenotype	10.90 (10.30, 11.50)
Index of Deficit Accumulation (>0.2)	32.00 (31.10, 32.90)
Biologic Syndrome Model (>3 frailty defining criteria)	11.00 (10.40, 11.60)
Weighted percentages	
Functional domains	21.30 (19.40, 23.30)
Burden model	14.79 (13.20, 16.60)
Biologic Syndrome Model	13.28 (11.70, 15.00)

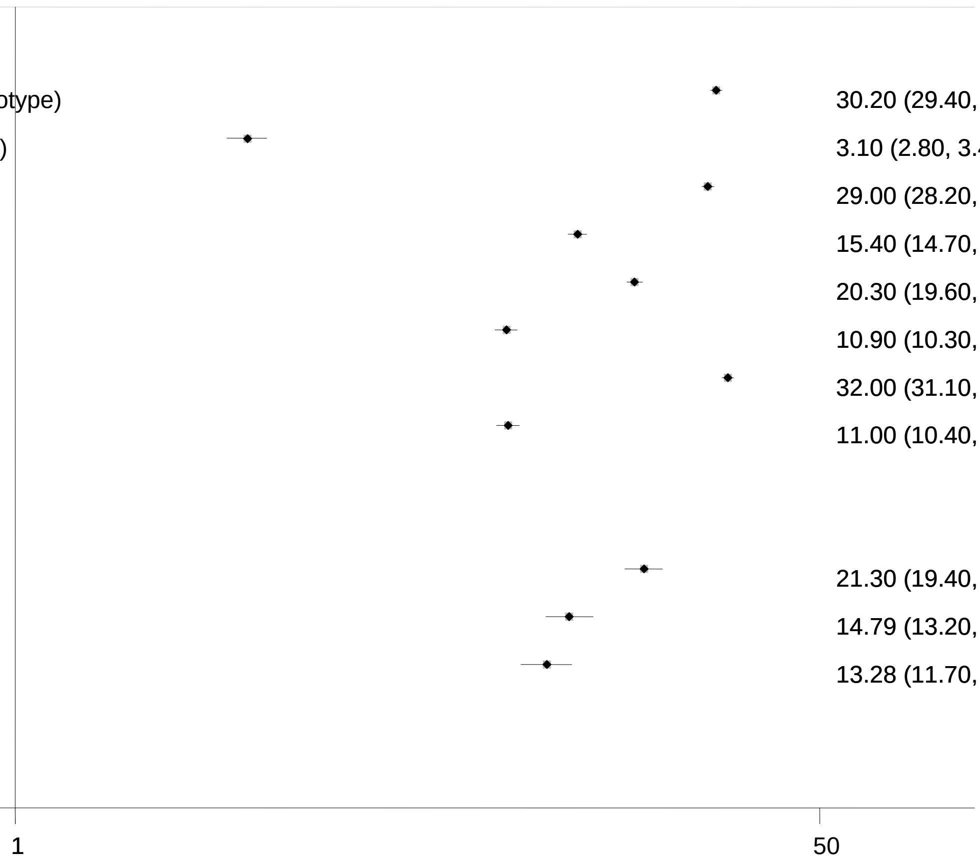


Figure 23. Prevalence of Any ADL Disability (Good-Quality Studies)[41,53,55-64]

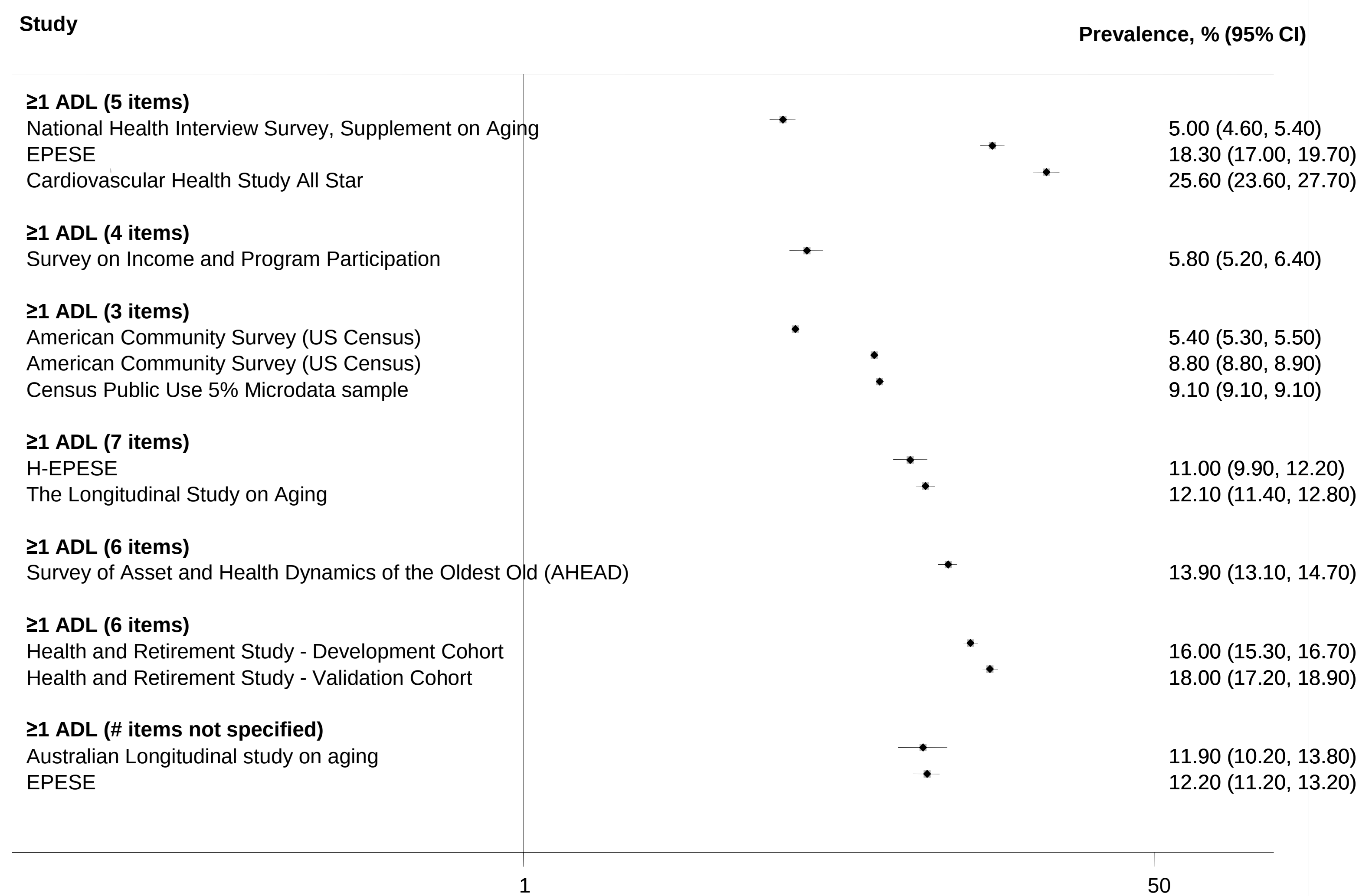


Figure 24. Prevalence of Moderate or Severe ADL Disability (Good-Quality Studies)[5,118]

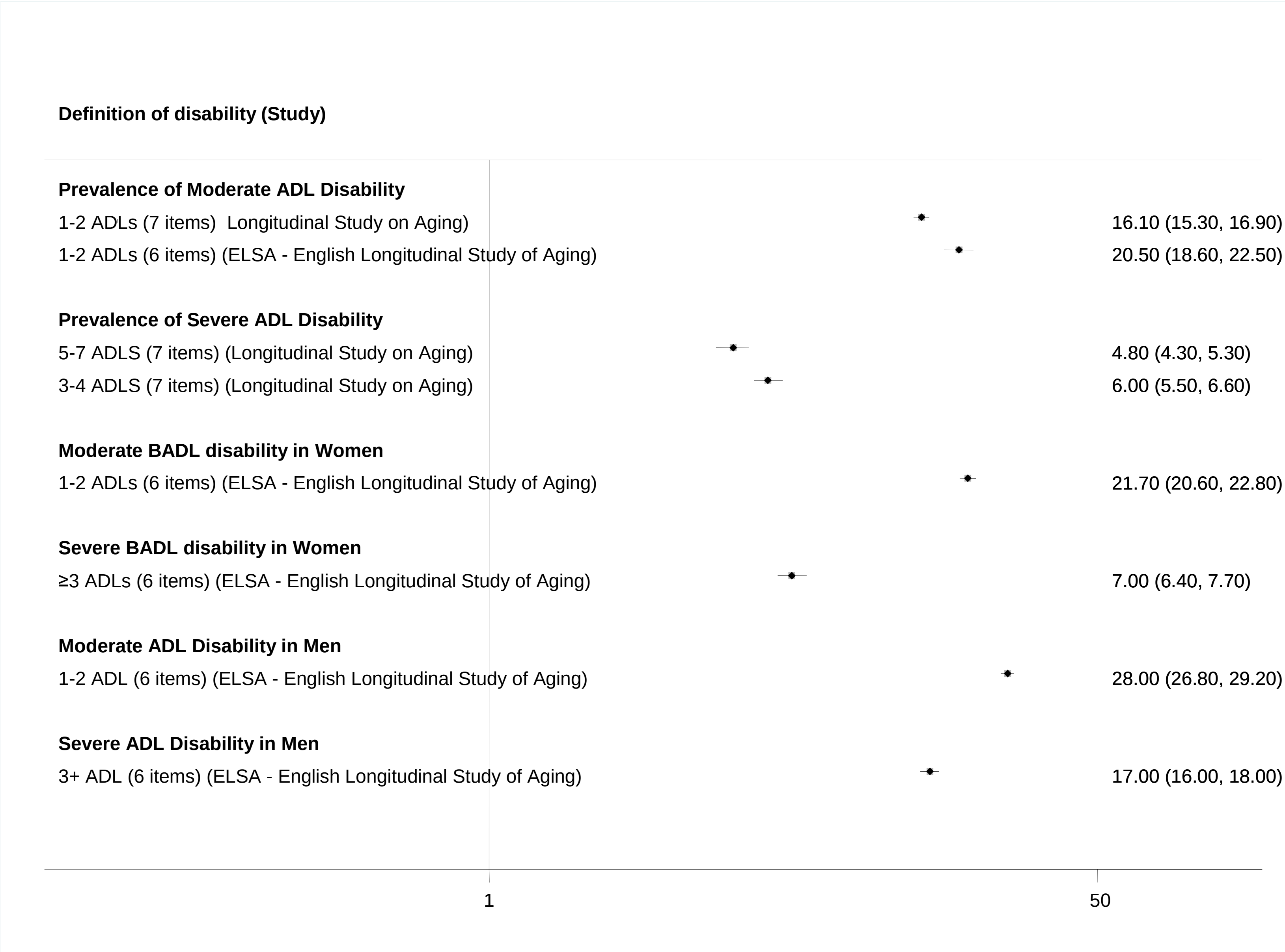


Figure 25. Prevalence of Bathing ADL Disability (High Level of Evidence)[53,55,58,65,122,248]

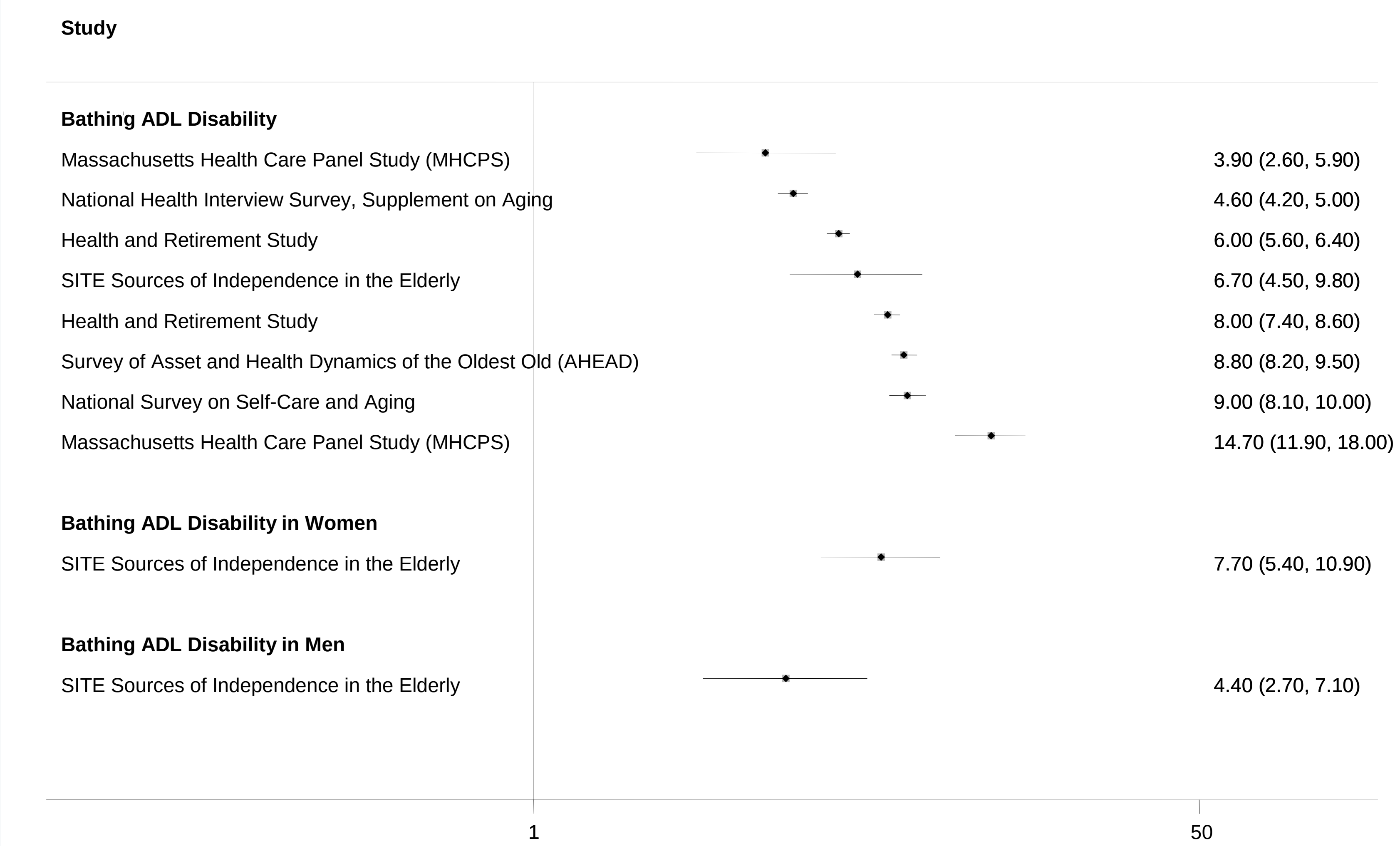


Figure 26. Prevalence of Dressing/Hygiene ADL Disability (High Level of Evidence)[53,55,58,65,248]

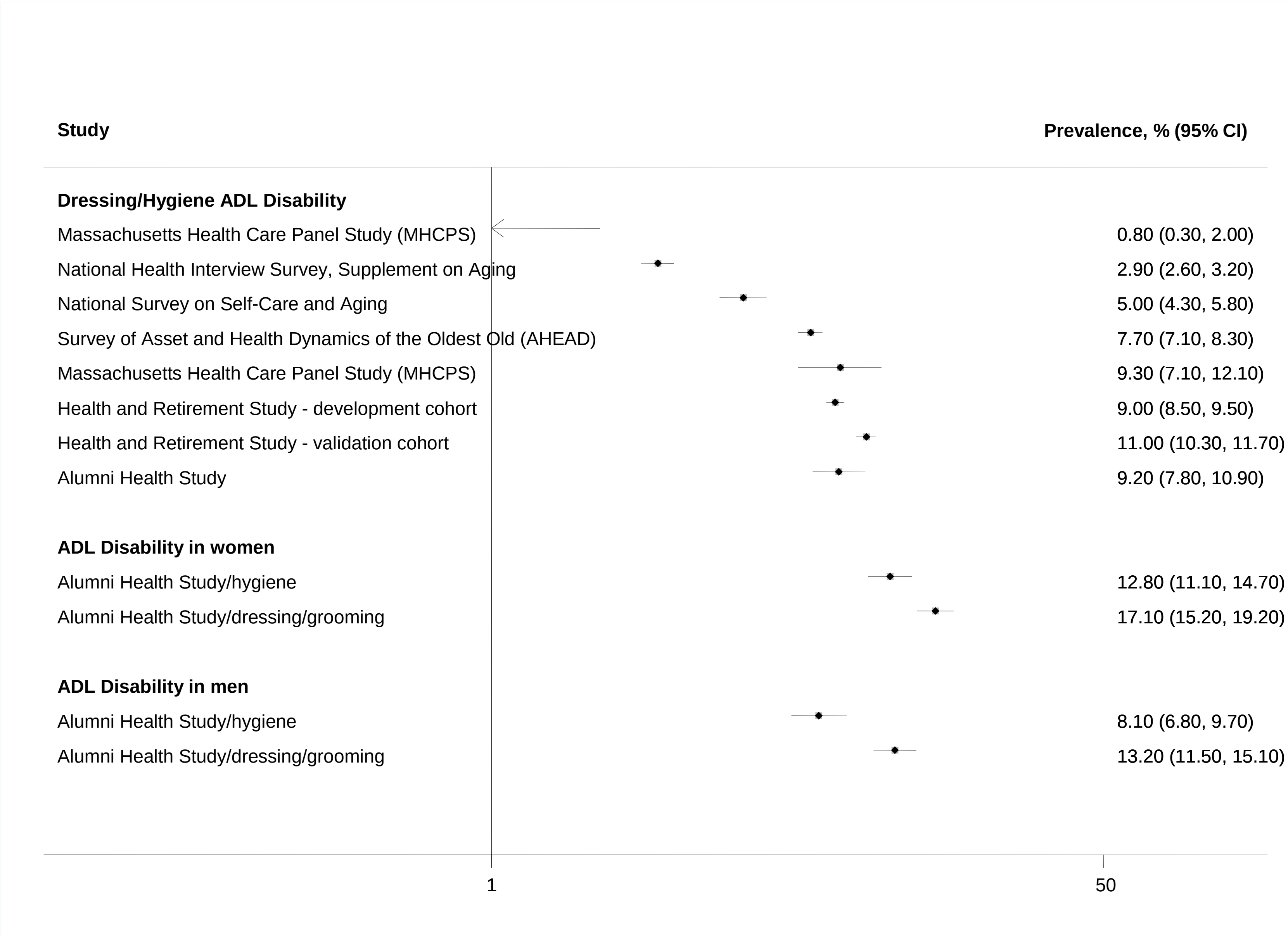


Figure 27. Prevalence of Eating ADL Disability (High Level of Evidence)[53,55,58,65,119,248]

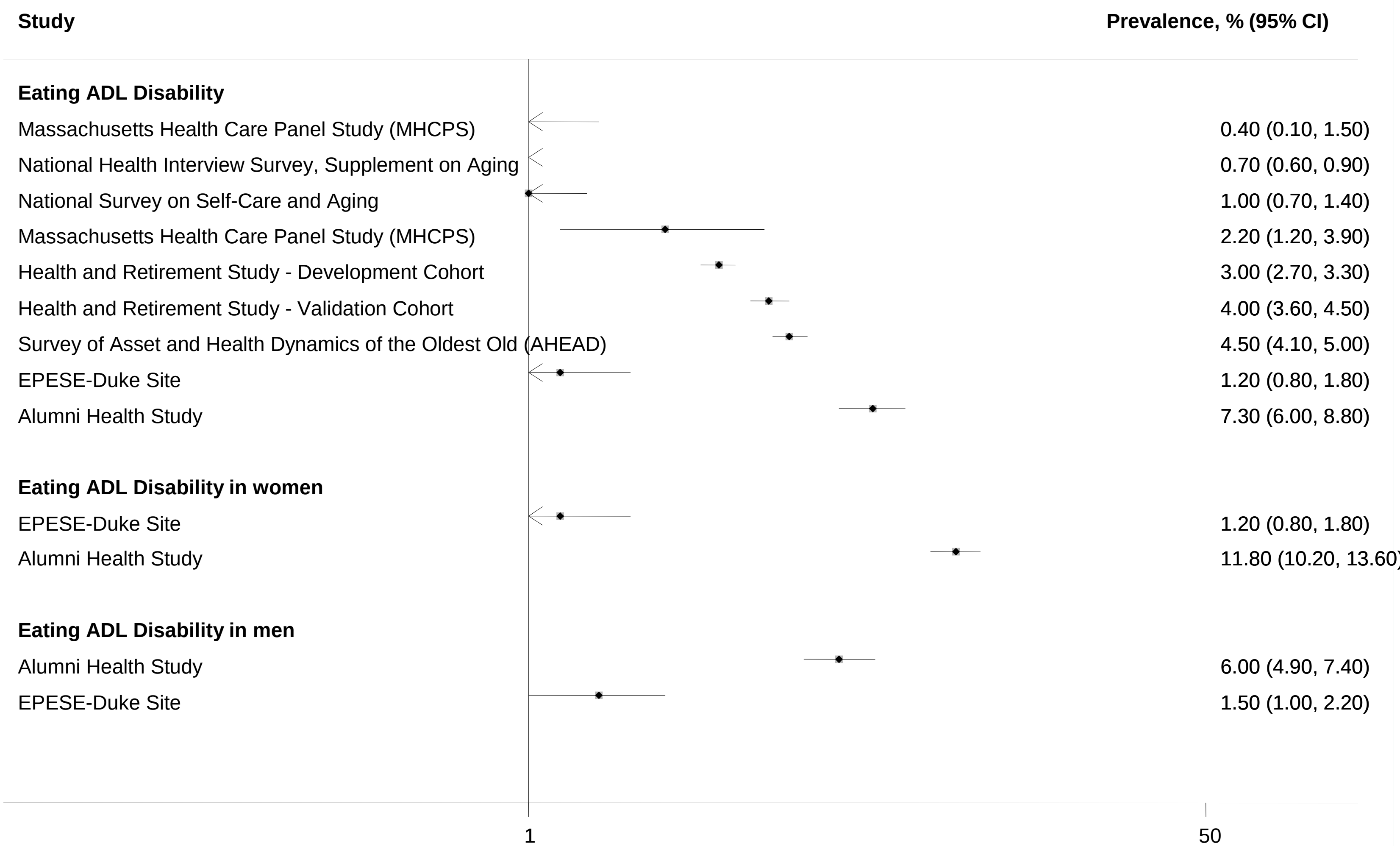


Figure 28. Prevalence of Individual ADL Disability (High Level of Evidence)[53,55,58,65,120]

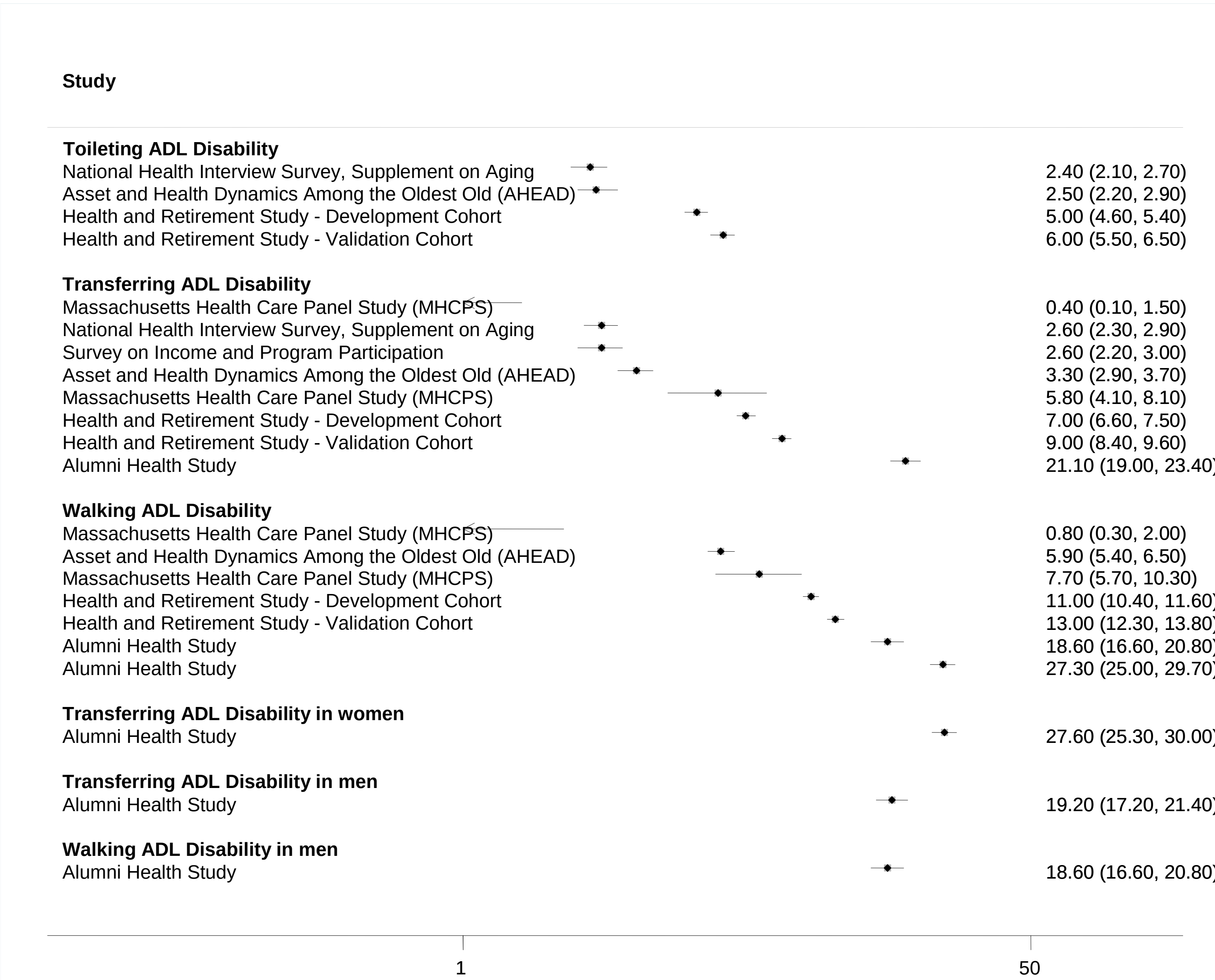


Figure 29. Prevalence of Instrumental ADL Disability (High Level of Evidence)[5,53-57,248,266,267]

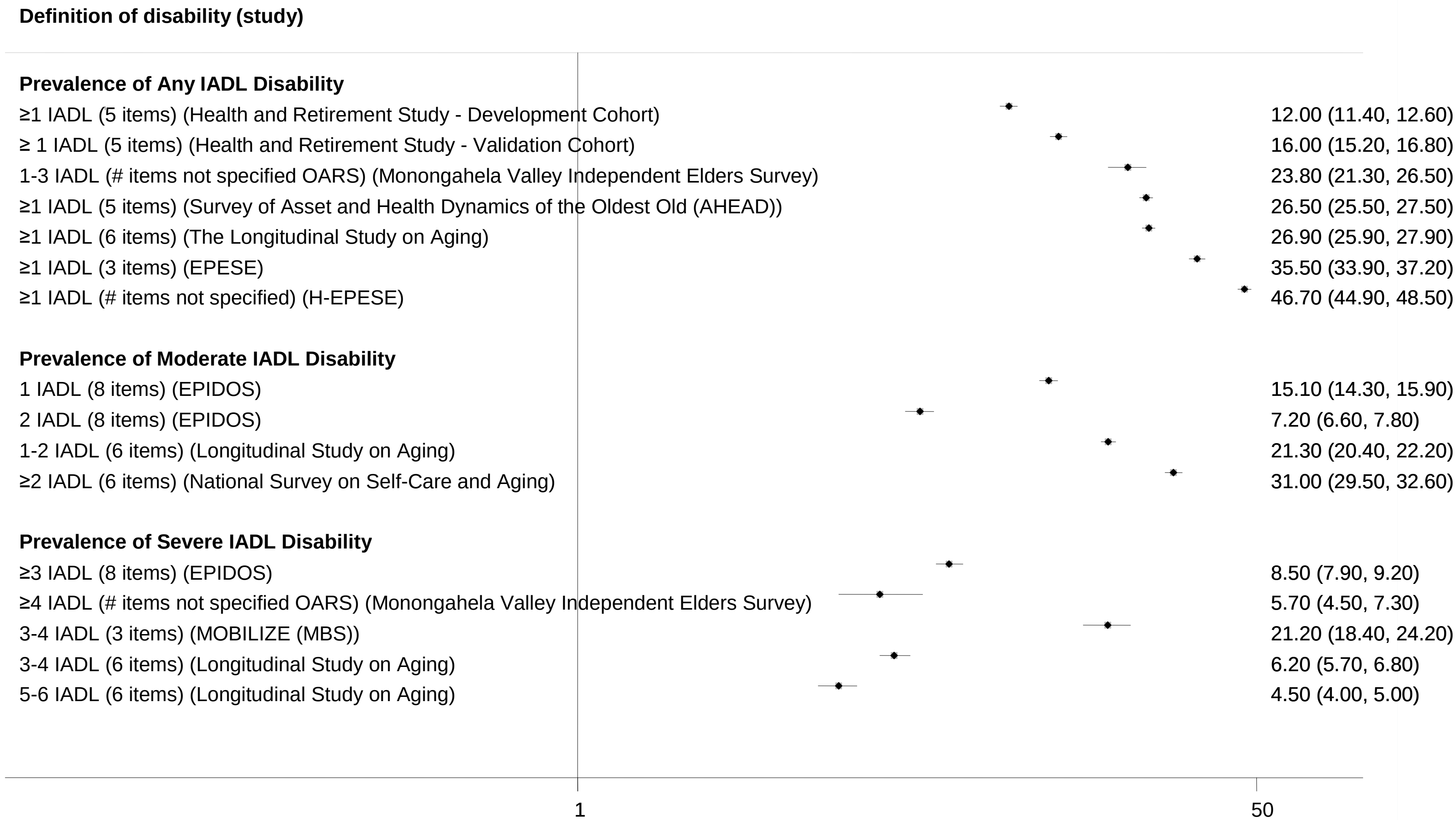


Figure 30. Prevalence of Individual Instrumental ADL Disability (High Level of Evidence)[53,55,65,119,122]

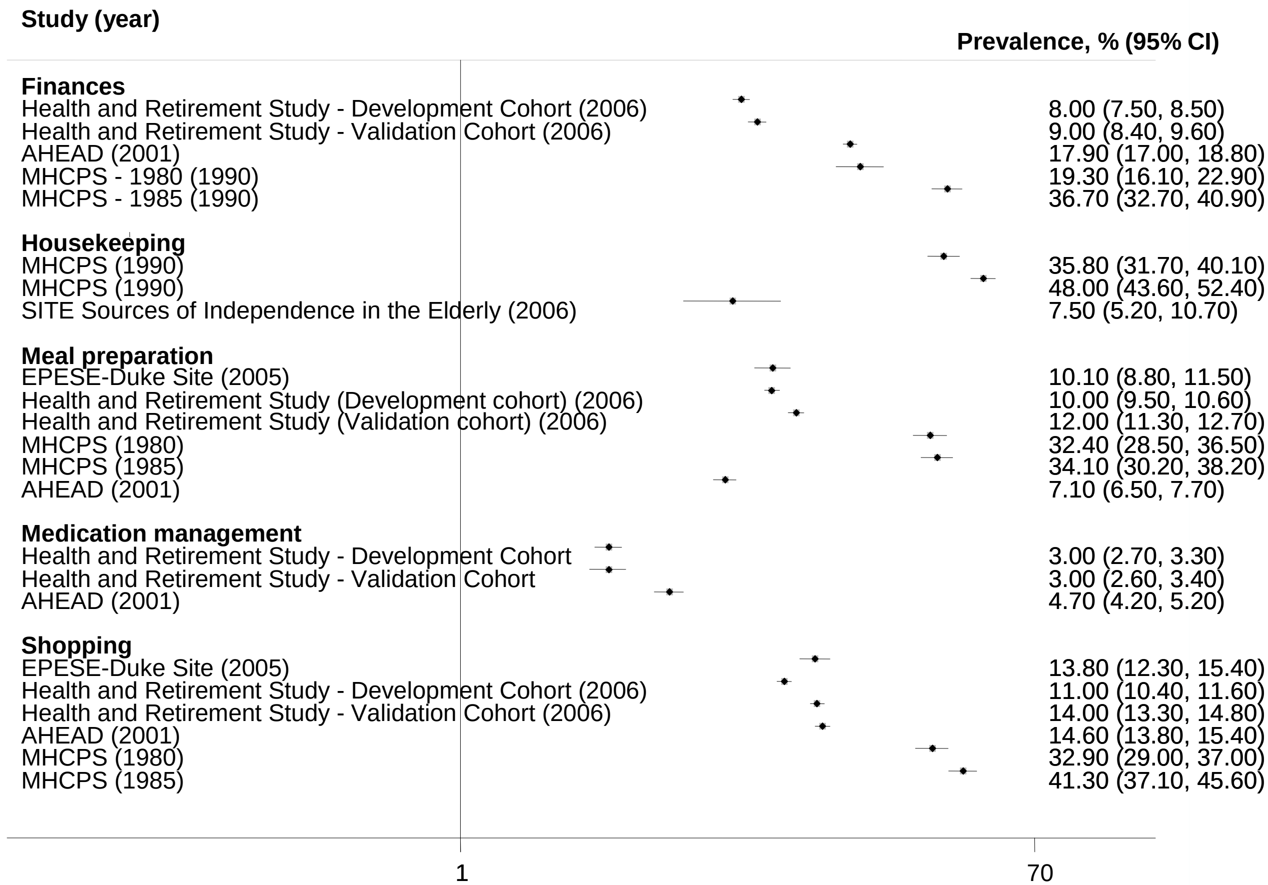


Figure 31. Prevalence of Telephone and Transportation Instrumental ADL Disability (Low to Moderate Level of Evidence)[53,55,65]

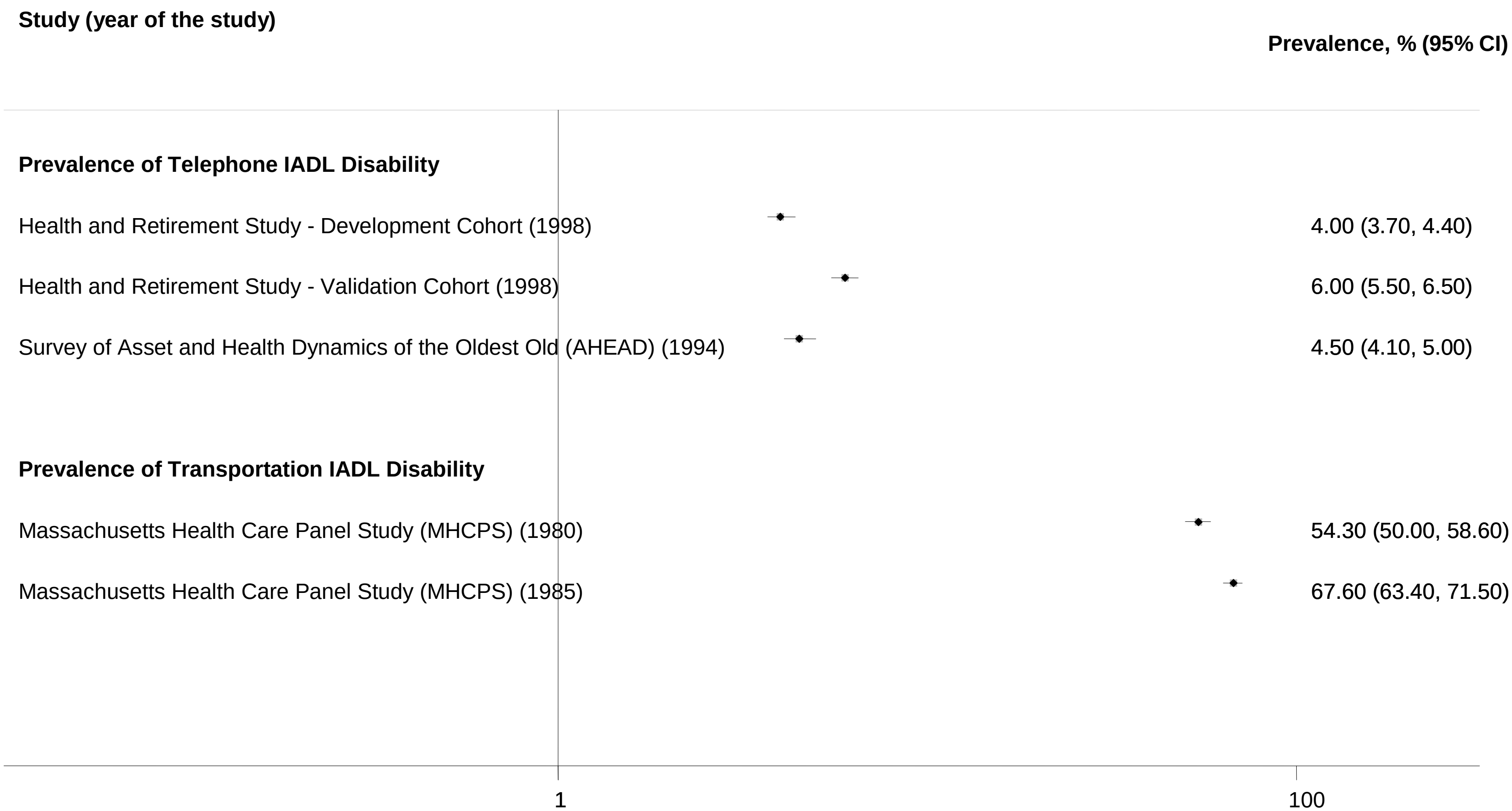
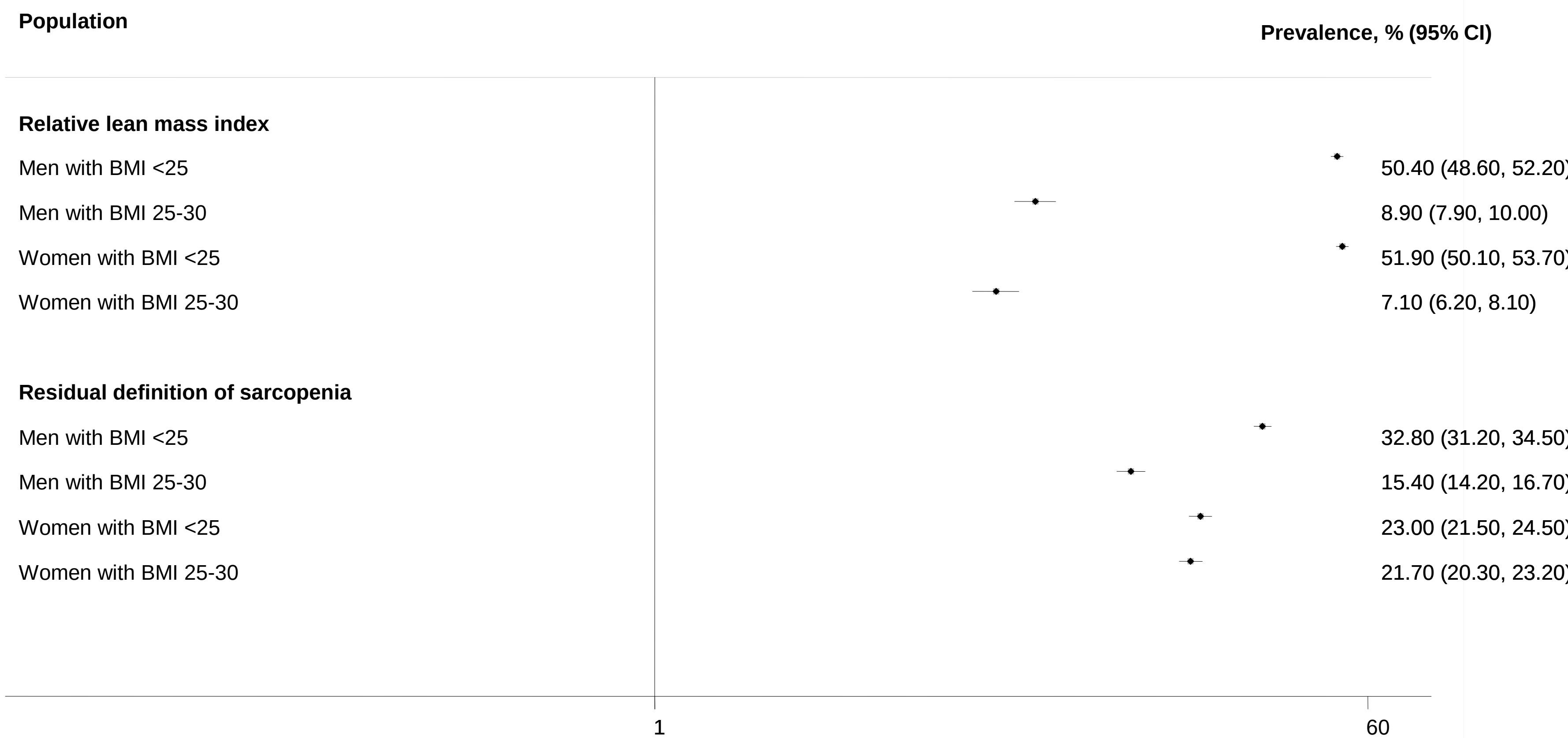


Figure 32. Prevalence of Sarcopenia in Participants of the Health, Aging, and Body Composition Study (Good-Quality Study)[123]



Sarcopenia was defined using relative lean mass index (<7.23 kg/m^2 for men and <5.67 kg/m^2 for women) and negative residuals that were derived by adjusting for fat mass in addition to height.

Figure 33. Prevalence of Micronutrient Deficiency in Older Persons (High Level of Evidence)[80,81]

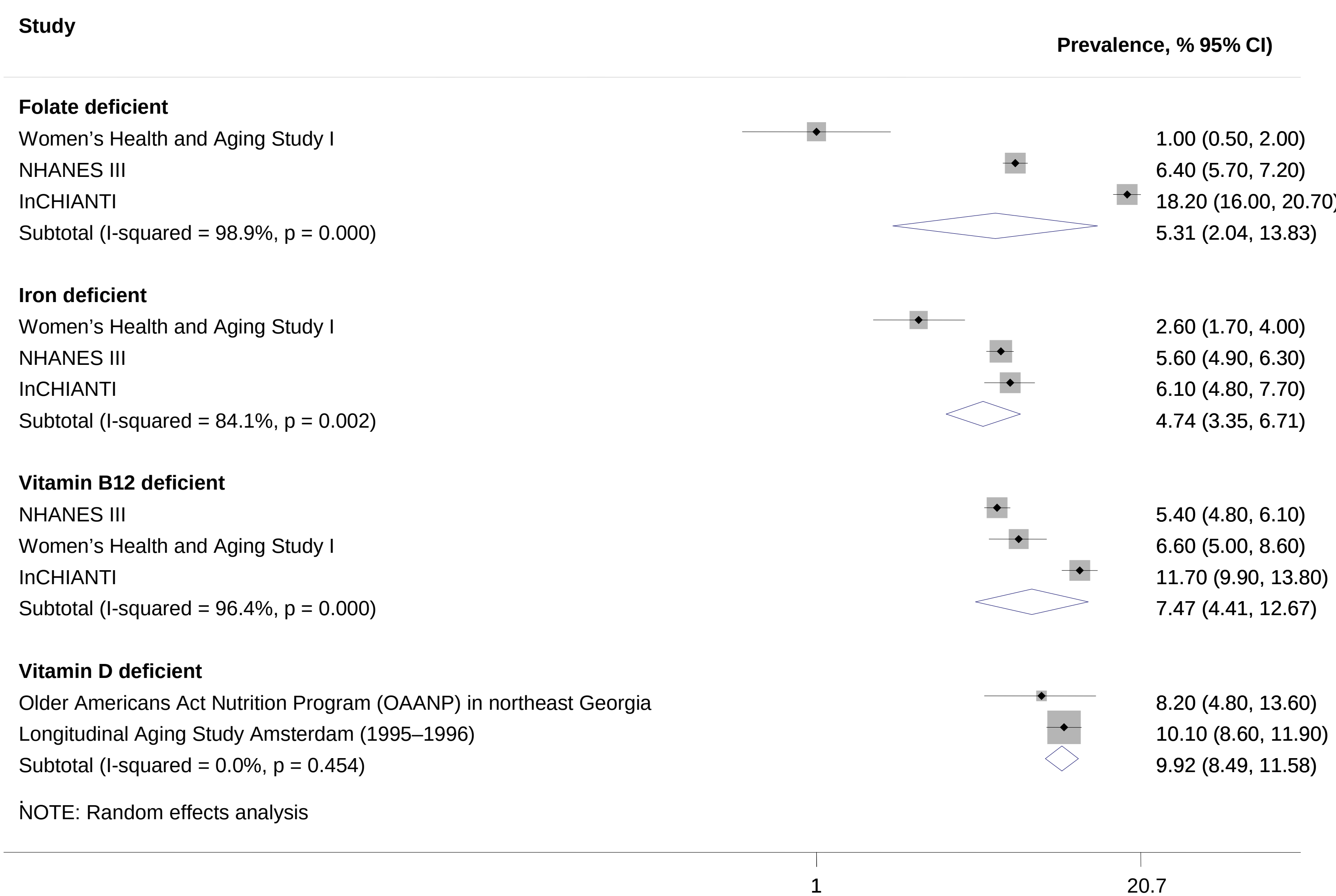


Figure 34. Prevalence of Malnutrition Using the Composite Nutritional Score (High Level of Evidence)[70,72,82-85]

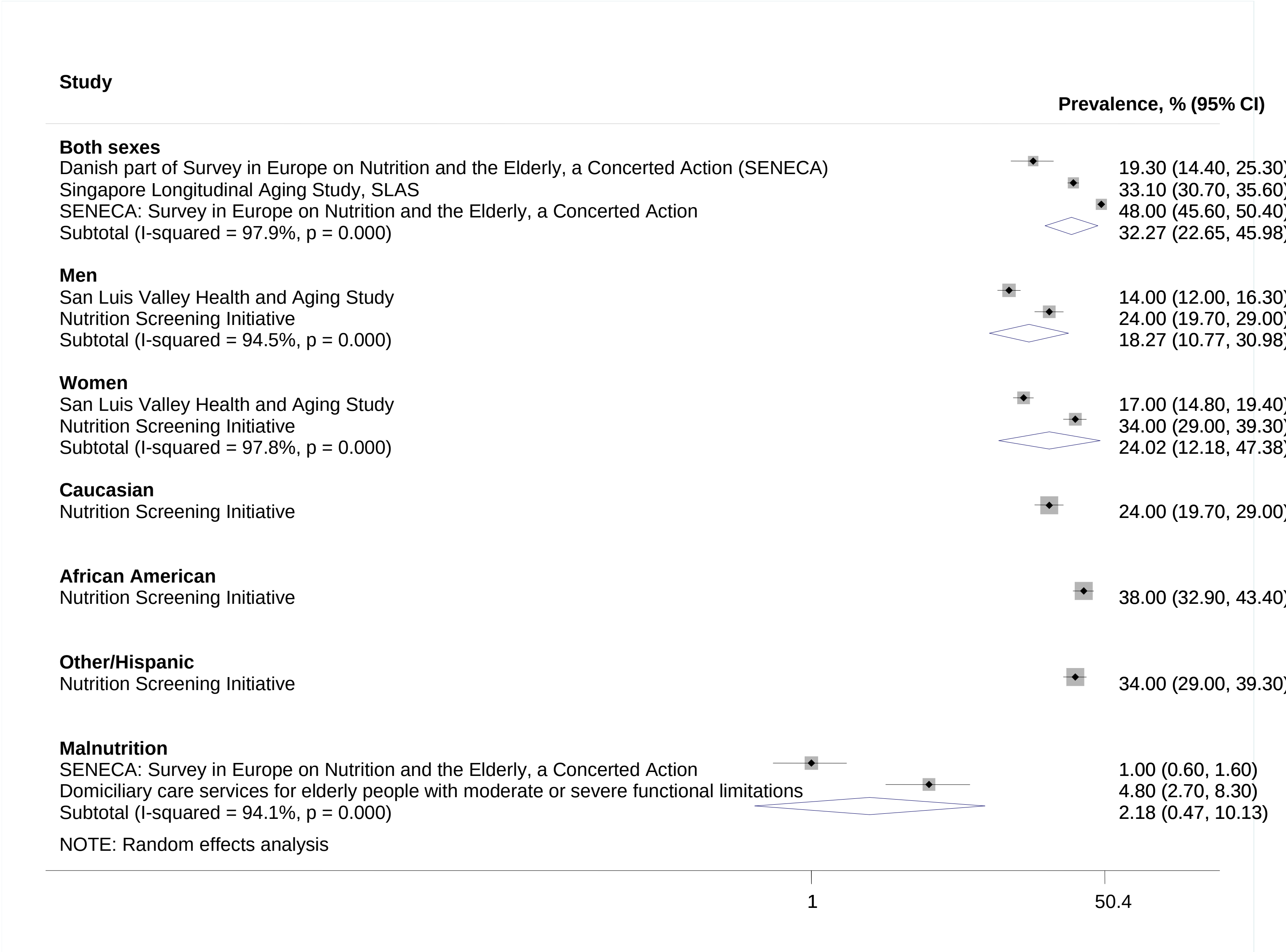


Figure 35. Prevalence of Fair/Poor Health Status in Older Men (Moderate Level of Evidence)[74,94,103,280]

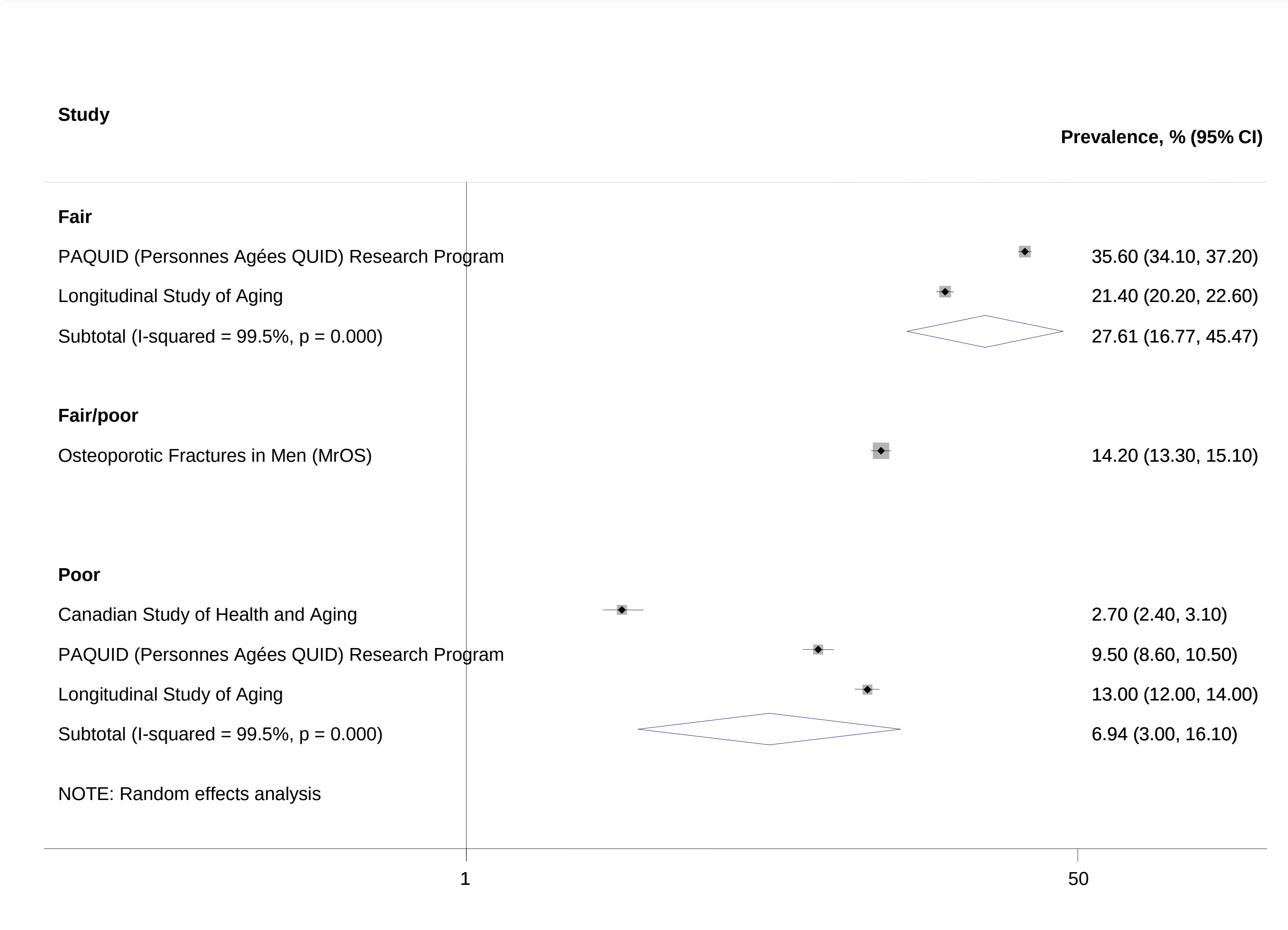


Figure 36. Prevalence of Fair/Poor Health Status in Older Women (Moderate Level of Evidence)[94,103,280]

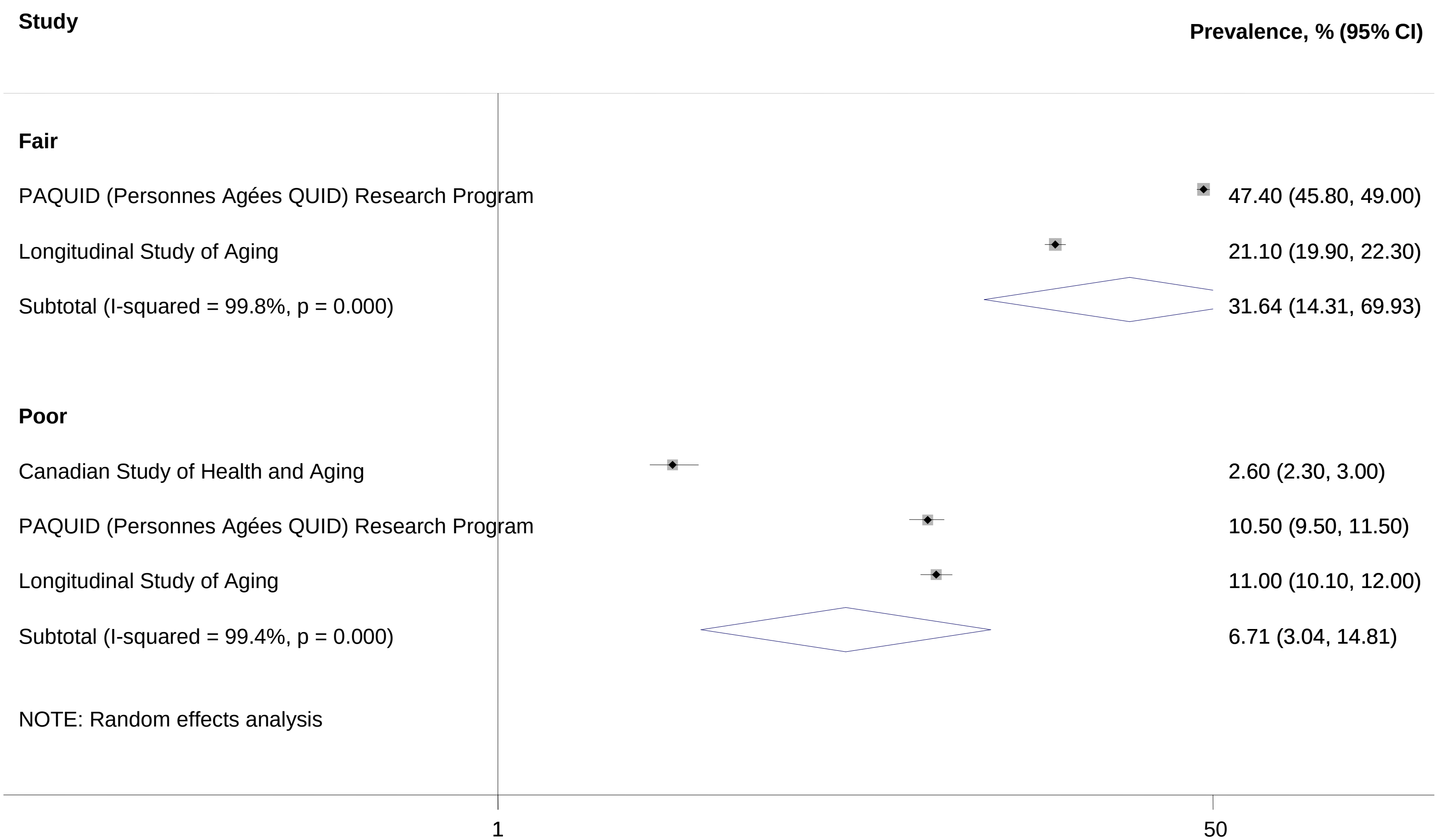


Figure 37. Prevalence of Mild Cognitive Impairment in Different Race and Age Categories Using the 3MSE Questionnaire for Cognitive Functioning (High Level of Evidence)[90,91,146,281]

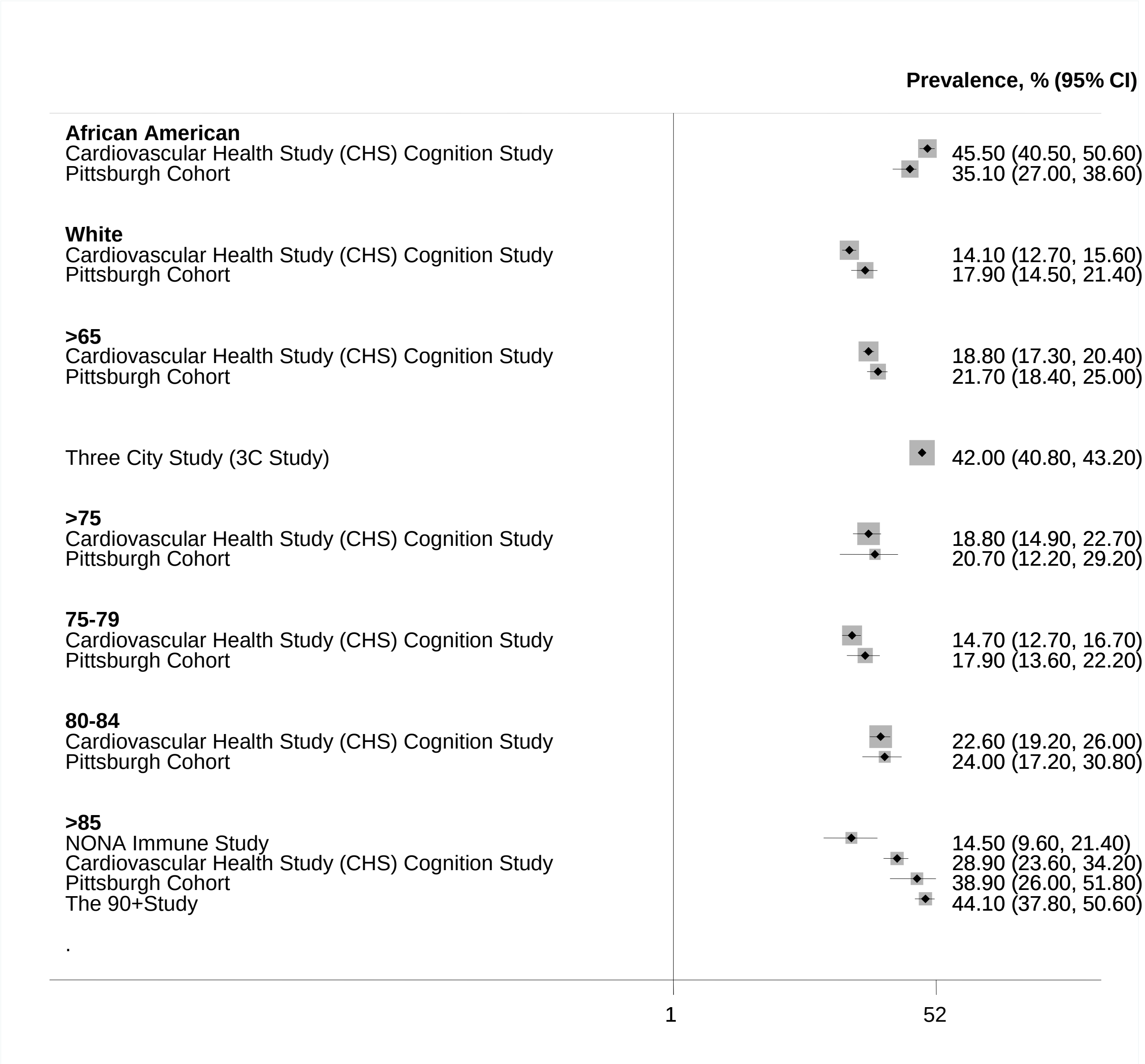


Figure 38. Prevalence of Vascular and Mixed Dementia in Older Men: Results From the EURODEM Prevalence Research Group (High Level of Evidence)[97]

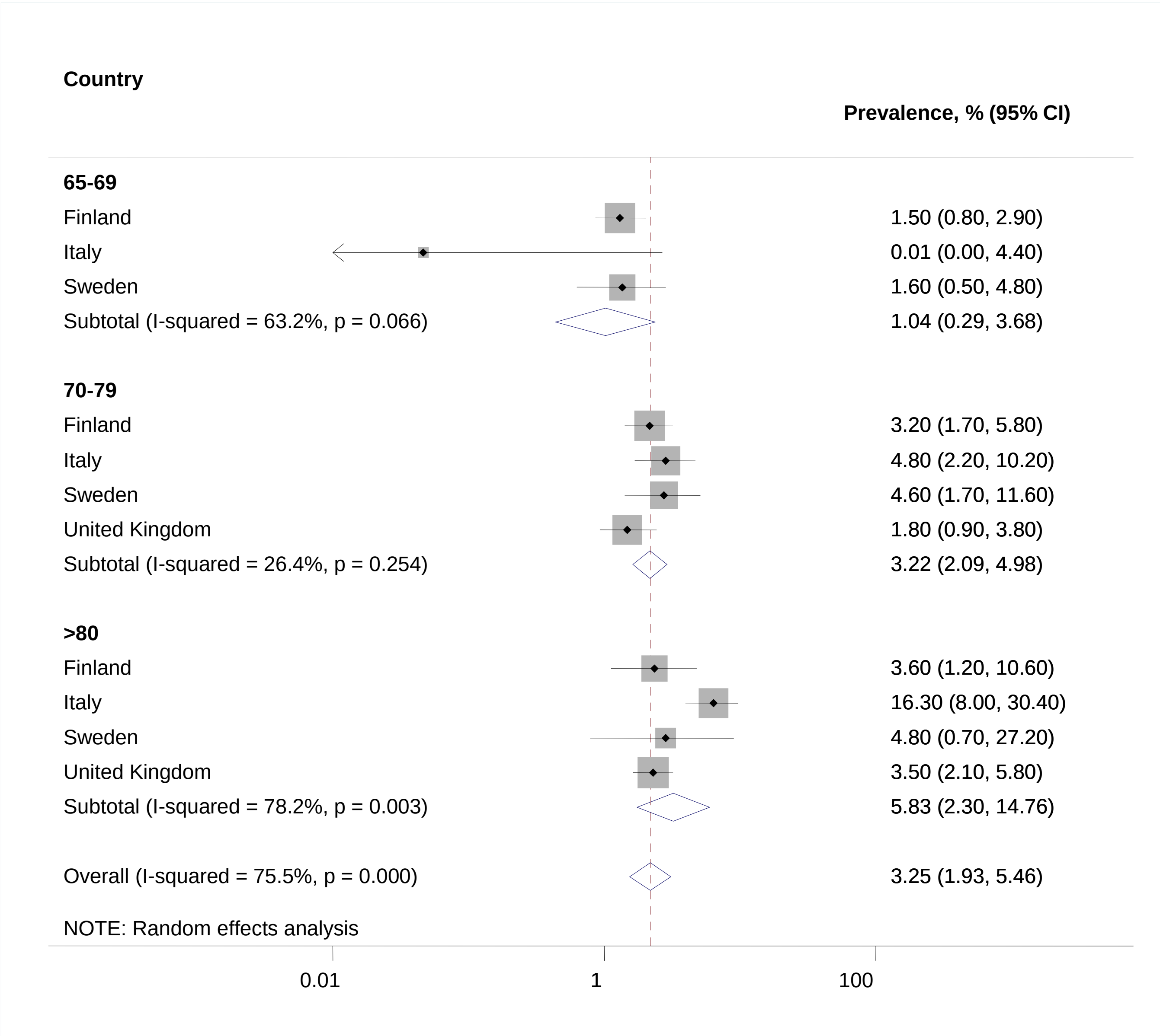


Figure 39. Prevalence of Dementia in Older Men in Age and Severity Categories (Moderate Level of Evidence)[95,282]

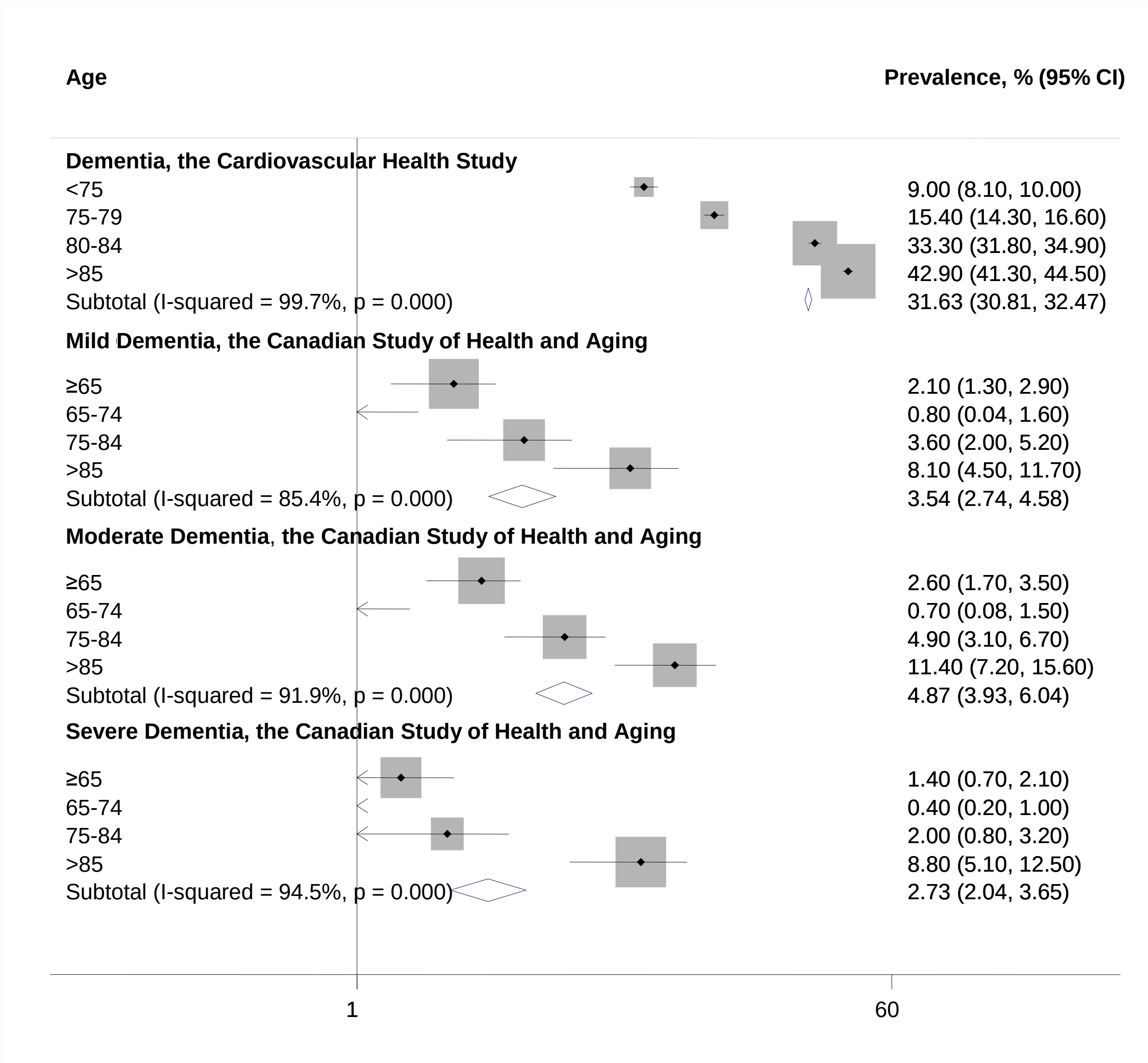
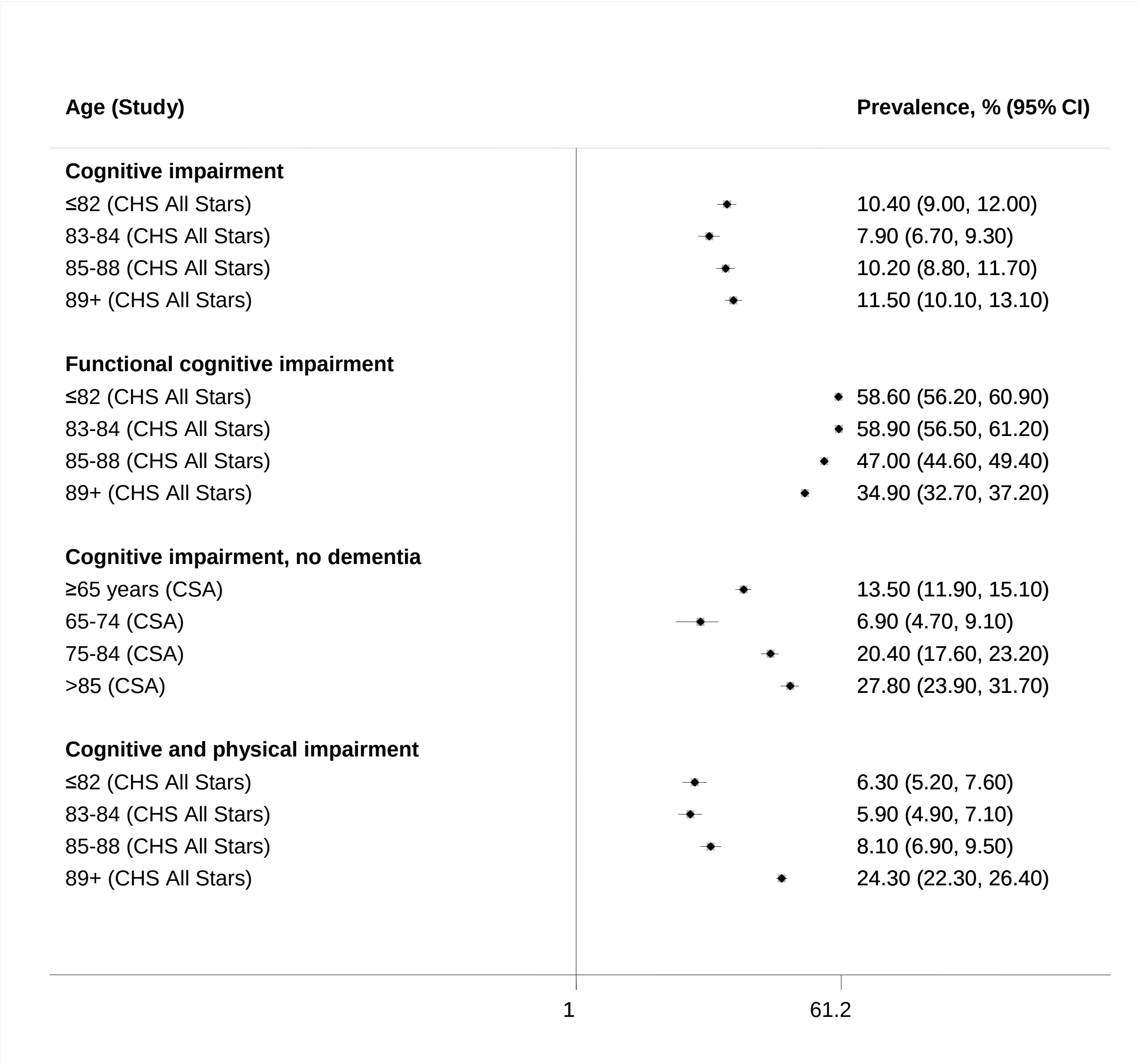


Figure 40. Prevalence of Cognitive Impairment in Older Women in Age Categories Using Definitions Derived From the 3MSE Questionnaire (Moderate Level of Evidence)[59,95]



CHS=Cardiovascular Health Study All Stars; CSA=Canadian Study of Aging.

Figure 41. Prevalence of Cognitive Impairment in Older Women Defined as an MMSE Score <24 (High Level of Evidence)[42,90,94,96]

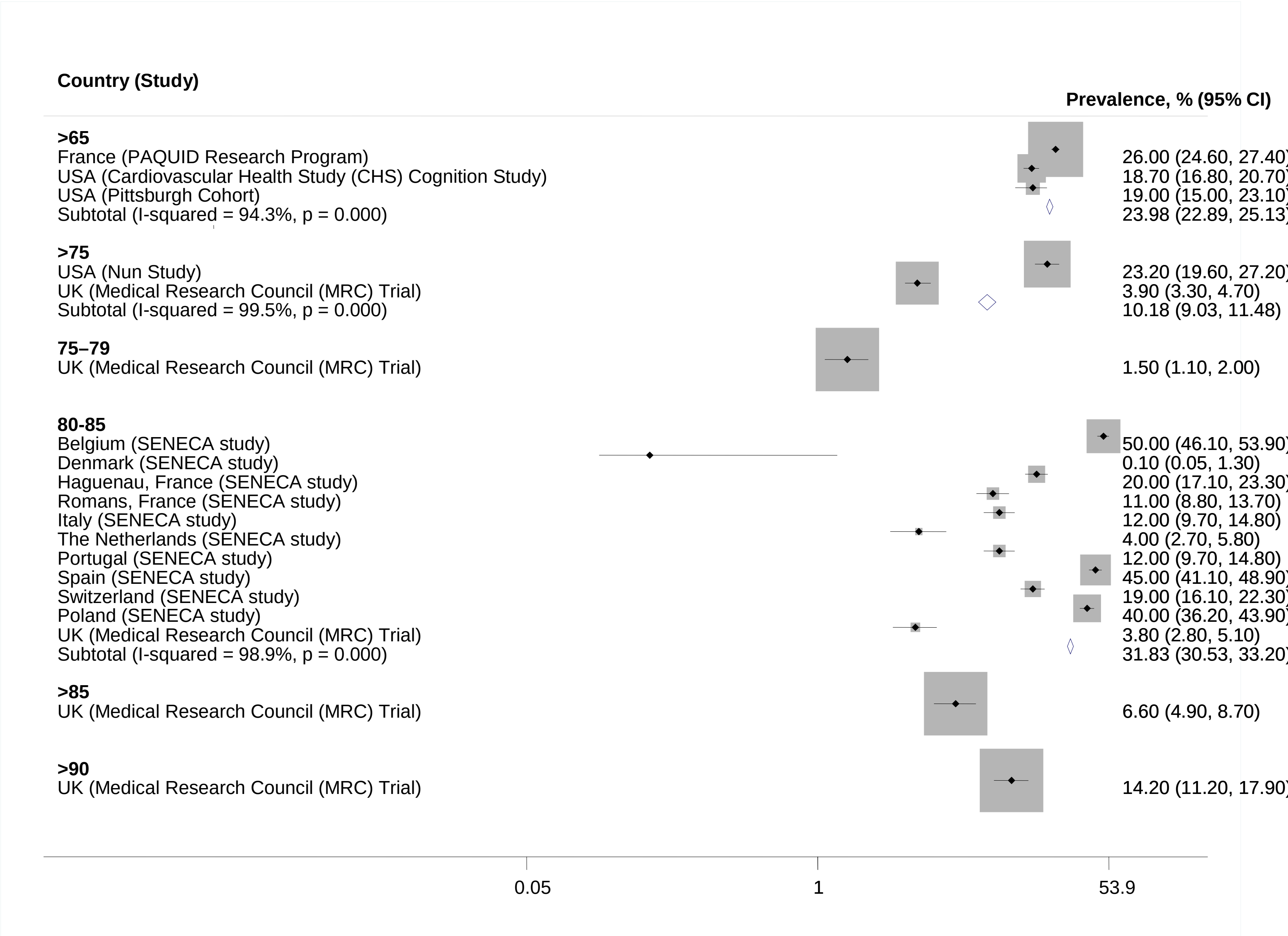


Figure 42. Prevalence of Cognitive Impairment in Older Women in the Cardiovascular Health Study Using the 3MSE Questionnaire and in the Second Longitudinal Study of Aging Using the Telephone Interview of Cognitive Status Instrument (Good-Quality Study)[49]

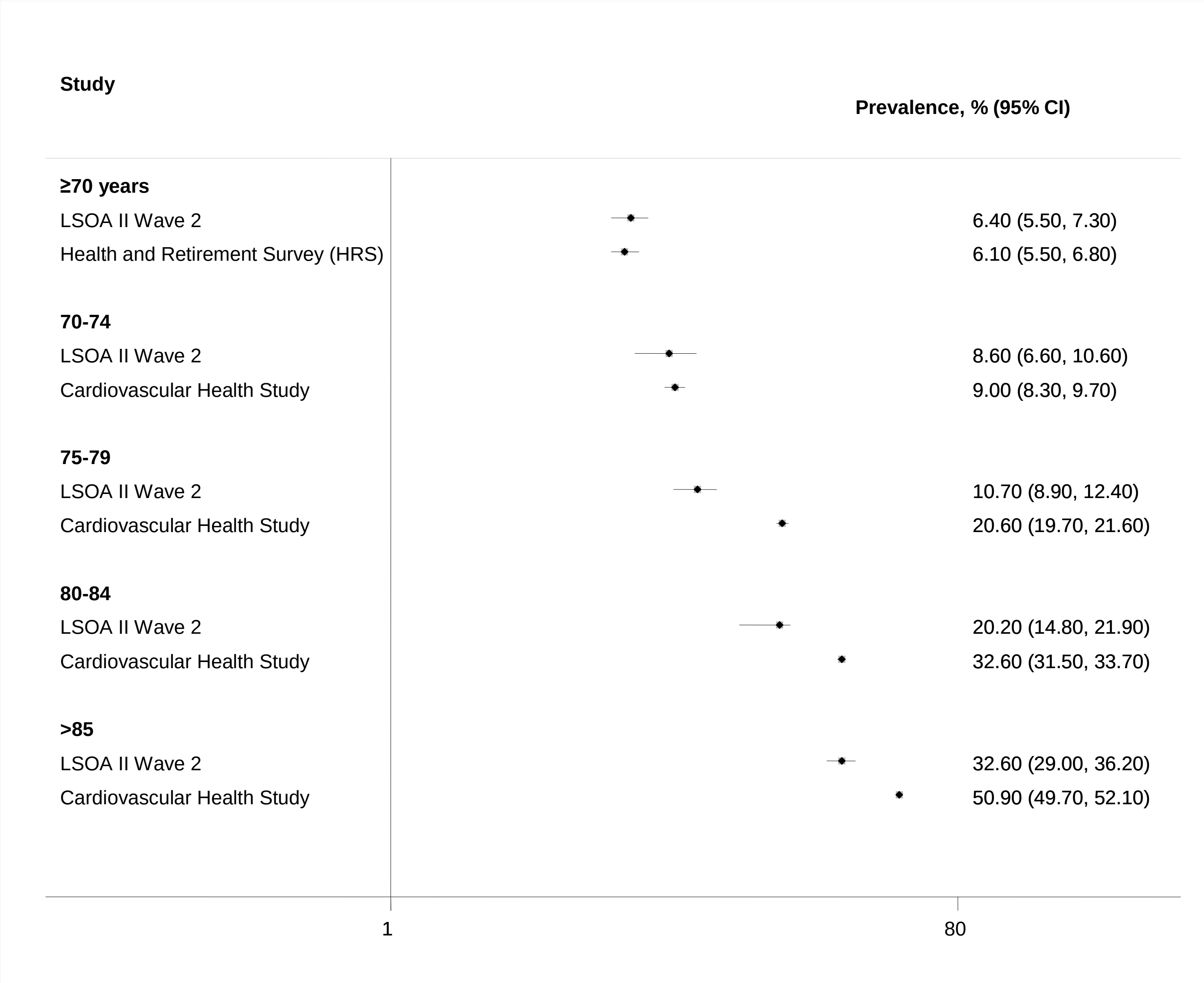


Figure 43. Prevalence of Vascular or Mixed Dementia in Older Women From the EURODEM Prevalence Research Group (High Level of Evidence)[97]

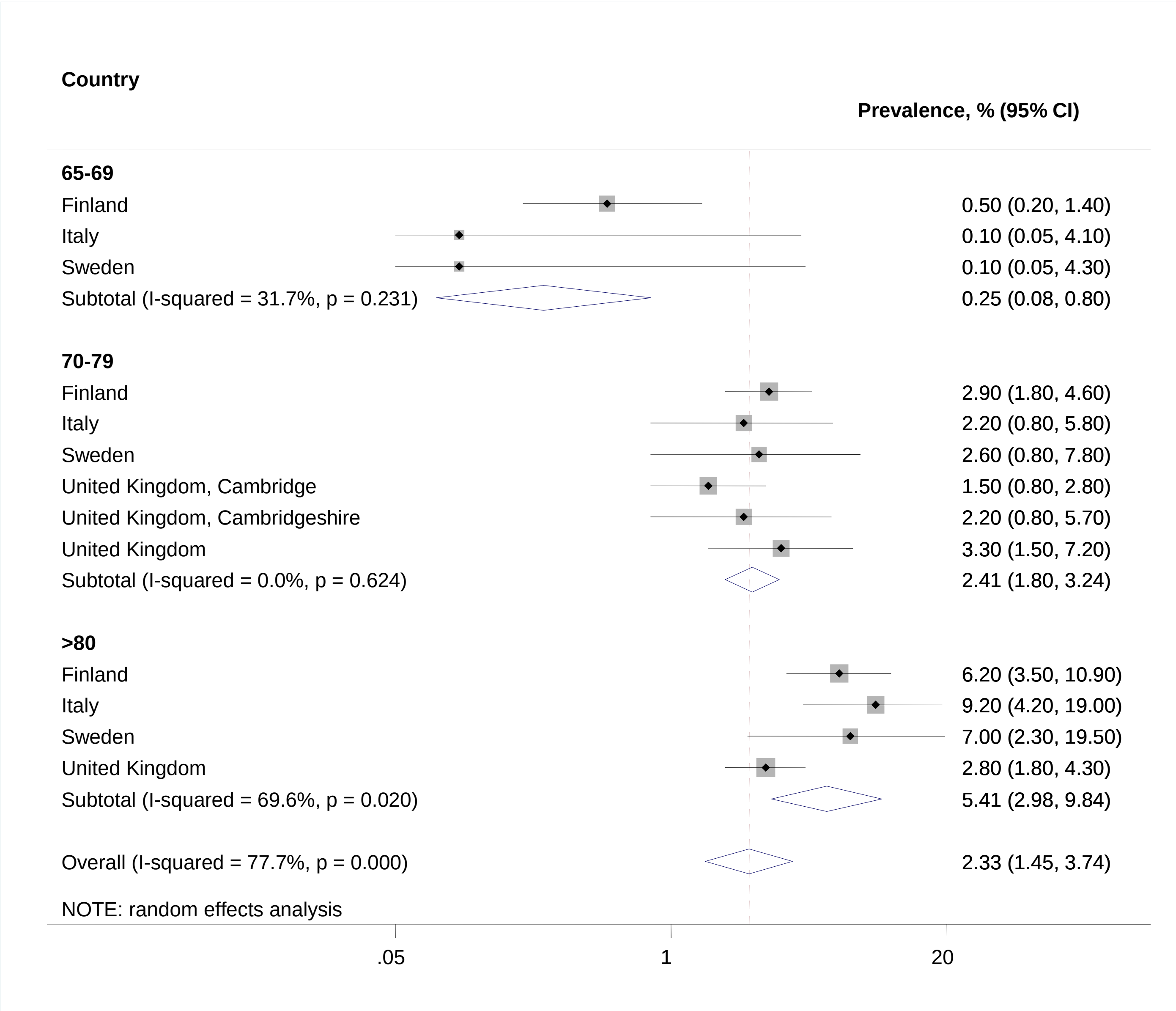


Figure 44. Prevalence of Dementia in Older Women in Age and Severity Categories (High Level of Evidence)[95,176,236,282]

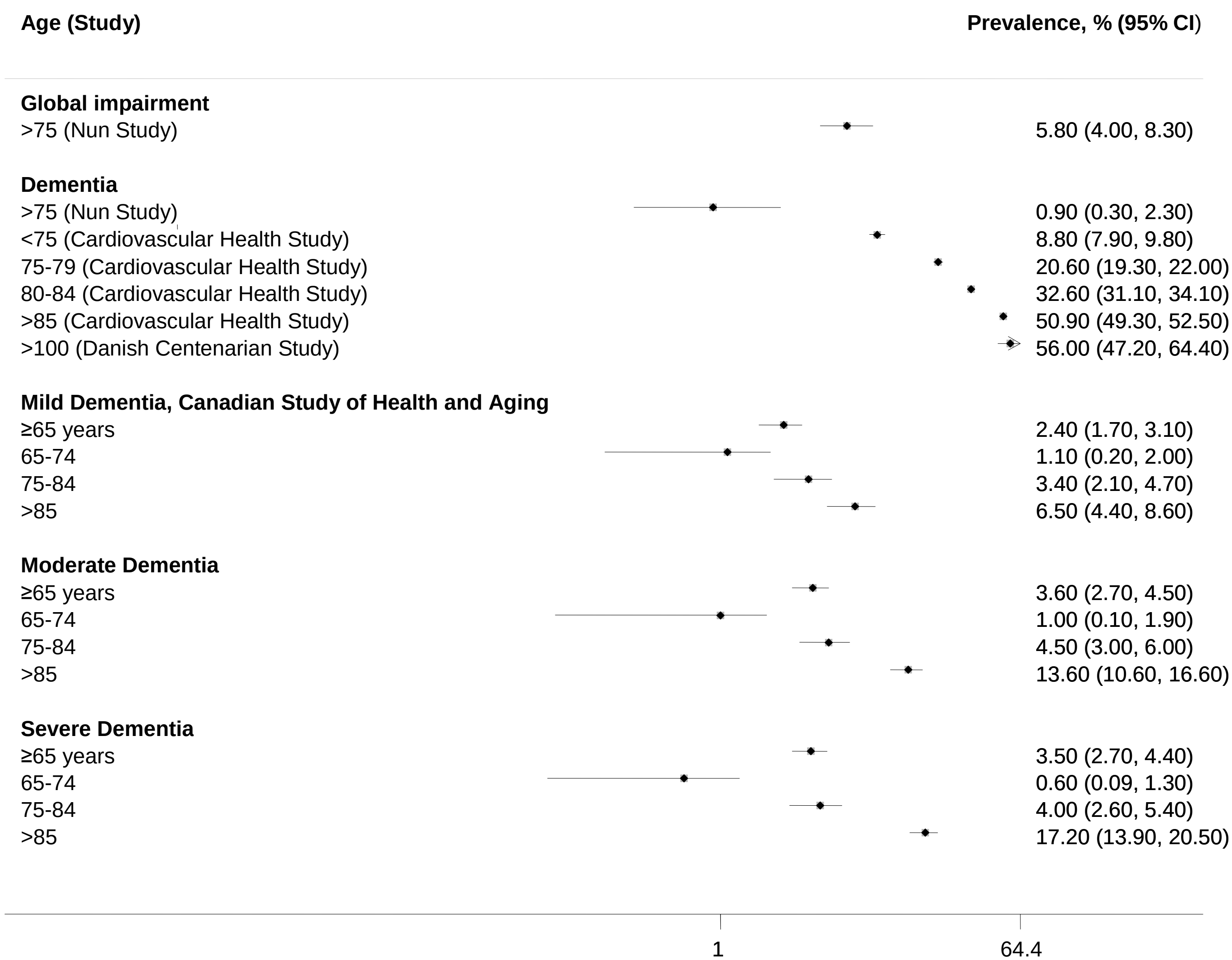


Figure 45. Differences in Prevalence of Frailty in Older Persons Ages 65 to 70 Years According to Definition of Frailty (Moderate Level of Evidence)[23,101-104]

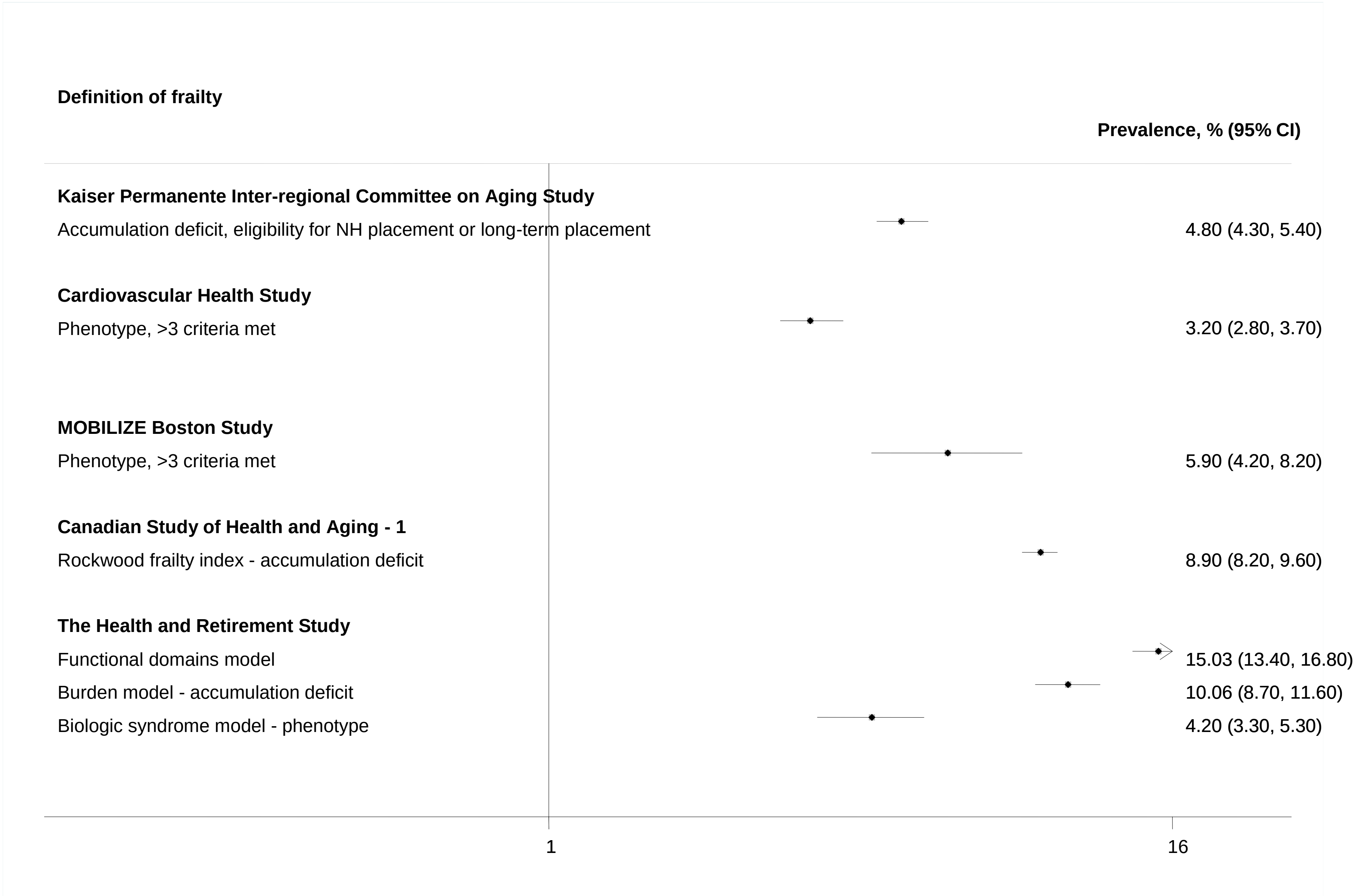


Figure 46. Differences in Prevalence of Frailty in Older Persons Ages 70 to 80 Years According to Definition of Frailty (Moderate Level of Evidence)[22,23,101,104,105]

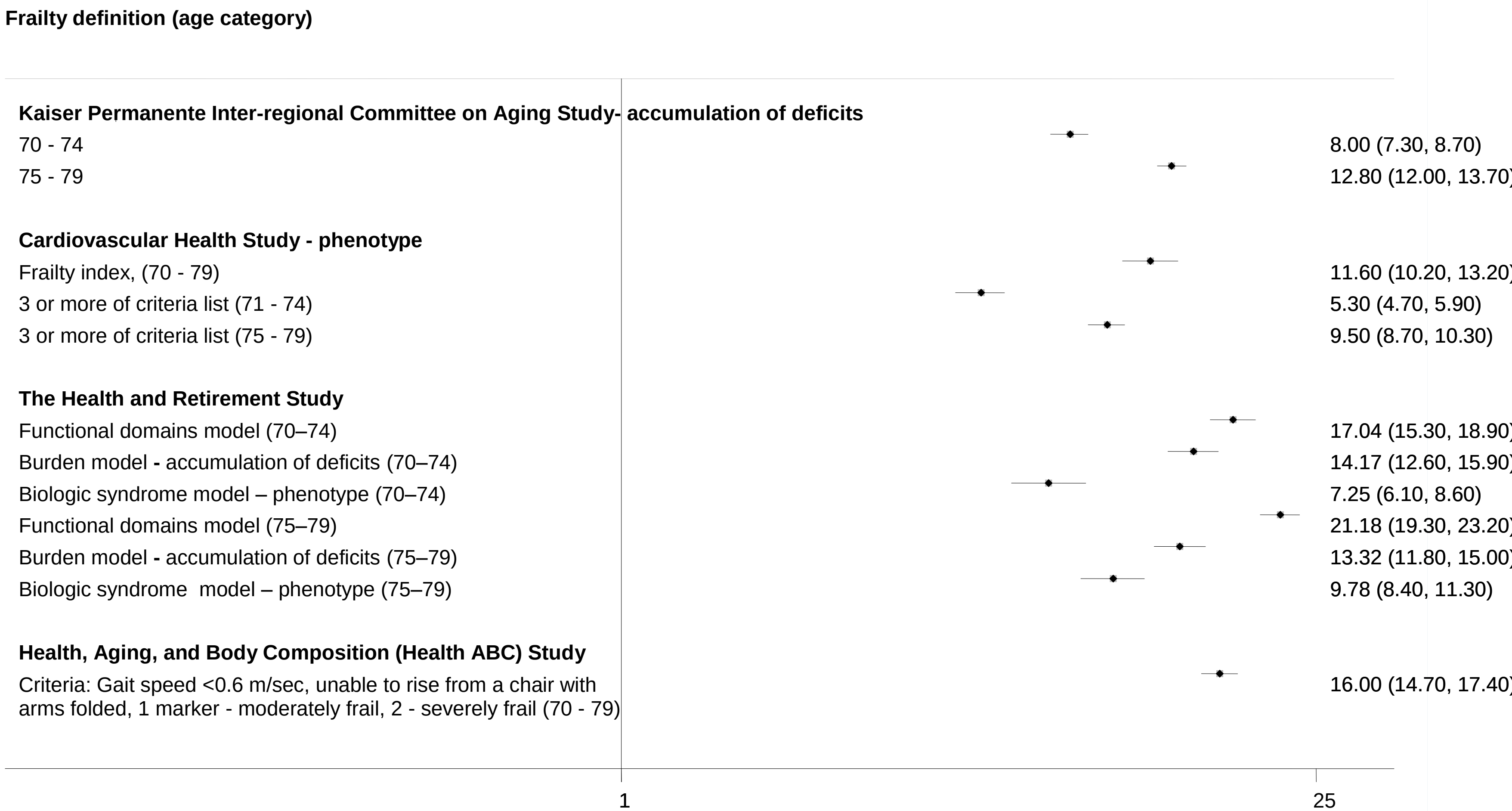


Figure 47. Differences in Prevalence of Frailty in Persons Older Than Age 80 Years According to Definition of Frailty (Moderate Level of Evidence)[23,101-104]

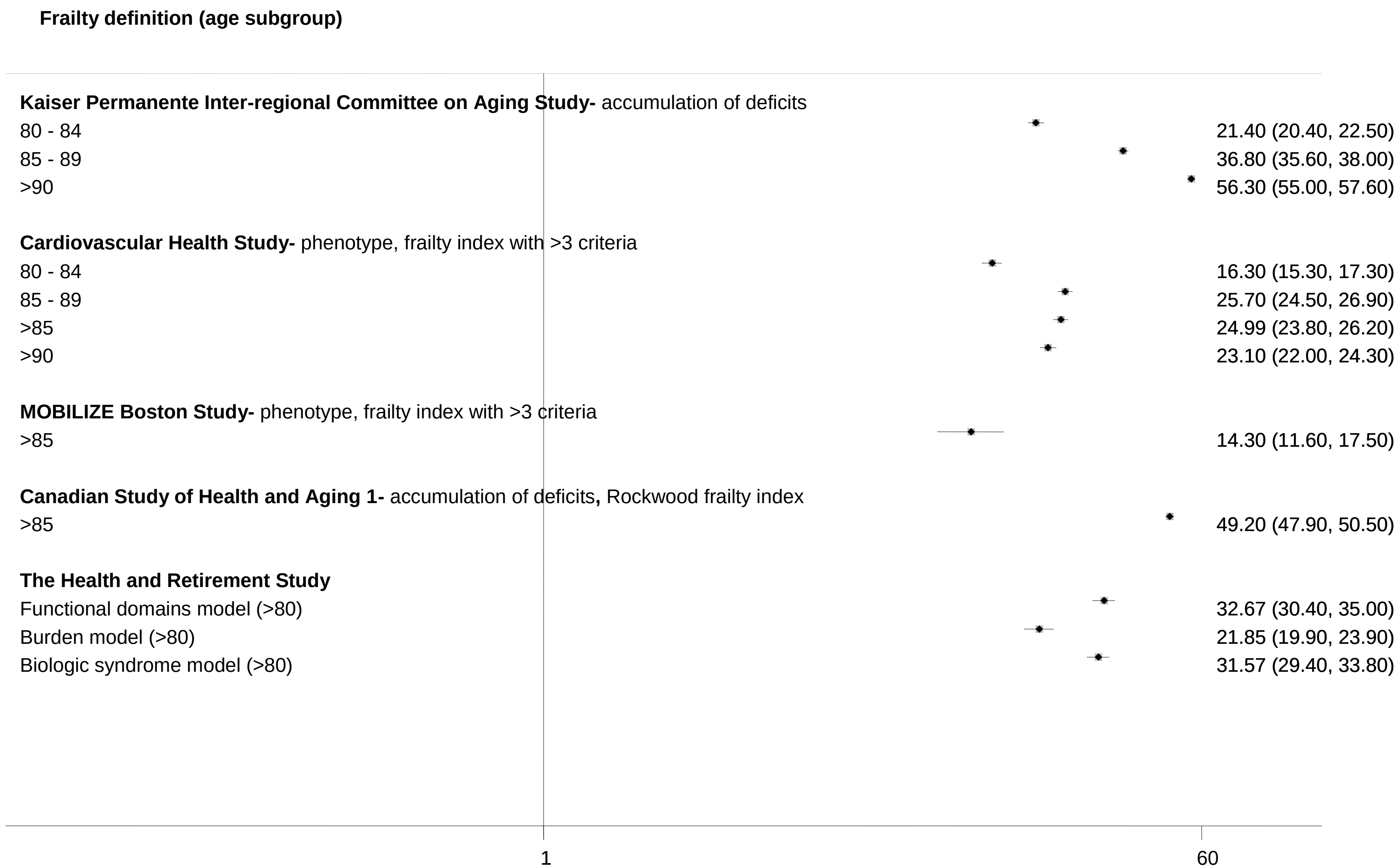


Figure 48. Prevalence of Frailty in Older African Americans According to Definition of Frailty (Moderate Level of Evidence)[23,104,106,107]

Figure 49. Prevalence of Frailty in Older Hispanics According to Definition of Frailty (Low Level of Evidence)[104,108]

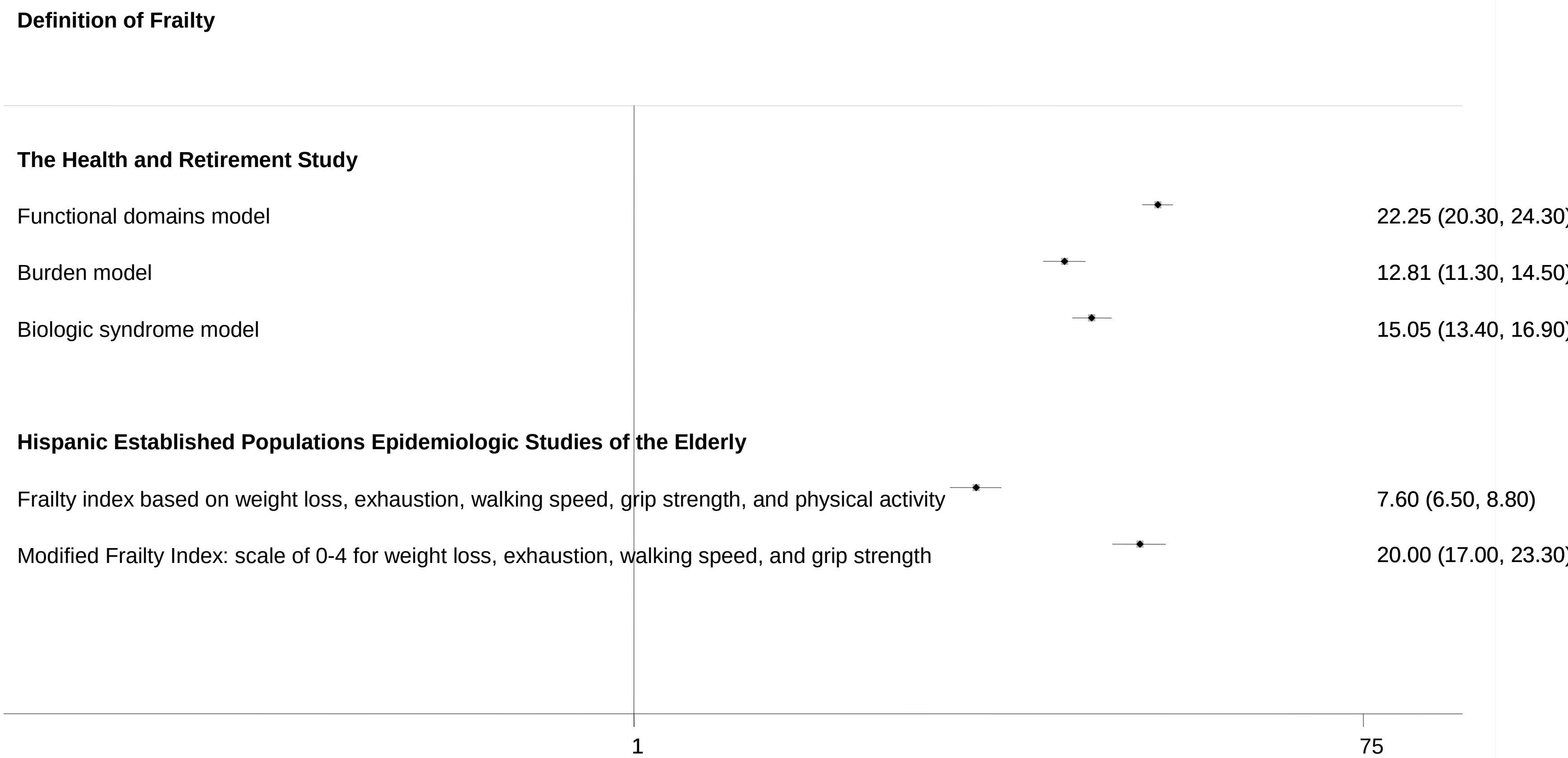


Figure 50. Prevalence of Frailty in Older Caucasians According to Definition of Frailty (Low Level of Evidence)[23,104,107,109]

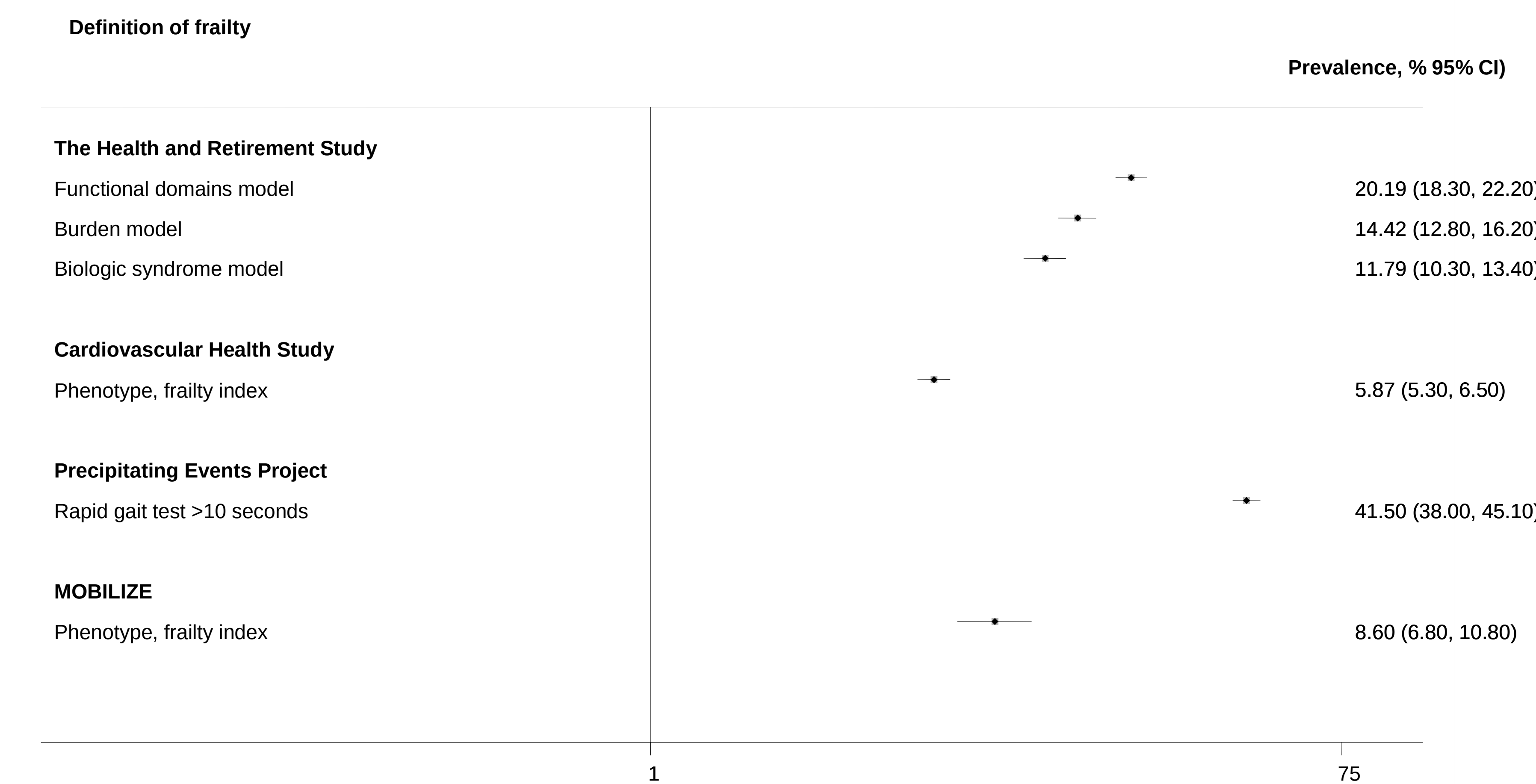


Figure 51. Prevalence of Frailty in Older Men (Moderate Level of Evidence)[23,103-105,107,109,111-115]

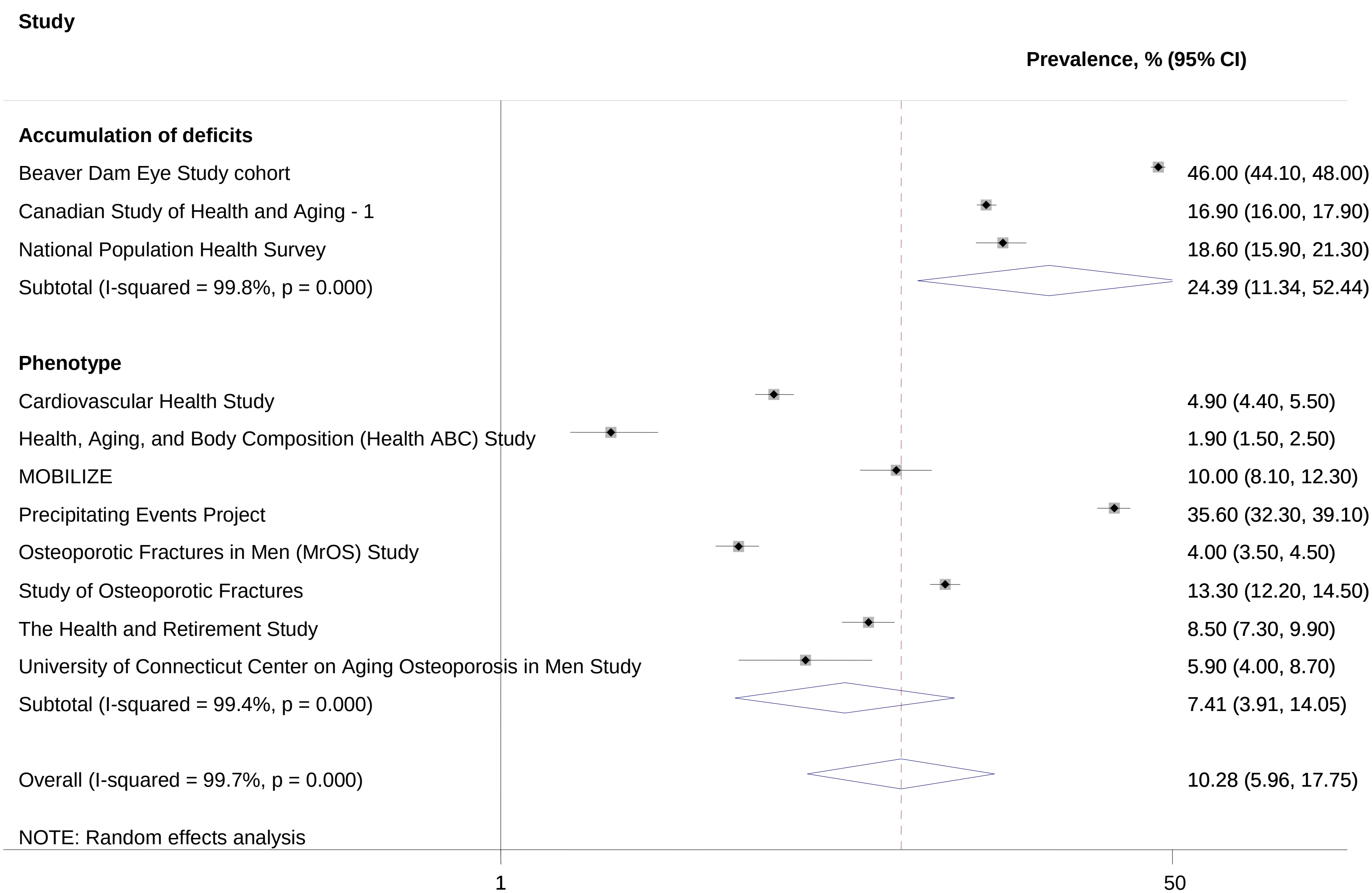


Figure 52. Prevalence of Frailty in Older Men By Definition and Age Group, Sorted By Increasing Age (High Level of Evidence)[23,101,111,113,115]

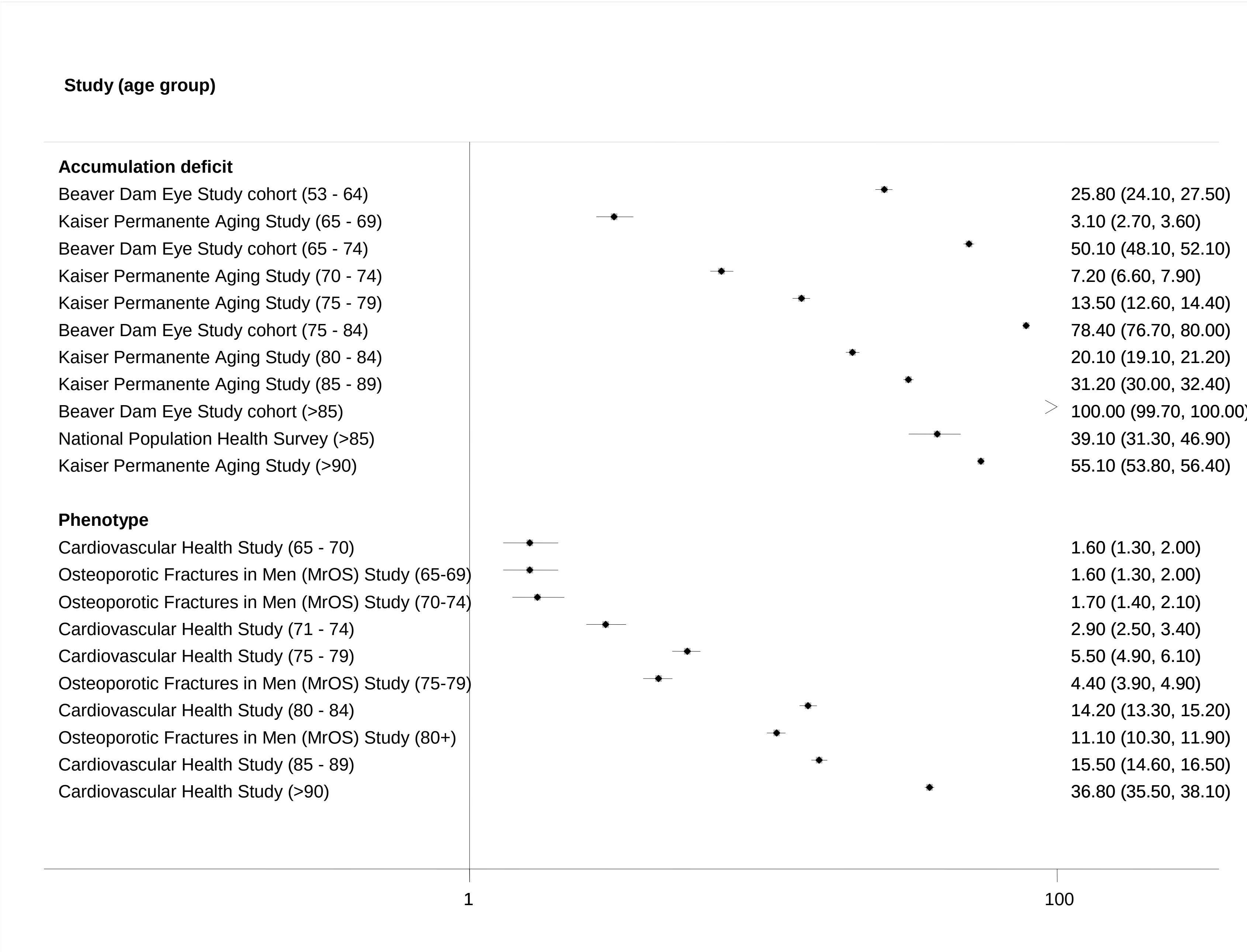


Figure 53. Prevalence of Frailty in Men Using Phenotype Definition in Race and Age Subgroups, Sorted By Increasing Age (High Level of Evidence)[23,113,116]

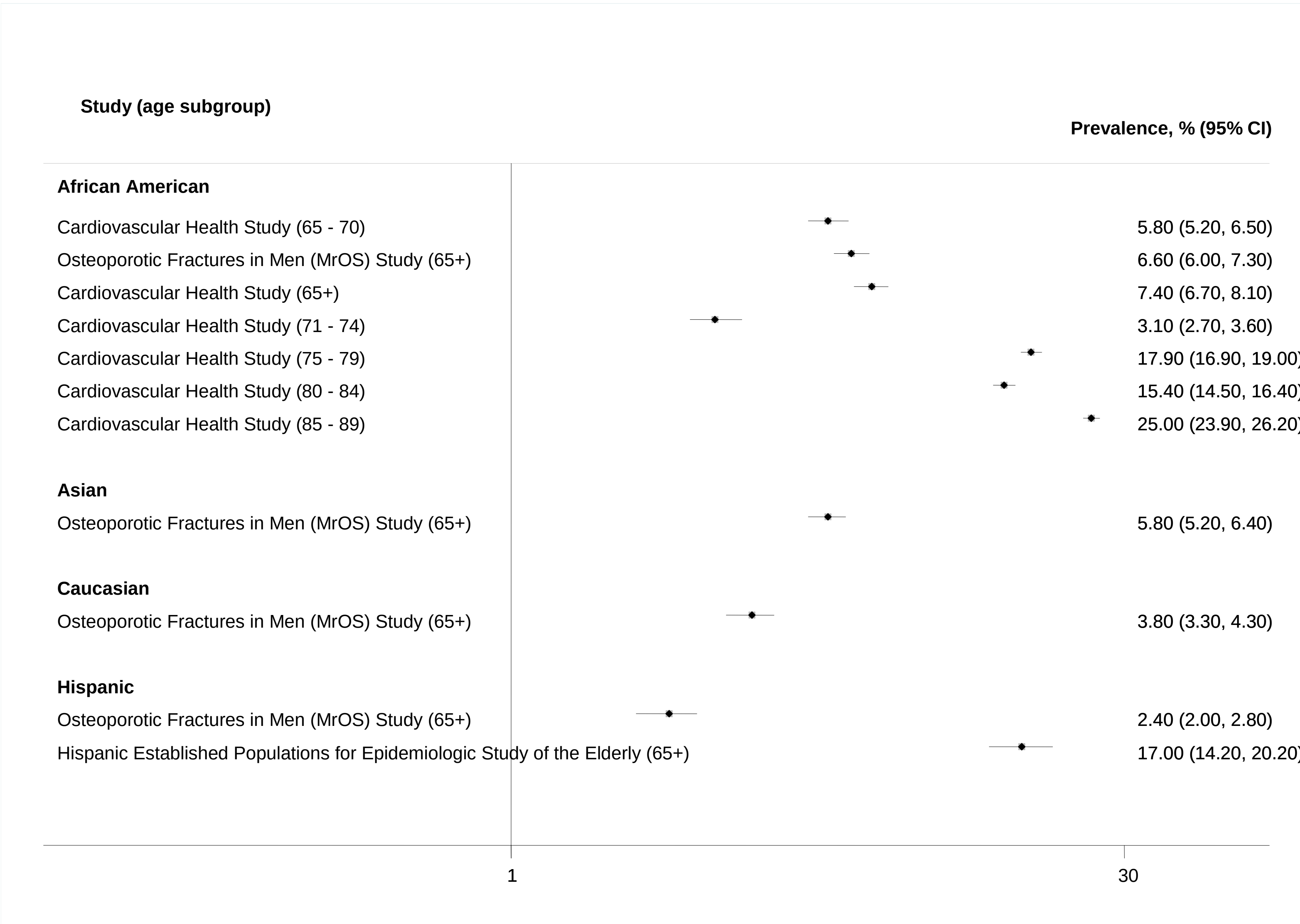


Figure 54. Prevalence of Frailty in Older Women According to Definition (High Level of Evidence)[23,24,103-105,107,109,111,115-117]

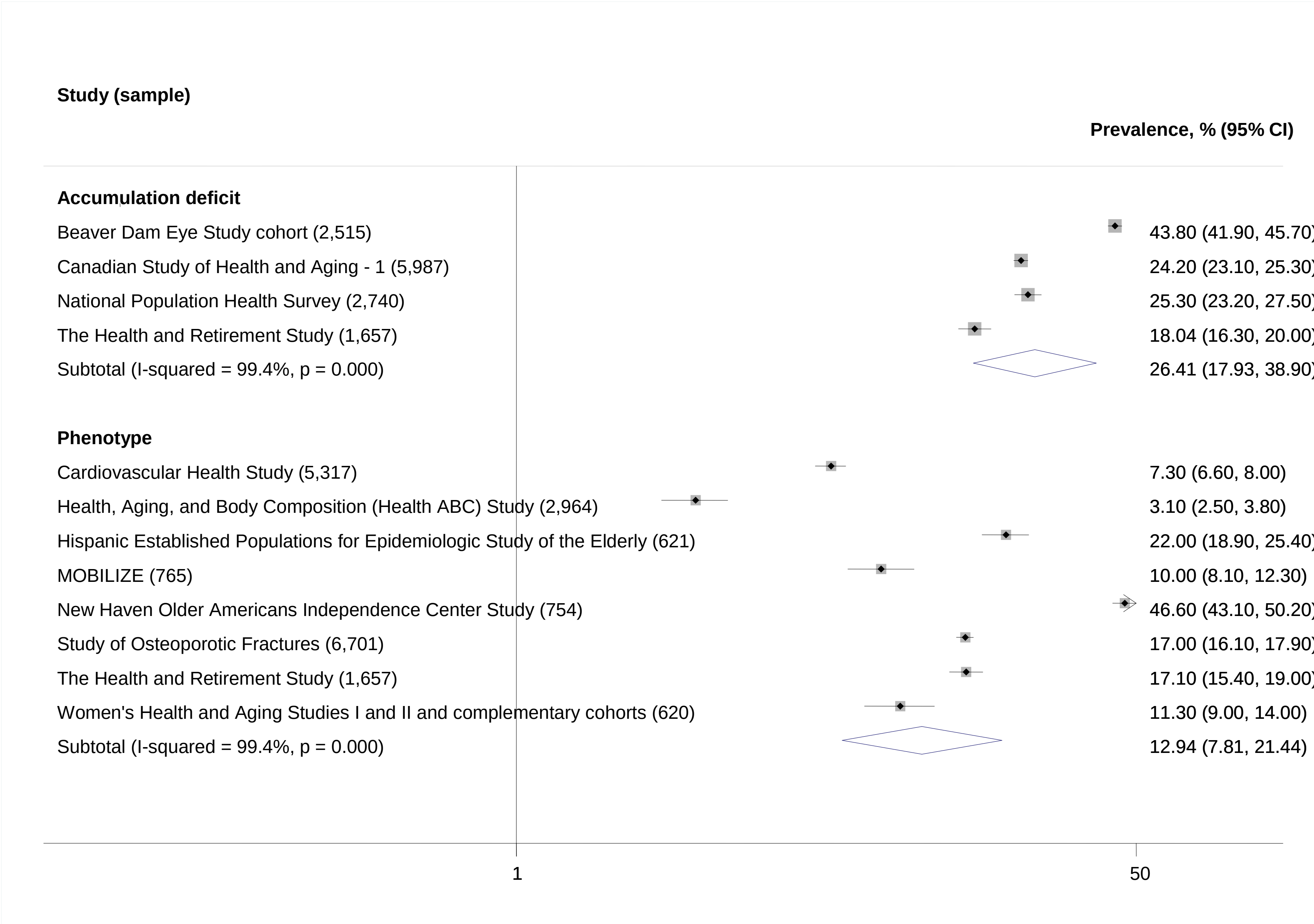


Figure 55. Prevalence of Frailty in Older Women By Definition and Age Group, Sorted By Increasing Age (High Level of Evidence)[23,101,104,111,115]

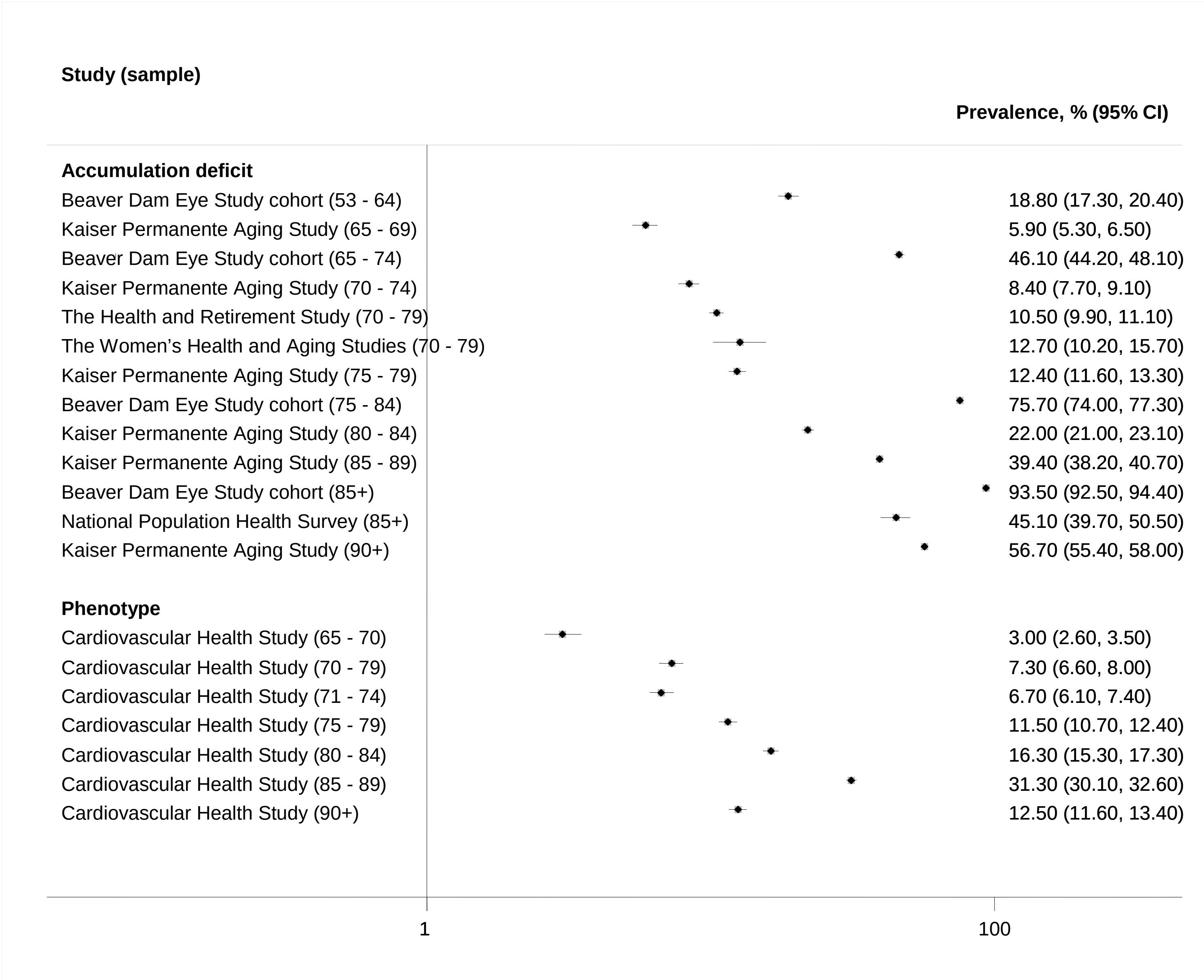


Figure 56. Prevalence of Frailty in Older Women Using Phenotype Definition in Race and Age Subgroups, Sorted By Increasing Age (Moderate Level of Evidence)[23,116]

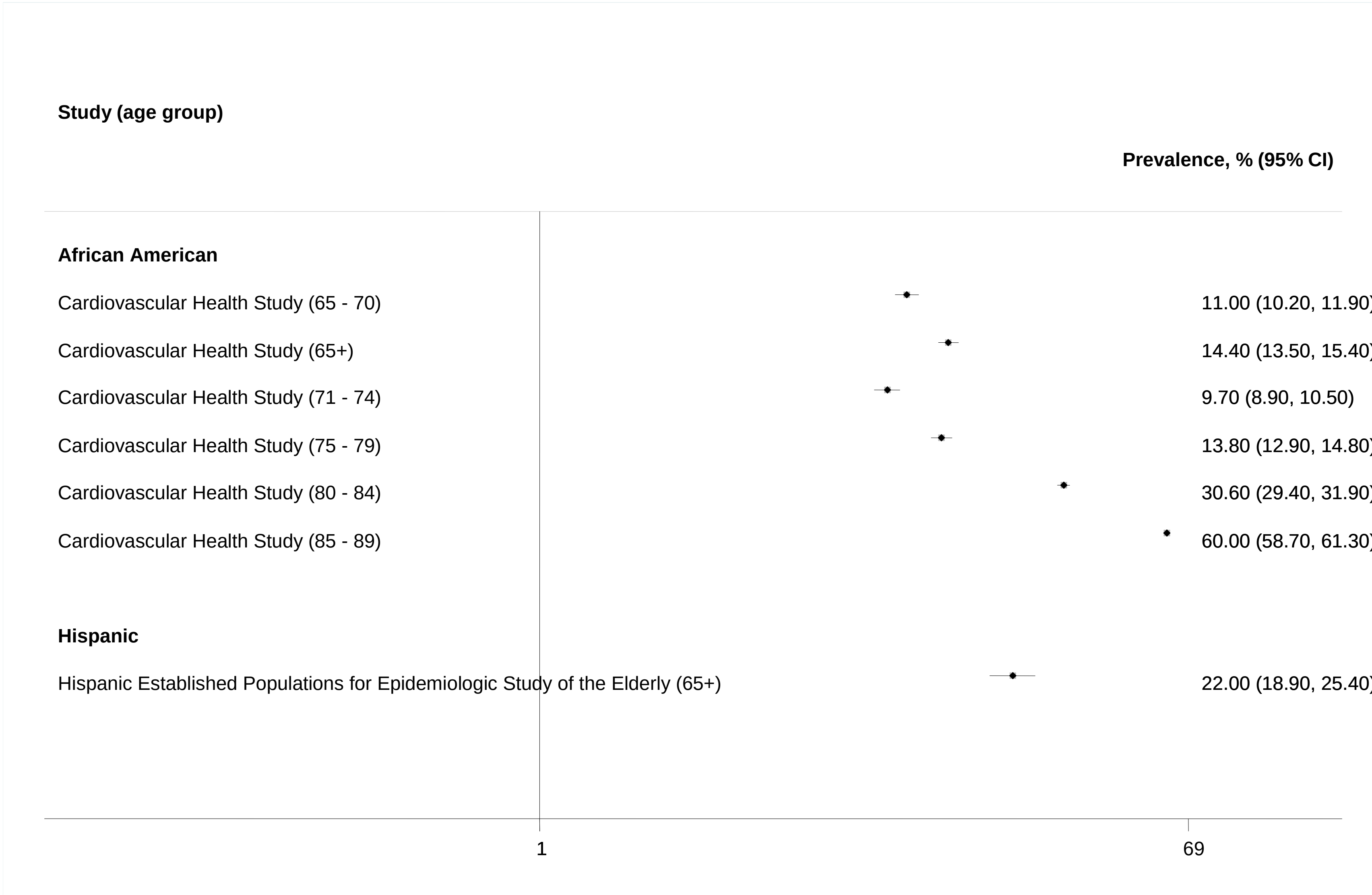


Figure 57. Prevalence of Any Basic ADL Disability in Women and Men (Moderate Level of Evidence)[61,63,64]

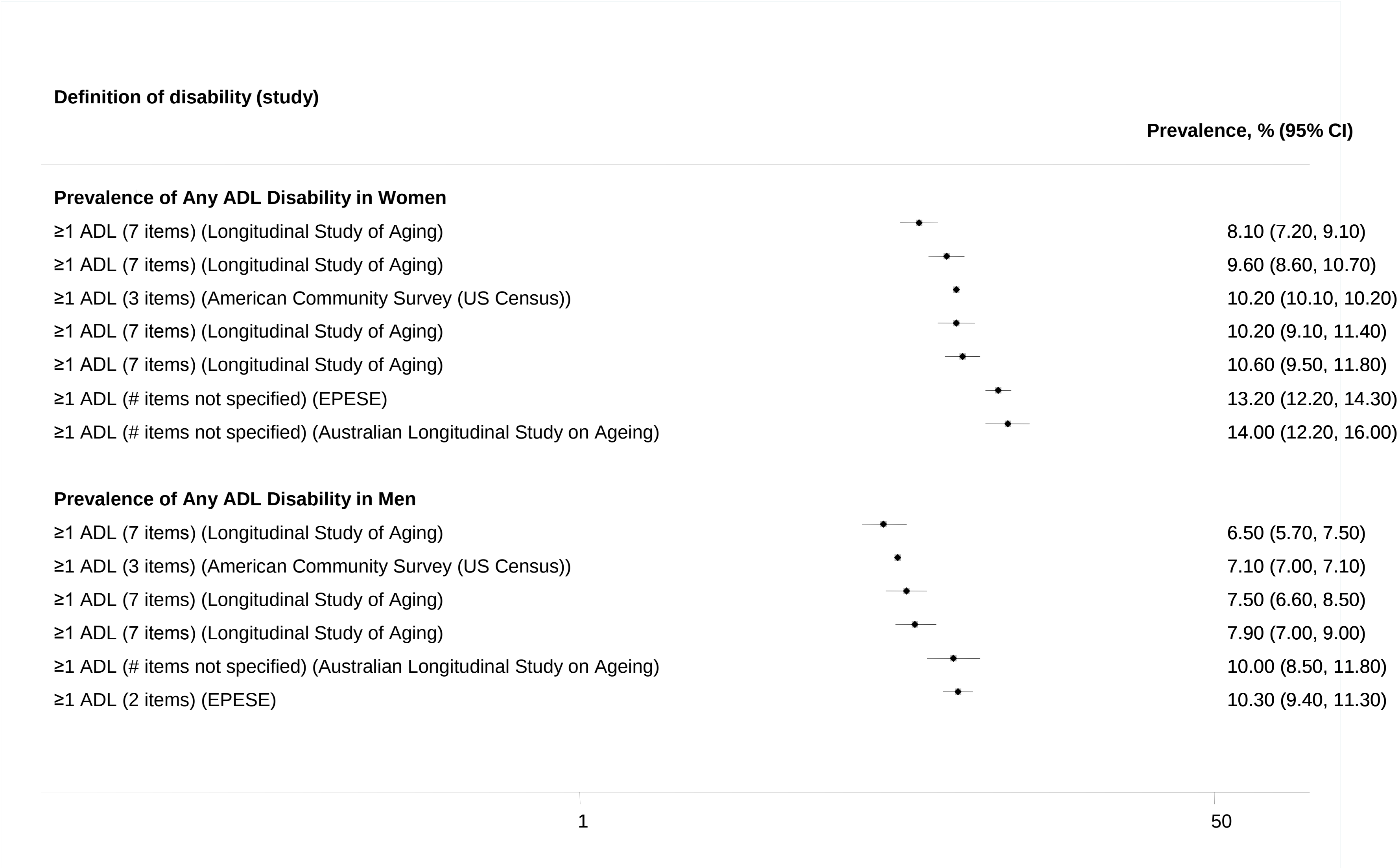


Figure 58. Prevalence of Any Basic ADL Disability in Women Increases With Older Age (Good-Quality Study)[59]

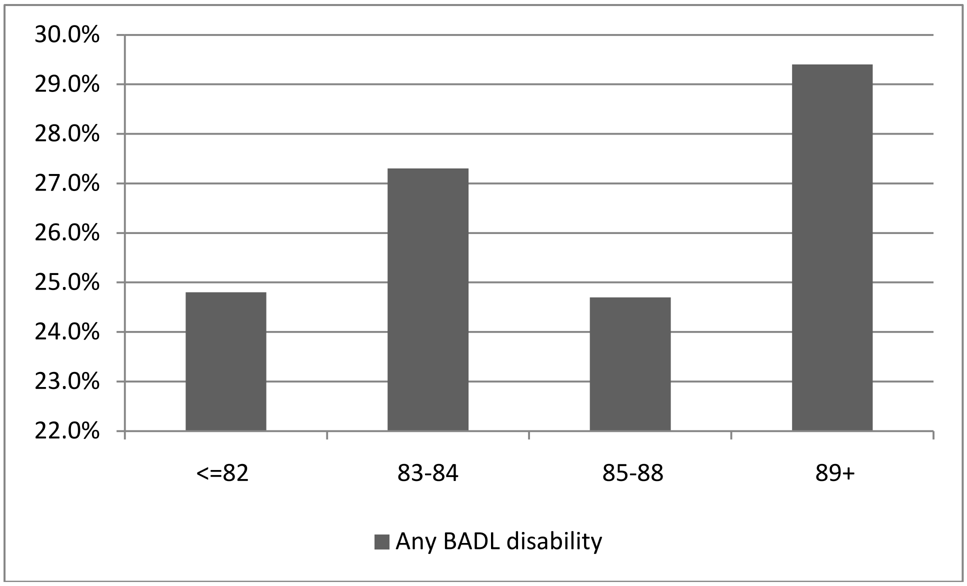


Figure 59. Prevalence of Any ADL Disability in the Cardiovascular Health Study Increases With Older Age (Good-Quality Study)[59]

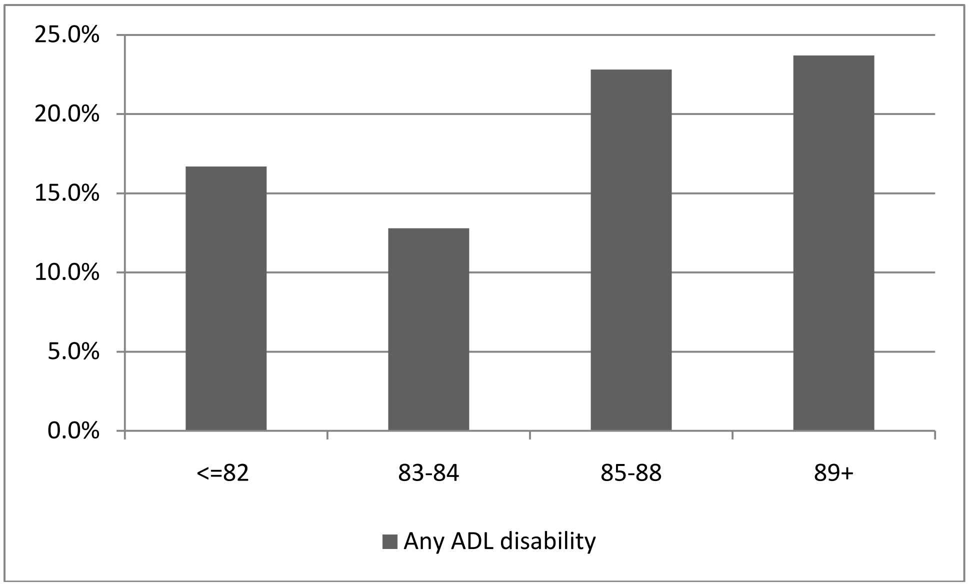


Figure 60. Differences in Prevalence of Any Basic ADL Disability By Age and Sex (Good-Quality Study)[59]

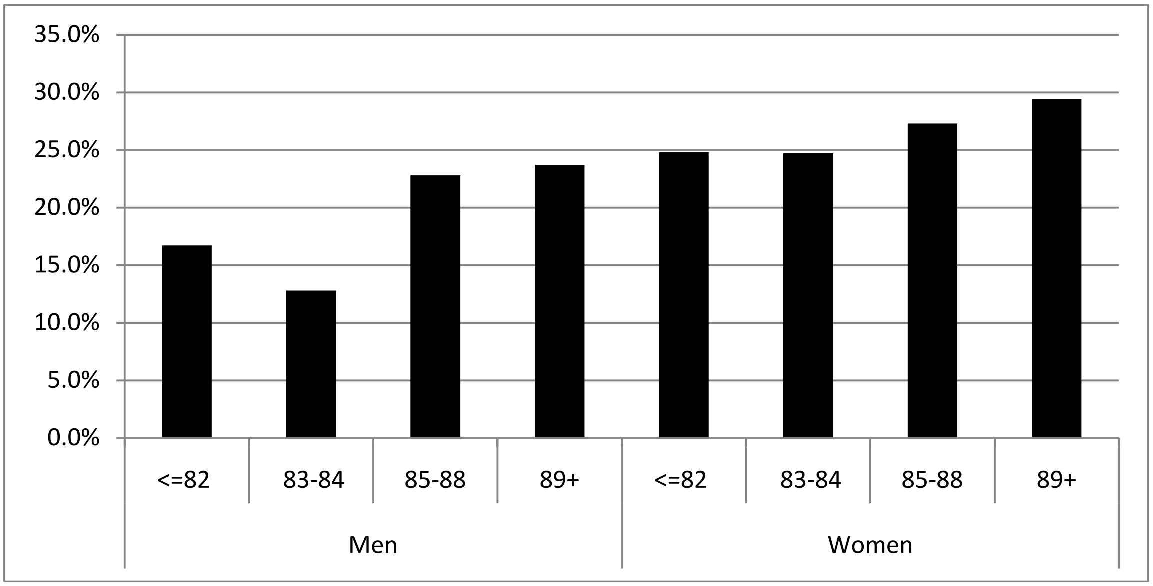


Figure 61. Prevalence of Moderate ADL Disability By Age (Good-Quality Study)[118]

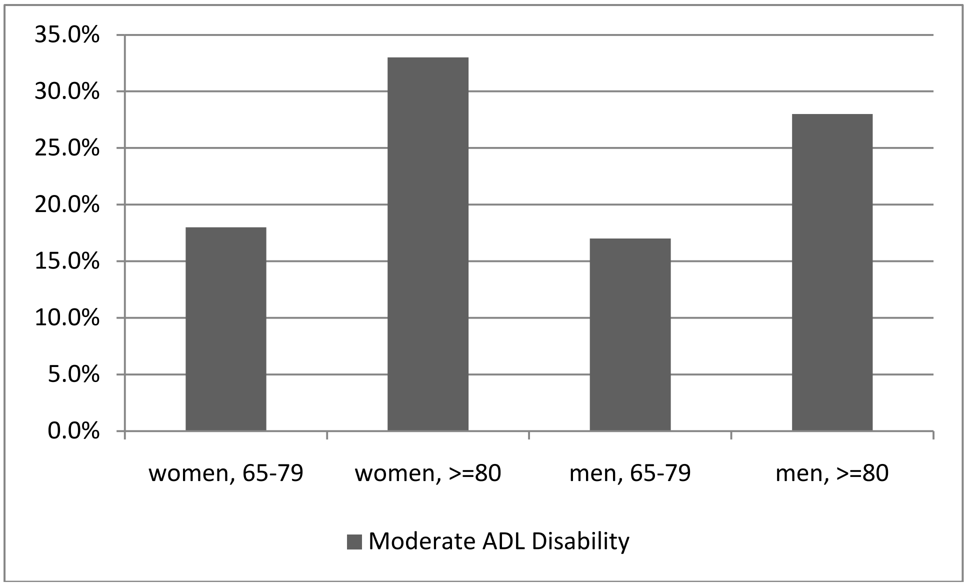


Figure 62. Prevalence of Severe ADL Disability By Age (Good-Quality Study)[118]

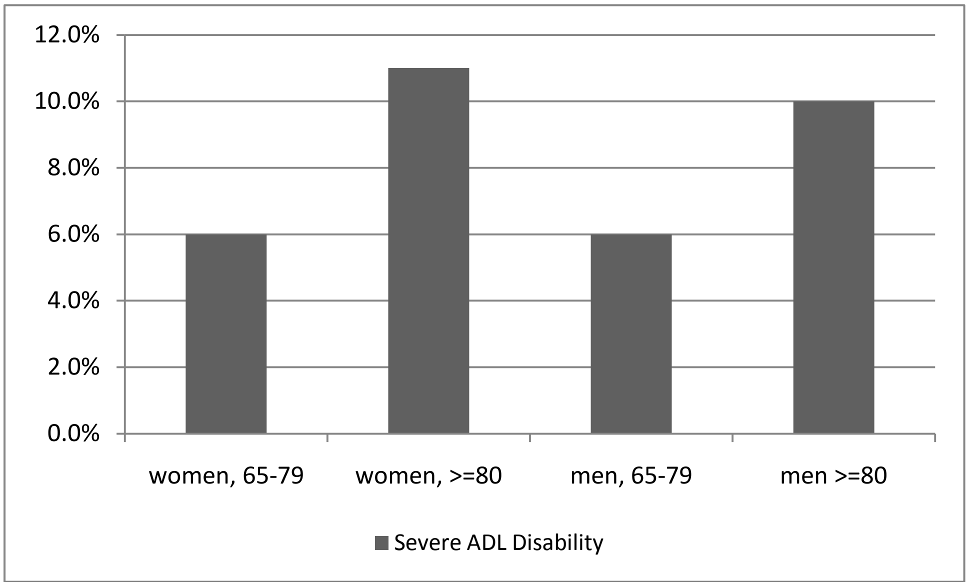


Figure 63. Time Trend and Differences in Prevalence of One or More Instrumental ADL Disabilities By Sex (Good-Quality Study)[121]

Figure 64. Difference in Prevalence of Meal Preparation and Shopping Disability By Sex (Good-Quality Study)[122]

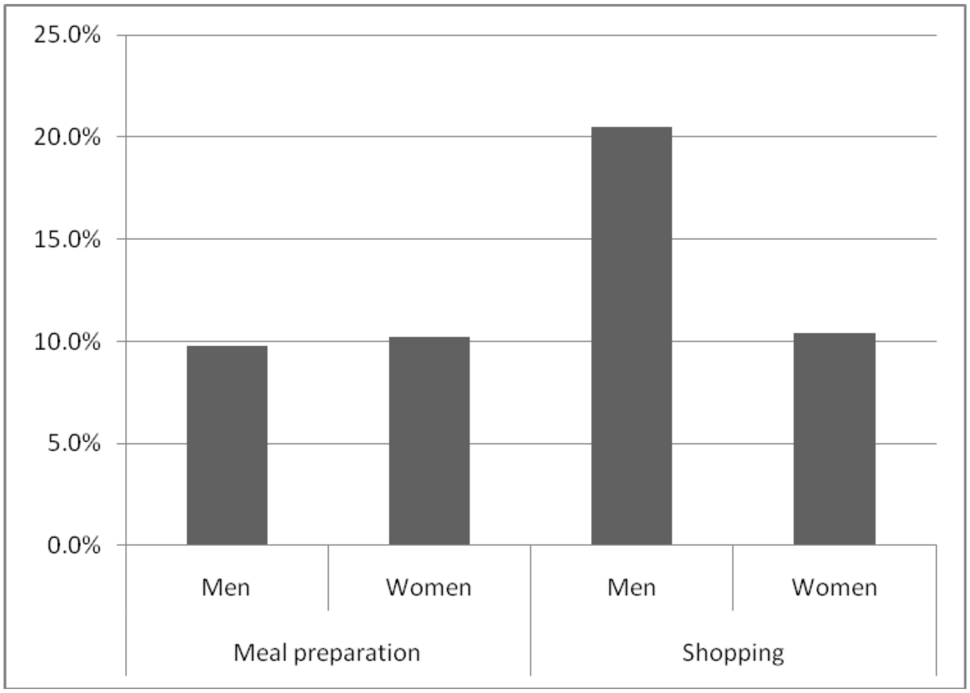


Figure 65. Prevalence of Housekeeping Disability By Sex and Age (Good-Quality Study)[122]

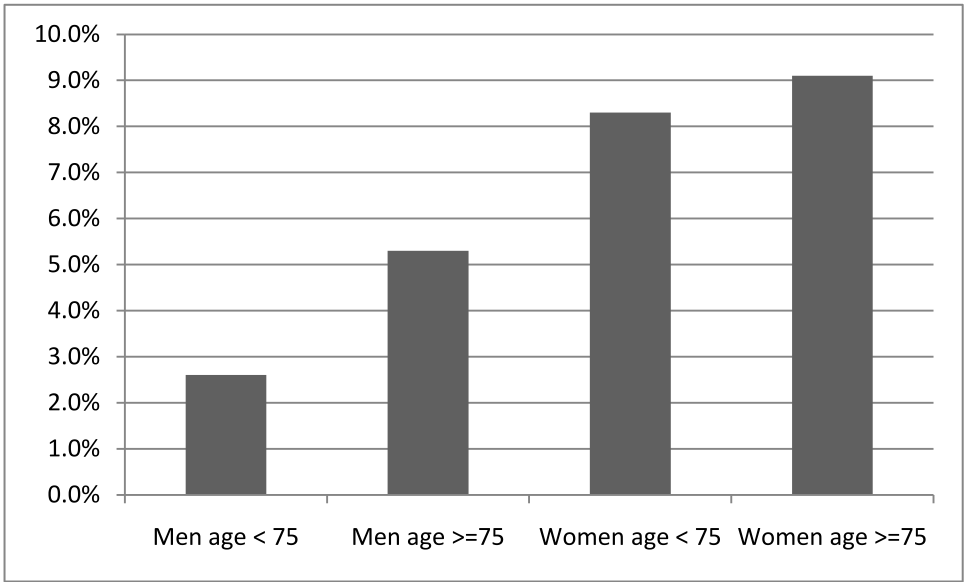


Figure 66. Differences in Prevalence of Any ADL Disability By Race and Ethnicity in the Census Public Use Microdata Sample (Good-Quality Study)[62]

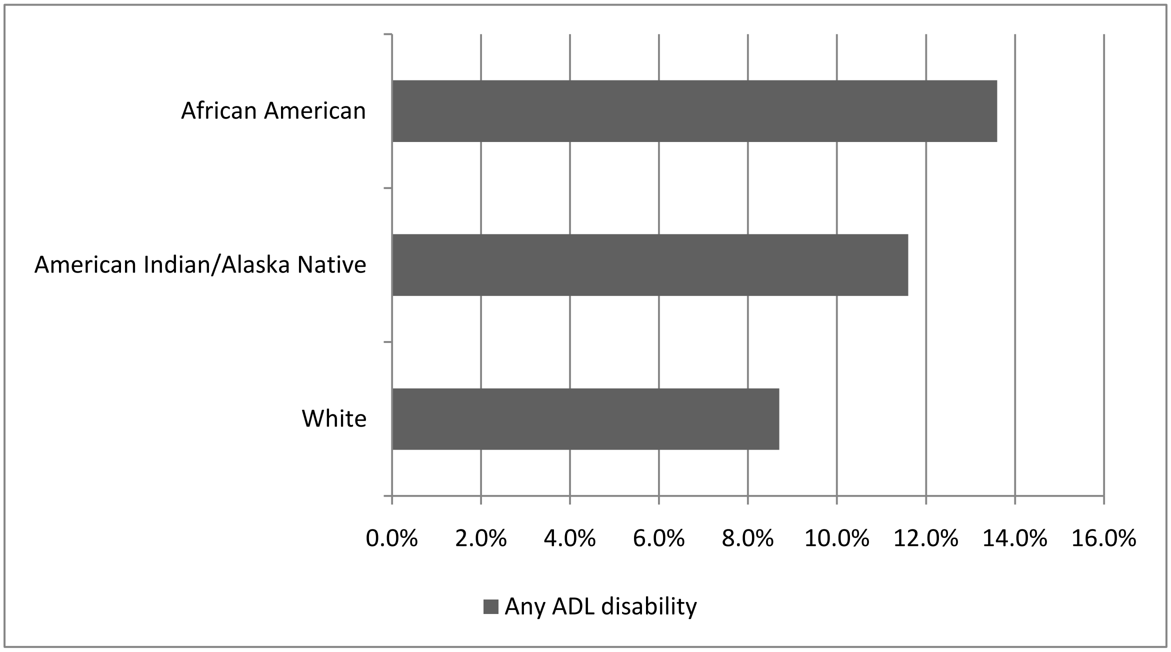


Figure 67. Differences in Prevalence of Any Basic ADL Disability By Sex and Race (Good-Quality Study)[60]

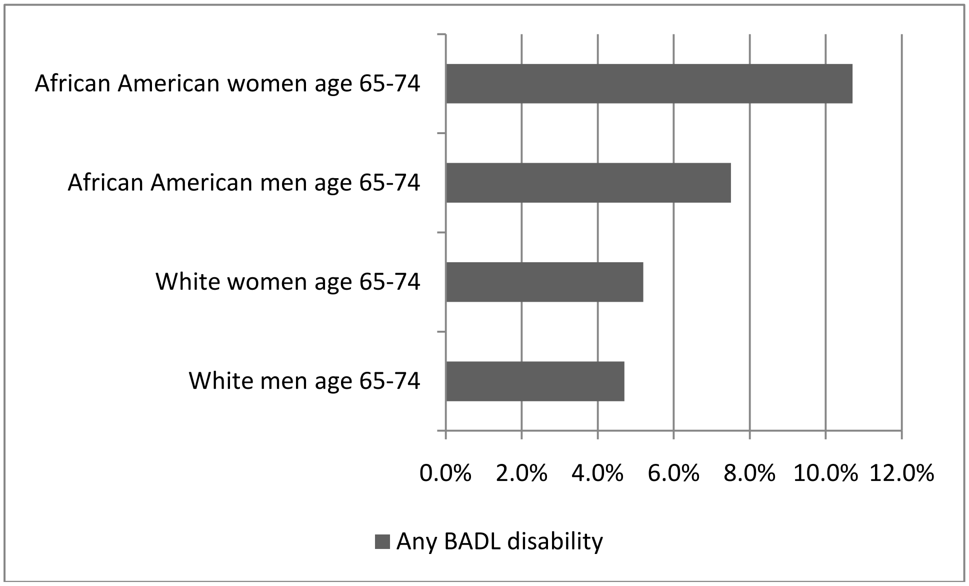


Figure 68. Differences in Prevalence of Eating Disability By Race and Sex (Good-Quality Study)[119]

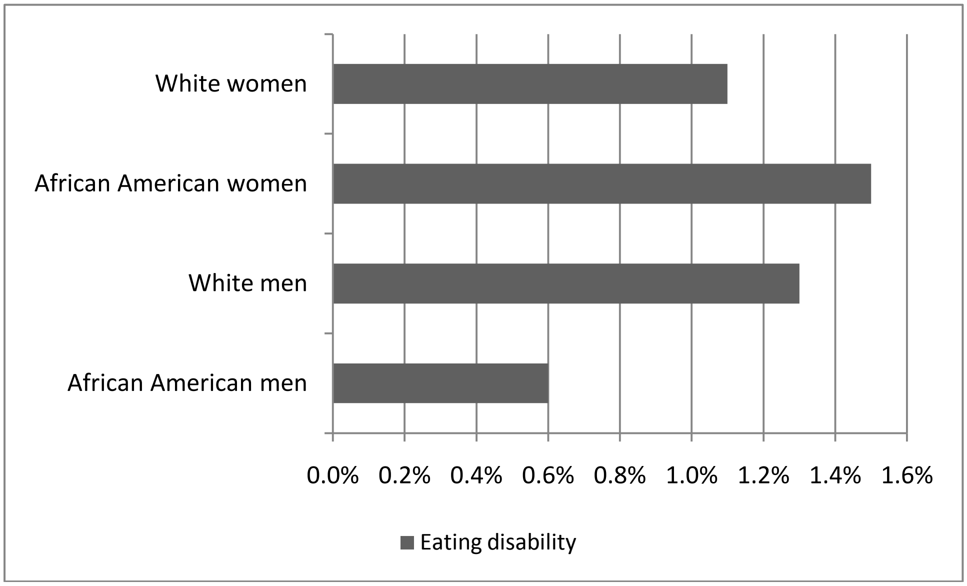


Figure 69. Prevalence of Shopping Disability By Race and Sex (Good-Quality Study)[119]

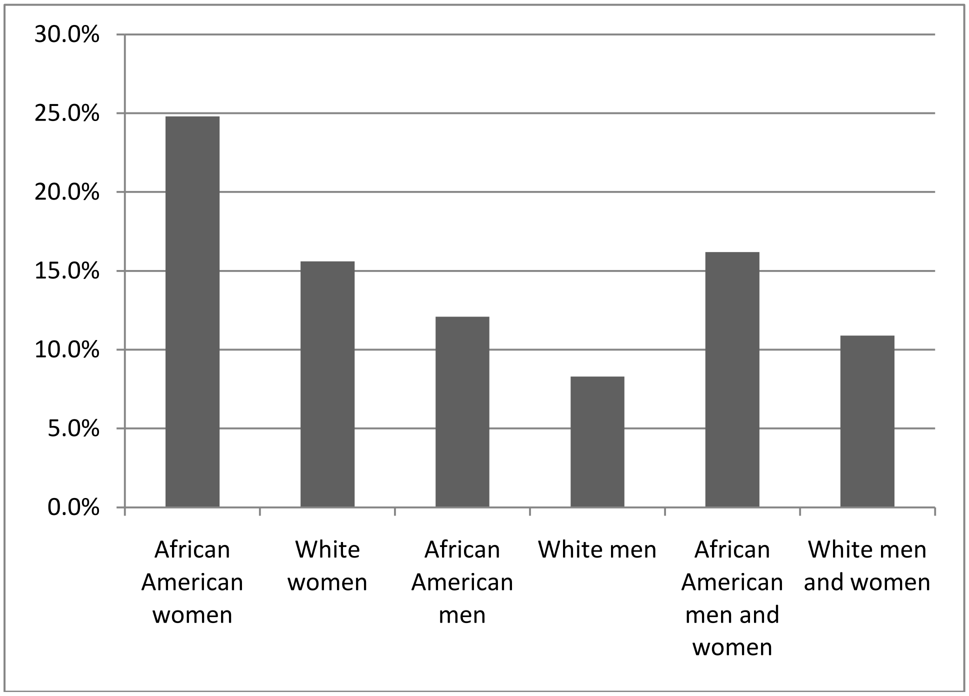


Figure 70. Prevalence of Meal Preparation Disability By Race and Sex (Good-Quality Study)[119]

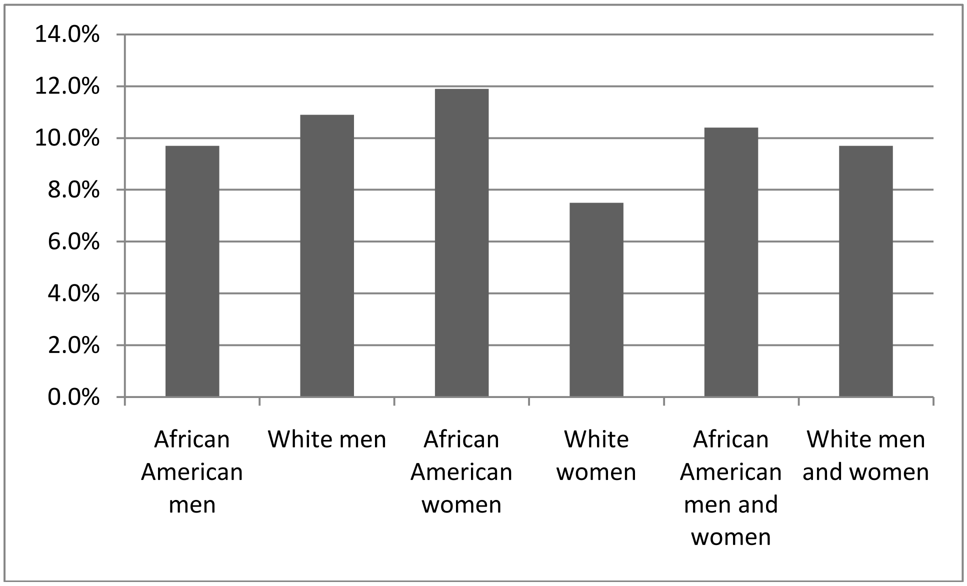


Figure 71. Factors Associated With Malnutrition Defined as High Nutritional Score, Low Body Mass Index, or Unintentional Weight Loss (Good-Quality Individual Studies)[79-81]

Associated factors (definition of malnutrition)	Relative measure of association (95% CI)
Residence	
Rural vs. urban (high nutritional risk)	2.70 (1.20, 5.90)
Sex	
Male vs. female (high nutritional risk)	1.15 (0.60, 2.30)
Race	
Hispanic/other vs. Caucasian (high nutritional risk)	1.30 (0.67, 2.40)
African American vs. Caucasian (high nutritional risk)	1.87 (0.86, 4.10)
African American vs. Caucasian (weight loss of 5%)	6.05 (1.66, 22.06)
Health	
Poor vs. excellent (high nutritional risk)	4.28 (1.02, 17.90)
Age	
>85 vs. 60-64 (high nutritional risk)	1.36 (0.34, 5.40)
75-84 vs. 60-64 (high nutritional risk)	1.50 (0.40, 5.66)
65-74 vs. 60-64 (high nutritional risk)	3.22 (0.76, 13.70)
Nutritional Assessment	
Mini Nutritional Assessment score of <31 (weight loss)	2.63 (1.67, 4.15)
Disability	
ADL disability (BMI <19 kg/m^2)	4.00 (1.40, 11.30)

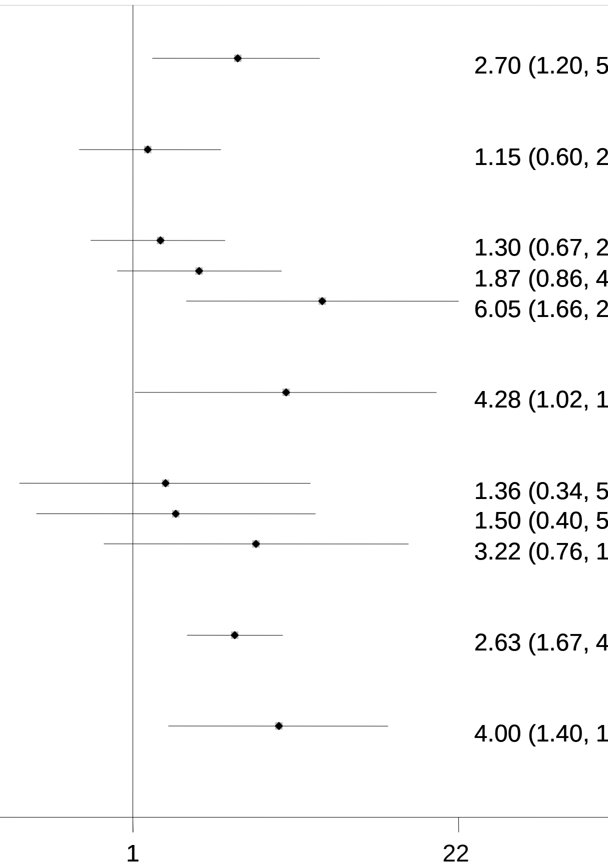


Figure 72. Prevalence of Malnutrition Defined as Low Body Mass Index, Low Serum Albumin Level, or Unintentional Weight Loss (Good-Quality Individual Studies)[46,70-77]

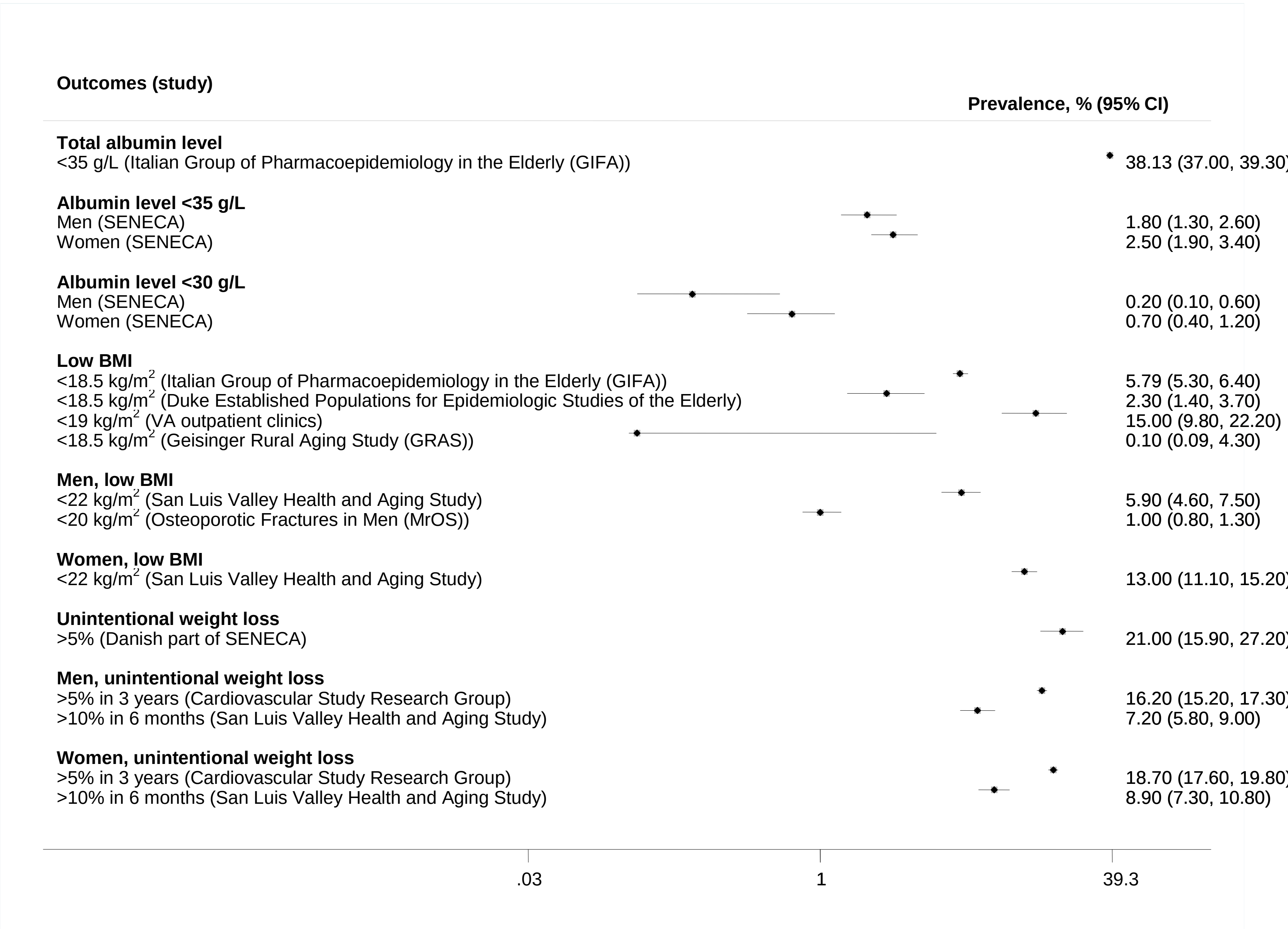


Figure 73. Association Between Mortality and Poor Self-Perceived Health (High Level of Evidence)[27,94,103,131,280]

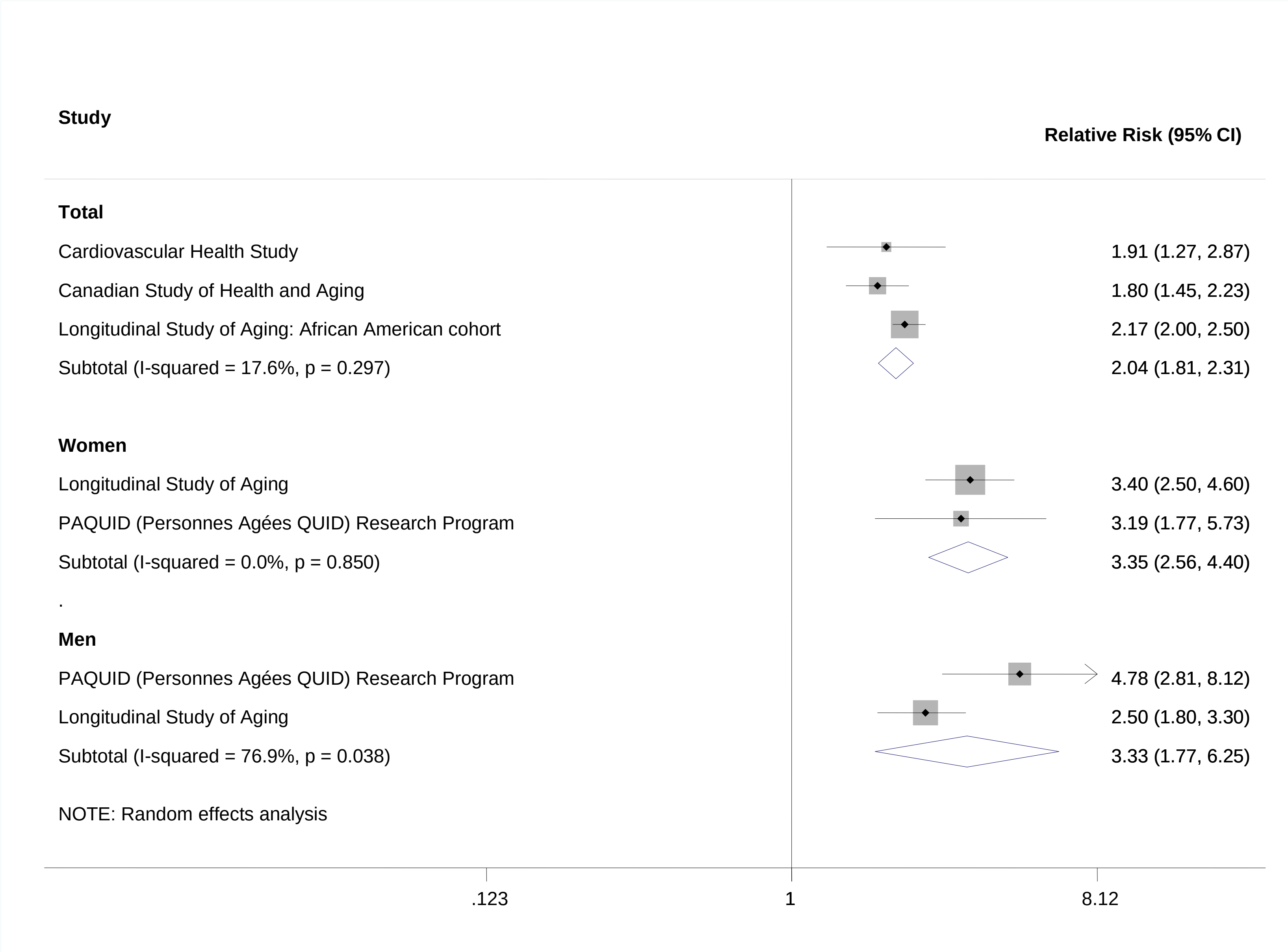


Figure 74. Association Between Cognitive Impairment and Mortality (High Level of Evidence)[39,44,54,143-148]

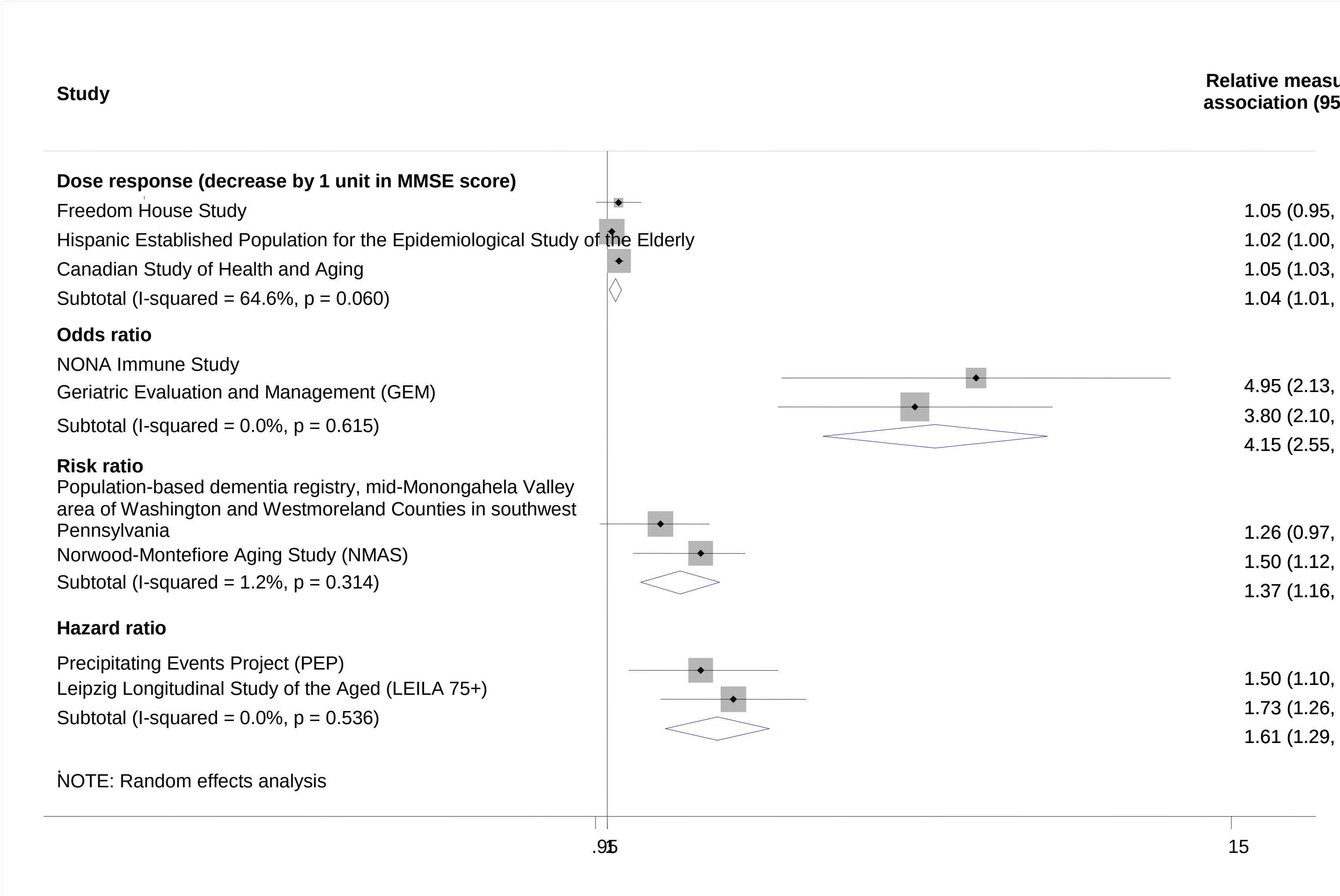


Figure 75. Association Between Cognitive Impairment and Mortality in Older Persons According to Measurement and Severity (Moderate Level of Evidence)[39,94,313]

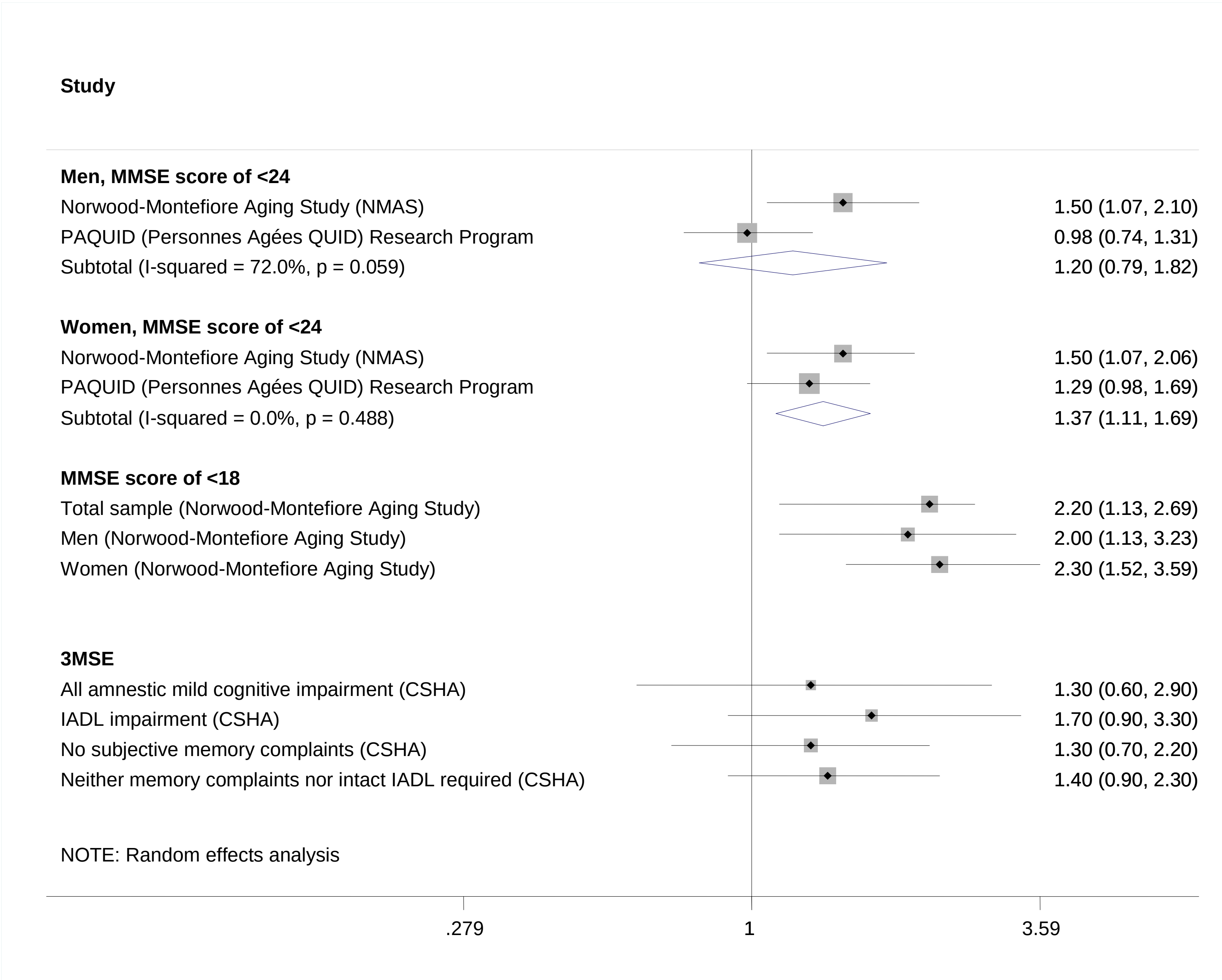


Figure 76. Association Between Frailty and Mortality in Older Persons: Effect of the Definition (Moderate Level of Evidence)[14,23,111,115,148,153-156]

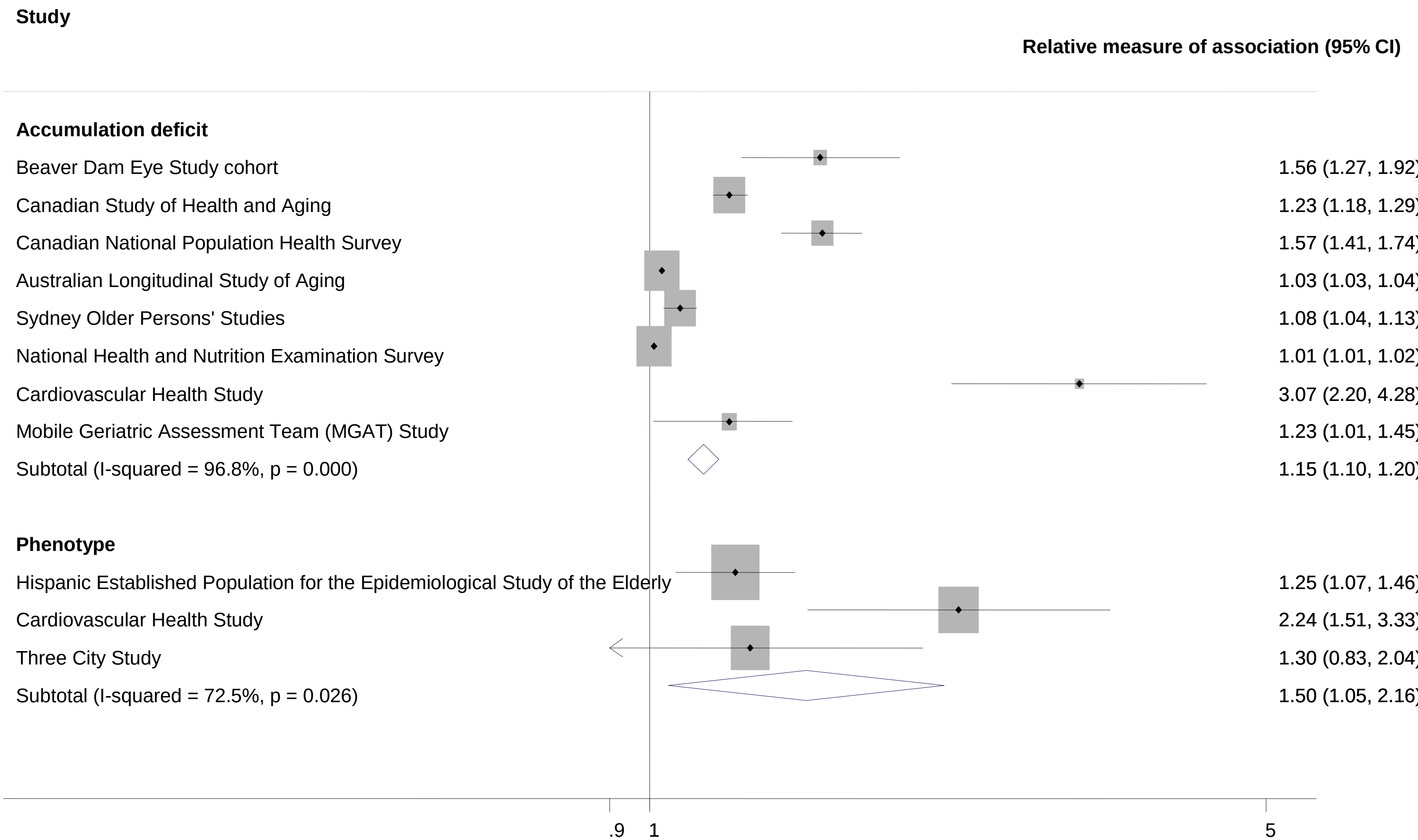
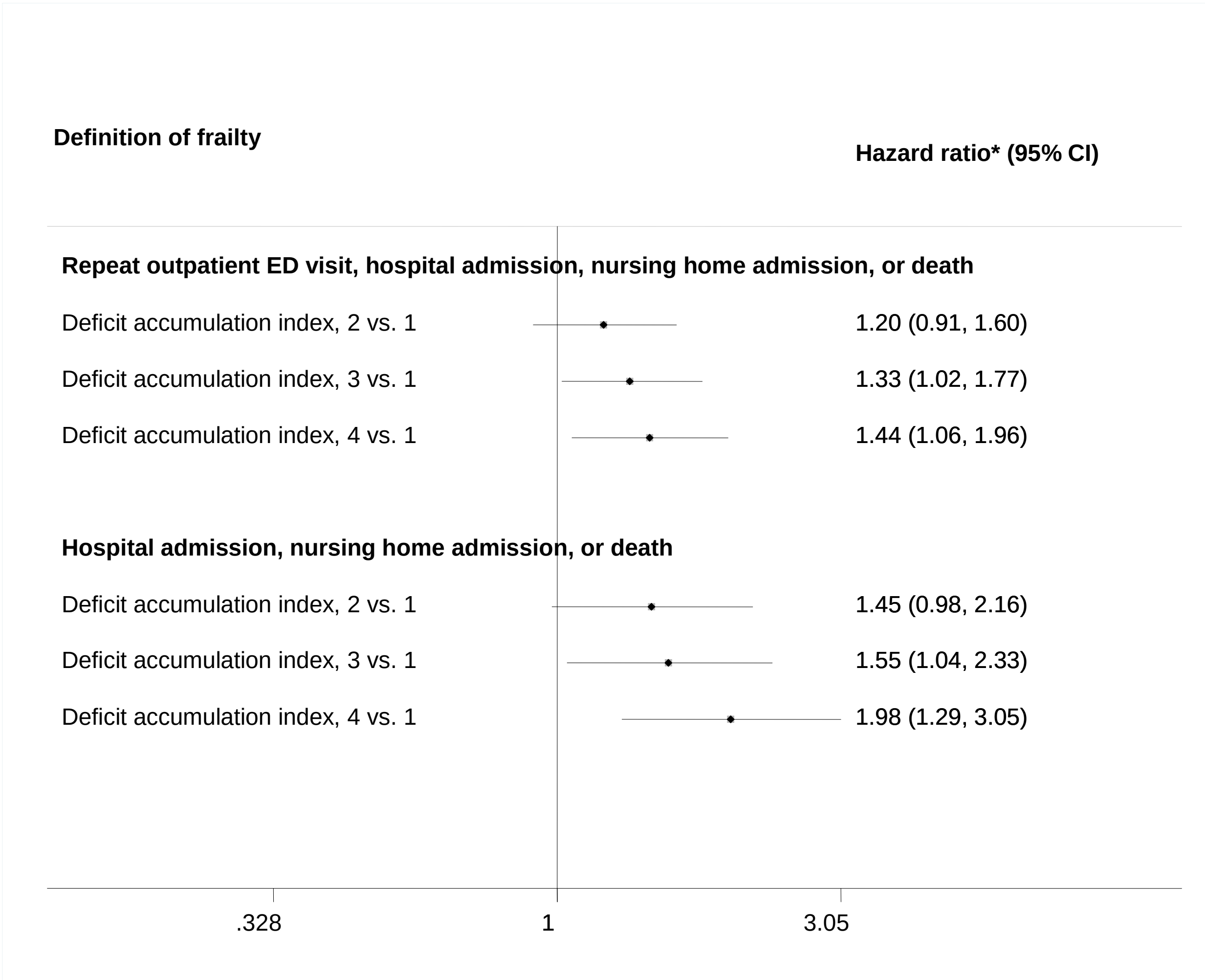


Figure 77. Dose Response Association Between Accumulation Deficits and Mortality or Treatment Utilization Among Medicare Beneficiaries (Good-Quality Study)[157]



*From the Medicare Current Beneficiary Survey; adjusted for age, sex, race, income, living alone, insurance status, previous emergency department (ED) visits, and previous hospitalizations.

Figure 78. Dose Response Association Between Mortality and Frailty Definitions in Older Persons (Good-Quality Individual Study)[14,156]

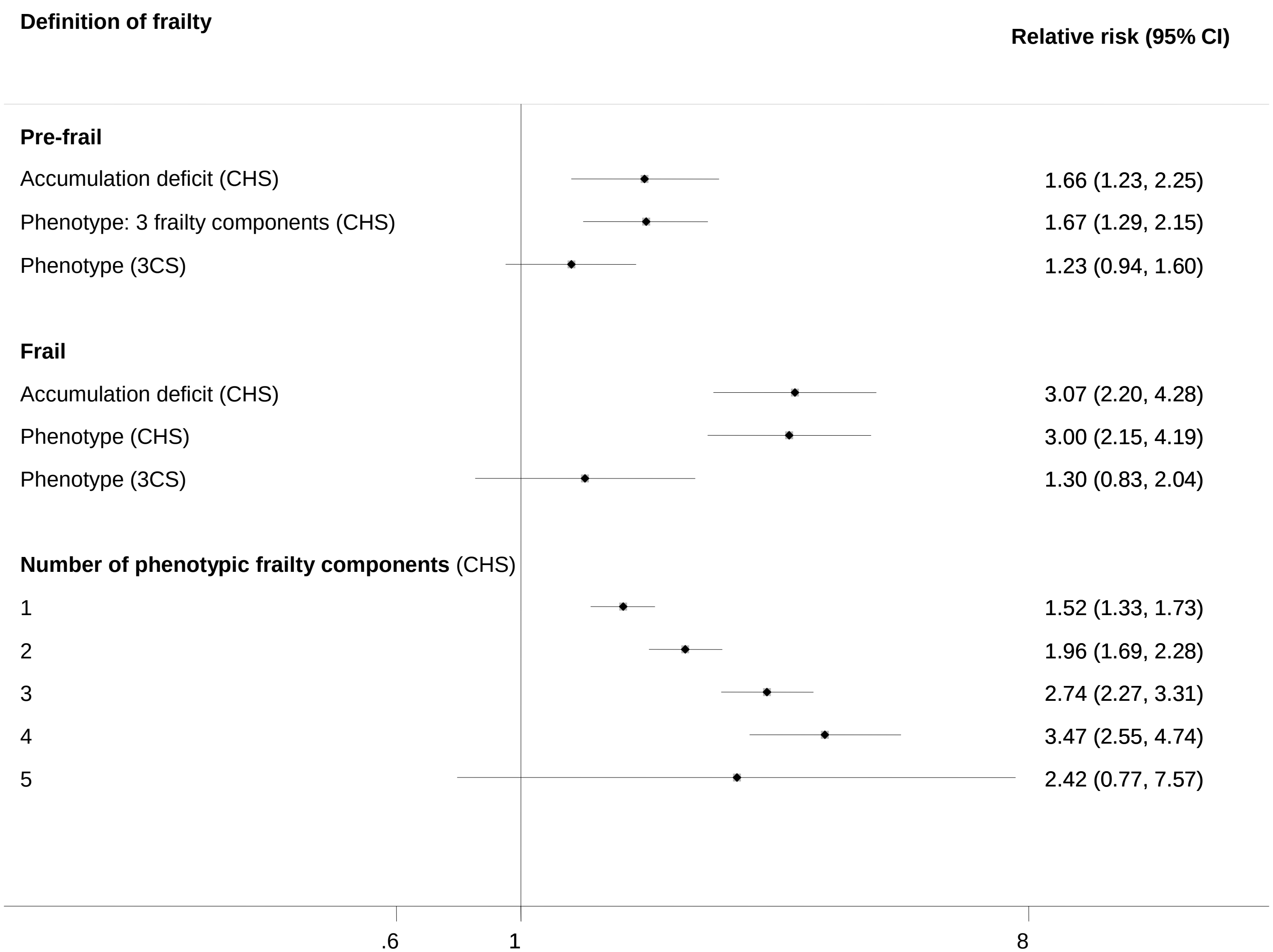


Figure 79. Dose Response Association Between Phenotypic Frailty Components and Mortality According to Time of Followup: Results From the Cardiovascular Health Study (Good-Quality Individual Study)[23,156]

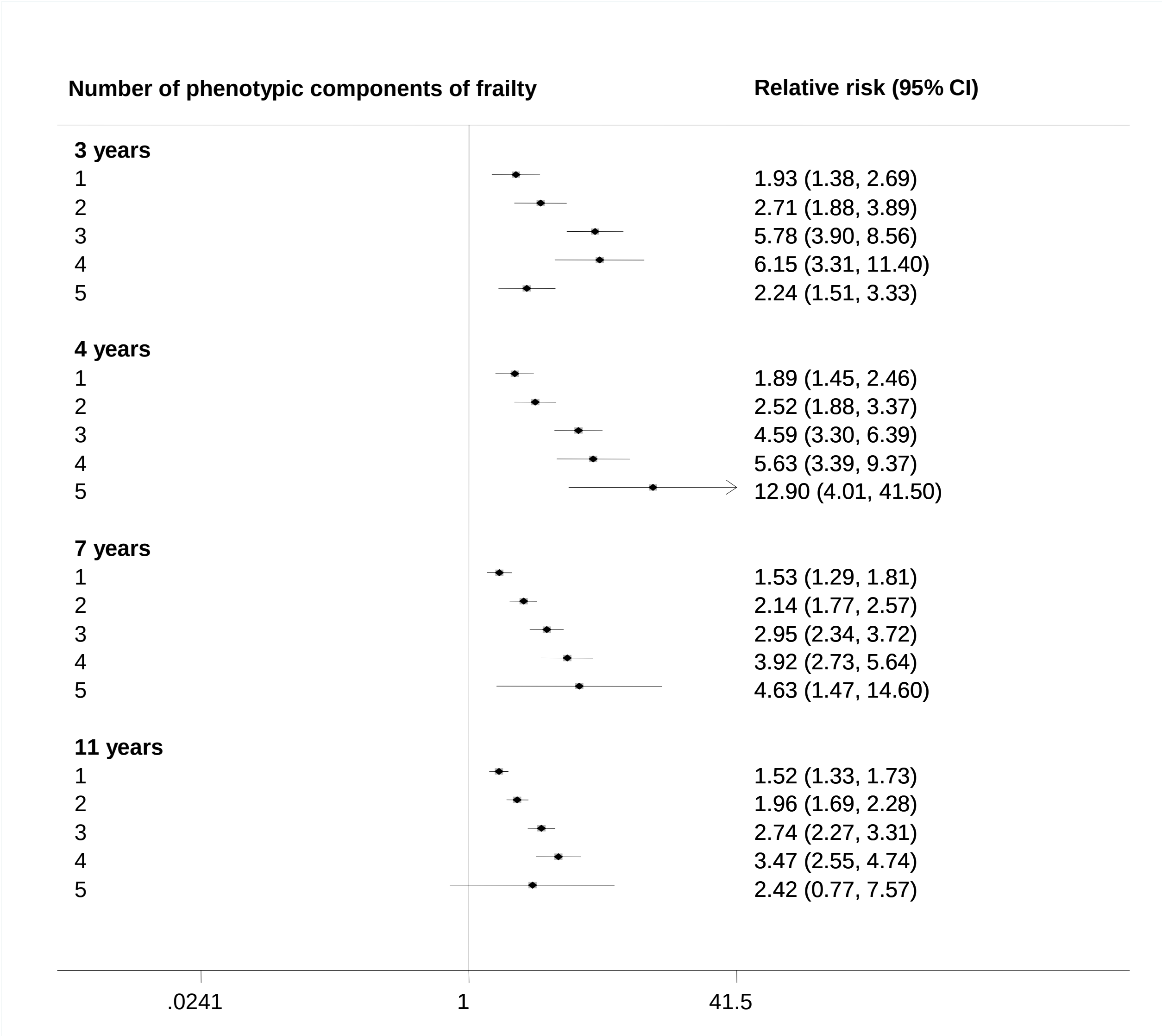


Figure 80. Different Definitions of Basic ADL Disability and Risk of Death in the General Older Adult Population[27,53,54,128,162,164,329,330]

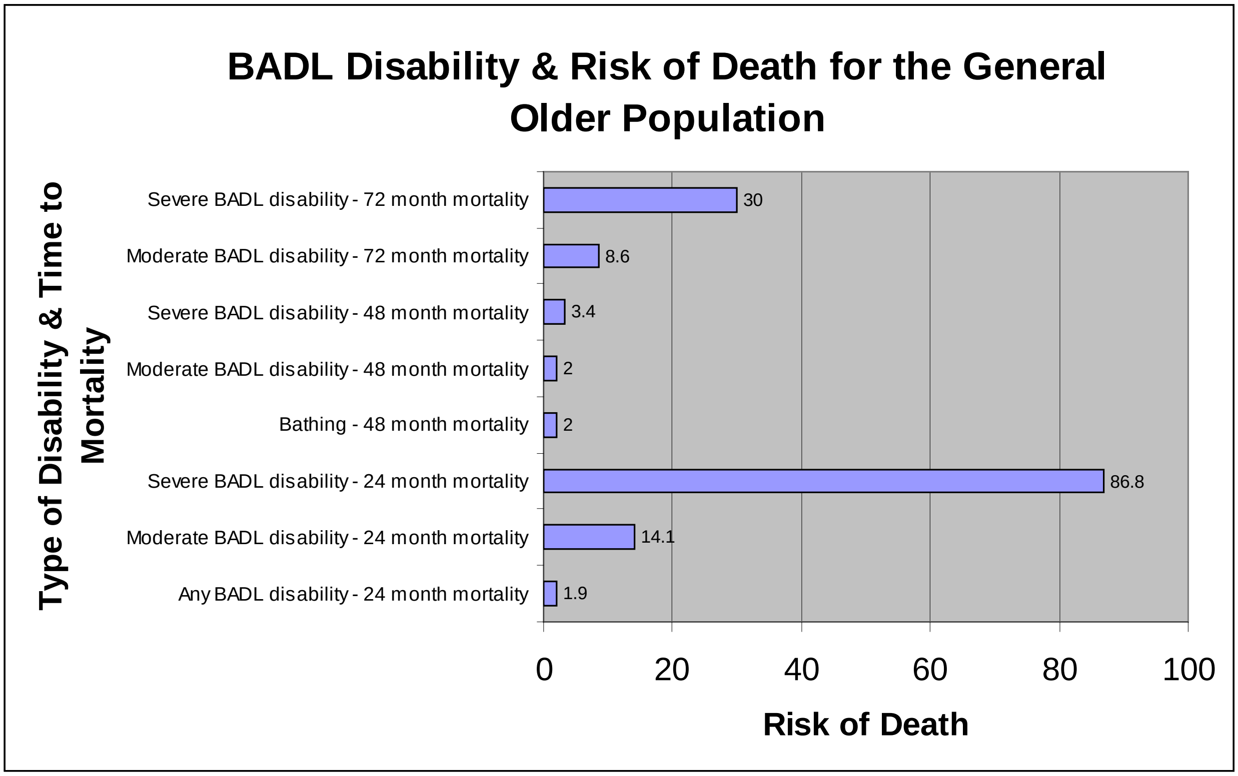


Figure 81. Different Definitions of Instrumental ADL Disability and Risk of Death in the General Older Adult Population[27,53,54,128,162,164,329,330]

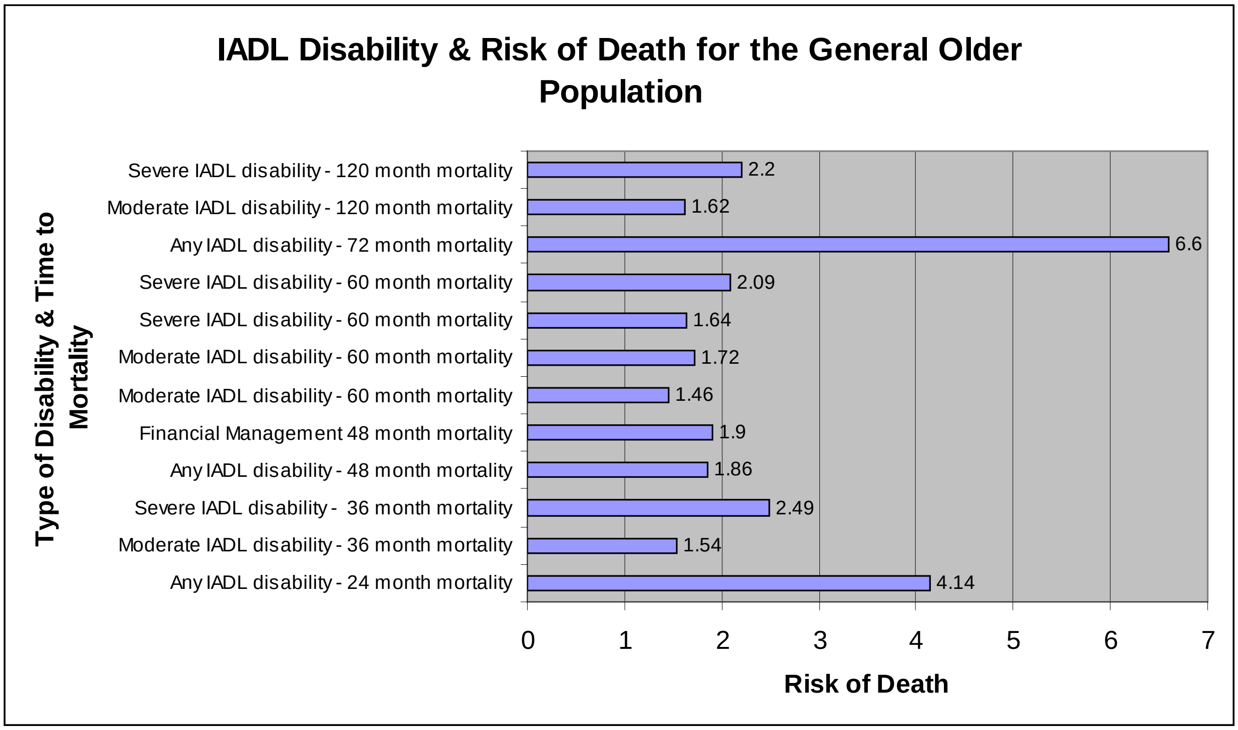


Figure 82. Risk of Death per 1-Point Increase in Disability Score[27,53,54,128,162,164,329,330]

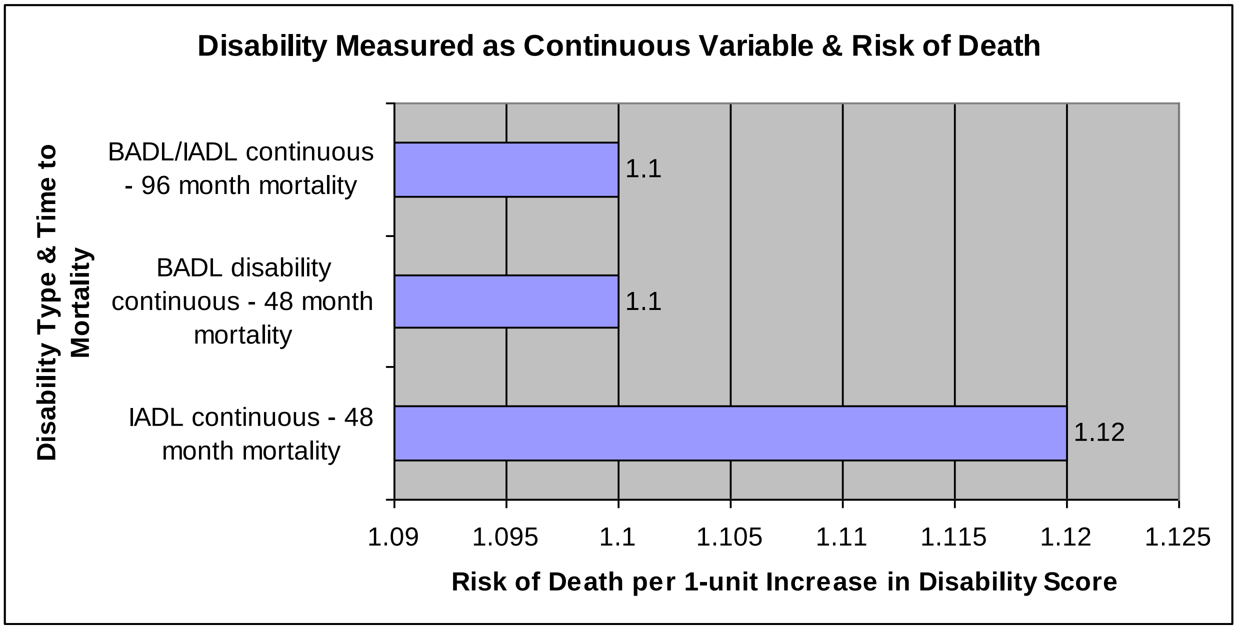
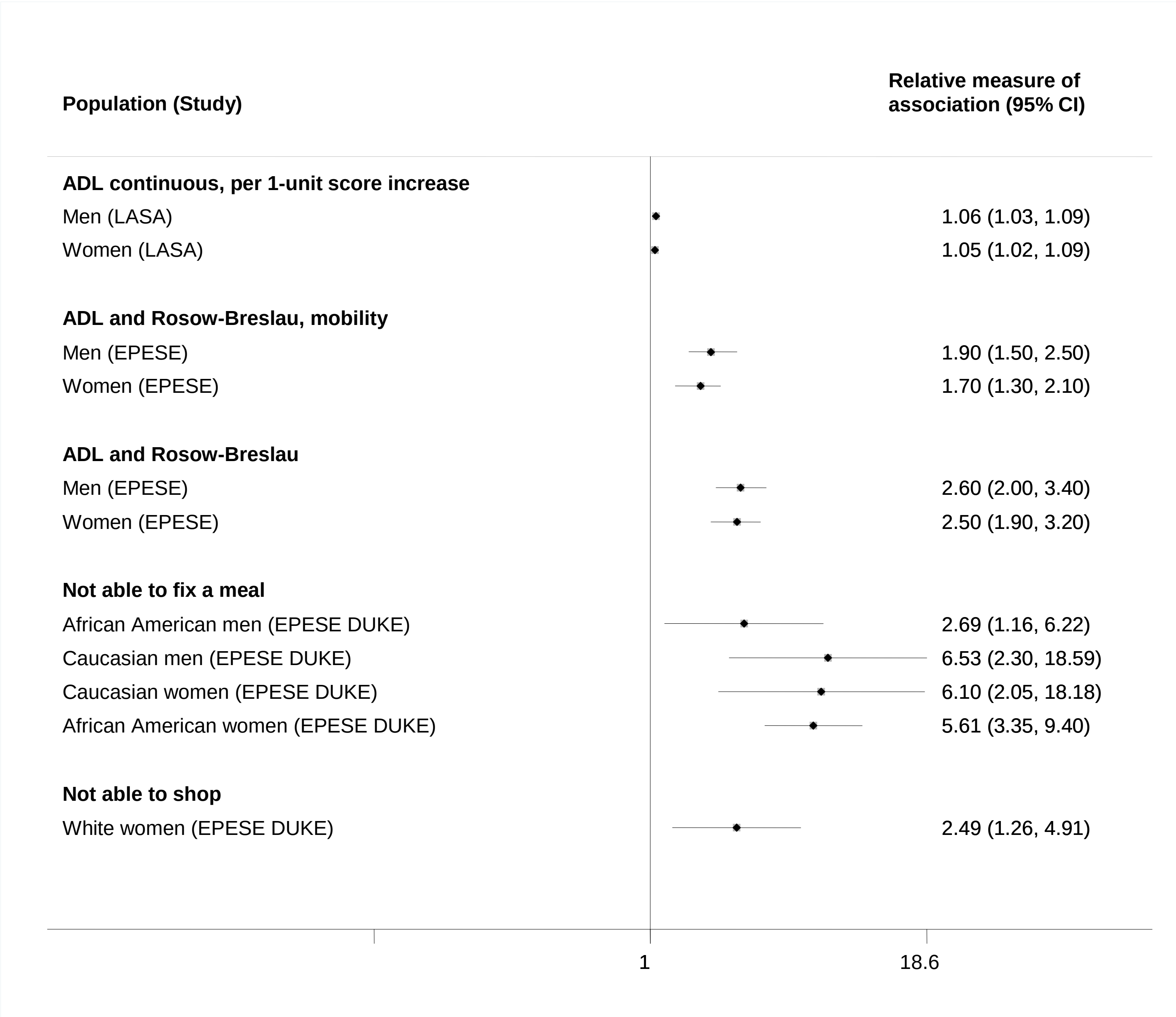
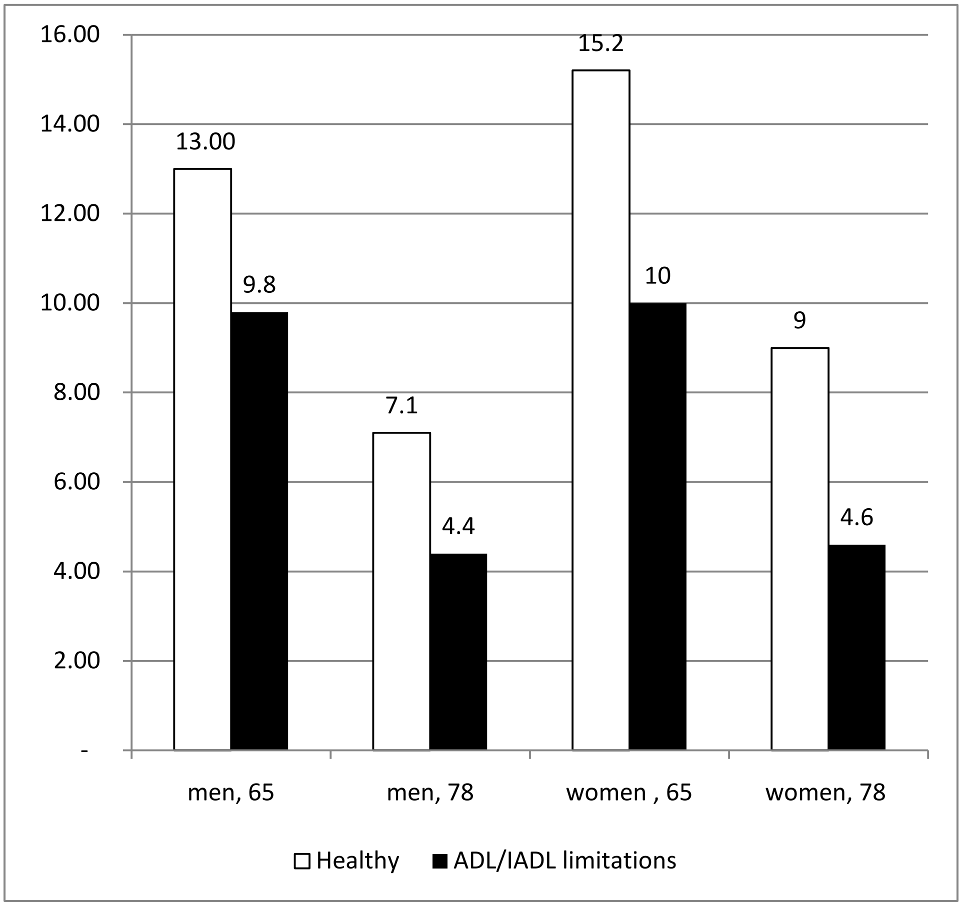


Figure 83. Association Between Disability and Mortality in Older Persons in Race and Sex Subgroups (Good-Quality Individual Studies)[64,119]



LASA=Longitudinal Study on Aging – Amsterdam; EPESE=Established Populations for Epidemiologic Studies of the Elderly.

Figure 84. Years of Expected Active Life Remaining in Older Persons With and Without Disability: Results From the Baltimore Epidemiologic Catchment Area (Good-Quality Individual Study)[40]



Vertical axis=years of life.

Figure 85. Association Between Different Definitions of Malnutrition and Mortality (Good-Quality Individual Studies)[70,71,83,166-169,331]

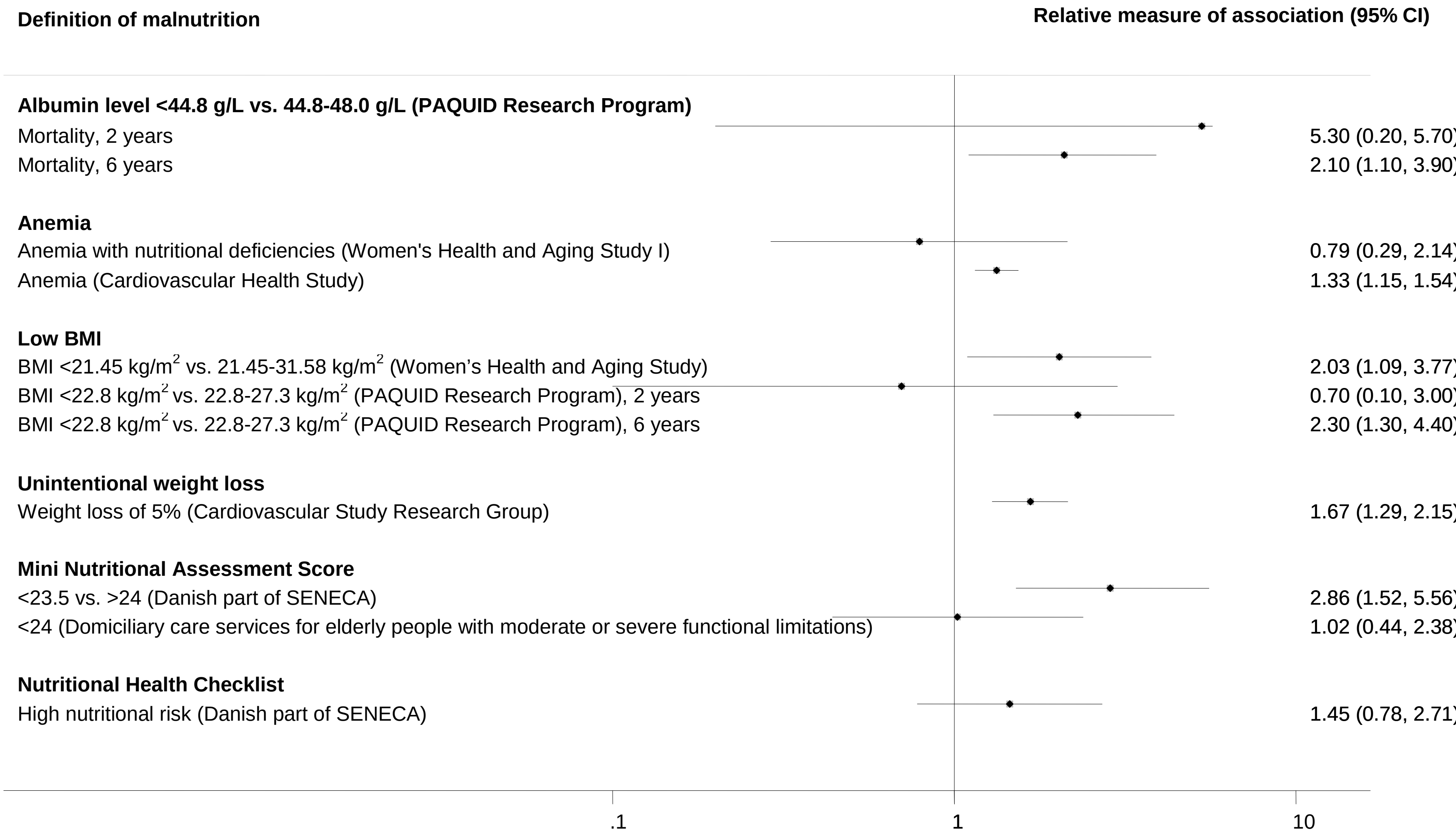


Figure 86. Association Between Mortality and Biomarkers of Malnutrition and Inflammation in Older Participants of the Pathologies Oculaires Liées à l'Age Cohort (Good-Quality Individual Study)[170]

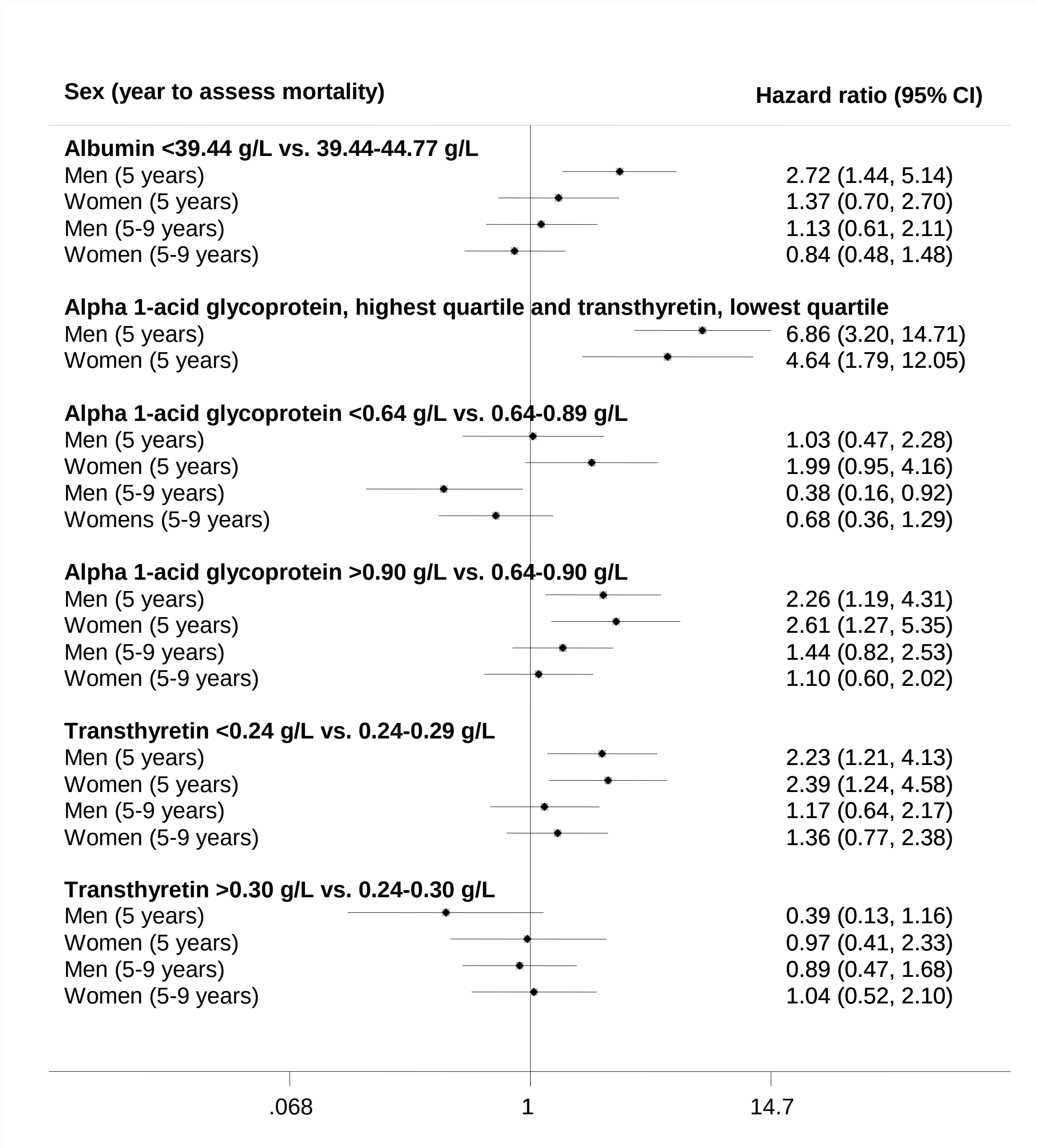
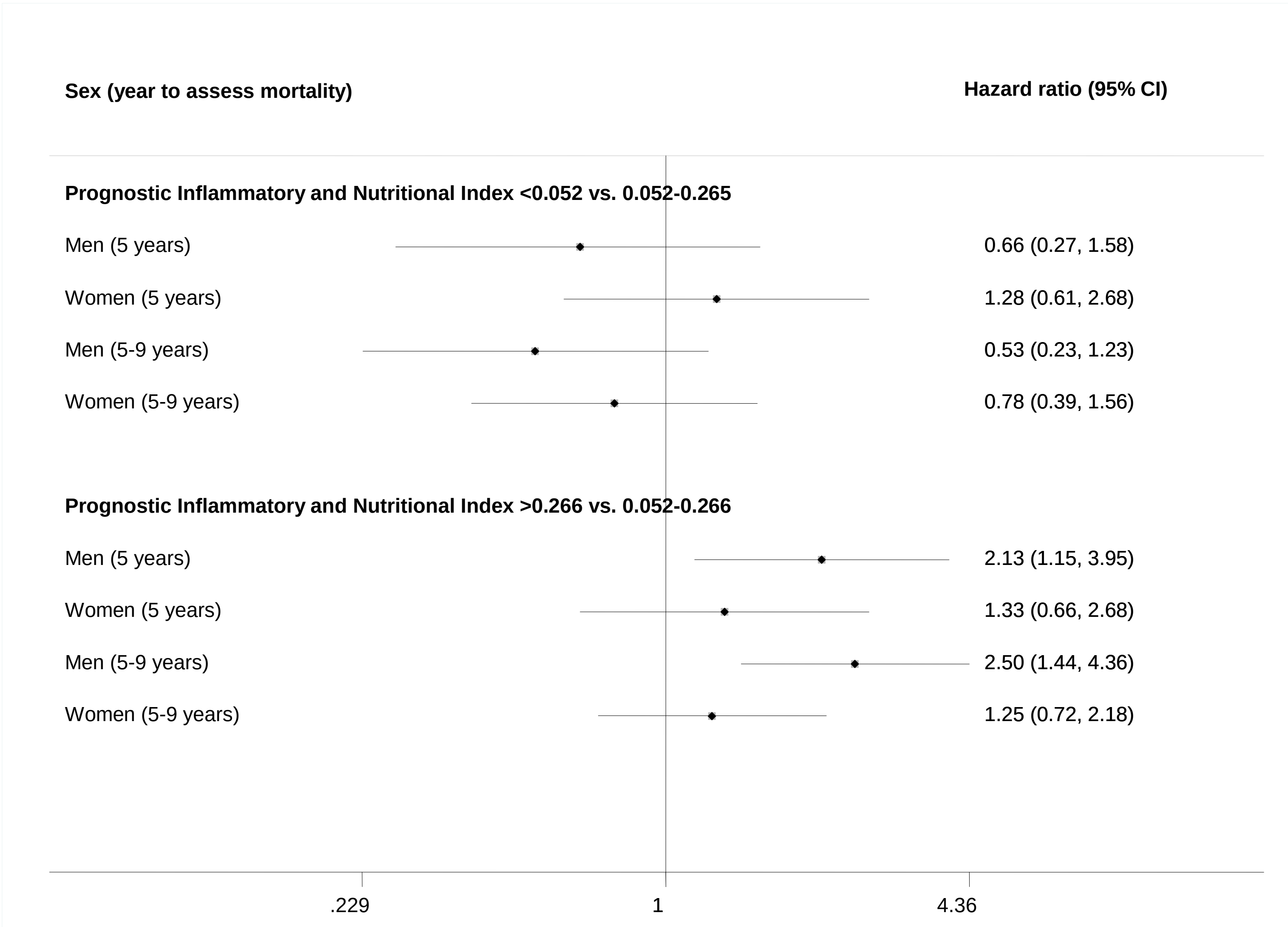


Figure 87. Association Between the Prognostic Inflammatory and Nutritional Index* and Mortality in Older Participants of the Pathologies Oculaires Liées à l'Age Cohort (Good-Quality Individual Study)[170]



*The Prognostic Inflammatory and Nutritional Index is defined as (C-reactive protein * alpha 1-acid glycoprotein)/(albumin * transthyretin).

Figure 88. Association Between Nutritional and Metabolic Abnormalities and Frailty in Older Women: Results From the Women's Health and Aging Studies I and II (Good-Quality Individual Studies)[238]

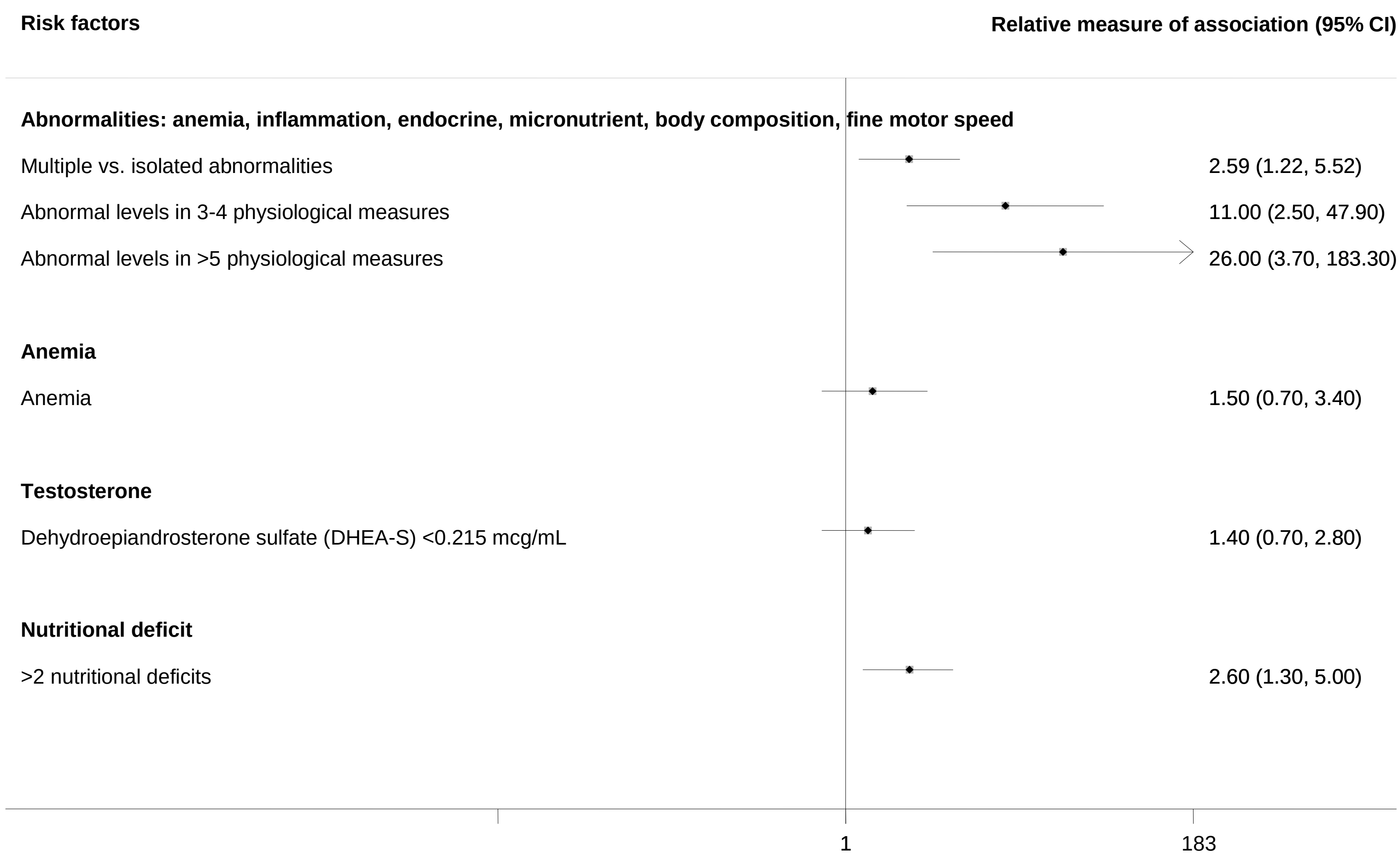


Figure 89. Association Between Increased Interleukin-6 and Mortality in Older Persons (High Level of Evidence)[124,174-177]

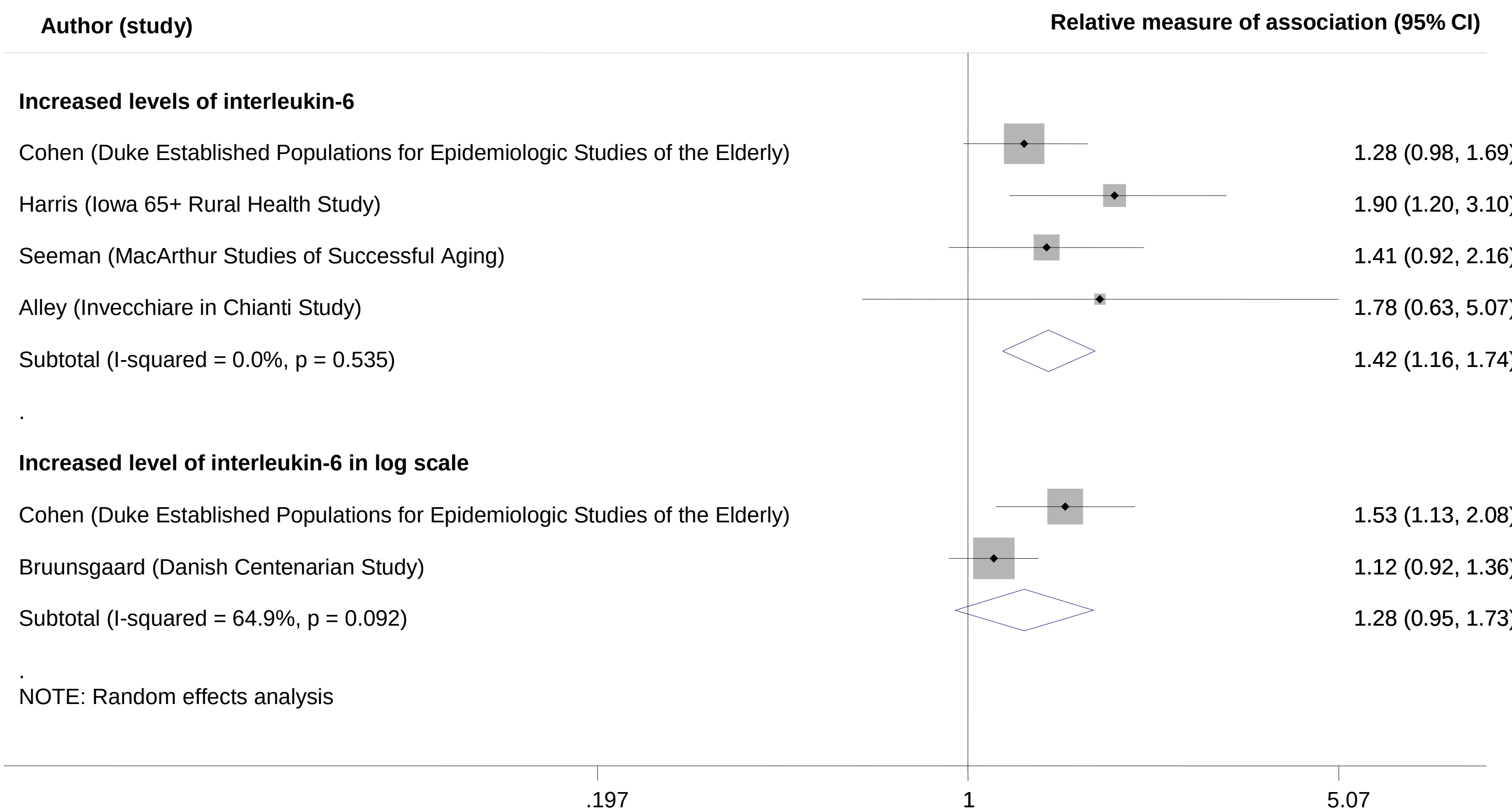
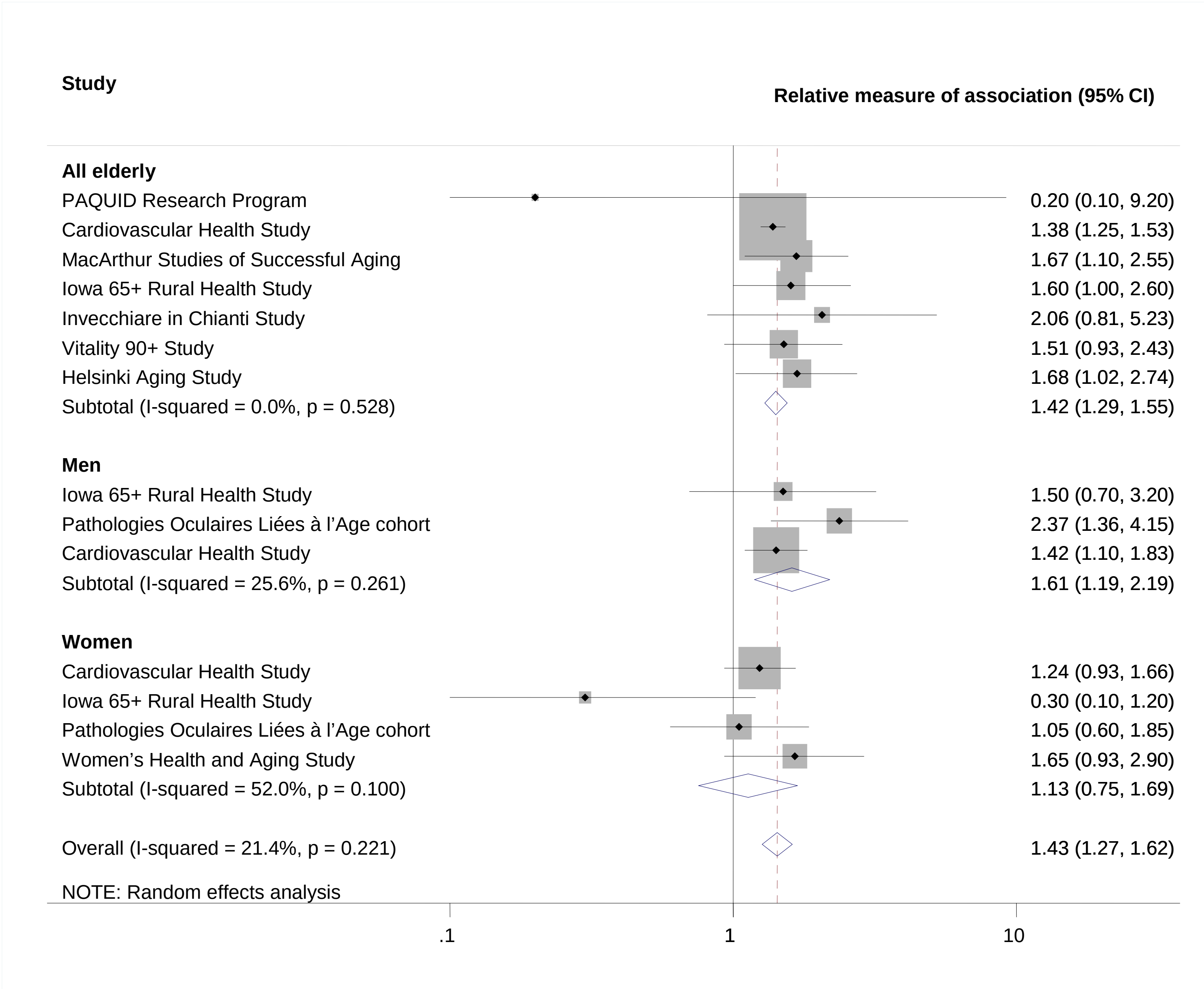


Figure 90. Association Between Elevated Levels of C-Reactive Protein and Mortality in Older Persons (High Level of Evidence)[87,124,129,166,167,170,174,177-179]



Appendix A. Literature Search

Ovid Technologies, Inc., email service

Search for: limit 9 to (English language and humans and yr="1999-Current")
Results: 1-52

Database: Ovid MEDLINE(R) <1950 to July Week 3 2009>
Search Strategy:
----
1 exp geriatric assessment/ (12945)
2 exp health services for the aged/ (12535)
3 (common$ adj3 syndrome$).mp. (4417)
4 1 or 2 (24542)
5 4 and 3 (19)
6 geriatric syndrome$.mp. (239)
7 common$.mp. (752036)
8 6 and 7 (58)
9 8 or 5 (65)
10 limit 9 to (English language and humans and yr="1999-Current") (52)

Database: Ovid MEDLINE(R) <1950 to July Week 3 2009>
Search Strategy:
----
1 exp health services for the aged/ (12535)
2 exp geriatric assessment/ (12945)
3 exp aged/ (1824150)
4 exp aging/ (161093)
5 1 or 2 or 3 or 4 (1931689)
6 syndrome/ or syndrome$.mp. (769191)
7 exp cognition disorders/ (40357)
8 exp sleep disorders/ (45845)
9 exp frail elderly/ (4572)
10 exp nutrition disorders/ (190734)
11 exp gait disorders, neurologic/ (2115)
12 exp urinary incontinence/ (22048)
13 exp fecal incontinence/ (6234)
14 exp vision disorders/ (48713)
15 exp hearing disorders/ (58328)
16 exp depression/ (52923)
17 exp delirium, dementia, amnestic, cognitive disorders/ (132607)
18 exp dizziness/ (2746)
19 exp syncope/ (8746)
20 exp osteoporosis/ (34707)
21 11 or 7 or 9 or 17 or 12 or 20 or 15 or 14 or 8 or 18 or 19 or 16 or 10 or 13 (587526)
22 6 or 21 (1285830)
23 22 and 5 (247880)
24 exp age factors/ (339878)
25 exp sex factors/ (171269)
26 exp Comorbidity/ (40572)
27 25 or 24 or 26 (468826)
28 27 and 23 (24028)
29 exp epidemiologic studies/ (1154895)
30 28 and 29 (7943)
31 (aging or aged or elder$ or geriatric or gerontol$ or older$).ti. (167258)
32 30 and 31 (1566)
33 limit 32 to (English language and humans and yr="1999-Current") (1104)

Database: Ovid MEDLINE(R) <1950 to July Week 3 2009>
Search Strategy:
----
1 exp health services for the aged/ (12535)
2 exp geriatric assessment/ (12945)
3 exp aged/ (1824150)

4 exp aging/ (161093)
5 1 or 2 or 3 or 4 (1931689)
6 syndrome/ or syndrome$.mp. (769191)
7 exp cognition disorders/ (40357)
8 exp sleep disorders/ (45845)
9 exp frail elderly/ (4572)
10 exp nutrition disorders/ (190734)
11 exp gait disorders, neurologic/ (2115)
12 exp urinary incontinence/ (22048)
13 exp fecal incontinence/ (6234)
14 exp vision disorders/ (48713)
15 exp hearing disorders/ (58328)
16 exp depression/ (52923)
17 exp delirium, dementia, amnestic, cognitive disorders/ (132607)
18 exp dizziness/ (2746)
19 exp syncope/ (8746)
20 exp osteoporosis/ (34707)
21 11 or 7 or 9 or 17 or 12 or 20 or 15 or 14 or 8 or 18 or 19 or 16 or 10 or 13 (587526)
22 6 or 21 (1285830)
23 22 and 5 (247880)
24 exp "Quality of Life"/ (76778)
25 exp "Activities of Daily Living"/ (37977)
26 exp Morbidity/ (260042)
27 exp mortality/ (209930)
28 27 or 25 or 24 or 26 (551893)
29 28 and 23 (31277)
30 limit 29 to (English language and humans and yr="1999-Current") (20039)
31 exp epidemiologic studies/ (1154895)
32 30 and 31 (9581)

Database: Ovid MEDLINE(R) <1950 to July Week 3 2009>
Search Strategy:

----

1 exp geriatric assessment/ (12945)
2 exp predictive value of tests/ (93910)
3 exp Survival Analysis/ (100091)
4 exp survival rate/ (90889)
5 exp mortality/ (209930)
6 exp forecasting/ (59830)
7 6 or 4 or 3 or 2 or 5 (436400)
8 1 and 7 (1483)
9 exp epidemiologic studies/ (1154895)
10 8 and 9 (822)
11 exp Mass Screening/ (95484)
12 screen$.mp. (347938)
13 target$.mp. (477594)
14 predictor$.mp. (122940)
15 11 or 13 or 12 or 14 (918257)
16 10 and 15 (332)
17 limit 16 to (English language and humans) (323)

Appendix A. Literature Search

July 30, 2009

Strings	Number Retrieved
“Comprehensive Geriatric Assessment”	318
Syndrome AND “Investigative Techniques”[Mesh] AND “Geriatric Assessment”[Mesh] Limits: Humans, English	222
Screening AND Survival AND “Investigative Techniques”[Mesh] AND “Geriatric Assessment”[Mesh] Limits: Humans, English	454
Frailty and mortality limits: Humans, English	343
“Investigative Techniques”[Mesh] AND “Geriatric Assessment”[Mesh] AND #42 Limits: Humans, Journal Article, English	735
“Geriatric Assessment”[Mesh] AND #42 AND Prevalence AND Cohort Limits: Humans, Journal Article, English	104
Fatigue Syndrome AND Frailty NOT Review Limits: Humans, Journal Article, English	7
Search: Prediction, Mortality, Elderly, Cohort, Geriatric NOT Review Limits: Humans, Journal Article, English	21

Ovid Technologies, Inc., email service

Search for: 1 and 12
Results: 1

Database: Ovid MEDLINE(R) <1950 to July Week 3 2009>
Search Strategy:
----
1 exp geriatric assessment/ (12945)
2 exp “Predictive Value of Tests”/ (93910)
3 1 and 2 (598)
4 limit 3 to (English language and humans and yr=”1990-Current”) (571)
5 limit 4 to (research support, NIH, extramural or research support, NIH, intramural or research support, non US gov't or research support, US gov't, non PHS or research support, US gov't, PHS) (347)
6 4 not 5 (224)
7 exp statistics as topic/ (1363257)
8 7 and 5 (276)
9 sn.fs. (330737)
10 9 and 5 (120)
11 8 or 10 (289)
12 exp mass screening/ (95484)
13 1 and 12 (698)

Ovid Technologies, Inc., email service

Search for: from 31 [limit 30 to (English language and humans)] keep 1-17
Results: 1-17

Database: Ovid MEDLINE(R) <1950 to July Week 4 2009>
Search Strategy:
----
1 exp frail elderly/ (4580)
2 exp cognition disorders/ (40416)
3 exp urinary incontinence/ (22064)
4 exp fecal incontinence/ (6249)
5 4 or 3 (26864)
6 exp sleep disorders/ (45899)
7 exp malnutrition/ (78569)
8 exp gait disorders, neurologic/ (2121)
9 8 or 6 or 7 or 2 or 5 (192419)
10 1 and 9 (325)

11 8 or 6 or 1 or 7 or 5 (157604)
12 11 and 2 (1346)
13 8 or 6 or 1 or 7 or 2 (170158)
14 13 and 5 (348)
15 8 or 1 or 7 or 2 or 5 (151675)
16 6 and 15 (900)
17 8 or 6 or 1 or 2 or 5 (118535)
18 7 and 17 (430)
19 6 or 1 or 7 or 2 or 5 (194716)
20 8 and 19 (163)
21 18 or 16 or 10 or 12 or 20 or 14 (1737)
22 exp mass screening/ or screen$.mp. (353711)
23 22 and 21 (82)
24 exp predictive value of tests/ (94078)
25 24 and 23 (6)
26 exp mortality/ or exp morbidity/ (452142)
27 exp survival analysis/ (100261)
28 27 or 26 (531928)
29 28 and 23 (13)
30 25 or 29 (19)
31 limit 30 to (English language and humans) (17)
32 from 31 keep 1-17 (17)
33 from 32 keep 1-17 (17)

Database: Ovid MEDLINE(R) <1950 to July Week 4 2009>
Search Strategy:

----
1 exp geriatric assessment/ (12973)
2 exp cost-benefit analysis/ (46253)
3 1 and 2 (113)
4 exp health services for the aged/ec [Economics] (1833)
5 exp mass screening/ or screen$.mp. (353711)
6 4 and 5 (31)
7 exp health services for the aged/ (12540)
8 7 and 5 (372)
9 ec.fs. (258305)
10 9 or 2 (267756)
11 8 and 10 (37)
12 6 or 11 or 3 (149)
13 limit 12 to (English language and humans) (131)

July 31

Strings	**Number Retrieved**
exp Geriatric Assessment/sn, cl, mt [Statistics & Numerical Data, Classification, Methods] AND exp Cohort Studies/ AND exp United States/ep [Epidemiology]	34
*"quality of life"/ or exp "health care quality, access, and evaluation"/ AND exp Geriatric Assessment/sn, cl, mt [Statistics & Numerical Data, Classification, Methods] AND exp United States/ep [Epidemiology]	126

September 24

"Disability Evaluation"[Mesh] AND ("United States"[Mesh] OR "United States Agency for Healthcare Research and Quality"[Mesh]) Limits: Humans, Journal Article, English, Aged: 65+ years, selected 201	578

September 29

Related Articles for PubMed (Select 15051585)	145
"The Yale Health and Aging Study"	51
"The Framingham Disability Study"	39

Appendix A. Literature Search

October 13, 2009

Strings	Number Retrieved
“Polypharmacy”[Mesh] AND Medicare	29
“Polypharmacy”[Mesh] AND Cohort Limits: Humans, Journal Article, English, Aged: 65+ years, 80 and over: 80+ years	65
October 21, 2009	
“Models, Economic”[Mesh] AND “Life Expectancy”[Mesh] NOT Review Limits: Humans, English, Aged: 65+ years	40
Select 5 document(s)	5
Search Kuntz KM[author] Limits: Humans, English, Aged: 65+ years	51
November 23, 2009	
Definition: Frailty Limits: Humans, Journal Article, English, Aged: 65+ years, 80 and over: 80+ years	55
February 10, 2010	
Search: Prevalence, Frailty, Cohort Limits: Journal Article, English	138
Select 30 document(s)	30
Related Articles for PubMed (Select 19196644)	1099
Search: Prevalence, "Chronic Inflammation," Cohort Limits: Humans, Journal Article, English, Aged: 65+ years, 80 and over: 80+ years	38
Select 4 document(s)	4
Related articles for PubMed (Select 17685096)	458
Search: Prevalence, Malnutrition, Cohort, Limits: Humans, Journal Article, English, Aged: 65+ years, 80 and over: 80+ years	294
March 17, 2010	
Search: Allostatic Limits: Humans, Journal Article, English, Aged: 65+ years, 80 and over: 80+ years	36

Appendix B. Excluded Studies

1. Geriatric nurse practitioner role grows in newer delivery system. Natl Rep Subacute Care 1996 Nov 6; 4(23):6. *Comment*
2. Medical management magnified under Medicare risk. Public Sect Contract Rep 1997 Jul; 3(7):97-100. *Comment*
3. Reduce risk by screening, managing frail elderly. Public Sect Contract Rep 1997 Jan; 3(1):1-6. *Not eligible full text can not be found*
4. Home visits by physicians improve care, reduce utilization, cut costs under Medicare risk. Public Sect Contract Rep 1998 May; 4(5):70-4. *Comment*
5. Finding frail elderly key to managing them. Manag Care Strateg 1998 Aug; 6(8):88, 93. *Comment*
6. Invest in data systems to manage your senior patients. Public Sect Contract Rep 1998 Jul; 4(7):97-100. *Comment*
7. Carle Clinic's risk screening tools identify, help manage at-risk senior patients. Public Sect Contract Rep 1998 Feb; 4(2):21-3. *Comment*
8. Manage your high-risk seniors to avoid financial ruin. Public Sect Contract Rep 1999 Jul; 5(7):97-100. *Comment*
9. Roadmap teams improve care for over-65 population. Healthc Demand Dis Manag 1999 Feb; 5(2):26-9. *Comment*
10. Tool helps ID high-risk seniors, cut costs under Medicare risk. Capitation Manag Rep 2000 Sep; 7(9):137-40, 29. *Comment*
11. Commonwealth Fund CEO says U.S. system faces 'serious problems'. Health Care Strateg Manage 2000 Jul; 18(7):11. *Comment*
12. HCFA to field test MDS version 3; update to MDS 2.0 now in effect. Natl Rep Subacute Care 2000 Sep 20; 8(19):1, 3-4. *Comment*
13. Prevention and treatment of infection. The role of nutrition in long-term care. Health Care Food Nutr Focus 2001 Nov; 18(3):7-8. *Not eligible target population*
14. Model for care of chronically ill blends DM and CM approaches. Clin Resour Manag 2001 Sep; 2(9):129-32. *Comment*
15. Screening tool helps identify high-risk seniors, cut costs. Clin Resour Manag 2001 Apr; 2(4):53-6, 49. *Comment*
16. Technical revisions to medical criteria for determinations of disability. Final rules. Fed Regist 2002 Apr 24; 67(79):20018-28. *Not eligible outcomes*
17. Aetna turns to enhanced HRA process to manage risk for seniors. Dis Manag Advis 2003 Jun; 9(6):90-1, 81.
18. Assisted living facilities. What they are and how to find one. Geriatrics 2003 Feb; 58(2):56. *Comment*
19. Social support and health-related quality of life among older adults--Missouri, 2000. MMWR Morb Mortal Wkly Rep 2005 May 6; 54(17):433-7. *Not eligible outcomes*
20. Universal protocol cuts hip surgery fatalities. Healthcare Benchmarks Qual Improv 2005 Mar; 12(3):30-1. *Comment*
21. Depression in elderly populations. Nebr Nurse 2005 Mar-May; 38(1):21-3. *Comment*
22. McClellan says CMS will protect duals ... but others express doubts. Med Health 2005 Mar 7; 59(9):3-4. *News*
23. Most Americans alarmed by impending Medicare cuts that will harm seniors' access to care. Congressional action needed now to avert Medicare physician payment cuts. J Miss State Med Assoc 2006 Oct; 47(10):311. *Not eligible outcomes*
24. Differential mortality, uncertain medical expenditures, and the savings decisions of the elderly. Natl Bur Econ Res Bull Aging Health 2006 Fall; (17):2-3. *Comment*
25. Apache II Scores Illustrate Homeostenosis Model. Available at: http://www.ouhsc.edu/geriatricmedicine/Education/Homeostenosis/HomeostenosisApache_II_Scores_Illustrate_Home.htm. *Not eligible outcomes*
26. Aalen OO. Heterogeneity in survival analysis. Stat Med 1988 Nov; 7(11):1121-37. *Not eligible outcomes*
27. Aartsen MJ, Martin M, Zimprich D. Gender differences in level and change in cognitive functioning. Results from the Longitudinal Aging Study Amsterdam. Gerontology 2004 Jan-Feb; 50(1):35-8. *Not eligible outcomes*
28. Abbott KC, Trespalacios FC, Taylor AJ, et al. Atrial fibrillation in chronic dialysis patients in the United States: risk factors for hospitalization and mortality. BMC Nephrol 2003 Jan 24; 4:1. *Not eligible target population*
29. Abbott RD, Ando F, Masaki KH, et al. Dietary magnesium intake and the future risk of coronary heart disease (the Honolulu Heart Program). American Journal of Cardiology 2003 Sep 15; 92(6):665-9. *Not eligible outcomes*
30. Abbott RD, Launer LJ, Rodriguez BL, et al. Serum estradiol and risk of stroke in elderly men. Neurology 2007 Feb 20; 68(8):563-8. *Not eligible outcomes*
31. Abhayaratna WP, Smith WT, Becker NG, et al. Prevalence of heart failure and systolic ventricular dysfunction in older Australians: the Canberra Heart Study. Med J Aust 2006 Feb 20; 184(4):151-4. *Not eligible outcomes*
32. Abou-Gareeb I, Lewallen S, Bassett K, et al. Gender and blindness: a meta-analysis of population-based prevalence surveys. Ophthalmic Epidemiol 2001 Feb; 8(1):39-56. *Not eligible outcomes*
33. Abraido-Lanza AF, White K, Armbrister AN, et al. Health status, activity limitations, and disability in work and housework among Latinos and non-Latinos with arthritis: an analysis of national data. Arthritis Rheum 2006 Jun 15; 55(3):442-50. *Not eligible outcomes*
34. Abrams RC, Lachs M, McAvay G, et al. Predictors of self-neglect in community-dwelling elders. Am J Psychiatry 2002 Oct; 159(10):1724-30. *Not eligible outcome*
35. Abrutyn E, Mossey J, Levison M, et al. Epidemiology of asymptomatic bacteriuria in elderly

women. J Am Geriatr Soc 1991 Apr; 39(4):388-93. *Not eligible outcomes*
36. Abuzeid WM, Ruckenstein MJ, Abuzeid WM, et al. Spirochetes in otology: are we testing for the right pathogens? Otolaryngology - Head & Neck Surgery 2008 Jan; 138(1):107-9. *Outcomes*
37. Achat H, Kawachi I, Spiro A, 3rd, et al. Optimism and depression as predictors of physical and mental health functioning: the Normative Aging Study. Annals of Behavioral Medicine 2000; 22(2):127-30. *Not eligible outcomes*
38. Acierno R, Resnick H, Kilpatrick D, et al. Assessing elder victimization--demonstration of a methodology. Soc Psychiatry Psychiatr Epidemiol 2003 Nov; 38(11):644-53. *Not eligible outcomes*
39. Ackermann RT, Williams B, Nguyen HQ, et al. Healthcare cost differences with participation in a community-based group physical activity benefit for medicare managed care health plan members. J Am Geriatr Soc 2008 Aug; 56(8):1459-65. *Not eligible outcomes*
40. Adak S, Illouz K, Gorman W, et al. Predicting the rate of cognitive decline in aging and early Alzheimer disease. Neurology 2004 Jul 13; 63(1):108-14. *Not eligible outcomes*
41. Adamis D, Lunn M, Martin FC, et al. Cytokines and IGF-I in delirious and non-delirious acutely ill older medical inpatients. Age & Ageing 2009 discussion 251; May; 38(3):326-32. *Not eligible target population*
42. Adams BD, Medeiros R, Dereska P, et al. Geriatric all-terrain vehicle trauma. Am Surg 2004 Apr; 70(4):329-32. *Not eligible outcomes*
43. Adams TD, Avelar E, Cloward T, et al. Design and rationale of the Utah obesity study. A study to assess morbidity following gastric bypass surgery. Contemporary Clinical Trials 2005 Oct; 26(5):534-51. *Not eligible outcomes*
44. Adams VH, 3rd, Jackson JS. The contribution of hope to the quality of life among aging African Americans: 1980-1992. International Journal of Aging & Human Development 2000; 50(4):279-95. *Not eligible outcomes*
45. Adams-Wendling L. Clocking care hours with workload measurement tools. Nurs Manage 2003 Aug; 34(8):34-9. *Not eligible outcomes*
46. Adelman RD, Greene MG, Friedmann E, et al. Discussion of depression in follow-up medical visits with older patients. J Am Geriatr Soc 2008 Jan; 56(1):16-22. *Not eligible outcomes*
47. Adeniran RK. Fraud and abuse--an overview. Geriatr Nurs 2002 Mar-Apr; 23(2):111-2. *Comment*
48. Adera T, Gaydos JC. Identifying comparison groups for evaluating occupational hearing loss: a statistical assessment of 22 industrial populations. American Journal of Industrial Medicine 1997 Feb; 31(2):243-9. *Not eligible outcomes*
49. Adler G, Silverstein NM. At-risk drivers with Alzheimer's disease: recognition, response, and referral. Traffic Inj Prev 2008 Aug; 9(4):299-303. *Not eligible target population*
50. Aggarwal NT, Bennett DA, Bienias JL, et al. The prevalence of dizziness and its association with functional disability in a biracial community population. J Gerontol A Biol Sci Med Sci 2000 May; 55(5):M288-92. *Not eligible outcomes*
51. Agree EM, Freedman VA. Incorporating assistive devices into community-based long-term care: an analysis of the potential for substitution and supplementation. J Aging Health 2000 Aug; 12(3):426-50. *Not eligible target population*
52. Ahmed N, Mandel R, Fain MJ. Frailty: an emerging geriatric syndrome. Am J Med 2007 Sep; 120(9):748-53. *Not eligible outcomes*
53. Ai AL, Peterson C, Tice TN, et al. Differential effects of faith-based coping on physical and mental fatigue in middle-aged and older cardiac patients. Int J Psychiatry Med 2006; 36(3):351-65. *Not eligible outcomes*
54. Aiello AE, Haan M, Blythe L, et al. The influence of latent viral infection on rate of cognitive decline over 4 years.[see comment]. Journal of the American Geriatrics Society 2006 Jul; 54(7):1046-54. *Not eligible outcomes*
55. Al Snih S, Fisher MN, Raji MA, et al. Diabetes mellitus and incidence of lower body disability among older Mexican Americans. J Gerontol A Biol Sci Med Sci 2005 Sep; 60(9):1152-6. *Not eligible outcomes*
56. Albert I, Jais JP. The use of frailty models in genetic studies: application to the relationship between end-stage renal failure and mutation type in Alport syndrome. European Community Alport Syndrome Concerted Action Group (ECASCA). J Epidemiol Biostat 2000; 5(3):169-75. *Not eligible outcomes*
57. Aliotta SL, Aubert RE, Kirby HB. A managed care approach to high-risk screening and case management in the elderly. Eff Clin Pract 1998 Oct-Nov; 1(2):93-4. *Not eligible outcomes*
58. Allaire JC, Willis SL. Competence in everyday activities as a predictor of cognitive risk and mortality. Neuropsychol Dev Cogn B Aging Neuropsychol Cogn 2006 Jun; 13(2):207-24. *Not eligible outcomes*
59. Allison DB, Gallagher D, Heo M, et al. Body mass index and all-cause mortality among people age 70 and over: the Longitudinal Study of Aging. International Journal of Obesity & Related Metabolic Disorders: Journal of the International Association for the Study of Obesity 1997 Jun; 21(6):424-31. *Not eligible exposure*
60. Allman RM, Damiano AM, Strauss MJ. Pressure ulcer status and post-discharge health care resource utilization among older adults with activity limitations. Adv Wound Care 1996 Mar-Apr; 9(2):38-44. *Not eligible outcomes*
61. Alter G. Height, frailty, and the standard of living: modelling the effects of diet and disease on declining mortality and increasing height. Popul Stud (Camb) 2004; 58(3):265-79. *Not eligible outcomes*
62. Alves de Moraes S, Szklo M, Knopman D, et al. The relationship between temporal changes in blood

pressure and changes in cognitive function: atherosclerosis risk in communities (ARIC) study. Preventive medicine 2002 Sep; 35(3):258-63. *Not eligible outcomes*

63. Amador LF, Al Snih S, Markides KS, et al. Weight change and mortality among older Mexican Americans. Aging Clin Exp Res 2006 Jun; 18(3):196-204. *Not eligible outcomes*
64. Amir O, Hassan Y, Sarriff A, et al. Incidence of risk factors for developing hyperkalemia when using ACE inhibitors in cardiovascular diseases. Pharm World Sci 2009 Jun; 31(3):387-93. *Not eligible outcomes*
65. Ananth CV, Demissie K, Smulian JC, et al. Placenta previa in singleton and twin births in the United States, 1989 through 1998: a comparison of risk factor profiles and associated conditions. American Journal of Obstetrics & Gynecology 2003 Jan; 188(1):275-81. *Not eligible outcomes*
66. Andersen PK, Klein JP, Zhang MJ. Testing for centre effects in multi-centre survival studies: a Monte Carlo comparison of fixed and random effects tests. Stat Med 1999 Jun 30; 18(12):1489-500. *Not eligible outcomes*
67. Anderson AA. Getting a grip on depression. Provider 2001 Jan; 27(1):37-8. *Not eligible outcomes*
68. Andres L. Motor vehicle crashes among the elderly: advocates cite the need for mandatory retesting of elderly drivers. J Emerg Nurs 2004 Oct; 30(5):509-11. *Not eligible outcomes*
69. Andresen EM, Bowley N, Rothenberg BM, et al. Test-retest performance of a mailed version of the Medical Outcomes Study 36-Item Short-Form Health Survey among older adults. Med Care 1996 Dec; 34(12):1165-70. *Not eligible outcomes*
70. Andrew MK, Mitnitski AB, Rockwood K. Social vulnerability, frailty and mortality in elderly people. PLoS One 2008; 3(5):e2232. *Not eligible outcomes*
71. Angel JL, De Jong GF, Cornwell GT, et al. Diminished Health and Living Arrangements of Rural Elderly Americans. National Journal of Sociology 1995; 9(1):31-57. *Not eligible outcomes*
72. Annaloro C, Usardi P, Airaghi L, et al. Prevalence of metabolic syndrome in long-term survivors of hematopoietic stem cell transplantation. Bone marrow transplantation 2008 May; 41(9):797-804. *Not eligible outcomes*
73. Anonymous. Asthma emerges as significant problem for elderly. Clin Resour Manag 2001 Nov; 2(11):170-3, 61. *Not eligible outcomes*
74. Anonymous. Summaries for patients. Cognitive impairment without dementia in older adults.[original report in Ann Intern Med. 2008 Mar 18;148(6):427-34; PMID: 18347351]. Annals of internal medicine 2008 Mar 18; 148(6):I-53. *Not eligible outcomes*
75. Appelt CJ, Burant CJ, Siminoff LA, et al. Arthritis-specific health beliefs related to aging among older male patients with knee and/or hip osteoarthritis. J Gerontol A Biol Sci Med Sci 2007 Feb; 62(2):184-90. *Not eligible outcomes*
76. Appleby C. Clinical paths. Prevention is the best medicine. Hosp Health Netw 1996 Aug 20; 70(16):40. *Comment*
77. Arai Y, Takayama M, Gondo Y, et al. Adipose endocrine function, insulin-like growth factor-1 axis, and exceptional survival beyond 100 years of age. J Gerontol A Biol Sci Med Sci 2008 Nov; 63(11):1209-18. *Not eligible outcomes*
78. Araujo AB, O'Donnell AB, Brambilla DJ, et al. Prevalence and incidence of androgen deficiency in middle-aged and older men: estimates from the Massachusetts Male Aging Study.[see comment]. Journal of Clinical Endocrinology & Metabolism 2004 Dec; 89(12):5920-6. *Not eligible outcomes*
79. Arbeev KG, Akushevich I, Kulminski AM, et al. Genetic model for longitudinal studies of aging, health, and longevity and its potential application to incomplete data. Journal of Theoretical Biology 2009; 258(1):103-11. *Simulation study*
80. Arfken CL, Lichtenberg PA, Tancer ME. Cognitive impairment and depression predict mortality in medically ill older adults. Journals of Gerontology Series A-Biological Sciences & Medical Sciences 1999 Mar; 54(3):M152-6. *Not eligible population*
81. Argekar P, Griffin V, Litaker D, et al. Sleep apnea in hemodialysis patients: risk factors and effect on survival. Hemodialysis International 2007 Oct; 11(4):435-41. *Not eligible outcomes*
82. Arnold AM, Psaty BM, Kuller LH, et al. Incidence of cardiovascular disease in older Americans: the cardiovascular health study. J Am Geriatr Soc 2005 Feb; 53(2):211-8. *Not eligible outcomes*
83. Arnow BA, Hunkeler EM, Blasey CM, et al. Comorbid depression, chronic pain, and disability in primary care. Psychosom Med 2006 Mar-Apr; 68(2):262-8. *Not eligible outcomes*
84. Arora VM, Georgitis E, Woodruff JN, et al. Improving sleep hygiene of medical interns: can the sleep, alertness, and fatigue education in residency program help?[see comment]. Archives of Internal Medicine 2007 Sep 10; 167(16):1738-44. *Not eligible outcomes*
85. Arsenault LN, Matthan N, Scott TM, et al. Validity of estimated dietary eicosapentaenoic acid and docosahexaenoic acid intakes determined by interviewer-administered food frequency questionnaire among older adults with mild-to-moderate cognitive impairment or dementia. American Journal of Epidemiology 2009 Jul 1; 170(1):95-103. *Not eligible outcomes*
86. Arzt M, Young T, Finn L, et al. Association of sleep-disordered breathing and the occurrence of stroke. American Journal of Respiratory & Critical Care Medicine 2005 Dec 1; 172(11):1447-51. *Not eligible outcomes*
87. Arzt M, Young T, Finn L, et al. Sleepiness and sleep in patients with both systolic heart failure and obstructive sleep apnea.[see comment]. Archives of Internal Medicine 2006 Sep 18; 166(16):1716-22. *Not eligible outcomes*

Appendix B. Excluded Studies

88. Aschwanden C, Aschwanden C. Taking the long view. Science of Aging Knowledge Environment 2004 Jun 30; 2004(26):ns3. *Not eligible outcomes*
89. Asghar M, Adhiyaman V, Greenway MW, et al. Chronic subdural haematoma in the elderly--a North Wales experience. J R Soc Med 2002 Jun; 95(6):290-2. *Not eligible outcomes*
90. Ashford JW, Kumar V, Barringer M, et al. Assessing Alzheimer severity with a global clinical scale. Int Psychogeriatr 1992 Summer; 4(1):55-74. *Not eligible outcomes*
91. Astone NM, Ensminger M, Juon HS, et al. Early adult characteristics and mortality among inner-city African American women. American Journal of Public Health 2002 Apr; 92(4):640-5. *Not eligible outcomes*
92. Astrand B, Astrand E, Antonov K, et al. Detection of potential drug interactions - a model for a national pharmacy register. Eur J Clin Pharmacol 2006 Sep; 62(9):749-56. *Not eligible outcomes*
93. Astrand E, Astrand B, Antonov K, et al. Potential drug interactions during a three-decade study period: a cross-sectional study of a prescription register. Eur J Clin Pharmacol 2007 Sep; 63(9):851-9. *Not eligible outcomes*
94. Atchison KA, Andersen RM. Demonstrating successful aging using the International Collaborative Study for Oral Health Outcomes. Journal of Public Health Dentistry 2000; 60(4):282-8. *Not eligible exposure*
95. Aud MA, Rantz MJ. Admissions to skilled nursing facilities from assisted living facilities. J Nurs Care Qual 2005 Jan-Mar; 20(1):16-25. *Not eligible outcomes*
96. Aung K, Burnett J, Smith SM, et al. Vitamin D deficiency associated with self-neglect in the elderly. J Elder Abuse Negl 2006; 18(4):63-78. *Not eligible outcomes*
97. Avidan AY, Fries BE, James ML, et al. Insomnia and hypnotic use, recorded in the minimum data set, as predictors of falls and hip fractures in Michigan nursing homes.[see comment]. Journal of the American Geriatrics Society 2005 Jun; 53(6):955-62. *Not eligible target population*
98. Ayalon L, Mackin S, Arean PA, et al. The role of cognitive functioning and distress in suicidal ideation in older adults. J Am Geriatr Soc 2007 Jul; 55(7):1090-4. *Not eligible outcomes*
99. Aytac IA, Araujo AB, Johannes CB, et al. Socioeconomic factors and incidence of erectile dysfunction: findings of the longitudinal Massachussetts Male Aging Study. Social science & medicine 2000 Sep; 51(5):771-8. *Not eligible outcomes*
100. Azad N, Tierney M, Victor G, et al. Adverse drug events in the elderly population admitted to a tertiary care hospital. J Healthc Manag 2002 Sep-Oct; 47(5):295-305; discussion -6. *Not eligible outcomes*
101. Azkona G, Garcia-Belenguer S, Chacon G, et al. Prevalence and risk factors of behavioural changes associated with age-related cognitive impairment in geriatric dogs. Journal of Small Animal Practice 2009 Feb; 50(2):87-91. *Not eligible outcomes*
102. Azzopardi S, Lee G. Health-related quality of life 2 years after coronary artery bypass graft surgery. Journal of Cardiovascular Nursing 2009 May-Jun; 24(3):232-40. *Not eligible outcomes*
103. Bach P, Wormland RT, Mohring C, et al. Electromotive drug-administration: a pilot study for minimal-invasive treatment of therapy-resistant idiopathic detrusor overactivity. Neurourology & Urodynamics 2009; 28(3):209-13. *Not eligible exposure*
104. Bachman DL, Stuckey M, Ebeling M, et al. Establishment of a predominantly African-American cohort for the study of Alzheimer's disease: the South Carolina Alzheimer's disease clinical core. Dementia & Geriatric Cognitive Disorders 2009; 27(4):329-36. *Not eligible exposure*
105. Bachman SS, Vedrani M, Drainoni ML, et al. Variations in provider capacity to offer accessible health care for people with disabilities. J Soc Work Disabil Rehabil 2007; 6(3):47-63. *Not eligible outcomes*
106. Baker FM. Ethnic minority elders: a mental health research agenda. Hosp Community Psychiatry 1992 Apr; 43(4):337-8, 42. *Not eligible outcomes*
107. Baker ML, Wang JJ, Rogers S, et al. Early age-related macular degeneration, cognitive function, and dementia: the Cardiovascular Health Study. Archives of Ophthalmology 2009 May; 127(5):667-73. *Not eligible outcomes*
108. Baker TA. For the patient. How chronic pain affects African Americans. Ethn Dis 2005 Spring; 15(2):353. *Not eligible outcomes*
109. Baker TA. Chronic pain in older Black Americans: the influence of health and psychosocial factors. Ethn Dis 2005 Spring; 15(2):179-86. *Not eligible outcomes*
110. Baker TA, Whitfield KE. Physical functioning in older blacks: an exploratory study identifying psychosocial and clinical predictors. J Natl Med Assoc 2006 Jul; 98(7):1114-20. *Not eligible outcomes*
111. Balan S, Leibovitz A, Zila SO, et al. The relation between the clinical subtypes of delirium and the urinary level of 6-SMT. Journal of Neuropsychiatry & Clinical Neurosciences 2003; 15(3):363-6. *Not eligible outcomes*
112. Balducci L. Aging, frailty, and chemotherapy. Cancer Control 2007 Jan; 14(1):7-12. *Not eligible outcomes*
113. Balducci L, Extermann M. Management of cancer in the older person: a practical approach. Oncologist 2000; 5(3):224-37. *Not eligible outcomes*
114. Baldwin CM, Bell IR, Guerra S, et al. Associations between chemical odor intolerance and sleep disturbances in community-living adults. Sleep Medicine 2004 Jan; 5(1):53-9. *Not eligible outcomes*
115. Baldwin RL, Craven RF, Dimond M. Falls: are rural elders at greater risk? J Gerontol Nurs 1996 Aug; 22(8):14-21. *Not eligible outcomes*

Appendix B. Excluded Studies

116. Ball LJ, Ogden A, Mandi D, et al. The validation of a mailed health survey for screening of dementia of the Alzheimer's type. J Am Geriatr Soc 2001 Jun; 49(6):798-802. *Not eligible outcomes*
117. Bambauer KZ, Safran DG, Ross-Degnan D, et al. Depression and cost-related medication nonadherence in Medicare beneficiaries. Arch Gen Psychiatry 2007 May; 64(5):602-8. *Not eligible outcomes*
118. Banerjee S, Wall MM, Carlin BP. Frailty modeling for spatially correlated survival data, with application to infant mortality in Minnesota. Biostatistics 2003 Jan; 4(1):123-42. *Not eligible outcomes*
119. Barbieri M, Ferrucci L, Ragno E, et al. Chronic inflammation and the effect of IGF-I on muscle strength and power in older persons. Am J Physiol Endocrinol Metab 2003 Mar; 284(3):E481-7. *Not eligible outcomes*
120. Bardia A, Ebbert JO, Vierkant RA, et al. Association of aspirin and nonaspirin nonsteroidal anti-inflammatory drugs with cancer incidence and mortality. Journal of the National Cancer Institute 2007 Jun 6; 99(11):881-9. *Not eligible exposure*
121. Barger SD, Burke SM, Limbert MJ. Do induced moods really influence health perceptions? Health Psychol 2007 Jan; 26(1):85-95. *Not eligible outcomes*
122. Barker P, Henderson R. Small sample bias in the gamma frailty model for univariate survival. Lifetime Data Anal 2005 Jun; 11(2):265-84. *Not eligible outcomes*
123. Barnes LL, Mendes de Leon CF, Wilson RS, et al. Social resources and cognitive decline in a population of older African Americans and whites. Neurology 2004 Dec 28; 63(12):2322-6. *Not eligible exposure*
124. Barney DD. Use of mental and health services by American Indian and Alaska Native elders. Am Indian Alsk Native Ment Health Res 1994; 5(3):1-14. *Not eligible outcomes*
125. Barrett-Connor E, Edelstein SL. A prospective study of dehydroepiandrosterone sulfate and cognitive function in an older population: the Rancho Bernardo Study. J Am Geriatr Soc 1994 Apr; 42(4):420-3. *Not eligible outcomes*
126. Barry MJ, Link CL, McNaughton-Collins MF, et al. Overlap of different urological symptom complexes in a racially and ethnically diverse, community-based population of men and women. BJU International 2008 Jan; 101(1):45-51. *Not eligible outcomes*
127. Barton C, Miller B, Yaffe K. Improved evaluation and management of cognitive impairment: results of a comprehensive intervention in long-term care.[see comment]. Journal of the American Medical Directors Association 2006 Feb; 7(2):84-9. *Not eligible target population*
128. Bass DS, Attix DK, Phillips-Bute B, et al. An efficient screening tool for preoperative depression: the Geriatric Depression Scale-Short Form. Anesthesia & Analgesia 2008 table of contents; Mar; 106(3):805-9. *Not eligible outcomes*
129. Bassett SS, Folstein MF. Memory complaint, memory performance, and psychiatric diagnosis: a community study. J Geriatr Psychiatry Neurol 1993 Apr-Jun; 6(2):105-11. *Not eligible outcomes*
130. Bassiony MM, Steinberg MS, Warren A, et al. Delusions and hallucinations in Alzheimer's disease: prevalence and clinical correlates. Int J Geriatr Psychiatry 2000 Feb; 15(2):99-107. *Not eligible outcomes*
131. Basu R, Dodge H, Stoehr GP, et al. Sedative-hypnotic use of diphenhydramine in a rural, older adult, community-based cohort: effects on cognition. American Journal of Geriatric Psychiatry 2003 Mar-Apr; 11(2):205-13. *Not eligible outcomes*
132. Bath PA, Morgan K. Differential risk factor profiles for indoor and outdoor falls in older people living at home in Nottingham, UK. Eur J Epidemiol 1999 Jan; 15(1):65-73. *Not eligible outcomes*
133. Baumgarten M, Margolis D, Gruber-Baldini AL, et al. Pressure ulcers and the transition to long-term care. Adv Skin Wound Care 2003 Nov; 16(6):299-304. *Not eligible target population*
134. Bazargan M, Baker RS, Bazargan SH. Sensory impairments and subjective well-being among aged African American persons. J Gerontol B Psychol Sci Soc Sci 2001 Sep; 56(5):P268-78. *Outcomes*
135. Bean J, Kiely DK, Leveille SG, et al. Associating the onset of motor impairments with disability progression in nursing home residents. Am J Phys Med Rehabil 2002 Sep; 81(9):696-704; quiz 5-7, 20. *Not eligible target population*
136. Beard JL, Richards RE, Smiciklas-Wright H, et al. Iron nutrition in rural home bound elderly persons. J Nutr Elder 1996; 15(4):3-19. *Not eligible outcomes*
137. Beard JR, Blaney S, Cerda M, et al. Neighborhood characteristics and disability in older adults. J Gerontol B Psychol Sci Soc Sci 2009 Mar; 64(2):252-7. *Not eligible outcomes*
138. Beattie ER, Song J, LaGore S. A comparison of wandering behavior in nursing homes and assisted living facilities. Res Theory Nurs Pract 2005 Summer; 19(2):181-96. *Not eligible outcomes*
139. Beaulieu MD, Dufresne L, LeBlanc D. Treating hypertension. Are the right drugs given to the right patients? Can Fam Physician 1998 Feb; 44:294-8, 301-2. *Not eligible outcomes*
140. Beck J, Ferrucci L, Sun K, et al. Low serum selenium concentrations are associated with poor grip strength among older women living in the community. Biofactors 2007; 29(1):37-44. *Not eligible outcomes*
141. Becker JT, Lopez OL, Dew MA, et al. Prevalence of cognitive disorders differs as a function of age in HIV virus infection. AIDS 2004 Jan 1; 18 Suppl 1:S11-8. *Not eligible outcomes*
142. Beckett LA, Evans DA. Estimating prevalence and incidence of chronic conditions in the elderly: design and sampling issues. Alzheimer Dis Assoc Disord 1994; 8 Suppl 1:S274-80. *Review*

143. Beckett WS, Hallman E, May J, et al. Follow-up to Farm Family Health and Hazard Survey.[comment]. Journal of Occupational & Environmental Medicine 2004 Apr; 46(4):314-5. *Comment*
144. Beeber AS, Thorpe JM, Clipp EC. Community-based service use by elders with dementia and their caregivers: a latent class analysis. Nurs Res 2008 Sep-Oct; 57(5):312-21. *Not eligible outcomes*
145. Beer C, Xiao J, Flicker L, et al. Long-term mortality following stroke, myocardial infarction and fractured neck of femur in Western Australia. Intern Med J 2007 Dec; 37(12):815-9. *Not eligible exposure*
146. Behrman JR, Sickles RC, Taubman P. Age-specific death rates with tobacco smoking and occupational activity: sensitivity to sample length, functional form, and unobserved frailty. Demography 1990 May; 27(2):267-84. *Not elgible target population*
147. Beissner K, Henderson CR, Jr., Papaleontiou M, et al. Physical therapists' use of cognitive-behavioral therapy for older adults with chronic pain: a nationwide survey. Phys Ther 2009 May; 89(5):456-69. *Not eligible outcomes*
148. Bell DS, O'Keefe JH, Bell DSH, et al. White cell count, mortality, and metabolic syndrome in the Baltimore longitudinal study of aging.[comment]. Journal of the American College of Cardiology 2007 Oct 30; 50(18):1810; author reply -1. *Comment*
149. Bennett DA, Schneider JA, Buchman AS, et al. The Rush Memory and Aging Project: study design and baseline characteristics of the study cohort. Neuroepidemiology 2005; 25(4):163-75. *Not eligible outcomes*
150. Berges IM, Kuo YF, Markides KS, et al. Attendance at religious services and physical functioning after stroke among older Mexican Americans. Exp Aging Res 2007 Jan-Mar; 33(1):1-11. *Not eligible outcomes*
151. Bergman H, Ferrucci L, Guralnik J, et al. Frailty: an emerging research and clinical paradigm--issues and controversies. J Gerontol A Biol Sci Med Sci 2007 Jul; 62(7):731-7. *Not eligible outcomes*
152. Berkey CS, Chuang SK, Douglass CW, et al. Longitudinal statistical models for loss of sound surfaces. Community Dentistry & Oral Epidemiology 1993 Apr; 21(2):62-6. *Not eligible outcomes*
153. Berkman BHLK. Social work and health care in an aging society education, policy, practice, and research. New York : Springer [Internet Resource; Computer File Date of Entry: 20081215]. Available at: http://www.netLibrary.com/urlapi.asp?action=summary&v=1&bookid=246182. *Not eligible outcomes*
154. Berlowitz DR, Bezerra HQ, Brandeis GH, et al. Are we improving the quality of nursing home care: the case of pressure ulcers. J Am Geriatr Soc 2000 Jan; 48(1):59-62. *Not eligible target population*
155. Berlowitz DR, Brandeis GH, Anderson JJ, et al. Evaluation of a risk-adjustment model for pressure ulcer development using the Minimum Data Set. J Am Geriatr Soc 2001 Jul; 49(7):872-6. *Not eligible target population*
156. Berlowitz DR, Brandeis GH, Morris JN, et al. Deriving a risk-adjustment model for pressure ulcer development using the Minimum Data Set. J Am Geriatr Soc 2001 Jul; 49(7):866-71. *Not eligible outcomes*
157. Bernabei R, Gambassi G, Lapane K, et al. Characteristics of the SAGE database: a new resource for research on outcomes in long-term care. SAGE (Systematic Assessment of Geriatric drug use via Epidemiology) Study Group. J Gerontol A Biol Sci Med Sci 1999 Jan; 54(1):M25-33. *Not eligible outcomes*
158. Bernabei R, Landi F, Onder G, et al. Second and third generation assessment instruments: the birth of standardization in geriatric care. J Gerontol A Biol Sci Med Sci 2008 Mar; 63(3):308-13. *Not eligible outcomes*
159. Berndt SI, Carter HB, Landis PK, et al. Prediagnostic plasma vitamin C levels and the subsequent risk of prostate cancer. Nutrition 2005 Jun; 21(6):686-90. *Not eligible outcomes*
160. Berry P, Mascia J, Steinman BA. Vision and hearing loss in older adults: "Double trouble". Care Manag J 2004 Spring; 5(1):35-40. *Not eligible outcomes*
161. Berry SD, Samelson EJ, Bordes M, et al. Survival of aged nursing home residents with hip fracture. J Gerontol A Biol Sci Med Sci 2009 Jul; 64(7):771-7. *Not eligible target population*
162. Best C, Eckhardt-Henn A, Tschan R, et al. Psychiatric morbidity and comorbidity in different vestibular vertigo syndromes. Results of a prospective longitudinal study over one year. Journal of neurology 2009 Jan; 256(1):58-65. *Not eligible outcomes*
163. Beydoun MA, Lhotsky A, Wang Y, et al. Association of adiposity status and changes in early to mid-adulthood with incidence of Alzheimer's disease. American Journal of Epidemiology 2008 Nov 15; 168(10):1179-89. *Not eligible exposure*
164. Bezjak A, Adam J, Panzarella T, et al. Radiotherapy for brain metastases: defining palliative response. Radiother Oncol 2001 Oct; 61(1):71-6. *Not eligible outcomes*
165. Bhalla RK, Butters MA, Mulsant BH, et al. Persistence of neuropsychologic deficits in the remitted state of late-life depression. Am J Geriatr Psychiatry 2006 May; 14(5):419-27. *Not eligible outcomes*
166. Bhargava A, Jamison DT, Lau LJ, et al. Modeling the effects of health on economic growth. J Health Econ 2001 May; 20(3):423-40. *Not eligible outcomes*
167. Bienias JL, Beckett LA, Bennett DA, et al. Design of the Chicago Health and Aging Project (CHAP). J Alzheimers Dis 2003 Oct; 5(5):349-55. *No hypothesis tested*
168. Bierman AS, Clancy CM. Health disparities among older women: identifying opportunities to improve quality of care and functional health outcomes. Journal of the American Medical Womens

Association 2001 188; 56(4):155-9. *Not eligible outcomes*
169. Bijnen FC, Feskens EJ, Caspersen CJ, et al. Age, period, and cohort effects on physical activity among elderly men during 10 years of follow-up: the Zutphen Elderly Study. J Gerontol A Biol Sci Med Sci 1998 May; 53(3):M235-41. *Not eligible outcomes*
170. Bilchik GS. The age wave. Trustee 2000 Jan; 53(1):14-7, 1. *Comment*
171. Biller C. Discrete duration models combining dynamic and random effects. Lifetime Data Anal 2000 Dec; 6(4):375-90. *Not eligible outcomes*
172. Bird CE, Fremont AM. Gender, time use, and health. Journal of Health & Social Behavior 1991 Jun; 32(2):114-29. *Not eligible outcomes*
173. Birge SJ. Osteoporotic fractures: a brain or bone disease? Curr Osteoporos Rep 2008 Jun; 6(2):57-61. *Not eligible outcomes*
174. Birnbaum EH, Dreznik Z, Myerson RJ, et al. Early effect of external beam radiation therapy on the anal sphincter: a study using anal manometry and transrectal ultrasound. Diseases of the Colon & Rectum 1992 Aug; 35(8):757-61. *Not eligible exposure*
175. Birren JE, University of California Los Angeles--Multicampus Division of Geriatric Medicine and Gerontology. The Concept and Measurement of Quality of Life in the Frail Elderly. San Diego: Academic Press; 1991. *Not eligible outcomes*
176. Bjarnason H, Hougaard P. Fisher information for two gamma frailty bivariate Weibull models. Lifetime Data Anal 2000 Mar; 6(1):59-71. *Not eligible outcomes*
177. Black DM, Palermo L, Nevitt MC, et al. Defining incident vertebral deformity: a prospective comparison of several approaches. The Study of Osteoporotic Fractures Research Group. Journal of Bone & Mineral Research 1999 Jan; 14(1):90-101. *Not eligible outcomes*
178. Black SA, Goodwin JS, Markides KS. The association between chronic diseases and depressive symptomatology in older Mexican Americans. J Gerontol A Biol Sci Med Sci 1998 May; 53(3):M188-94. *Not eligible outcomes*
179. Black SA, Markides KS. Depressive symptoms and mortality in older Mexican Americans. Ann Epidemiol 1999 Jan; 9(1):45-52. *Not eligible outcomes*
180. Black SA, Markides KS, Miller TQ. Correlates of depressive symptomatology among older community-dwelling Mexican Americans: the Hispanic EPESE. J Gerontol B Psychol Sci Soc Sci 1998 Jul; 53(4):S198-208. *Not eligible outcomes*
181. Blanchon F, Grivaux M, Asselain B, et al. 4-year mortality in patients with non-small-cell lung cancer: development and validation of a prognostic index. Lancet Oncol 2006 Oct; 7(10):829-36. *Not eligible outcomes*
182. Blank K, Hixon L, Gruman C, et al. Determinants of geropsychiatric inpatient length of stay. Psychiatr Q 2005 Summer; 76(2):195-212. *Not eligible outcomes*
183. Blass DM, Black BS, Phillips H, et al. Medication use in nursing home residents with advanced dementia. Int J Geriatr Psychiatry 2008 May; 23(5):490-6. *Not eligible target population*
184. Blaum CS, Ofstedal MB, Liang J. Low cognitive performance, comorbid disease, and task-specific disability: findings from a nationally representative survey. J Gerontol A Biol Sci Med Sci 2002 Aug; 57(8):M523-31. *Not eligible outcomes*
185. Blazer DG, Sachs-Ericsson N, Hybels CF, et al. Perception of unmet basic needs as a predictor of depressive symptoms among community-dwelling older adults. Journals of Gerontology Series A-Biological Sciences & Medical Sciences 2007 Feb; 62(2):191-5. *Not eligible outcomes*
186. Ble A, Cherubini A, Volpato S, et al. Lower plasma vitamin E levels are associated with the frailty syndrome: the InCHIANTI study. J Gerontol A Biol Sci Med Sci 2006 Mar; 61(3):278-83. *Not eligible outcomes*
187. Blixen CE, McDougall GJ, Suen LJ. Dual diagnosis in elders discharged from a psychiatric hospital. Int J Geriatr Psychiatry 1997 Mar; 12(3):307-13. *Not eligible outcomes*
188. Blow FC, Walton MA, Barry KL, et al. The relationship between alcohol problems and health functioning of older adults in primary care settings. J Am Geriatr Soc 2000 Jul; 48(7):769-74. *Not eligible outcomes*
189. Bluestein D. Preventive services: screening. Health maintenance examinations include screening for diabetes, heart disease, cancer, osteoporosis, hearing and vision loss. Geriatrics 2005 Feb; 60(2):34-9. *Not eligible outcomes*
190. Blustein J, Hoy EC. Who is enrolled in for-profit vs. nonprofit Medicare HMOs? Health Aff (Millwood) 2000 Jan-Feb; 19(1):210-20. *Not eligible outcomes*
191. Boaz RF. Improved versus deteriorated physical functioning among long-term disabled elderly. Medical Care 1994 Jun; 32(6):588-602. *Not eligible outcomes*
192. Boeve B, McCormick J, Smith G, et al. Mild cognitive impairment in the oldest old. Neurology 2003 Feb 11; 60(3):477-80. *Not eligible outcomes*
193. Bogner HR, Dahlberg B, de Vries HF, et al. Older patients' views on the relationship between depression and heart disease. Fam Med 2008 Oct; 40(9):652-7. *Not eligible outcomes*
194. Bogner HR, Gallo JJ, Swartz KL, et al. Anxiety disorders and disability secondary to urinary incontinence among adults over age 50. International Journal of Psychiatry in Medicine 2002; 32(2):141-54. *Not eligible exposure*
195. Bohannon RW, Lee N. Association of physical functioning with same-hospital readmission after stroke. Am J Phys Med Rehabil 2004 Jun; 83(6):434-8. *Not eligible outcomes*
196. Boix R, del Barrio JL, Saz P, et al. Stroke prevalence among the Spanish elderly: an analysis based on screening surveys. BMC Neurol 2006; 6:36. *Not eligible outcome*

Appendix B. Excluded Studies

197. Bolge SC, Doan JF, Kannan H, et al. Association of insomnia with quality of life, work productivity, and activity impairment. Qual Life Res 2009 May; 18(4):415-22. *Not eligible outcomes*
198. Bonafe M, Barbi C, Olivieri F, et al. An allele of HRAS1 3'variable number of tandem repeats is a frailty allele: implication for an evolutionarily-conserved pathway involved in longevity. Gene 2002 Mar 6; 286(1):121-6. *Not eligible outcomes*
199. Bonneux L, Birnie E. The discount rate in the economic evaluation of prevention: a thought experiment. J Epidemiol Community Health 2001 Feb; 55(2):123-5. *Not eligible outcomes*
200. Boockvar KS, Meier DE. Palliative care for frail older adults: "there are things I can't do anymore that I wish I could . . . ". JAMA 2006 Nov 8; 296(18):2245-53. *Not eligible outcomes*
201. Borgermans LA, Abraham IL, Milisen K, et al. Nursing case management for psychogeriatric patients and their families: description of a clinical model. Nurs Clin North Am 1998 Sep; 33(3):529-42. *Not eligible outcomes*
202. Borkon AM, Muehlebach GF, Jones PG, et al. An analysis of the effect of age on survival after heart transplant. Journal of Heart & Lung Transplantation 1999 Jul; 18(7):668-74. *Not eligible outcomes*
203. Bortz WM, 2nd. The physics of frailty. J Am Geriatr Soc 1993 Sep; 41(9):1004-8. *Review*
204. Bosworth HB, Schaie KW, Willis SL. Cognitive and sociodemographic risk factors for mortality in the Seattle Longitudinal Study. J Gerontol B Psychol Sci Soc Sci 1999 Sep; 54(5):P273-82. *Not eligible outcomes*
205. Bould S. A population health perspective on disability and depression in elderly women and men. Journal of aging & social policy 2005; 17(2):7-24. *Not eligible outcomes*
206. Boult C, Altmann M, Gilbertson D, et al. Decreasing disability in the 21st century: the future effects of controlling six fatal and nonfatal conditions.[see comment]. American Journal of Public Health 1996 Oct; 86(10):1388-93. *Not eligible outcomes*
207. Boult C, Kane RL, Louis TA, et al. Forecasting the number of future disabled elderly using Markovian and mathematical models. J Clin Epidemiol 1991; 44(9):973-80. *Not eligible outcomes*
208. Boult C, Pualwan TF, Fox PD, et al. Identification and assessment of high-risk seniors. HMO Workgroup on Care Management. Am J Manag Care 1998 Aug; 4(8):1137-46. *Not eligible outcomes*
209. Boult C, Rassen J, Rassen A, et al. The effect of case management on the costs of health care for enrollees in Medicare Plus Choice plans: a randomized trial. J Am Geriatr Soc 2000 Aug; 48(8):996-1001. *Not eligible outcomes*
210. Boult L, Boult C, Pirie P, et al. Test-retest reliability of a questionnaire that identifies elders at risk for hospital admission. J Am Geriatr Soc 1994 Jul; 42(7):707-11. *Not eligible outcomes*
211. Bouman A, van Rossum E, Evers S, et al. Effects on health care use and associated cost of a home visiting program for older people with poor health status: a randomized clinical trial in the Netherlands. Journals of Gerontology Series A-Biological Sciences & Medical Sciences 2008 Mar; 63(3):291-7. *Not eligible outcomes*
212. Bourdel-Marchasson I, Berrut G. Caring the elderly diabetic patient with respect to concepts of successful aging and frailty. Diabetes Metab 2005 Dec; 31 Spec No 2:5S13-5S9. *Not eligible outcomes*
213. Bowles KH. Vulnerable links in the home care referral process. Caring 2000 Nov; 19(11):34-7. *Not eligible outcomes*
214. Boyington JE, Howard DL, Carter-Edwards L, et al. Differences in resident characteristics and prevalence of urinary incontinence in nursing homes in the southeastern United States. Nurs Res 2007 Mar-Apr; 56(2):97-107. *Not eligible target population*
215. Brach JS, Perera S, Studenski S, et al. The reliability and validity of measures of gait variability in community-dwelling older adults. Arch Phys Med Rehabil 2008 Dec; 89(12):2293-6. *Not eligible outcomes*
216. Brach JS, Simonsick EM, Kritchevsky S, et al. The association between physical function and lifestyle activity and exercise in the health, aging and body composition study. J Am Geriatr Soc 2004 Apr; 52(4):502-9. *Not eligible outcomes*
217. Brach JS, Solomon C, Naydeck BL, et al. Incident physical disability in people with lower extremity peripheral arterial disease: the role of cardiovascular disease. J Am Geriatr Soc 2008 Jun; 56(6):1037-44. *Not eligible exposure*
218. Brach JS, VanSwearingen JM. Physical impairment and disability: relationship to performance of activities of daily living in community-dwelling older men. Phys Ther 2002 Aug; 82(8):752-61. *Not eligible outcomes*
219. Bradley CJ, Yabroff KR, Dahman B, et al. Productivity costs of cancer mortality in the United States: 2000-2020. J Natl Cancer Inst 2008 Dec 17; 100(24):1763-70. *Not eligible outcomes*
220. Branch LG, Jette AM. The Framingham Disability Study: I. Social disability among the aging. Am J Public Health 1981 Nov; 71(11):1202-10. *Not eligible outcomes*
221. Brand FN, Kiely DK, Kannel WB, et al. Family patterns of coronary heart disease mortality: the Framingham Longevity Study. Journal of Clinical Epidemiology 1992 Feb; 45(2):169-74. *Not eligible outcomes*
222. Brandeis GH, Ooi WL, Hossain M, et al. A longitudinal study of risk factors associated with the formation of pressure ulcers in nursing homes. J Am Geriatr Soc 1994 Apr; 42(4):388-93. *Not eligible target population*
223. Brandt DK, Hind JA, Robbins J, et al. Challenges in the design and conduct of a randomized study of two interventions for liquid aspiration. Clin Trials 2006; 3(5):457-68. *Not eligible outcomes*
224. Breitner JC, Haneuse SJ, Walker R, et al. Risk of dementia and AD with prior exposure to NSAIDs in

an elderly community-based cohort. Neurology 2009 Jun 2; 72(22):1899-905. *Not eligible exposure*

225. Brenes GA, Kritchevsky SB, Mehta KM, et al. Scared to death: results from the Health, Aging, and Body Composition study. Am J Geriatr Psychiatry 2007 Mar; 15(3):262-5. *Not eligible outcomes*
226. Brenes GA, Miller ME, Stanley MA, et al. Insomnia in older adults with generalized anxiety disorder. American Journal of Geriatric Psychiatry 2009 Jun; 17(6):465-72. *Not eligible outcomes*
227. Brescianini S, Maggi S, Farchi G, et al. Low total cholesterol and increased risk of dying: are low levels clinical warning signs in the elderly? Results from the Italian Longitudinal Study on Aging. J Am Geriatr Soc 2003 Jul; 51(7):991-6. *Not eligible exposure*
228. Breslau N, Roth T, Rosenthal L, et al. Sleep disturbance and psychiatric disorders: a longitudinal epidemiological study of young adults. Biological psychiatry 1996 Mar 15; 39(6):411-8. *Not eligible outcomes*
229. Bretsky P, Guralnik JM, Launer L, et al. The role of APOE-epsilon4 in longitudinal cognitive decline: MacArthur Studies of Successful Aging. Neurology 2003 Apr 8; 60(7):1077-81. *Not eligible exposure*
230. Brhel S. Increasing the quality of life for the older adult : geriatric observable activities for longevity program. 1st ed. Binghamton, NY: Brundage Pub. Co.; 2005. *Not eligible outcomes*
231. Brickman AM, Schupf N, Manly JJ, et al. Brain morphology in older African Americans, Caribbean Hispanics, and whites from northern Manhattan. Archives of Neurology 2008 Aug; 65(8):1053-61. *Not eligible outcomes*
232. Bridevaux IP, Bradley KA, Bryson CL, et al. Alcohol screening results in elderly male veterans: association with health status and mortality. J Am Geriatr Soc 2004 Sep; 52(9):1510-7. *Not elgible target population*
233. Brinkley TE, Leng X, Miller ME, et al. Chronic inflammation is associated with low physical function in older adults across multiple comorbidities. J Gerontol A Biol Sci Med Sci 2009 Apr; 64(4):455-61. *not eligible outcome*
234. Brismar K, Nilsson SE. Interrelations and associations of serum levels of steroids and pituitary hormones with markers of insulin resistance, inflammatory activity, and renal function in men and women aged >70 years in an 8-year longitudinal study of opposite-sex twins. Gender Medicine 2009; 6(Suppl 1):123-36. *Not eligible outcomes*
235. Brody BL, Gamst AC, Williams RA, et al. Depression, visual acuity, comorbidity, and disability associated with age-related macular degeneration. Ophthalmology 2001 Oct; 108(10):1893-900; discussion 900-1. *Not eligible outcomes*
236. Brody KK, Maslow K, Perrin NA, et al. Usefulness of a single item in a mail survey to identify persons with possible dementia: a new strategy for finding high-risk elders. Dis Manag 2005 Apr; 8(2):59-72. *Not eligible outcomes*
237. Brogan DJ, Haber M, Kutner NG. Functional decline among older adults: comparing a chronic disease cohort and controls when mortality rates are markedly different. Journal of Clinical Epidemiology 2000 Aug; 53(8):847-51. *Not eligible outcomes*
238. Bromberger JT, Kravitz HM, Matthews K, et al. Predictors of first lifetime episodes of major depression in midlife women. Psychological Medicine 2009 Jan; 39(1):55-64. *Not eligible outcomes*
239. Bronikowski AM, Alberts SC, Altmann J, et al. The aging baboon: comparative demography in a non-human primate. Proc Natl Acad Sci U S A 2002 Jul 9; 99(14):9591-5. *Not eligible outcomes*
240. Brown EL, Bruce ML, Nassisi P, et al. An agency-university research partnership: focus on late-life depression. Home Healthc Nurse 2004 Sep; 22(9):597-600. *Not eligible outcomes*
241. Brown GC, Brown MM, Sharma S, et al. Incremental cost-effectiveness of laser therapy for visual loss secondary to branch retinal vein occlusion. Ophthalmic Epidemiol 2002 Feb; 9(1):1-10. *Not eligible outcomes*
242. Brown GC, Brown MM, Sharma S, et al. The burden of age-related macular degeneration: a value-based medicine analysis. Transactions of the American Ophthalmological Society 2005; 103:173-84; discussion 84-6. *Not eligible outcome*
243. Brown SL, Salive ME, Pahor M, et al. Occult caffeine as a source of sleep problems in an older population. Journal of the American Geriatrics Society 1995 Aug; 43(8):860-4. *Not eligible outcomes*
244. Bruce ML, McAvay GJ, Raue PJ, et al. Major depression in elderly home health care patients. Am J Psychiatry 2002 Aug; 159(8):1367-74. *Not eligible outcomes*
245. Brush JA, Threats TT, Calkins MP. Influences on perceived function of a nursing home resident. J Commun Disord 2003 Sep-Oct; 36(5):379-93. *Not eligible target population*
246. Bucci AT. Be a continence champion: use the CHAMMP tool to individualize the plan of care. Geriatr Nurs 2007 Mar-Apr; 28(2):120-4; quiz 5. *Not eligible target population*
247. Buchanan RJ, Barkley J, Wang S, et al. Analyses of nursing home residents with cancer at admission. Cancer Nurs 2005 Sep-Oct; 28(5):406-14. *Not eligible target population*
248. Buchman AS, Boyle PA, Wilson RS, et al. Association between late-life social activity and motor decline in older adults. Arch Intern Med 2009 Jun 22; 169(12):1139-46. *Not eligible outcomes*
249. Buchman AS, Boyle PA, Wilson RS, et al. Pulmonary function, muscle strength and mortality in old age. Mech Ageing Dev 2008 Nov; 129(11):625-31. *Not eligible outcomes*
250. Buchsbaum GM, Duecy EE, Kerr LA, et al. Urinary incontinence in nulliparous women and their parous sisters. Obstetrics & Gynecology 2005 Dec; 106(6):1253-8. *Not eligible outcomes*

Appendix B. Excluded Studies

251. Budnik A, Liczbinska G. Urban and rural differences in mortality and causes of death in historical Poland. Am J Phys Anthropol 2006 Feb; 129(2):294-304. *Not eligible outcomes*
252. Bulat T, Castle SC, Rutledge M, et al. Clinical practice algorithms: medication management to reduce fall risk in the elderly--part 2, summary algorithm. J Am Acad Nurse Pract 2008 Jan; 20(1):1-4. *Not eligible outcomes*
253. Buntinx F, Niclaes L, Suetens C, et al. Evaluation of Charlson's comorbidity index in elderly living in nursing homes. J Clin Epidemiol 2002 Nov; 55(11):1144-7. *Not eligible target population*
254. Burchfiel CM, Marcus EB, Curb JD, et al. Effects of smoking and smoking cessation on longitudinal decline in pulmonary function. American Journal of Respiratory & Critical Care Medicine 1995 Jun; 151(6):1778-85. *Not eligible outcomes*
255. Burgio KL, Locher JL, Ives DG, et al. Nocturnal enuresis in community-dwelling older adults. J Am Geriatr Soc 1996 Feb; 44(2):139-43. *Not eligible outcomes*
256. Burgio KL, Matthews KA, Engel BT. Prevalence, incidence and correlates of urinary incontinence in healthy, middle-aged women. Journal of Urology 1991 Nov; 146(5):1255-9. *Not eligible outcomes*
257. Burke GL, Arnold AM, Bild DE, et al. Factors associated with healthy aging: the cardiovascular health study. Journal of the American Geriatrics Society 2001 Mar; 49(3):254-62. *Not eligible outcomes*
258. Burns R, Graney MJ, Lummus AC, et al. Differences of self-reported osteoarthritis disability and race. J Natl Med Assoc 2007 Sep; 99(9):1046-51. *Not eligible outcomes*
259. Burns R, Nichols LO, Martindale-Adams J, et al. Interdisciplinary geriatric primary care evaluation and management: two-year outcomes. J Am Geriatr Soc 2000 Jan; 48(1):8-13. *Not eligible outcomes*
260. Burnside I. The frail elderly: those 85 and over. Nurs Adm Q 1990 Winter; 14(2):37-41. *Not eligible outcomes*
261. Burrowes JD, Larive B, Chertow GM, et al. Self-reported appetite, hospitalization and death in haemodialysis patients: findings from the Hemodialysis (HEMO) Study. Nephrology Dialysis Transplantation 2005 Dec; 20(12):2765-74. *Not eligible target population*
262. Burton L, Kasper J, Shore A, et al. The structure of informal care: are there differences by race? Gerontologist 1995 Dec; 35(6):744-52. *Not eligible outcomes*
263. Busby WJ, Campbell AJ, Robertson MC. Is low blood pressure in elderly people just a consequence of heart disease and frailty? Age Ageing 1994 Jan; 23(1):69-74. *Not eligible outcomes*
264. Busse A, Bischkopf J, Riedel-Heller SG, et al. Subclassifications for mild cognitive impairment: prevalence and predictive validity. Psychol Med 2003 Aug; 33(6):1029-38. *Not eligible outcomes*
265. Busse A, Bischkopf J, Riedel-Heller SG, et al. Mild cognitive impairment: prevalence and predictive validity according to current approaches. Acta Neurol Scand 2003 Aug; 108(2):71-81. *Not eligible outcomes*
266. Busse A, Bischkopf J, Riedel-Heller SG, et al. Mild cognitive impairment: prevalence and incidence according to different diagnostic criteria. Results of the Leipzig Longitudinal Study of the Aged (LEILA75+). Br J Psychiatry 2003 May; 182:449-54. *Not eligible outcomes*
267. Busse A, Hensel A, Guhne U, et al. Mild cognitive impairment: long-term course of four clinical subtypes. Neurology 2006 Dec 26; 67(12):2176-85. *Not eligible outcomes*
268. Byles J, Millar CJ, Sibbritt DW, et al. Living with urinary incontinence: a longitudinal study of older women. Age & Ageing 2009 discussion 251; May; 38(3):333-8. *Not outcome*
269. Bylow K, Mohile SG, Stadler WM, et al. Does androgen-deprivation therapy accelerate the development of frailty in older men with prostate cancer?: a conceptual review. Cancer 2007 Dec 15; 110(12):2604-13. *Not eligible outcomes*
270. Cacchione PZ, Culp K, Dyck MJ, et al. Risk for acute confusion in sensory-impaired, rural, long-term-care elders. Clinical nursing research 2003 Nov; 12(4):340-55. *Not eligible target population*
271. Cacciatore F, Abete P, Mazzella F, et al. Frailty predicts long-term mortality in elderly subjects with chronic heart failure. Eur J Clin Invest 2005 Dec; 35(12):723-30. *Not eligible outcomes*
272. Cagney KA, Glass TA, Skarupski KA, et al. Neighborhood-level cohesion and disorder: measurement and validation in two older adult urban populations. J Gerontol B Psychol Sci Soc Sci 2009 May; 64(3):415-24. *Not eligible outcomes*
273. Cahir JG, Toms AP. Regional migratory osteoporosis. Eur J Radiol 2008 Jul; 67(1):2-10. *Not eligible outcomes*
274. Calabrese JM, Friedman PK, Rose LM, et al. Using the GOHAI to assess oral health status of frail homebound elders: reliability, sensitivity, and specificity. Spec Care Dentist 1999 Sep-Oct; 19(5):214-9. *Not eligible outcomes*
275. Calabrese JR, Hirschfeld RM, Reed M, et al. Impact of bipolar disorder on a U.S. community sample. J Clin Psychiatry 2003 Apr; 64(4):425-32. *Not eligible outcomes*
276. Callahan CM, Unverzagt FW, Hui SL, et al. Six-item screener to identify cognitive impairment among potential subjects for clinical research.[see comment]. Medical Care 2002 Sep; 40(9):771-81. *Not eligible outcomes*
277. Callisaya ML, Blizzard L, Schmidt MD, et al. A population-based study of sensorimotor factors affecting gait in older people. Age & Ageing 2009 May; 38(3):290-5. *Not eligible outcomes*
278. Cameron DJ, Yang Z, Tong Z, et al. 10q26 is associated with increased risk of age-related macular degeneration in the Utah population. Advances in Experimental Medicine & Biology 2008; 613:253-8. *Not eligible exposure*

Appendix B. Excluded Studies

279. Camm AJ. Atrial fibrillation in the elderly--a near epidemic. Am J Geriatr Cardiol 2002 Nov-Dec; 11(6):352. *Not eligible outcomes*
280. Campbell AJ, Buchner DM. Unstable disability and the fluctuations of frailty. Age Ageing 1997 Jul; 26(4):315-8. *Comment*
281. Canada National Advisory Council on Aging. Geriatric assessment and treatment : members of the team : the contribution of interdisciplinary teamwork to the quality of life of Canada's seniors; 1991. *Not eligible outcomes*
282. Cannon KT, Choi MM, Zuniga MA. Potentially inappropriate medication use in elderly patients receiving home health care: a retrospective data analysis. American Journal Geriatric Pharmacotherapy 2006 Jun; 4(2):134-43. *Not eligible outcomes*
283. Capo JP, Jr., Laramee C, Lucente V, et al. Solifenacin treatment for overactive bladder in Hispanic patients: patient-reported symptom bother and quality of life outcomes from the VESIcare Open-Label Trial. Int J Clin Pract 2008 Jan; 62(1):39-46. *Not eligible outcomes*
284. Caprini JA, Botteman MF, Stephens JM, et al. Economic burden of long-term complications of deep vein thrombosis after total hip replacement surgery in the United States. Value in Health 2003 Jan-Feb; 6(1):59-74. *Not eligible outcomes*
285. Carmelli D, DeCarli C, Swan GE, et al. The joint effect of apolipoprotein E epsilon4 and MRI findings on lower-extremity function and decline in cognitive function. J Gerontol A Biol Sci Med Sci 2000 Feb; 55(2):M103-9. *Not eligible outcomes*
286. Carnahan RM, Lund BC, Perry PJ, et al. The concurrent use of anticholinergics and cholinesterase inhibitors: rare event or common practice? J Am Geriatr Soc 2004 Dec; 52(12):2082-7. *Not eligible outcomes*
287. Carriere I, Delcourt C, Lacroux A, et al. Nutrient intake in an elderly population in southern France (POLANUT): deficiency in some vitamins, minerals and omega-3 PUFA. International Journal for Vitamin & Nutrition Research 2007 Jan; 77(1):57-65. *Not eligible outcomes*
288. Carter HB, Metter EJ, Wright J, et al. Prostate-specific antigen and all-cause mortality: results from the Baltimore Longitudinal Study On Aging. Journal of the National Cancer Institute 2004 Apr 7; 96(7):557-8. *Not eligible outcomes*
289. Casteel C, Martin SL, Smith JB, et al. National study of physical and sexual assault among women with disabilities. Inj Prev 2008 Apr; 14(2):87-90. *Not eligible outcomes*
290. Castle NG. Mental health outcomes and physical restraint use in nursing homes {private}. Adm Policy Ment Health 2006 Nov; 33(6):696-704. *Not eligible target population*
291. Cauley JA, Zmuda JM, Lui LY, et al. Lipid-lowering drug use and breast cancer in older women: a prospective study. Journal of Women's Health 2003 Oct; 12(8):749-56. *Not eligible outcome*
292. Cella D, Yount S, Rothrock N, et al. The Patient-Reported Outcomes Measurement Information System (PROMIS): progress of an NIH Roadmap cooperative group during its first two years. Med Care 2007 May; 45(5 Suppl 1):S3-S11. *Not eligible outcomes*
293. Cepeda MS, Farrar JT, Baumgarten M, et al. Side effects of opioids during short-term administration: effect of age, gender, and race. Clinical Pharmacology & Therapeutics 2003 Aug; 74(2):102-12. *Not eligible outcomes*
294. Cerhan JR, Wallace RB, el-Khoury GY, et al. Decreased survival with increasing prevalence of full-body, radiographically defined osteoarthritis in women. American Journal of Epidemiology 1995 Feb 1; 141(3):225-34. *Not eligible outcomes*
295. Cesari M, Leeuwenburgh C, Lauretani F, et al. Frailty syndrome and skeletal muscle: results from the Invecchiare in Chianti study. Am J Clin Nutr 2006 May; 83(5):1142-8. *Not eligible outcomes*
296. Cesari M, Penninx BW, Newman AB, et al. Inflammatory markers and cardiovascular disease (The Health, Aging and Body Composition [Health ABC] Study). Am J Cardiol 2003 Sep 1; 92(5):522-8. *Not eligible outcomes*
297. Chakravarty EF, Hubert HB, Lingala VB, et al. Reduced disability and mortality among aging runners: a 21-year longitudinal study. Arch Intern Med 2008 Aug 11; 168(15):1638-46. *Not eligible outcomes*
298. Chan BK, Marshall LM, Winters KM, et al. Incident fall risk and physical activity and physical performance among older men: the Osteoporotic Fractures in Men Study. Am J Epidemiol 2007 Mar 15; 165(6):696-703. *Not eligible outcomes*
299. Chang JI, Karuza J, Katz PR, et al. Patient outcomes in hospital-based respite: a study of potential risks and benefits. J Am Board Fam Pract 1992 Sep-Oct; 5(5):475-81. *Not elgible target population*
300. Chaperon CM, Farr LA, LoChiano E. Sleep disturbance of residents in a continuing care retirement community. J Gerontol Nurs 2007 Oct; 33(10):21-8; quiz 30-1. *Not eligible outcomes*
301. Chapman DP, Williams SM, Strine TW, et al. Dementia and its implications for public health. Prev Chronic Dis 2006 Apr; 3(2):A34. *Review*
302. Chapman IM. Endocrinology of anorexia of ageing. Best Pract Res Clin Endocrinol Metab 2004 Sep; 18(3):437-52. *Not eligible outcomes*
303. Chapman RH, Benner JS, Girase P, et al. Generic and therapeutic statin switches and disruptions in therapy. Curr Med Res Opin 2009 May; 25(5):1247-60. *Not eligible outcomes*
304. Charlifue S, Lammertse DP, Adkins RH, et al. Aging with spinal cord injury: changes in selected health indices and life satisfaction. Archives of Physical Medicine & Rehabilitation 2004 Nov; 85(11):1848-53. *Not eligible outcomes*
305. Charlifue SW, Weitzenkamp DA, Whiteneck GG. Longitudinal outcomes in spinal cord injury: aging, secondary conditions, and well-being. Archives of

Physical Medicine & Rehabilitation 1999 Nov; 80(11):1429-34. *Not eligible outcomes*
306. Chaudhry SI, Wang Y, Gill TM, et al. Geriatric conditions and subsequent mortality in older patients with heart failure. Journal of the American College of Cardiology 2010 Jan 26; 55(4):309-16. *Not eligible outcomes*
307. Chaves PH, Varadhan R, Lipsitz LA, et al. Physiological complexity underlying heart rate dynamics and frailty status in community-dwelling older women. J Am Geriatr Soc 2008 Sep; 56(9):1698-703. *Not eligible outcomes*
308. Chen CC, Chang CK, Chyun DA, et al. Dynamics of nutritional health in a community sample of american elders: a multidimensional approach using roy adaptation model. ANS Adv Nurs Sci 2005 Oct-Dec; 28(4):376-89. *Not eligible target population*
309. Chen H, Guo X. Obesity and functional disability in elderly Americans. J Am Geriatr Soc 2008 Apr; 56(4):689-94. *Not eligible outcomes*
310. Chen J, Radford MJ, Wang Y, et al. Care and outcomes of elderly patients with acute myocardial infarction by physician specialty: the effects of comorbidity and functional limitations. Am J Med 2000 Apr 15; 108(6):460-9. *Not eligible target population*
311. Chen P, Ganguli M, Mulsant BH, et al. The temporal relationship between depressive symptoms and dementia: a community-based prospective study. Archives of General Psychiatry 1999 Mar; 56(3):261-6. *Not eligible outcomes*
312. Chen P, Kales HC, Weintraub D, et al. Antidepressant treatment of veterans with Parkinson's disease and depression: analysis of a national sample. J Geriatr Psychiatry Neurol 2007 Sep; 20(3):161-5. *Not eligible outcomes*
313. Chen Q, Kane RL. Effects of using consumer and expert ratings of an activities of daily living scale on predicting functional outcomes of postacute care. J Clin Epidemiol 2001 Apr; 54(4):334-42. *Not eligible target population*
314. Chen YM, Hwang SJ, Chen LK, et al. Urinary incontinence among institutionalized oldest old Chinese men in Taiwan. Neurourology & Urodynamics 2009; 28(4):335-8. *Not eligible target population*
315. Cherner M, Letendre S, Heaton RK, et al. Hepatitis C augments cognitive deficits associated with HIV infection and methamphetamine.[see comment]. Neurology 2005 Apr 26; 64(8):1343-7. *Not eligible outcomes*
316. Chertkow H. Diagnosis and treatment of dementia: introduction. Introducing a series based on the Third Canadian Consensus Conference on the Diagnosis and Treatment of Dementia. CMAJ 2008 Jan 29; 178(3):316-21. *Not eligible outcomes*
317. Chi YY, Ibrahim JG. Joint models for multivariate longitudinal and multivariate survival data. Biometrics 2006 Jun; 62(2):432-45. *Not eligible outcomes*
318. Chichin E. Community care for the frail elderly: the case of non-professional home care workers. Women Health 1988; 14(3-4):93-104. *Not eligible outcomes*
319. Chin APMJ, de Groot LC, van Gend SV, et al. Inactivity and weight loss: effective criteria to identify frailty. J Nutr Health Aging 2003; 7(1):55-60. *Not eligible outcomes*
320. Chin APMJ, Dekker JM, Feskens EJ, et al. How to select a frail elderly population? A comparison of three working definitions. J Clin Epidemiol 1999 Nov; 52(11):1015-21. *Not eligible outcomes*
321. Chio A, Cocito D, Leone M, et al. Guillain-Barre syndrome: a prospective, population-based incidence and outcome survey. Neurology 2003 Apr 8; 60(7):1146-50. *Not eligible outcomes*
322. Chiu CJ, Hubbard LD, Armstrong J, et al. Dietary glycemic index and carbohydrate in relation to early age-related macular degeneration.[see comment]. American Journal of Clinical Nutrition 2006 Apr; 83(4):880-6. *Not eligible outcomes*
323. Chiu CJ, Morris MS, Rogers G, et al. Carbohydrate intake and glycemic index in relation to the odds of early cortical and nuclear lens opacities. American Journal of Clinical Nutrition 2005 Jun; 81(6):1411-6. *Not eligible outcomes*
324. Chiu PY, Liu CH, Tsai CH. Neuropsychiatric manifestations in vascular cognitive impairment patients with and without dementia. Acta Neurologica Taiwanica 2007 Jun; 16(2):86-91. *Not eligible outcomes*
325. Choi NG. Determinants of engagement in paid work following social security benefit receipt among older women. Journal of Women & Aging 2000; 12(3-4):133-54. *Not eligible outcomes*
326. Choi SW, Peek-Asa C, Sprince NL, et al. Hearing loss as a risk factor for agricultural injuries. American Journal of Industrial Medicine 2005 Oct; 48(4):293-301. *Not eligible outcomes*
327. Choumenkovitch SF, Selhub J, Wilson PW, et al. Folic acid intake from fortification in United States exceeds predictions. Journal of Nutrition 2002 Sep; 132(9):2792-8. *Not eligible outcomes.*
328. Chrischilles EA, Carter BL, Lund BC, et al. Evaluation of the Iowa Medicaid pharmaceutical case management program. J Am Pharm Assoc (2003) 2004 May-Jun; 44(3):337-49. *Not eligible outcomes*
329. Christ SL, Lee DJ, Fleming LE, et al. Employment and occupation effects on depressive symptoms in older Americans: does working past age 65 protect against depression? J Gerontol B Psychol Sci Soc Sci 2007 Nov; 62(6):S399-403. *Not eligible outcomes*
330. Christensen MD, White HK. Dementia assessment and management.[see comment]. Journal of the American Medical Directors Association 2006 Feb; 7(2):109-18. *Review*
331. Christie J, Smith GR, Williamson GM, et al. Quality of informal care is multidimensional. Rehabilitation Psychology 2009 May; 54(2):173-81. *Not eligible outcomes*
332. Chueh KH, Yang MS, Chen CS, et al. Poor sleep quality and alcohol use problems among elderly

Taiwanese aboriginal women. International Psychogeriatrics 2009 Jun; 21(3):593-9. *Not eligible outcomes*

333. Chung S, Song MY, Shin HD, et al. Korean and Caucasian overweight premenopausal women have different relationship of body mass index to percent body fat with age. Journal of Applied Physiology 2005 Jul; 99(1):103-7. *Not eligible target population*
334. Church TS, Gill TM, Newman AB, et al. Maximal fitness testing in sedentary elderly at substantial risk of disability: LIFE-P study experience. J Aging Phys Act 2008 Oct; 16(4):408-15. *Not eligible outcomes*
335. Chyou PH, Burchfiel CM, Yano K, et al. Obesity, alcohol consumption, smoking, and mortality. Annals of Epidemiology 1997 May; 7(4):311-7. *Not eligible exposure*
336. Cigolle CT, Langa KM, Kabeto MU, et al. Setting eligibility criteria for a care-coordination benefit. J Am Geriatr Soc 2005 Dec; 53(12):2051-9. *Not eligible outcomes*
337. Cigolle CT, Langa KM, Kabeto MU, et al. Setting eligibility criteria for a care-coordination benefit.[see comment]. Journal of the American Geriatrics Society 2005 Dec; 53(12):2051-9. *Not eligible outcomes*
338. Cipher DJ, Clifford PA, Roper KD. Behavioral manifestations of pain in the demented elderly. J Am Med Dir Assoc 2006 Jul; 7(6):355-65. *Not eligible outcomes*
339. Clark WW, Bohl CD, Clark WW, et al. Hearing levels of firefighters: risk of occupational noise-induced hearing loss assessed by cross-sectional and longitudinal data.[see comment]. Ear & Hearing 2005 Jun; 26(3):327-40. *Not eligible outcomes*
340. Class CA, Unverzagt FW, Gao S, et al. Psychiatric disorders in African American nursing home residents. Am J Psychiatry 1996 May; 153(5):677-81. *Not eligible target population*
341. Classen S, Meuleman J, Garvan C, et al. Review of prescription medications in home-based older adults with stroke: a pilot study. Res Social Adm Pharm 2007 Mar; 3(1):104-22. *Not eligible outcomes*
342. Clauser SB, Bierman AS. Significance of functional status data for payment and quality. Health Care Financ Rev 2003 Spring; 24(3):1-12. *Not eligible outcomes*
343. Clerisme-Beaty E, Rand CS, Clerisme-Beaty E, et al. The effect of obesity on asthma incidence: moving past the epidemiologic evidence.[comment]. Journal of Allergy & Clinical Immunology 2009 Jan; 123(1):96-7. *Not eligible outcomes*
344. Cline CM, Broms K, Willenheimer RB, et al. Hospitalization and Health Care Costs Due to Congestive Heart Failure in the Elderly. Am J Geriatr Cardiol 1996 Jul; 5(4):10-4. *Not eligible outcomes*
345. Cline MG, Dodge R, Lebowitz MD, et al. Determinants of percent predicted FEV1 in current asthmatic subjects. Chest 1994 Oct; 106(4):1089-93. *Not eligible outcomes*
346. Coast J, Flynn TN, Natarajan L, et al. Valuing the ICECAP capability index for older people. Social science & medicine 2008 Sep; 67(5):874-82. *Not eligible outcomes*
347. Cohen A, Houck PR, Szanto K, et al. Social inequalities in response to antidepressant treatment in older adults. Arch Gen Psychiatry 2006 Jan; 63(1):50-6. *Not eligible outcomes*
348. Cohen CI, Magai C, Yaffee R, et al. Racial differences in paranoid ideation and psychoses in an older urban population. Am J Psychiatry 2004 May; 161(5):864-71. *Not eligible outcomes*
349. Cohen J, Cohen J. Influenza. Study questions the benefits of vaccinating the elderly. Science 2005 Feb 18; 307(5712):1026. *Not eligible outcomes*
350. Colantonio A, Kasl SV, Ostfeld AM, et al. Prestroke physical function predicts stroke outcomes in the elderly. Arch Phys Med Rehabil 1996 Jun; 77(6):562-6. *Not eligible exposure*
351. Colbert LH, Visser M, Simonsick EM, et al. Physical activity, exercise, and inflammatory markers in older adults: findings from the Health, Aging and Body Composition Study. J Am Geriatr Soc 2004 Jul; 52(7):1098-104. *Not eligible outcome*
352. Coleman EA, Grothaus LC, Sandhu N, et al. Chronic care clinics: a randomized controlled trial of a new model of primary care for frail older adults. Journal of the American Geriatrics Society 1999 Jul; 47(7):775-83. *Not eligible exposure*
353. Coleman EA, Wagner EH, Grothaus LC, et al. Predicting hospitalization and functional decline in older health plan enrollees: are administrative data as accurate as self-report? J Am Geriatr Soc 1998 Apr; 46(4):419-25. *Not eligible outcomes*
354. Colenda CC, Sherman FT. Managed Medicare: an overview for the primary care physician. Geriatrics 1998 Jan; 53(1):57-63; quiz 4. *Not eligible outcomes*
355. Collins TCESKDSJTBCOESCSRSESEKE. Peripheral arterial disease is associated with higher rates of hip bone loss and increased fracture risk in older men. Circulation 2009 May 5; 119(17):2305-12. *Not eligible outcomes*
356. Cologne JB, Cologne JB. Re: "when is baseline adjustment useful in analyses of change? An example with education and cognitive change".[comment]. American Journal of Epidemiology 2006 Dec 1; 164(11):1138-9; author reply 9-40. *Not eligible outcomes*
357. Congdon N, Broman KW, Lai H, et al. Cortical, but not posterior subcapsular, cataract shows significant familial aggregation in an older population after adjustment for possible shared environmental factors. Ophthalmology 2005 Jan; 112(1):73-7. *Not eligible outcomes*
358. Congdon P. Modelling frailty in area mortality. Stat Med 1995 Sep 15; 14(17):1859-74. *Not eligible outcomes*
359. Consortium LWGftL, Belle SH, Chapman W, et al. Relationship of body mass index with demographic and clinical characteristics in the Longitudinal Assessment of Bariatric Surgery (LABS). Surgery for Obesity & Related Diseases 2008 Jul-Aug; 4(4):474-80. *Not eligible outcomes*

360. Conwell Y. Suicide among elderly persons. Psychiatr Serv 1995 Jun; 46(6):563-4. *Not eligible outcomes*
361. Coogan PF, Palmer JR, O'Connor GT, et al. Body mass index and asthma incidence in the Black Women's Health Study.[see comment]. Journal of Allergy & Clinical Immunology 2009 Jan; 123(1):89-95. *Not eligible outcomes*
362. Cook SE, Marsiske M, McCoy KJ. The use of the Modified Telephone Interview for Cognitive Status (TICS-M) in the detection of amnestic mild cognitive impairment. Journal of Geriatric Psychiatry & Neurology 2009 Jun; 22(2):103-9. *Not eligible outcomes*
363. Cooke CR, Shah CV, Gallop R, et al. A simple clinical predictive index for objective estimates of mortality in acute lung injury. Crit Care Med 2009 Jun; 37(6):1913-20. *Not eligible outcome*
364. Copeland JR. Prevalence of depressive illness in the elderly community. J R Coll Gen Pract Occas Pap 1987 Sep; (36):5-7; discussion -8. *Not eligible outcomes*
365. Copeland LA, Zeber JE, Rosenheck RA, et al. Unforeseen inpatient mortality among veterans with schizophrenia. Med Care 2006 Feb; 44(2):110-6. *Not elgible target population*
366. Corcoran TB, O'Neill MA, Webb SA, et al. Prevalence of vitamin deficiencies on admission: relationship to hospital mortality in critically ill patients. Anaesth Intensive Care 2009 Mar; 37(2):254-60. *Not eligible outcomes*
367. Corder EH, Basun H, Fratiglioni L, et al. Inherited frailty. ApoE alleles determine survival after a diagnosis of heart disease or stroke at ages 85+. Ann N Y Acad Sci 2000 Jun; 908:295-8. *Not eligible outcomes*
368. Corder LS, Woodbury MA, Manton KG. Proxy response patterns among the aged: effects on estimates of health status and medical care utilization from the 1982-1984 long-term care surveys. J Clin Epidemiol 1996 Feb; 49(2):173-82. *Not eligible outcomes*
369. Corey-Bloom J, Galasko D, Hofstetter CR, et al. Clinical features distinguishing large cohorts with possible AD, probable AD, and mixed dementia. Journal of the American Geriatrics Society 1993 Jan; 41(1):31-7. *Not eligible outcomes*
370. Corrada MM, Brookmeyer R, Berlau D, et al. Prevalence of dementia after age 90: results from the 90+ study. Neurology 2008 Jul 29; 71(5):337-43. *Not eligible outcomes*
371. Corrada MM, Kawas CH, Mozaffar F, et al. Association of body mass index and weight change with all-cause mortality in the elderly. American Journal of Epidemiology 2006 May 15; 163(10):938-49. *Not eligible exposure*
372. Corser WD. The perceptions of older veterans concerning their postdischarge outcome experiences. Appl Nurs Res 2006 May; 19(2):63-9. *Not elgible target population*
373. Corti MC, Guralnik JM, Salive ME, et al. Clarifying the direct relation between total cholesterol levels and death from coronary heart disease in older persons. Ann Intern Med 1997 May 15; 126(10):753-60. *Not eligible outcomes*
374. Costa AJ, Gerson LW. Tetanus immunization status and predictors of immunity in older family practice outpatients. J Am Board Fam Pract 1998 Jul-Aug; 11(4):315-7. *Not eligible outcomes*
375. Cote V. Are your residents safe in their beds? Director 2004 Summer; 12(3):166, 8. *Not eligible outcomes*
376. Counsell SR, Callahan CM, Buttar AB, et al. Geriatric Resources for Assessment and Care of Elders (GRACE): a new model of primary care for low-income seniors. Journal of the American Geriatrics Society 2006 Jul; 54(7):1136-41. *Not eligible outcomes*
377. Covinsky KE, Newcomer R, Fox P, et al. Patient and caregiver characteristics associated with depression in caregivers of patients with dementia. J Gen Intern Med 2003 Dec; 18(12):1006-14. *Not eligible outcomes*
378. Coward RT, Horne C, Peek CW. Predicting nursing home admissions among incontinent older adults: a comparison of residential differences across six years. Gerontologist 1995 Dec; 35(6):732-43. *Not eligible outcomes*
379. Cowie MR, Wood DA, Coats AJ, et al. Incidence and aetiology of heart failure; a population-based study. Eur Heart J 1999 Mar; 20(6):421-8. *Not eligible outcome*
380. Craig JC, Barratt A, Cumming R, et al. Feasibility study of the early detection and treatment of renal disease by mass screening. Intern Med J 2002 Jan-Feb; 32(1-2):6-14. *Not eligible outcomes*
381. Craig KW, Zweig SC. Evaluation of the elderly driver. Mo Med 2007 Jan-Feb; 104(1):73-6. *Not eligible outcomes*
382. Cravens DD, Mehr DR, Campbell JD, et al. Home-based comprehensive assessment of rural elderly persons: the CARE project. J Rural Health 2005 Fall; 21(4):322-8. *Not eligible outcomes*
383. Cremieux PY, Meilleur MC, Ouellette P, et al. Public and private pharmaceutical spending as determinants of health outcomes in Canada. Health Econ 2005 Feb; 14(2):107-16. *Not eligible outcomes*
384. Crews JE, Campbell VA. Vision impairment and hearing loss among community-dwelling older Americans: implications for health and functioning. Am J Public Health 2004 May; 94(5):823-9. *Not eligible outcomes*
385. Cricco M, Simonsick EM, Foley DJ. The impact of insomnia on cognitive functioning in older adults.[see comment]. Journal of the American Geriatrics Society 2001 Sep; 49(9):1185-9. *Not eligible outcomes*
386. Crimmins E, Saito Y. Getting better and getting worse: Transitions in functional status among older Americans. Journal of Aging & Health 1993; 5(1):3-36. *Not eligible outcomes*
387. Crogan NL, Alvine C. Testing of the Individual Nutrition Rx assessment process among nursing

home residents. Appl Nurs Res 2006 May; 19(2):102-4. *Not eligible target population*
388. Crogan NL, Corbett CF, Short RA. The minimum data set: predicting malnutrition in newly admitted nursing home residents. Clin Nurs Res 2002 Aug; 11(3):341-53. *Not eligible target population*
389. Crogan NL, Shultz JA, Adams CE, et al. Barriers to nutrition care for nursing home residents. J Gerontol Nurs 2001 Dec; 27(12):25-31. *Not eligible target population*
390. Crossett JHW. The best is yet to be: preventing, detecting, and treating depression in older women. Journal of the American Medical Womens Association 2004; 59(3):210-5. *Not eligible outcomes*
391. Cruickshanks KJ, Tweed TS, Wiley TL, et al. The 5-year incidence and progression of hearing loss: the epidemiology of hearing loss study. Archives of Otolaryngology -- Head & Neck Surgery 2003 Oct; 129(10):1041-6. *Not eligible outcomes*
392. Cruickshanks KJ, Wiley TL, Tweed TS, et al. Prevalence of hearing loss in older adults in Beaver Dam, Wisconsin. The Epidemiology of Hearing Loss Study. American Journal of Epidemiology 1998 Nov 1; 148(9):879-86. *Not eligible outcomes*
393. Crum RM, Storr CL, Chan YF, et al. Sleep disturbance and risk for alcohol-related problems. American Journal of Psychiatry 2004 Jul; 161(7):1197-203. *Not eligible outcomes*
394. Crystal S, Johnson RW, Harman J, et al. Out-of-pocket health care costs among older Americans. J Gerontol B Psychol Sci Soc Sci 2000 Jan; 55(1):S51-62. *Not eligible outcomes*
395. Culleton BF, Larson MG, Kannel WB, et al. Serum uric acid and risk for cardiovascular disease and death: the Framingham Heart Study.[see comment]. Annals of internal medicine 1999 Jul 6; 131(1):7-13. *Not eligible outcomes*
396. Cully JA, Gfeller JD, Heise RA, et al. Geriatric depression, medical diagnosis, and functional recovery during acute rehabilitation. Arch Phys Med Rehabil 2005 Dec; 86(12):2256-60. *Not eligible target population*
397. Culp KR, Cacchione PZ, Culp KR, et al. Nutritional status and delirium in long-term care elderly individuals. Applied Nursing Research 2008 May; 21(2):66-74. *Not eligible target population*
398. Currie MS, Rao MK, Blazer DG, et al. Age and functional correlations of markers of coagulation and inflammation in the elderly: functional implications of elevated crosslinked fibrin degradation products (D-dimers). Journal of the American Geriatrics Society 1994 Jul; 42(7):738-42. *Not eligible outcomes*
399. Currow DC, Stevenson JP, Abernethy AP, et al. Prescribing in palliative care as death approaches. J Am Geriatr Soc 2007 Apr; 55(4):590-5. *Not eligible outcomes*
400. Curtis LH, Ostbye T, Sendersky V, et al. Prescription of QT-prolonging drugs in a cohort of about 5 million outpatients. Am J Med 2003 Feb 1; 114(2):135-41. *Not eligible outcomes*
401. Dalton DS, Cruickshanks KJ, Klein BE, et al. The impact of hearing loss on quality of life in older adults. Gerontologist 2003 Oct; 43(5):661-8. *Not eligible outcomes*
402. Dalton DS, Cruickshanks KJ, Klein R, et al. Association of NIDDM and hearing loss.[see comment]. Diabetes Care 1998 Sep; 21(9):1540-4. *Not eligible outcomes*
403. Daltroy LH, Logigian M, Iversen MD, et al. Does musculoskeletal function deteriorate in a predictable sequence in the elderly? Arthritis Care Res 1992 Sep; 5(3):146-50. *Not eligible outcomes*
404. Dam TT, Ewing S, Ancoli-Israel S, et al. Association between sleep and physical function in older men: the osteoporotic fractures in men sleep study. J Am Geriatr Soc 2008 Sep; 56(9):1665-73. *Not eligible outcomes*
405. Danaceau P. Prevention drives care management strategies for Medicare HMOs. Health Syst Lead 1995 Jun; 2(5):4-10. *Not eligible outcomes*
406. Danielson ME, Justice AC. Veterans Aging Cohort Study (VACS) meeting summary. Journal of Clinical Epidemiology 2001 Dec; 54 Suppl 1:S9-11. *Not eligible outcomes*
407. Danner DD, Snowdon DA, Friesen WV. Positive emotions in early life and longevity: findings from the nun study. Journal of Personality & Social Psychology 2001 May; 80(5):804-13. *Not eligible outcomes*
408. Datto CJ, Thompson R, Knott K, et al. Older adult report of change in depressive symptoms as a treatment decision tool. J Am Geriatr Soc 2006 Apr; 54(4):627-31. *Not eligible outcomes*
409. Davey A, Halverson CF, Jr., Zonderman AB, et al. Change in depressive symptoms in the Baltimore longitudinal study of aging. Journals of Gerontology Series B-Psychological Sciences & Social Sciences 2004 Nov; 59(6):P270-7. *Not eligible exposure*
410. Davidson BR, Neoptolemos JP, Carr-Locke DL. Endoscopic sphincterotomy for common bile duct calculi in patients with gall bladder in situ considered unfit for surgery. Gut 1988 Jan; 29(1):114-20. *Not eligible outcomes*
411. Davidson J, Getz M. Nutrition screening and assessment of anthropometry and bioelectrical impedance in the frail elderly: a clinical appraisal of methodology in a clinical setting. Journal of nutrition for the elderly 2004; 23(4):47-63. *Not eligible outcomes*
412. Daviglus ML, Liu K, Yan LL, et al. Body mass index in middle age and health-related quality of life in older age: the Chicago heart association detection project in industry study. Archives of Internal Medicine 2003 Nov 10; 163(20):2448-55. *Not eligible exposure*
413. Dawson DA. Alcohol consumption, alcohol dependence, and all-cause mortality.[erratum appears in Alcohol Clin Exp Res 2000 Mar;24(3):395]. Alcoholism: Clinical & Experimental Research 2000 Jan; 24(1):72-81. *Not eligible outcomes*

Appendix B. Excluded Studies

414. de Carle AJ, Kohn R. Risk factors for falling in a psychogeriatric unit. Int J Geriatr Psychiatry 2001 Aug; 16(8):762-7. *Not eligible outcomes*
415. de Gramont A, Buyse M, Abrahantes JC, et al. Reintroduction of oxaliplatin is associated with improved survival in advanced colorectal cancer. J Clin Oncol 2007 Aug 1; 25(22):3224-9. *Not eligible outcomes*
416. de Jong FJ, Masaki K, Chen H, et al. Thyroid function, the risk of dementia and neuropathologic changes: the Honolulu-Asia aging study. Neurobiology of aging 2009 Apr; 30(4):600-6. *Not eligible exposure*
417. De Lepeleire J, Iliffe S, Mann E, et al. Frailty: an emerging concept for general practice. Br J Gen Pract 2009 May; 59(562):e177-82. *Not eligible outcomes*
418. de Lissovoy G, Stier DM, Ciesla G, et al. Economic implications of nesiritide versus dobutamine in the treatment of patients with acutely decompensated congestive heart failure. Am J Cardiol 2003 Sep 1; 92(5):631-3. *Not eligible outcomes*
419. Dellefield ME. Implementation of the resident assessment instrument/minimum data set in the nursing home as organization: implications for quality improvement in RN clinical assessment. Geriatr Nurs 2007 Nov-Dec; 28(6):377-86. *Not eligible target population*
420. Delmonico MJ, Harris TB, Lee JS, et al. Alternative definitions of sarcopenia, lower extremity performance, and functional impairment with aging in older men and women. J Am Geriatr Soc 2007 May; 55(5):769-74. *Not eligible outcomes*
421. Denny SD, Kuchibhatla MN, Cohen HJ, et al. Impact of anemia on mortality, cognition, and function in community-dwelling elderly. American Journal of Medicine 2006 Apr; 119(4):327-34. *Not eligible exposure*
422. Denti L, Annoni V, Cattadori E, et al. Insulin-like growth factor 1 as a predictor of ischemic stroke outcome in the elderly. Am J Med 2004 Sep 1; 117(5):312-7. *Not eligible outcomes*
423. Denton FT, Gafni A, Spencer BG. Exploring the effects of population change on the costs of physician services. J Health Econ 2002 Sep; 21(5):781-803. *Not eligible outcomes*
424. Depp CA, Cain AE, Palmer BW, et al. Assessment of medication management ability in middle-aged and older adults with bipolar disorder. J Clin Psychopharmacol 2008 Apr; 28(2):225-9. *Not eligible outcomes*
425. Derby CA, Barbour MM, Hume AL, et al. Drug therapy and prevalence of erectile dysfunction in the Massachusetts Male Aging Study cohort. Pharmacotherapy 2001 Jun; 21(6):676-83. *Not eligible outcomes*
426. Desquilbet L, Jacobson LP, Fried LP, et al. HIV-1 infection is associated with an earlier occurrence of a phenotype related to frailty. J Gerontol A Biol Sci Med Sci 2007 Nov; 62(11):1279-86. *Not eligible exposure*
427. Desquilbet L, Margolick JB, Fried LP, et al. Relationship between a frailty-related phenotype and progressive deterioration of the immune system in HIV-infected men. J Acquir Immune Defic Syndr 2009 Mar 1; 50(3):299-306. *Not eligible outcomes*
428. DeVita MV, Rasenas LL, Bansal M, et al. Assessment of renal osteodystrophy in hemodialysis patients. Medicine 1992 Sep; 71(5):284-90. *Not eligible outcomes*
429. Devitt R, Colantonio A, Dawson D, et al. Prediction of long-term occupational performance outcomes for adults after moderate to severe traumatic brain injury. Disabil Rehabil 2006 May 15; 28(9):547-59. *Not eligible outcomes*
430. DeVore PA. Prevalence of olfactory dysfunction, hearing deficit, and cognitive dysfunction among elderly patients in a suburban family practice. South Med J 1992 Sep; 85(9):894-6. *Not eligible outcomes*
431. DeWitte SN, Wood JW. Selectivity of black death mortality with respect to preexisting health. Proc Natl Acad Sci U S A 2008 Feb 5; 105(5):1436-41. *Not eligible outcomes*
432. Dexter PR, Wolinsky FD, Gramelspacher GP, et al. Opportunities for advance directives to influence acute medical care. Journal of Clinical Ethics 2003; 14(3):173-82. *Not eligible target population*
433. Dharmarajan TS, Avula S, Norkus EP. Anemia increases risk for falls in hospitalized older adults: an evaluation of falls in 362 hospitalized, ambulatory, long-term care, and community patients. J Am Med Dir Assoc 2006 Jun; 7(5):287-93. *Not eligible target population*
434. Di Serio C. The protective impact of a covariate on competing failures with an example from a bone marrow transplantation study. Lifetime Data Anal 1997; 3(2):99-122. *Not eligible outcomes*
435. Diamond PT, Gale SD, Evans BA. Relationship of initial hematocrit level to discharge destination and resource utilization after ischemic stroke: a pilot study. Arch Phys Med Rehabil 2003 Jul; 84(7):964-7. *Not eligible outcomes*
436. Diez Roux AV, Chambless L, Merkin SS, et al. Socioeconomic disadvantage and change in blood pressure associated with aging. Circulation 2002 Aug 6; 106(6):703-10. *Not eligible outcomes*
437. DiFronzo LA, Yamin N, Patel K, et al. Benefits of early feeding and early hospital discharge in elderly patients undergoing open colon resection. J Am Coll Surg 2003 Nov; 197(5):747-52. *Not eligible outcomes*
438. Dillon CF, Hirsch R, Rasch EK, et al. Symptomatic hand osteoarthritis in the United States: prevalence and functional impairment estimates from the third U.S. National Health and Nutrition Examination Survey, 1991-1994. Am J Phys Med Rehabil 2007 Jan; 86(1):12-21. *Not eligible outcome*
439. Ding J, Visser M, Kritchevsky SB, et al. The association of regional fat depots with hypertension in older persons of white and African American ethnicity. American Journal of Hypertension 2004 Oct; 17(10):971-6. *Not eligible outcomes*

Appendix B. Excluded Studies

440. Dobie SA, Baldwin LM, Dominitz JA, et al. Completion of therapy by Medicare patients with stage III colon cancer. J Natl Cancer Inst 2006 May 3; 98(9):610-9. *Not eligible outcomes*
441. Doblhammer G, Oeppen J. Reproduction and longevity among the British peerage: the effect of frailty and health selection. Proc Biol Sci 2003 Aug 7; 270(1524):1541-7. *Not eligible outcomes*
442. Dobscha SK, Corson K, Perrin NA, et al. Collaborative care for chronic pain in primary care: a cluster randomized trial. JAMA 2009 Mar 25; 301(12):1242-52. *Not eligible outcomes*
443. Dokhi M, Ohtaki M, Hiyama E. A cure Weibull gamma-frailty survival model and its application to exploring the prognosis factors of neuroblastoma. Hiroshima J Med Sci 2009 Mar; 58(1):25-35. *Not eligible outcomes*
444. Dolejs J. Theory of the age dependence of mortality from congenital defects. Mech Ageing Dev 2001 Oct; 122(15):1865-85. *Not eligible outcomes*
445. Dominick KL, Ahern FM, Gold CH, et al. Health-related quality of life among older adults with arthritis. Health Qual Life Outcomes 2004; 2:5. *Not eligible outcomes*
446. Donini LM, De Felice MR, Cannella C. Nutritional status determinants and cognition in the elderly. Archives of Gerontology & Geriatrics 2007; 44(Suppl 1):143-53. *Not eligible outcomes*
447. Donini LM, Savina C, Ricciardi LM, et al. Predicting the outcome of artificial nutrition by clinical and functional indices. Nutrition 2009 Jan; 25(1):11-9. *Not eligible outcomes*
448. Donini LM, Savina C, Rosano A, et al. MNA predictive value in the follow-up of geriatric patients. J Nutr Health Aging 2003; 7(5):282-93. *Not eligible outcomes*
449. Dorfman RA, Lubben JE, Mayer-Oakes A, et al. Screening for depression among a well elderly population. Soc Work 1995 May; 40(3):295-304. *Not eligible outcomes*
450. Dornberger S. Insomnia: definition an prevalence in the elderly. Director 2008 Winter; 16(1):10-2. *Not eligible outcomes*
451. Douris K, Pritchard M. When you suspect elder abuse. Adv Nurse Pract 1999 Apr; 7(4):22. *Not eligible outcomes*
452. Dowd JB, Haan MN, Blythe L, et al. Socioeconomic gradients in immune response to latent infection. American Journal of Epidemiology 2008 Jan 1; 167(1):112-20. *Not eligible outcomes*
453. Drame M, Jovenin N, Novella JL, et al. Predicting early mortality among elderly patients hospitalised in medical wards via emergency department: the SAFES cohort study. J Nutr Health Aging 2008 Oct; 12(8):599-604. *Not eligible target population*
454. Drinka PJ, Krause PF, Nest LJ, et al. Determinants of vitamin D levels in nursing home residents. J Am Med Dir Assoc 2007 Feb; 8(2):76-9. *Not eligible target population*
455. Drummond MF, Sculpher MJ, Torrance GW, et al. Methods for the Economic Evaluation of Health Care Programmes. Third ed. Oxford: Oxford University Press; 2005. *Not eligible outcomes*
456. Dubuc N, Haley S, Ni P, et al. Function and disability in late life: comparison of the Late-Life Function and Disability Instrument to the Short-Form-36 and the London Handicap Scale. Disabil Rehabil 2004 Mar 18; 26(6):362-70. *Not eligible population*
457. Dudgeon BJ, Hoffman JM, Ciol MA, et al. Managing activity difficulties at home: a survey of Medicare beneficiaries. Arch Phys Med Rehabil 2008 Jul; 89(7):1256-61. *Not eligible outcomes*
458. Duh MS, Mody SH, Lefebvre P, et al. Anaemia and the risk of injurious falls in a community-dwelling elderly population. Drugs Aging 2008; 25(4):325-34. *Not eligible outcomes*
459. Dulisse B. Older drivers and risk to other road users. Accid Anal Prev 1997 Sep; 29(5):573-82. *Not eligible outcomes*
460. Dumurgier J, Elbaz A, Ducimetiere P, et al. Slow walking speed and cardiovascular death in well functioning older adults: prospective cohort study. BMJ 2009; 339:b4460. *Not eligible outcomes*
461. Duncan HD, Hodgkinson L, Deakin M, et al. The safety of diagnostic and therapeutic ERCP as a daycase procedure with a selective admission policy. Eur J Gastroenterol Hepatol 1997 Sep; 9(9):905-8. *Not eligible outcomes*
462. Duncan PW, Bode RK, Min Lai S, et al. Rasch analysis of a new stroke-specific outcome scale: the Stroke Impact Scale. Arch Phys Med Rehabil 2003 Jul; 84(7):950-63. *Not eligible outcomes*
463. Duncan PW, Lai SM, Tyler D, et al. Evaluation of proxy responses to the Stroke Impact Scale. Stroke 2002 Nov; 33(11):2593-9. *Not eligible outcomes*
464. Duncan RP, Coward RT, Gilbert GH. Rural-urban comparisons of age and health at the time of nursing home admission. J Rural Health 1997 Spring; 13(2):118-25. *Not eligible target population*
465. Dunlop DD, Hughes SL, Edelman P, et al. Impact of joint impairment on disability-specific domains at four years. Journal of Clinical Epidemiology 1998 Dec; 51(12):1253-61. *Not eligible outcomes*
466. Dunlop DD, Hughes SL, Manheim LM. Disability in activities of daily living: patterns of change and a hierarchy of disability. American Journal of Public Health 1997 Mar; 87(3):378-83. *Not eligible outcomes*
467. Dunlop DD, Semanik P, Song J, et al. Risk factors for functional decline in older adults with arthritis. Arthritis Rheum 2005 Apr; 52(4):1274-82. *Not eligible target population*
468. Dunson DB, Chen Z. Selecting factors predictive of heterogeneity in multivariate event time data. Biometrics 2004 Jun; 60(2):352-8. *Not eligible outcomes*
469. Dupee R, Halpern R. Identifying, assessing and managing high-risk patients under Medicare risk contracts. J Med Pract Manage 2001 May-Jun; 16(6):321-5. *Not eligible outcomes*
470. Dupre ME, Franzese AT, Parrado EA. Religious attendance and mortality: implications for the black-

white mortality crossover. Demography 2006 Feb; 43(1):141-64. *Not eligible outcomes*

471. Dupre ME, Gu D, Warner DF, et al. Frailty and type of death among older adults in China: prospective cohort study. BMJ 2009; 338:b1175. *Not eligible population*
472. Duthie E, Mark D, Tresch D, et al. Utilization of cardiopulmonary resuscitation in nursing homes in one community: rates and nursing home characteristics. J Am Geriatr Soc 1993 Apr; 41(4):384-8. *Not eligible target population*
473. Dyeson TB, Murphy J, Stryker K. Demographic and psychosocial characteristics of cognitively-intact chronically Ill elders receiving home health services. Home Health Care Serv Q 1999; 18(2):1-25. *Not eligible outcomes*
474. Dziura J, Mendes de Leon C, Kasl S, et al. Can physical activity attenuate aging-related weight loss in older people? The Yale Health and Aging Study, 1982-1994. American Journal of Epidemiology 2004 Apr 15; 159(8):759-67. *Not eligible exposure*
475. Edwards ER, Lindquist K, Yaffe K. Clinical profile and course of cognitively normal patients evaluated in memory disorders clinics. Neurology 2004 May 11; 62(9):1639-42. *Not eligible outcomes*
476. Edwards MS, Craven TE, Burke GL, et al. Renovascular disease and the risk of adverse coronary events in the elderly: a prospective, population-based study. Arch Intern Med 2005 Jan 24; 165(2):207-13. *Not eligible outcomes*
477. Egan KM, Signorello LB, Munro HM, et al. Vitamin D insufficiency among African-Americans in the southeastern United States: implications for cancer disparities (United States). Cancer Causes & Control 2008 Jun; 19(5):527-35. *Not eligible outcomes*
478. Egede LE. Major depression in individuals with chronic medical disorders: prevalence, correlates and association with health resource utilization, lost productivity and functional disability. Gen Hosp Psychiatry 2007 Sep-Oct; 29(5):409-16. *Not eligible outcomes*
479. Eggermont LH, Bean JF, Guralnik JM, et al. Comparing pain severity versus pain location in the MOBILIZE Boston study: chronic pain and lower extremity function. J Gerontol A Biol Sci Med Sci 2009 Jul; 64(7):763-70. *Not eligible outcomes*
480. Ehreke L, Luppa M, Luck T, et al. Is the clock drawing test appropriate for screening for mild cognitive impairment?--Results of the German study on Ageing, Cognition and Dementia in Primary Care Patients (AgeCoDe). Dement Geriatr Cogn Disord 2009; 28(4):365-72. *Not eligible outcomes*
481. Eigenbrodt ML, Bursac Z, Rose KM, et al. Common carotid arterial interadventitial distance (diameter) as an indicator of the damaging effects of age and atherosclerosis, a cross-sectional study of the Atherosclerosis Risk in Community Cohort Limited Access Data (ARICLAD), 1987-89. Cardiovascular Ultrasound 2006; 4:1. *Not eligible outcomes*
482. Eisen SA, Goldberg J, True WR, et al. A co-twin control study of the effects of the Vietnam War on the self-reported physical health of veterans. American Journal of Epidemiology 1991 Jul 1; 134(1):49-58. *Not eligible outcomes*
483. Eisner MD, Iribarren C, Yelin EH, et al. Pulmonary function and the risk of functional limitation in chronic obstructive pulmonary disease. Am J Epidemiol 2008 May 1; 167(9):1090-101. *Not eligible outcomes*
484. Eklund SA, Burt BA. Risk factors for total tooth loss in the United States; longitudinal analysis of national data. Journal of Public Health Dentistry 1994; 54(1):5-14. *Not eligible outcomes*
485. Elhai JD, Grubaugh AL, Richardson JD, et al. Outpatient medical and mental healthcare utilization models among military veterans: results from the 2001 National Survey of Veterans. J Psychiatr Res 2008 Aug; 42(10):858-67. *Not eligible outcomes*
486. Elias MF, Sullivan LM, D'Agostino RB, et al. Framingham stroke risk profile and lowered cognitive performance. Stroke 2004 Feb; 35(2):404-9. *Not Eligible exposure*
487. Elie M, Boss K, Cole MG, et al. A retrospective, exploratory, secondary analysis of the association between antipsychotic use and mortality in elderly patients with delirium. International Psychogeriatrics 2009 Jun; 21(3):588-92. *Not eligible outcomes*
488. Elkins JS, Johnston SC, Ziv E, et al. Methylenetetrahydrofolate reductase C677T polymorphism and cognitive function in older women. American Journal of Epidemiology 2007 Sep 15; 166(6):672-8. *Not eligible outcomes*
489. Elkins JS, Knopman DS, Yaffe K, et al. Cognitive function predicts first-time stroke and heart disease. Neurology 2005 May 24; 64(10):1750-5. *Not eligible outcomes*
490. Elkins JS, O'Meara ES, Longstreth WT, Jr., et al. Stroke risk factors and loss of high cognitive function. Neurology 2004 Sep 14; 63(5):793-9. *Not eligible exposure*
491. Ell K, Unutzer J, Aranda M, et al. Routine PHQ-9 depression screening in home health care: depression, prevalence, clinical and treatment characteristics and screening implementation. Home Health Care Serv Q 2005; 24(4):1-19. *Not eligible outcomes*
492. El-Solh AA, Pietrantoni C, Bhat A, et al. Microbiology of severe aspiration pneumonia in institutionalized elderly. Am J Respir Crit Care Med 2003 Jun 15; 167(12):1650-4. *Not eligible outcomes*
493. Endeshaw Y. Correlates of self-reported nocturia among community-dwelling older adults. J Gerontol A Biol Sci Med Sci 2009 Jan; 64(1):142-8. *Not eligible outcomes*
494. Endeshaw YW, Bloom HL, Bliwise DL, et al. Sleep-disordered breathing and cardiovascular disease in the Bay Area Sleep Cohort. Sleep 2008 Apr 1; 31(4):563-8. *Not eligible outcomes*
495. Endeshaw YW, Ouslander JG, Schnelle JF, et al. Polysomnographic and clinical correlates of behaviorally observed daytime sleep in nursing home residents. Journals of Gerontology Series A-Biological Sciences & Medical Sciences 2007 Jan; 62(1):55-61. *Not eligible target population*

Appendix B. Excluded Studies

496. Engelhart MJ, Geerlings MI, Meijer J, et al. Inflammatory proteins in plasma and the risk of dementia: the rotterdam study. Arch Neurol 2004 May; 61(5):668-72. *Not eligible target population*
497. Engle VF, Graney MJ. Predicting outcomes of nursing home residents: death and discharge home. J Gerontol 1993 Sep; 48(5):S269-75. *Not eligible target population*
498. Enright PL, Burchette RJ, Peters JA, et al. Peak flow lability: association with asthma and spirometry in an older cohort. Chest 1997 Oct; 112(4):895-901. *Not eligible outcomes*
499. Ensrud KE, Thompson DE, Cauley JA, et al. Prevalent vertebral deformities predict mortality and hospitalization in older women with low bone mass. Fracture Intervention Trial Research Group.[see comment]. Journal of the American Geriatrics Society 2000 Mar; 48(3):241-9. *Not eligible outcomes*
500. Ertel KA, Glymour MM, Glass TA, et al. Frailty modifies effectiveness of psychosocial intervention in recovery from stroke. Clin Rehabil 2007 Jun; 21(6):511-22. *Not eligble outcomes*
501. Escalante A, Lichtenstein MJ, Hazuda HP. Determinants of shoulder and elbow flexion range: results from the San Antonio Longitudinal Study of Aging. Arthritis Care Res 1999 Aug; 12(4):277-86. *Not eligible outcomes*
502. Espeland MA, Gu L, Masaki KH, et al. Association between reported alcohol intake and cognition: results from the Women's Health Initiative Memory Study.[see comment]. American Journal of Epidemiology 2005 Feb 1; 161(3):228-38. *Not eligible outcomes*
503. Espino DV, Lichtenstein MJ, Palmer RF, et al. Ethnic differences in mini-mental state examination (MMSE) scores: where you live makes a difference. J Am Geriatr Soc 2001 May; 49(5):538-48. *Not eligible outcomes*
504. Espino DV, Palmer RF, Miles TP, et al. Prevalence and severity of urinary incontinence in elderly Mexican-American women. Journal of the American Geriatrics Society 2003 Nov; 51(11):1580-6. *Not eligible outcomes*
505. Espino DV, Palmer RF, Miles TP, et al. Prevalence, incidence, and risk factors associated with hip fractures in community-dwelling older Mexican Americans: results of the Hispanic EPESE study. Establish Population for the Epidemiologic Study for the Elderly. J Am Geriatr Soc 2000 Oct; 48(10):1252-60. *Not eligible outcomes*
506. Everitt DE, Fields DR, Soumerai SS, et al. Resident behavior and staff distress in the nursing home. J Am Geriatr Soc 1991 Aug; 39(8):792-8. *Not eligible target population*
507. Everson-Rose SA, Mendes de Leon CF, Bienias JL, et al. Early life conditions and cognitive functioning in later life. American Journal of Epidemiology 2003 Dec 1; 158(11):1083-9. *Not eligible outcomes*
508. Fabre JM, Wood RH, Cherry KE, et al. Age-related deterioration in flexibility is associated with health-related quality of life in nonagenarians. J Geriatr Phys Ther 2007; 30(1):16-22. *Not eligible target population*
509. Fairhall N, Aggar C, Kurrle SE, et al. Frailty Intervention Trial (FIT). BMC Geriatr 2008; 8:27. *Not eligible outcomes*
510. Falconer JA, Naughton BJ, Strasser DC, et al. Stroke inpatient rehabilitation: a comparison across age groups. J Am Geriatr Soc 1994 Jan; 42(1):39-44. *Not eligible outcomes*
511. Fang J, Mensah GA, Croft JB, et al. Heart failure-related hospitalization in the U.S., 1979 to 2004. J Am Coll Cardiol 2008 Aug 5; 52(6):428-34. *Not eligible exposure*
512. Fanuele J, Koval KJ, Lurie J, et al. Distal radial fracture treatment: what you get may depend on your age and address. J Bone Joint Surg Am 2009 Jun; 91(6):1313-9. *Not eligible outcomes*
513. Faulkner KA, Cauley JA, Zmuda JM, et al. Higher 1,25-dihydroxyvitamin D3 concentrations associated with lower fall rates in older community-dwelling women. Osteoporos Int 2006; 17(9):1318-28. *Not eligible exposure*
514. Feart C, Jutand MA, Larrieu S, et al. Energy, macronutrient and fatty acid intake of French elderly community dwellers and association with socio-demographic characteristics: data from the Bordeaux sample of the Three-City Study. Br J Nutr 2007 Nov; 98(5):1046-57. *Not eligible outcomes*
515. Feinfeld DA, Guzik H, Carvounis CP, et al. Sequential changes in renal function tests in the old old: results from the Bronx Longitudinal Aging Study.[see comment]. Journal of the American Geriatrics Society 1995 Apr; 43(4):412-4. *Not eligible outcomes*
516. Feldman HA, Johannes CB, Araujo AB, et al. Low dehydroepiandrosterone and ischemic heart disease in middle-aged men: prospective results from the Massachusetts Male Aging Study. American Journal of Epidemiology 2001 Jan 1; 153(1):79-89. *Not eligible outcomes*
517. Feldman HA, Johannes CB, Derby CA, et al. Erectile dysfunction and coronary risk factors: prospective results from the Massachusetts male aging study. Preventive medicine 2000 Apr; 30(4):328-38. *Not eligible outcomes*
518. Felson DT, Niu J, Clancy M, et al. Effect of recreational physical activities on the development of knee osteoarthritis in older adults of different weights: the Framingham Study. Arthritis Rheum 2007 Feb 15; 57(1):6-12. *Not eligible outcome*
519. Feng L, Yap KB, Kua EH, et al. Depressive symptoms, physician visits and hospitalization among community-dwelling older adults. International Psychogeriatrics 2009 Jun; 21(3):568-75. *Not eligible outcomes*
520. Ferguson RP, O'Connor P, Crabtree B, et al. Serum albumin and prealbumin as predictors of clinical outcomes of hospitalized elderly nursing home residents. Journal of the American Geriatrics Society 1993 May; 41(5):545-9. *Not eligible target population*

521. Feringa HH, Bax JJ, Hoeks S, et al. A prognostic risk index for long-term mortality in patients with peripheral arterial disease. Arch Intern Med 2007 Dec 10; 167(22):2482-9. *Not eligible outcomes*
522. Ferrara A, Barrett-Connor E, Shan J. Total, LDL, and HDL cholesterol decrease with age in older men and women. The Rancho Bernardo Study 1984-1994. Circulation 1997 Jul 1; 96(1):37-43. *Not eligible outcomes*
523. Ferraro KF. Are black older adults health-pessimistic? J Health Soc Behav 1993 Sep; 34(3):201-14. *Not eligible outcomes*
524. Ferraro KF, Farmer MM. Double jeopardy to health hypothesis for African Americans: analysis and critique. Journal of Health & Social Behavior 1996 Mar; 37(1):27-43. *Not eligible outcomes*
525. Ferraro KF, Su YP, Gretebeck RJ, et al. Body mass index and disability in adulthood: a 20-year panel study. Am J Public Health 2002 May; 92(5):834-40. *Not eligible outcomes*
526. Ferraro KF, Wilmoth JM. Measuring morbidity: disease counts, binary variables, and statistical power. J Gerontol B Psychol Sci Soc Sci 2000 May; 55(3):S173-89. *Not eligible outcomes*
527. Ferrell BA, Josephson K, Norvid P, et al. Pressure ulcers among patients admitted to home care. J Am Geriatr Soc 2000 Sep; 48(9):1042-7. *Not eligible outcomes*
528. Ferrucci L, Guralnik JM, Cavazzini C, et al. The frailty syndrome: a critical issue in geriatric oncology. Crit Rev Oncol Hematol 2003 May; 46(2):127-37. *Not eligible outcomes*
529. Ferrucci L, Izmirlian G, Leveille S, et al. Smoking, physical activity, and active life expectancy. American Journal of Epidemiology 1999 Apr 1; 149(7):645-53. *Not eligible outcomes*
530. Feuerstein M, Luff GM, Harrington CB, et al. Pattern of workplace disputes in cancer survivors: a population study of ADA claims. J Cancer Surviv 2007 Sep; 1(3):185-92. *Not eligible outcomes*
531. Field TS, Mazor KM, Briesacher B, et al. Adverse drug events resulting from patient errors in older adults. J Am Geriatr Soc 2007 Feb; 55(2):271-6. *Not eligible outcomes*
532. Fields SD, Fulop G, Sachs CJ, et al. Usefulness of the Neurobehavioral Cognitive Status Examination in the hospitalized elderly. Int Psychogeriatr 1992 Summer; 4(1):93-102. *Not eligible outcomes*
533. Fillenbaum GG, Hanlon JT, Landerman LR, et al. Impact of estrogen use on decline in cognitive function in a representative sample of older community-resident women. American Journal of Epidemiology 2001 Jan 15; 153(2):137-44. *Not eligible outcomes*
534. Fillenbaum GG, Heyman A, Huber MS, et al. The prevalence and 3-year incidence of dementia in older Black and White community residents. J Clin Epidemiol 1998 Jul; 51(7):587-95. *Not eligible outcomes*
535. Fillenbaum GG, Landerman LR, Blazer DG, et al. The relationship of APOE genotype to cognitive functioning in older African-American and Caucasian community residents. Journal of the American Geriatrics Society 2001 Sep; 49(9):1148-55. *Not eligible outcomes*
536. Fillenbaum GG, Landerman LR, Simonsick EM. Equivalence of two screens of cognitive functioning: the Short Portable Mental Status Questionnaire and the Orientation-Memory-Concentration test. J Am Geriatr Soc 1998 Dec; 46(12):1512-8. *Not eligible outcomes*
537. Filleul L, Rondeau V, Vandentorren S, et al. Twenty five year mortality and air pollution: results from the French PAARC survey. Occup Environ Med 2005 Jul; 62(7):453-60. *Not eligible outcomes*
538. Fillit H. Challenges for acute care geriatric inpatient units under the present Medicare prospective payment system. J Am Geriatr Soc 1994 May; 42(5):553-8. *Not eligible outcomes*
539. Fillit HM, Futterman R, Orland BI, et al. Polypharmacy management in Medicare managed care: changes in prescribing by primary care physicians resulting from a program promoting medication reviews. Am J Manag Care 1999 May; 5(5):587-94. *Not eligible outcomes*
540. Finkel SI, Lyons JS, Anderson RL. A brief agitation rating scale (BARS) for nursing home elderly. J Am Geriatr Soc 1993 Jan; 41(1):50-2. *Not eligible target population*
541. Finkelstein FO, Afolalu B, Wuerth D, et al. The elderly patient on CAPD: helping patients cope with peritoneal dialysis. Perit Dial Int 2008 Sep-Oct; 28(5):449-51. *Not eligible outcomes*
542. Finn L, Young T, Palta M, et al. Sleep-disordered breathing and self-reported general health status in the Wisconsin Sleep Cohort Study. Sleep 1998 Nov 1; 21(7):701-6. *Not eligible outcomes*
543. Fiocco M, Putter H, Van Houwelingen JC. A new serially correlated gamma-frailty process for longitudinal count data. Biostatistics 2009 Apr; 10(2):245-57. *Not eligible outcomes*
544. Firchow N. No room at the inn. Am J Nurs 2008 Sep; 108(9):88. *Not eligible outcomes*
545. Fischer HC, Funk GF, Karnell LH, et al. Associations between selected demographic parameters and dental status: potential implications for orodental rehabilitation. J Prosthet Dent 1998 May; 79(5):526-31. *Not eligible outcomes*
546. Fisher KM, Copenhaver V. Assessing the mental health of rural older adults in public housing facilities: a comparison of screening tools. J Gerontol Nurs 2006 Sep; 32(9):26-33. *Not eligible outcomes*
547. Fisher MN, Snih SA, Ostir GV, et al. Positive affect and disability among older Mexican Americans with arthritis. Arthritis Rheum 2004 Feb 15; 51(1):34-9. *Not eligible outcomes*
548. Flaherty JH, Liu ML, Ding L, et al. China: the aging giant. Journal of the American Geriatrics Society 2007 Aug; 55(8):1295-300. *Not eligible outcomes*
549. Fleischman DA, Wilson RS, Schneider JA, et al. Parkinsonian signs and functional disability in old age. Exp Aging Res 2007 Jan-Mar; 33(1):59-76. *Not eligible outcomes*

550. Fleming DJ, Jacques PF, Tucker KL, et al. Iron status of the free-living, elderly Framingham Heart Study cohort: an iron-replete population with a high prevalence of elevated iron stores.[see comment]. American Journal of Clinical Nutrition 2001 Mar; 73(3):638-46. *Not eligible outcomes*
551. Florio ER, Hendryx MS, Jensen JE, et al. A comparison of suicidal and nonsuicidal elders referred to a community mental health center program. Suicide Life Threat Behav 1997 Summer; 27(2):182-93. *Not eligible outcomes*
552. Foelker GA, Jr., Shewchuk RM. Somatic complaints and the CES-D. J Am Geriatr Soc 1992 Mar; 40(3):259-62. *Not eligible outcomes*
553. Foley DJ, Masaki K, White L, et al. Sleep-disordered breathing and cognitive impairment in elderly Japanese-American men. Sleep 2003 Aug 1; 26(5):596-9. *Not eligible exposure*
554. Foley DJ, Monjan A, Simonsick EM, et al. Incidence and remission of insomnia among elderly adults: an epidemiologic study of 6,800 persons over three years. Sleep 1999 May 1; 22 Suppl 2:S366-72. *Not eligible outcomes*
555. Foley DJ, Monjan AA, Brown SL, et al. Sleep complaints among elderly persons: an epidemiologic study of three communities. Sleep 1995 Jul; 18(6):425-32. *Not eligible outcomes*
556. Foley DJ, Monjan AA, Izmirlian G, et al. Incidence and remission of insomnia among elderly adults in a biracial cohort. Sleep 1999 May 1; 22 Suppl 2:S373-8. *Not eligible outcomes*
557. Foley DJ, Wallace RB, Eberhard J. Risk factors for motor vehicle crashes among older drivers in a rural community. J Am Geriatr Soc 1995 Jul; 43(7):776-81. *Not eligible outcomes*
558. Foley RN, Murray AM, Li S, et al. Chronic kidney disease and the risk for cardiovascular disease, renal replacement, and death in the United States Medicare population, 1998 to 1999. J Am Soc Nephrol 2005 Feb; 16(2):489-95. *Not eligible outcomes*
559. Folsom AR, French SA, Zheng W, et al. Weight variability and mortality: the Iowa Women's Health Study. International Journal of Obesity & Related Metabolic Disorders: Journal of the International Association for the Study of Obesity 1996 Aug; 20(8):704-9. *Not eligible exposure*
560. Fonda SJ, Herzog AR. Patterns and risk factors of change in somatic and mood symptoms among older adults. Ann Epidemiol 2001 Aug; 11(6):361-8. *Not eligible outcomes*
561. Foote JA, Giuliano AR, Harris RB. Older adults need guidance to meet nutritional recommendations. J Am Coll Nutr 2000 Oct; 19(5):628-40. *Not eligible outcomes*
562. Forbes GB, Reina JC. Adult lean body mass declines with age: some longitudinal observations. Metabolism: Clinical & Experimental 1970 Sep; 19(9):653-63. *Not eligible target population*
563. Ford AB, Mefrouche Z, Friedland RP, et al. Smoking and cognitive impairment: a population-based study.[see comment]. Journal of the American Geriatrics Society 1996 Aug; 44(8):905-9. *Not eligible exposure*
564. Ford K, Sowers M, Crutchfield M, et al. A longitudinal study of the predictors of prevalence and severity of symptoms commonly associated with menopause. Menopause 2005 May-Jun; 12(3):308-17. *Not eligible outcomes*
565. Forinash K, Meade DM. Trauma in the elderly. Emerg Med Serv 2000 Sep; 29(9):79-84, 6-8; quiz 106. *Not eligible outcomes*
566. Foroni M, Salvioli G, Rielli R, et al. A retrospective study on heat-related mortality in an elderly population during the 2003 heat wave in Modena, Italy: the Argento Project. J Gerontol A Biol Sci Med Sci 2007 Jun; 62(6):647-51. *Not eligible target population*
567. Forrest KY, Zmuda JM, Cauley JA. Correlates of decline in lower extremity performance in older women: A 10-year follow-up study. J Gerontol A Biol Sci Med Sci 2006 Nov; 61(11):1194-200. *Not eligible outcomes*
568. Fortinsky RH, Iannuzzi-Sucich M, Baker DI, et al. Fall-risk assessment and management in clinical practice: views from healthcare providers. J Am Geriatr Soc 2004 Sep; 52(9):1522-6. *Not eligible outcomes*
569. Foster A. Are cohort mortality rates autocorrelated? Demography 1991 Nov; 28(4):619-37. *Not eligible outcomes*
570. Foster CB, Gorga D, Padial C, et al. The development and validation of a screening instrument to identify hospitalized medical patients in need of early functional rehabilitation assessment. Qual Life Res 2004 Aug; 13(6):1099-108. *Not eligible outcomes*
571. Fox KM, Reuland M, Hawkes WG, et al. Accuracy of medical records in hip fracture. Journal of the American Geriatrics Society 1998 Jun; 46(6):745-50. *Not eligible outcomes*
572. Fragoso CA, Gahbauer EA, Van Ness PH, et al. Peak expiratory flow as a predictor of subsequent disability and death in community-living older persons. J Am Geriatr Soc 2008 Jun; 56(6):1014-20. *Not eligible outcomes*
573. Frank RG, Elliott TR. Handbook of rehabilitation psychology. Washington, DC: American Psychological Association [Internet Resource Date of Entry: 19991216]. Available at: http://content.apa.org/books/2000-05059-000 *Not eligible outcomes*
574. Franklin GM, Stover BD, Turner JA, et al. Early opioid prescription and subsequent disability among workers with back injuries: the Disability Risk Identification Study Cohort. Spine (Phila Pa 1976) 2008 Jan 15; 33(2):199-204. *Not eligible exposure*
575. Franzini L, Dyer CB. Healthcare costs and utilization of vulnerable elderly people reported to Adult Protective Services for self-neglect.[see comment]. Journal of the American Geriatrics Society 2008 Apr; 56(4):667-76. *Not eligible outcomes*

Appendix B. Excluded Studies

576. Fraser C, McGurl J. Psychometric testing of the Americanized version of the Guy's Neurological Disability Scale. J Neurosci Nurs 2007 Feb; 39(1):13-9. *Not eligible outcomes*
577. Frawley KA, Asmonga DD. HCFA publishes proposed rule on conditions of participation. J AHIMA 1998 Mar; 69(3):12, 4, 6. *Not eligible outcomes*
578. Freburger JK, Holmes GM, Agans RP, et al. The rising prevalence of chronic low back pain. Arch Intern Med 2009 Feb 9; 169(3):251-8. *Not eligible outcomes*
579. Freedman VA, Aykan H, Martin LG. Another look at aggregate changes in severe cognitive impairment: further investigation into the cumulative effects of three survey design issues. J Gerontol B Psychol Sci Soc Sci 2002 Mar; 57(2):S126-31. *Not eligible outcomes*
580. Freedman VA, Martin LG. The role of education in explaining and forecasting trends in functional limitations among older Americans. Demography 1999 Nov; 36(4):461-73. *Not eligible outcomes*
581. French DD, Werner DC, Campbell RR, et al. A multivariate fall risk assessment model for VHA nursing homes using the minimum data set. J Am Med Dir Assoc 2007 Feb; 8(2):115-22. *Not eligible target population*
582. French SA, Jeffery RW, Folsom AR, et al. Weight variability in a population-based sample of older women: reliability and intercorrelation of measures. International Journal of Obesity & Related Metabolic Disorders: Journal of the International Association for the Study of Obesity 1995 Jan; 19(1):22-9. *Not eligible outcomes*
583. Fried LP, Young Y, Rubin G, et al. Self-reported preclinical disability identifies older women with early declines in performance and early disease. Journal of Clinical Epidemiology 2001 Sep; 54(9):889-901. *Not eligible outcomes*
584. Fried TR, Mor V. Frailty and hospitalization of long-term stay nursing home residents.[see comment]. Journal of the American Geriatrics Society 1997 Mar; 45(3):265-9. *Not eligible population*
585. Friedman B, Delavan RL, Sheeran TH, et al. The effect of major and minor depression on Medicare home healthcare services use. J Am Geriatr Soc 2009 Apr; 57(4):669-75. *Not eligible outcomes*
586. Friedman B, Kane RL. HMO medical directors' perceptions of geriatric practice in Medicare HMOs. J Am Geriatr Soc 1993 Oct; 41(10):1144-9. *Not eligible outcomes*
587. Friedman HS, Tucker JS, Schwartz JE, et al. Psychosocial and behavioral predictors of longevity. The aging and death of the "termites". American Psychologist 1995 Feb; 50(2):69-78. *Not eligible outcomes*
588. Friedman SM, Munoz B, Rubin GS, et al. Characteristics of discrepancies between self-reported visual function and measured reading speed. Salisbury Eye Evaluation Project Team. Invest Ophthalmol Vis Sci 1999 Apr; 40(5):858-64. *Not eligible outcomes*
589. Frierson RL, Shea SJ, Shea MEC. Competence-to-stand-trial evaluations of geriatric defendants. Journal of the American Academy of Psychiatry & the Law 2002; 30(2):252-6. *Not eligible outcomes*
590. Fries BE, Hawes C, Morris JN, et al. Effect of the National Resident Assessment Instrument on selected health conditions and problems. J Am Geriatr Soc 1997 Aug; 45(8):994-1001. *Not eligible target population*
591. Fries JF. Frailty, heart disease, and stroke: the Compression of Morbidity paradigm. Am J Prev Med 2005 Dec; 29(5 Suppl 1):164-8. *Secondary data analysis*
592. Frisard MI, Broussard A, Davies SS, et al. Aging, resting metabolic rate, and oxidative damage: results from the Louisiana Healthy Aging Study. J Gerontol A Biol Sci Med Sci 2007 Jul; 62(7):752-9. *Not eligible outcomes*
593. Froehlich TE, Robison JT, Inouye SK. Screening for dementia in the outpatient setting: the time and change test. J Am Geriatr Soc 1998 Dec; 46(12):1506-11. *Not eligible outcomes*
594. Fulk GD, Echternach JL, Nof L, et al. Clinometric properties of the six-minute walk test in individuals undergoing rehabilitation poststroke. Physiother Theory Pract 2008 May-Jun; 24(3):195-204. *Not eligible outcomes*
595. Fulton AT. Dementia screening: should we screen asymptomatic older adults? Med Health R I 2008 Jul; 91(7):224-5. *Not eligible outcomes*
596. Fung K, Krewski D, Burnett R, et al. Testing the harvesting hypothesis by time-domain regression analysis. II: covariate effects. J Toxicol Environ Health A 2005 Jul 9-23; 68(13-14):1155-65. *Not eligible outcomes*
597. Furner SE. Chartbook on health data on older Americans: United States, 1992. Health status. Vital Health Stat 3 1993 May; (29):3-19. *Not eligible outcomes*
598. Furner SE. Chartbook on health data on older Americans: United States, 1992. Health care use and its cost. Vital Health Stat 3 1993 May; (29):21-36. *Not eligible outcomes*
599. Gabella BA, Mangione EJ, Hedegaard H, et al. Comparison of nursing home residents with and without traumatic brain injury: use of the Minimum Data Set. J Head Trauma Rehabil 2007 Nov-Dec; 22(6):368-76. *Not eligible target population*
600. Galanis DJ, Joseph C, Masaki KH, et al. A longitudinal study of drinking and cognitive performance in elderly Japanese American men: the Honolulu-Asia Aging Study. American Journal of Public Health 2000 Aug; 90(8):1254-9. *Not eligible exposure*
601. Galanis DJ, Petrovitch H, Launer LJ, et al. Smoking history in middle age and subsequent cognitive performance in elderly Japanese-American men. The Honolulu-Asia Aging Study. American Journal of Epidemiology 1997 Mar 15; 145(6):507-15. *Not eligible exposure*

Appendix B. Excluded Studies

602. Gallagher-Thompson D, Brooks JO, 3rd, Bliwise D, et al. The relations among caregiver stress, "sundowning" symptoms, and cognitive decline in Alzheimer's disease. Journal of the American Geriatrics Society 1992 Aug; 40(8):807-10. *Not eligible outcomes*
603. Gallucci M, Ongaro F, Amici GP, et al. Frailty, disability and survival in the elderly over the age of seventy: Evidence from "The Treviso Longeva (TRELONG) Study". Arch Gerontol Geriatr 2009 May-Jun; 48(3):281-3. *Not eligible outcomes*
604. Clinical strategies for successful aging management of geriatric syndromes [Visual Material; Computer File Date of Entry: 19980702]: Fort Lee, N.J.: Network for Continuing Medical Education; 1996. *Not eligible outcomes*
605. Gammack JKMJE. Geriatric medicine. Medical clinics of North America,; v. 90, no. 5; 2006:xvii p., pp. [769]-1048. *Not eligible outcomes*
606. Gandjour A. Aging diseases--do they prevent preventive health care from saving costs? Health Econ 2009 Mar; 18(3):355-62. *Not eligible outcomes*
607. Ganguli M, Reynolds CF, Gilby JE. Prevalence and persistence of sleep complaints in a rural older community sample: the MoVIES project. Journal of the American Geriatrics Society 1996 Jul; 44(7):778-84. *Not eligible outcomes*
608. Ganguli M, Rodriguez EG. Reporting of dementia on death certificates: a community study. J Am Geriatr Soc 1999 Jul; 47(7):842-9. *Not eligible outcomes*
609. Ganz DA, Wenger NS, Roth CP, et al. The effect of a quality improvement initiative on the quality of other aspects of health care: the law of unintended consequences? Med Care 2007 Jan; 45(1):8-18. *Not eligible outcomes*
610. Garand L, Mitchell AM, Dietrick A, et al. Suicide in older adults: nursing assessment of suicide risk. Issues in Mental Health Nursing 2006 May; 27(4):355-70. *Not eligible outcomes*
611. Gass KA, Gaustad G, Oberst MT, et al. Relocation appraisal, functional independence, morale, and health of nursing home residents. Issues Ment Health Nurs 1992 Jul-Sep; 13(3):239-53. *Not eligible target population*
612. Gates GA, Cobb JL, D'Agostino RB, et al. The relation of hearing in the elderly to the presence of cardiovascular disease and cardiovascular risk factors. Archives of Otolaryngology -- Head & Neck Surgery 1993 Feb; 119(2):156-61. *Not eligible outcomes*
613. Gaugler JE, Mittelman MS, Hepburn K, et al. Predictors of change in caregiver burden and depressive symptoms following nursing home admission. Psychology & Aging 2009 Jun; 24(2):385-96. *Not eligible target population*
614. Gerdes LU, Jeune B, Ranberg KA, et al. Estimation of apolipoprotein E genotype-specific relative mortality risks from the distribution of genotypes in centenarians and middle-aged men: apolipoprotein E gene is a "frailty gene," not a "longevity gene". Genet Epidemiol Vol 19. 2000/10/03 ed; 2000: 202-10. *Not eligible outcomes*
615. Gerdhem P, Ivaska KK, Isaksson A, et al. Associations between homocysteine, bone turnover, BMD, mortality, and fracture risk in elderly women. J Bone Miner Res 2007 Jan; 22(1):127-34. *Not eligible outcomes*
616. Gerdhem P, Ringsberg KA, Magnusson H, et al. Bone mass cannot be predicted by estimations of frailty in elderly ambulatory women. Gerontology 2003 May-Jun; 49(3):168-72. *Not eligible outcomes*
617. Gerrity MS, Gaylord S, Williams ME. Short versions of the Timed Manual Performance Test. Development, reliability, and validity. Med Care 1993 Jul; 31(7):617-28. *Not eligible outcomes*
618. Gerstorf D, Hoppmann CA, Anstey KJ, et al. Dynamic links of cognitive functioning among married couples: longitudinal evidence from the Australian Longitudinal Study of Ageing. Psychology & Aging 2009 Jun; 24(2):296-309. *Not eligible outcomes*
619. Ghali JK, Cooper R, Ford E. Trends in hospitalization rates for heart failure in the United States, 1973-1986. Evidence for increasing population prevalence. Arch Intern Med 1990 Apr; 150(4):769-73. *Not eligible outcomes*
620. Giannini R, Petazzoni E, Savorani G, et al. Outcomes from a program of home care attendance in very frail elderly subjects. Arch Gerontol Geriatr 2007 Mar-Apr; 44(2):95-103. *Not eligile outcomes*
621. Gill SS, Mamdani M, Naglie G, et al. A prescribing cascade involving cholinesterase inhibitors and anticholinergic drugs. Arch Intern Med 2005 Apr 11; 165(7):808-13. *Not eligible outcomes*
622. Gill TM, Gahbauer EA. Overestimation of chronic disability among elderly persons. Arch Intern Med 2005 Dec 12-26; 165(22):2625-30. *Not eligible outcomes*
623. Gill TM, Williams CS, Tinetti ME. Environmental hazards and the risk of nonsyncopal falls in the homes of community-living older persons. Medical Care 2000 Dec; 38(12):1174-83. *Not eligible exposure*
624. Given B, Given C, Azzouz F, et al. Physical functioning of elderly cancer patients prior to diagnosis and following initial treatment. Nurs Res 2001 Jul-Aug; 50(4):222-32. *Not eligible outcomes*
625. Given CW, Given B, Azzouz F, et al. Comparison of changes in physical functioning of elderly patients with new diagnoses of cancer. Med Care 2000 May; 38(5):482-93. *Not eligible exposure*
626. Givens JL, Sanft TB, Marcantonio ER, et al. Functional recovery after hip fracture: the combined effects of depressive symptoms, cognitive impairment, and delirium. Journal of the American Geriatrics Society 2008 Jun; 56(6):1075-9. *Not eligible exposure*
627. Glasgow SC, Birnbaum EH, Kodner IJ, et al. Recurrence and quality of life following perineal proctectomy for rectal prolapse. Journal of Gastrointestinal Surgery 2008 Aug; 12(8):1446-51. *Not eligible outcomes*

628. Glass TA, Bandeen-Roche K, McAtee M, et al. Neighborhood psychosocial hazards and the association of cumulative lead dose with cognitive function in older adults. American Journal of Epidemiology 2009 Mar 15; 169(6):683-92. *Not eligible outcomes*
629. Glei DA, Goldman N, Chuang YL, et al. Do chronic stressors lead to physiological dysregulation? Testing the theory of allostatic load. Psychosom Med 2007 Nov; 69(8):769-76. *Not eligible outcomes*
630. Gloth FM, 3rd, Gundberg CM, Hollis BW, et al. Vitamin D deficiency in homebound elderly persons.[see comment]. JAMA 1995 Dec 6; 274(21):1683-6. *Not eligible outcomes*
631. Glymour MM, Weuve J, Berkman LF, et al. When is baseline adjustment useful in analyses of change? An example with education and cognitive change.[see comment]. American Journal of Epidemiology 2005 Aug 1; 162(3):267-78. *Not eligible outcomes*
632. Glynn RJ, Field TS, Rosner B, et al. Evidence for a positive linear relation between blood pressure and mortality in elderly people. Lancet 1995 Apr 1; 345(8953):825-9. *Not eligible outcomes*
633. Glynn RJ, Schneeweiss S, Wang PS, et al. Selective prescribing led to overestimation of the benefits of lipid-lowering drugs. J Clin Epidemiol 2006 Aug; 59(8):819-28. *Not eligible outcome*
634. Gohari MR, Mahmoudi M, Mohammed K, et al. Recurrence in breast cancer. Analysis with frailty model. Saudi Med J 2006 Aug; 27(8):1187-93. *Not eligible outcomes*
635. Golant SM. Do impaired older persons with health care needs occupy U.S. assisted living facilities? An analysis of six national studies. J Gerontol B Psychol Sci Soc Sci 2004 Mar; 59(2):S68-79. *Not eligible outcomes*
636. Gold DT, Bonnick SL, Amonkar MM, et al. Descriptive analysis of concomitant prescription medication patterns from 1999 to 2004 among US women receiving daily or weekly oral bisphosphonate therapy. Gend Med 2008 Dec; 5(4):374-84. *Not eligible target population*
637. Goldman SE, Ancoli-Israel S, Boudreau R, et al. Sleep problems and associated daytime fatigue in community-dwelling older individuals. Journals of Gerontology Series A-Biological Sciences & Medical Sciences 2008 Oct; 63(10):1069-75. *Not eligible outcomes*
638. Gonzalez JR, Fernandez E, Moreno V, et al. Sex differences in hospital readmission among colorectal cancer patients. J Epidemiol Community Health 2005 Jun; 59(6):506-11. *Not eligible exposure*
639. Goodis HE, Rossall JC, Kahn AJ. Endodontic status in older U.S. adults. Report of a survey. J Am Dent Assoc 2001 Nov; 132(11):1525-30; quiz 95-6. *Not eligible outcomes*
640. Goodwin RD, Friedman HS. Health status and the five-factor personality traits in a nationally representative sample. Journal of Health Psychology 2006 Sep; 11(5):643-54. *Not eligible outcomes*
641. Gopal S. Risks of care at home for the frail aged. J Long Term Home Health Care 1997 Summer; 16(3):36-46. *Not eligible outcomes*
642. Gopinath B, Rochtchina E, Flood V, et al. Association of elevated homocysteine level and vitamin B12 deficiency with anemia in older adults. Archives of Internal Medicine 2009 May 11; 169(9):901-2. *Not eligible outcomes*
643. Gopinath B, Rochtchina E, Wang JJ, et al. Prevalence of age-related hearing loss in older adults: Blue Mountains Study. Archives of Internal Medicine 2009 Feb 23; 169(4):415-6. *Not eligible outcomes*
644. Gozalo PL, Miller SC, Intrator O, et al. Hospice effect on government expenditures among nursing home residents. Health Serv Res 2008 Feb; 43(1 Pt 1):134-53. *Not eligible target population*
645. Grabowski CJ. Falls.... A prelude to litigation. Director 2003 Spring; 11(2):50-4. *Not eligible outcomes*
646. Grady KL, Jalowiec A, Grusk BB, et al. Symptom distress in cardiac transplant candidates. Heart & Lung 1992 Sep-Oct; 21(5):434-9. *Not eligible outcomes*
647. Graham JE, Mitnitski AB, Mogilner AJ, et al. Dynamics of cognitive aging: distinguishing functional age and disease from chronologic age in a population. Am J Epidemiol 1999 Nov 15; 150(10):1045-54. *Not eligible outcomes*
648. Graves AB, Rajaram L, Bowen JD, et al. Cognitive decline and Japanese culture in a cohort of older Japanese Americans in King County, WA: the Kame Project. Journals of Gerontology Series B-Psychological Sciences & Social Sciences 1999 May; 54(3):S154-61. *Not eligible outcomes*
649. Graves MT, Slater MA, Maravilla V, et al. Implementing an early intervention case management program in three medical groups. Case Manager 2003 Sep-Oct; 14(5):48-52. *Not eligible outcomes*
650. Graziano F, Santini D, Testa E, et al. A phase II study of weekly cisplatin, 6S-stereoisomer leucovorin and fluorouracil as first-line chemotherapy for elderly patients with advanced gastric cancer. British journal of cancer 2003 Oct 20; 89(8):1428-32. *Not eligible outcomes*
651. Green CR, Ndao-Brumblay SK, Nagrant AM, et al. Race, age, and gender influences among clusters of African American and white patients with chronic pain. J Pain 2004 Apr; 5(3):171-82. *Not eligible outcomes*
652. Green JL, Hawley JN, Rask KJ. Is the number of prescribing physicians an independent risk factor for adverse drug events in an elderly outpatient population? American Journal Geriatric Pharmacotherapy 2007 Mar; 5(1):31-9. *Not eligible outcomes*
653. Greenlee RT, Zentner J, Kieke B, Jr., et al. Farm health surveillance in the Marshfield Epidemiologic Study Area: a pilot study. Journal of Agricultural Safety & Health 2005 May; 11(2):211-8. *Not eligible target population*

Appendix B. Excluded Studies

654. Gregg EW, Mangione CM, Cauley JA, et al. Diabetes and incidence of functional disability in older women. Diabetes Care 2002 Jan; 25(1):61-7. *Not eligible exposure*
655. Gregg EW, Yaffe K, Cauley JA, et al. Is diabetes associated with cognitive impairment and cognitive decline among older women? Study of Osteoporotic Fractures Research Group.[see comment]. Archives of Internal Medicine 2000 Jan 24; 160(2):174-80. *Not eligible exposure*
656. Griffore RJ, Barboza GE, Mastin T, et al. Family members' reports of abuse in Michigan nursing homes. J Elder Abuse Negl 2009 Apr; 21(2):105-14. *Not eligible target population*
657. Grinker J, Rush D, Vokonas P. Changing body habitus among healthy older men: the NAS Boston VA study of weight stability in healthy male volunteers aged 40-80 years. Diabetes Research & Clinical Practice 1990; 10 Suppl 1:S89-94. *Not eligible outcomes*
658. Grinker JA, Tucker K, Vokonas PS, et al. Overweight and leanness in adulthood: prospective study of male participants in the Normative Aging Study. International Journal of Obesity & Related Metabolic Disorders: Journal of the International Association for the Study of Obesity 1996 Jun; 20(6):561-9. *Not eligible outcomes*
659. Grisso JA, Schwarz DF, Wolfson V, et al. The impact of falls in an inner-city elderly African-American population. J Am Geriatr Soc 1992 Jul; 40(7):673-8. *outcomes*
660. Grodstein F, Fretts R, Lifford K, et al. Association of age, race, and obstetric history with urinary symptoms among women in the Nurses' Health Study. American Journal of Obstetrics & Gynecology 2003 Aug; 189(2):428-34. *Not eligible outcomes*
661. Groessl EJ, Kaplan RM, Rejeski WJ, et al. Health-related quality of life in older adults at risk for disability. Am J Prev Med 2007 Sep; 33(3):214-8. *Not eligible outcomes*
662. Gronniger JT, Gronniger JT. Familial obesity as a proxy for omitted variables in the obesity-mortality relationship. Demography 2005 Nov; 42(4):719-35. *Not eligible exposure*
663. Groot W, Van Den Brink HM, Plug E. Money for health: the equivalent variation of cardiovascular diseases. Health Econ 2004 Sep; 13(9):859-72. *Not eligible outcomes*
664. Grossi EA, Schwartz CF, Yu PJ, et al. High-risk aortic valve replacement: are the outcomes as bad as predicted? Ann Thorac Surg 2008 Jan; 85(1):102-6; discussion 7. *Not eligible outcomes*
665. Gruber-Baldini AL, Zimmerman SI, Mortimore E, et al. The validity of the minimum data set in measuring the cognitive impairment of persons admitted to nursing homes. J Am Geriatr Soc 2000 Dec; 48(12):1601-6. *Not eligible target population*
666. Gu MG, Sun L, Zuo G. A baseline-free procedure for transformation models under interval censorship. Lifetime Data Anal 2005 Dec; 11(4):473-88. *Not eligible outcomes*
667. Gubler KD, Maier RV, Davis R, et al. Trauma recidivism in the elderly. J Trauma 1996 Dec; 41(6):952-6. *Not eligible outcomes*
668. Guess HA, Arrighi HM, Metter EJ, et al. Cumulative prevalence of prostatism matches the autopsy prevalence of benign prostatic hyperplasia. Prostate 1990; 17(3):241-6. *Not eligible exposure*
669. Guilfoyle SM, Hale LJ. Community-based fall prevention programs for older adults in Wisconsin. WMJ 2005 Jan; 104(1):29-32. *Not eligible outcomes*
670. Guill JV, Griffin LA, Goodwin TD. Columbus Air Force Base medication profile intervention practice innovation. J Am Pharm Assoc (2003) 2008 Sep-Oct; 48(5):654-8. *Not eligible outcomes*
671. Guralnik JM, Ferrucci L, Balfour JL, et al. Progressive versus catastrophic loss of the ability to walk: implications for the prevention of mobility loss. J Am Geriatr Soc 2001 Nov; 49(11):1463-70. *Not eligible outcomes*
672. Guralnik JM, Ferrucci L, Penninx BW, et al. New and worsening conditions and change in physical and cognitive performance during weekly evaluations over 6 months: the Women's Health and Aging Study. J Gerontol A Biol Sci Med Sci 1999 Aug; 54(8):M410-22. *Not eligible outcomes*
673. Guralnik JM, Simonsick EM. Physical disability in older Americans. J Gerontol 1993 Sep; 48 Spec No:3-10. *Not eligible outcomes*
674. Guttman C. Older Americans 2000. New data system that tracks health and well-being finds successes and disparities. Geriatrics 2000 Oct; 55(10):63-6, 9. *Not eligible outcomes*
675. Haan MN, Aiello AE, West NA, et al. C-reactive protein and rate of dementia in carriers and non carriers of Apolipoprotein APOE4 genotype. Neurobiology of aging 2008 Dec; 29(12):1774-82. *Not eligible outcomes*
676. Haan MN, Weldon M. The influence of diabetes, hypertension, and stroke on ethnic differences in physical and cognitive functioning in an ethnically diverse older population. Ann Epidemiol 1996 Sep; 6(5):392-8. *Not eligible outcomes*
677. Hadaegh F, Zabetian A, Tohidi M, et al. Prevalence of metabolic syndrome by the Adult Treatment Panel III, International Diabetes Federation, and World Health Organization definitions and their association with coronary heart disease in an elderly Iranian population. Annals of the Academy of Medicine, Singapore 2009 Feb; 38(2):142-9. *Not eligible outcomes*
678. Haentjens P, Autier P, Barette M, et al. Survival and functional outcome according to hip fracture type: a one-year prospective cohort study in elderly women with an intertrochanteric or femoral neck fracture. Bone 2007 Dec; 41(6):958-64. *Not eligible exposure*
679. Haessler AL, Nguyen JN, Bhatia NN. Impact of urodynamic based incontinence diagnosis on quality of life in women. Neurourology & Urodynamics 2009; 28(3):183-7. *Not eligible outcomes*
680. Hagberg B, Bauer Alfredson B, Poon LW, et al. Cognitive functioning in centenarians: a coordinated analysis of results from three countries. J Gerontol B

Psychol Sci Soc Sci 2001 May; 56(3):P141-51. *Not eligible outcomes*
681. Haghjoo M, Faghfurian B, Taherpour M, et al. Predictors of syncope in patients with hypertrophic cardiomyopathy. Pacing & Clinical Electrophysiology 2009 May; 32(5):642-7. *Not eligible outcomes*
682. Hailu A, Knutsen SF, Fraser GE. Associations between meat consumption and the prevalence of degenerative arthritis and soft tissue disorders in the adventist health study, California U.S.A. Journal of Nutrition, Health & Aging 2006 Jan-Feb; 10(1):7-14. *Not eligible outcomes*
683. Hain DJ. Cognitive function and adherence of older adults undergoing hemodialysis. Nephrol Nurs J 2008 Jan-Feb; 35(1):23-9. *Not eligible outcomes*
684. Haines T, Brown C, Morrison J. Public provision of four-wheeled walkers: contingent valuation study of economic benefit. Australasian Journal on Ageing 2008 Sep; 27(3):161-4. *Not eligible outcomes*
685. Hakim AA, Curb JD, Burchfiel CM, et al. Screening for coronary heart disease in elderly men based on current and past cholesterol levels. Journal of Clinical Epidemiology 1999 Dec; 52(12):1257-65. *Not eligible outcomes*
686. Halbert RJ, Natoli JL, Gano A, et al. Global burden of COPD: systematic review and meta-analysis. European Respiratory Journal 2006 Sep; 28(3):523-32. *Not eligible outcomes*
687. Hall JA, Nelson MA, Meyer JW, et al. Costs and resources associated with the treatment of overactive bladder using retrospective medical care claims data. Managed Care Interface 2001 Aug; 14(8):69-75. *Not eligible outcomes*
688. Hall KS, Gao S, Baiyewu O, et al. Prevalence rates for dementia and Alzheimer's disease in African Americans: 1992 versus 2001. Alzheimer's & Dementia 2009 May; 5(3):227-33. *Not eligible outcomes*
689. Hallfors D, Leutz W, Capitman J, et al. Stability of frailty in the social/health maintenance organization. Health Care Financ Rev 1994 Summer; 15(4):105-16. *Not eligible outcomes*
690. Halmin M, Bellocco R, Lagerlund M, et al. Long-term inequalities in breast cancer survival--a ten year follow-up study of patients managed within a National Health Care System (Sweden). Acta Oncol 2008; 47(2):216-24. *Not eligible outcomes*
691. Hamasha AA, Hand JS, Levy SM. Medical conditions associated with missing teeth and edentulism in the institutionalized elderly. Spec Care Dentist 1998 May-Jun; 18(3):123-7. *Not eligible target population*
692. Hamilton BH, Hamilton VH. Estimating surgical volume--outcome relationships applying survival models: accounting for frailty and hospital fixed effects. Health Econ 1997 Jul-Aug; 6(4):383-95. *Not eligible outcomes*
693. Hanayama N, Hanayama N. An extended age period cohort model for analysing (age, period)-tabulated data. Statistics in Medicine 2007 Aug 15; 26(18):3459-75. *Not eligible outcomes*
694. Handy J. Options in ambulatory care for the elderly. J Ambul Care Manage 1990 May; 13(2):33-41. *Not eligible outcomes*
695. Haney EM, Stadler D, Bliziotes MM. Vitamin D insufficiency in internal medicine residents. Calcified tissue international 2005 Jan; 76(1):11-6. *Not eligible outcomes*
696. Hanlon JT, Schmader KE, Koronkowski MJ, et al. Adverse drug events in high risk older outpatients. J Am Geriatr Soc 1997 Aug; 45(8):945-8. *Not eligible outcomes*
697. Hanrahan P, Raymond M, McGowan E, et al. Criteria for enrolling dementia patients in hospice: a replication. Am J Hosp Palliat Care 1999 Jan-Feb; 16(1):395-400. *Not eligible outcomes*
698. Hansberry MR, Chen E, Gorbien MJ. Dementia and elder abuse. Clinics in geriatric medicine 2005 May; 21(2):315-32. *Not eligible outcomes*
699. Harder S, Saal K, Blauth E, et al. Appropriateness and surveillance of medication in a cohort of diabetic patients on polypharmacy. Int J Clin Pharmacol Ther 2009 Feb; 47(2):104-10. *Not eligible outcomes*
700. Harms SL, Eberly LE, Garrard JM, et al. Prevalence of appropriate and problematic antiepileptic combination therapy in older people in the nursing home. J Am Geriatr Soc 2005 Jun; 53(6):1023-8. *Not eligible target population*
701. Harris AH, Thoresen CE, Harris AHS, et al. Volunteering is associated with delayed mortality in older people: analysis of the longitudinal study of aging. Journal of Health Psychology 2005 Nov; 10(6):739-52. *Not eligible outcomes*
702. Harris CJ. Detecting depression. Provider 1998 Jun; 24(6):67-8. *Not eligible outcomes*
703. Harris T. Comparative analysis of health statistics for selected diseases common in older persons in the United States. Vital Health Stat 5 1991 Aug; (6):261-2. *Not eligible outcomes*
704. Harris Y. Depression as a risk factor for nursing home admission among older individuals. J Am Med Dir Assoc 2007 Jan; 8(1):14-20. *Not eligible outcomes*
705. Harris Y, Cooper JK. Depressive symptoms in older people predict nursing home admission. J Am Geriatr Soc 2006 Apr; 54(4):593-7. *Not eligible outcomes*
706. Harrison TC. A qualitative analysis of the meaning of aging for women with disabilities with policy implications. ANS Adv Nurs Sci 2006 Apr-Jun; 29(2):E1-13. *Not eligible outcomes*
707. Hart DL, Wang YC, Stratford PW, et al. A computerized adaptive test for patients with hip impairments produced valid and responsive measures of function. Arch Phys Med Rehabil 2008 Nov; 89(11):2129-39. *Not eligible outcomes*
708. Hartz AJ, Daly JM, Kohatsu ND, et al. Risk factors for insomnia in a rural population. Annals of Epidemiology 2007 Dec; 17(12):940-7. *Not eligible outcomes*
709. Harwood DG, Sultzer DL, Wheatley MV. Impaired insight in Alzheimer disease: association with

cognitive deficits, psychiatric symptoms, and behavioral disturbances. Neuropsychiatry, Neuropsychology, & Behavioral Neurology 2000 Apr; 13(2):83-8. *Not eligible outcomes*
710. Hatch J, Gill-Body KM, Portney LG. Determinants of balance confidence in community-dwelling elderly people. Phys Ther 2003 Dec; 83(12):1072-9. *Not eligible outcomes*
711. Haugh R. ACE units take a wholistic, team approach to meet the needs of an aging America. A fresh model for gerontology. Hosp Health Netw 2004 Mar; 78(3):52-6, 2. *Not eligible outcomes*
712. Hayden KM, Zandi PP, Khachaturian AS, et al. Does NSAID use modify cognitive trajectories in the elderly? The Cache County study.[see comment]. Neurology 2007 Jul 17; 69(3):275-82. *Not eligible outcomes*
713. Hazuda HP, Gerety MB, Lee S, et al. Measuring subclinical disability in older mexican americans. Psychosom Med 2002 May-Jun; 64(3):520-30. *Not eligible population*
714. Hazzard WR. Depressed albumin and high-density lipoprotein cholesterol: signposts along the final common pathway of frailty. J Am Geriatr Soc 2001 Sep; 49(9):1253-4. *Not eligible outcomes*
715. He K, Hu FB, Colditz GA, et al. Changes in intake of fruits and vegetables in relation to risk of obesity and weight gain among middle-aged women. International Journal of Obesity & Related Metabolic Disorders: Journal of the International Association for the Study of Obesity 2004 Dec; 28(12):1569-74. *Not eligible outcomes*
716. Heading RC. Prevalence of upper gastrointestinal symptoms in the general population: a systematic review. Scand J Gastroenterol Suppl 1999; 231:3-8. *Not eligible outcomes*
717. Hebert LE, Scherr PA, Bennett DA, et al. Blood pressure and late-life cognitive function change: a biracial longitudinal population study. Neurology 2004 Jun 8; 62(11):2021-4. *Not eligible outcomes*
718. Hee Kang J, Grodstein F, Hee Kang J, et al. Regular use of nonsteroidal anti-inflammatory drugs and cognitive function in aging women. Neurology 2003 May 27; 60(10):1591-7. *Not eligible outcomes*
719. Hefflin BJ. Final-year-of life pacemaker recipients. J Am Geriatr Soc 1998 Nov; 46(11):1396-400. *Not eligible outcomes*
720. Hegland A. Nutrition: at what price? Contemp Longterm Care 1993 Sep; 16(9):62-4, 104. *Not eligible outcomes*
721. Heinonen M, Karppi P, Huusko T, et al. Post-operative degree of mobilization at two weeks predicts one-year mortality after hip fracture. Aging Clin Exp Res 2004 Dec; 16(6):476-80. *Not eligible outcomes*
722. Helfand AE. Foot problems in older patients: a focused podogeriatric assessment study in ambulatory care. J Am Podiatr Med Assoc 2004 May-Jun; 94(3):293-304. *Not eligible outcomes*
723. Heller DA, Ahern FM, Pringle KE, et al. Among older adults, the responsiveness of self-rated health to changes in Charlson comorbidity was moderated by age and baseline comorbidity. J Clin Epidemiol 2009 Feb; 62(2):177-87. *Not eligible outcomes*
724. Henderson R. Modelling conditional distributions in bivariate survival. Lifetime Data Anal 1996; 2(3):241-59. *Not eligible outcomes*
725. Hendriks MR, Evers SM, Bleijlevens MH, et al. Cost-effectiveness of a multidisciplinary fall prevention program in community-dwelling elderly people: a randomized controlled trial (ISRCTN 64716113). International Journal of Technology Assessment in Health Care 2008; 24(2):193-202. *Not eligible outcomes*
726. Hennen J, Krumholz HM, Radford MJ. Mortality experience, 30-days and 365-days after admission, for the 20 most frequent DRG groups among Medicare inpatients aged 65 or older in Connecticut hospitals, fiscal years 1991, 1992, and 1993. Conn Med 1995 Mar; 59(3):137-42. *Not eligible outcomes*
727. Henry OF, Blacher J, Verdavaine J, et al. Alpha 1-acid glycoprotein is an independent predictor of in-hospital death in the elderly. Age Ageing 2003 Jan; 32(1):37-42. *Not eligible target population*
728. Hensel A, Angermeyer MC, Riedel-Heller SG. Measuring cognitive change in older adults. Do reliable change indices of the SIDAM predict dementia? J Neurol 2007 Oct; 254(10):1359-65. *Not eligible outcomes*
729. Hentati H, Arfa N, Haouas N, et al. Pancreaticoduodenectomy in the elderly over 80 years: a case report. Hepatobiliary Pancreat Dis Int 2007 Feb; 6(1):104-7. *Not eligible outcomes*
730. Henton FE, Hays BJ, Walker SN, et al. Determinants of Medicare home healthcare service use among Medicare recipients. Nurs Res 2002 Nov-Dec; 51(6):355-62. *Not eligible outcomes*
731. Herzog AR, Diokno AC, Brown MB, et al. Two-year incidence, remission, and change patterns of urinary incontinence in noninstitutionalized older adults. Journal of Gerontology 1990 Mar; 45(2):M67-74. *Not eligible outcomes*
732. Hewitt M, Rowland JH, Yancik R. Cancer survivors in the United States: age, health, and disability. J Gerontol A Biol Sci Med Sci 2003 Jan; 58(1):82-91. *Not eligible outcomes*
733. Hicks GE, Manal TJ. Psychometric properties of commonly used low back disability questionnaires: are they useful for older adults with low back pain? Pain Med 2009 Jan; 10(1):85-94. *Not eligible outcomes*
734. High K, Bradley S, Loeb M, et al. A new paradigm for clinical investigation of infectious syndromes in older adults: assessing functional status as a risk factor and outcome measure. Journal of the American Geriatrics Society 2005 Mar; 53(3):528-35. *Review*
735. Himes CL. Obesity, disease, and functional limitation in later life. Demography 2000 Feb; 37(1):73-82. *Not eligible exposure*
736. Hirdes JP, Frijters DH, Teare GF. The MDS-CHESS scale: a new measure to predict mortality in institutionalized older people. J Am Geriatr Soc 2003 Jan; 51(1):96-100. *Not eligible outcomes*

737. Hirsch HR. Can an improved environment cause maximum lifespan to decrease? Comments on lifespan criteria and longitudinal Gompertzian analysis. Experimental Gerontology 1994 Mar-Apr; 29(2):119-37. *Not eligible outcomes*
738. Ho KK, Pinsky JL, Kannel WB, et al. The epidemiology of heart failure: the Framingham Study. J Am Coll Cardiol 1993 Oct; 22(4 Suppl A):6A-13A. *Not eligible outcomes*
739. Hochberg MC, Lethbridge-Cejku M, Scott WW, Jr., et al. Upper extremity bone mass and osteoarthritis of the knees: data from the Baltimore Longitudinal Study of Aging. Journal of Bone & Mineral Research 1995 Mar; 10(3):432-8. *Not eligible exposure*
740. Hollins S, Attard MT, von Fraunhofer N, et al. Mortality in people with learning disability: risks, causes, and death certification findings in London. Dev Med Child Neurol 1998 Jan; 40(1):50-6. *Not eligible target population*
741. Hollis D. New pilot program helps physicians monitor chronically ill patients between office visits. Tenn Med 2006 Jun; 99(6):35. *Not eligible outcomes*
742. Holroyd-Leduc JM, Mehta KM, Covinsky KE. Urinary incontinence and its association with death, nursing home admission, and functional decline. J Am Geriatr Soc 2004 May; 52(5):712-8. *Not eligible exposure*
743. Holtzman J, Saleh K, Kane R. Gender differences in functional status and pain in a Medicare population undergoing elective total hip arthroplasty. Med Care 2002 Jun; 40(6):461-70. *Not eligible outcomes*
744. Honsberg AE, Dodge RR, Cline MG, et al. Incidence and remission of habitual snoring over a 5- to 6-year period. Chest 1995 Sep; 108(3):604-9. *Not eligible outcomes*
745. Horgas AL, Yoon SL, Nichols AL, et al. The relationship between pain and functional disability in Black and White older adults. Res Nurs Health 2008 Aug; 31(4):341-54. *Not eligible outcomes*
746. Horner RD, Cohen HJ, Blazer DG. Accuracy of self-reported stroke among elderly veterans. Aging Ment Health 2001 Aug; 5(3):275-81. *Not elgible target population*
747. Hornick T, Aron DC. Managing diabetes in the elderly: go easy, individualize. Cleve Clin J Med 2008 Jan; 75(1):70-8. *Not eligible outcomes*
748. Horton AM, Jr., Roberts C. Demographic effects on the Trail Making Test in marijuana abusers. International Journal of Neuroscience 2001; 110(3-4):173-80. *Not eligible outcomes*
749. Horton AM, Jr., Roberts C, Horton AM, Jr., et al. Derived trail making test indices in a sample of narcotic/other opiate abusers: demographic effects. International Journal of Neuroscience 2002 Sep; 112(9):1075-84. *Not eligible outcomes*
750. Houston DK, Ding J, Nicklas BJ, et al. The association between weight history and physical performance in the Health, Aging and Body Composition study. Int J Obes (Lond) 2007 Nov; 31(11):1680-7. *Not eligible outcomes*
751. Houston DK, Johnson MA, Daniel TD, et al. Health and dietary characteristics of supplement users in an elderly population. International Journal for Vitamin & Nutrition Research 1997; 67(3):183-91. *Not eligible outcomes*
752. Hoverman C, Shugarman LR, Saliba D, et al. Use of postacute care by nursing home residents hospitalized for stroke or hip fracture: how prevalent and to what end? J Am Geriatr Soc 2008 Aug; 56(8):1490-6. *Not eligible target population*
753. Howard DH. Life expectancy and the value of early detection. J Health Econ 2005 Sep; 24(5):891-906. *Not eligible outcomes*
754. Howieson DB, Camicioli R, Quinn J, et al. Natural history of cognitive decline in the old old. Neurology 2003 May 13; 60(9):1489-94. *Not eligible exposure*
755. Howland J, Peterson EW, Levin WC, et al. Fear of falling among the community-dwelling elderly. J Aging Health 1993 May; 5(2):229-43. *Not eligible outcomes*
756. Hozawa A, Okamura T, Kadowaki T, et al. Is weak association between cigarette smoking and cardiovascular disease mortality observed in Japan explained by low total cholesterol? NIPPON DATA80. Int J Epidemiol 2007 Oct; 36(5):1060-7. *Not eligible outcomes*
757. Hsieh LJ, Carter HB, Landis PK, et al. Association of energy intake with prostate cancer in a long-term aging study: Baltimore Longitudinal Study of Aging (United States). Urology 2003 Feb; 61(2):297-301. *Not eligible outcomes*
758. Hu H, Wu MT, Cheng Y, et al. The delta-aminolevulinic acid dehydratase (ALAD) polymorphism and bone and blood lead levels in community-exposed men: the Normative Aging Study. Environmental Health Perspectives 2001 Aug; 109(8):827-32. *Not eligible outcomes*
759. Hu P, Wagle N, Goldman N, et al. The associations between socioeconomic status, allostatic load and measures of health in older Taiwanese persons: Taiwan social environment and biomarkers of aging study. J Biosoc Sci 2007 Jul; 39(4):545-56. *Not eligible outcomes*
760. Hu PS, Trumble DA, Foley DJ, et al. Crash risks of older drivers: a panel data analysis. Accid Anal Prev 1998 Sep; 30(5):569-81. *Not eligible outcomes*
761. Huang C, Ross PD, Fujiwara S, et al. Determinants of vertebral fracture prevalence among native Japanese women and women of Japanese descent living in Hawaii. Bone 1996 May; 18(5):437-42. *Not eligible outcomes*
762. Huang ES, Basu A, Finch M, et al. The complexity of medication regimens and test ordering for patients with diabetes from 1995 to 2003. Curr Med Res Opin 2007 Jun; 23(6):1423-30. *Not eligible exposure*
763. Huang X, Liu L. A joint frailty model for survival and gap times between recurrent events. Biometrics 2007 Jun; 63(2):389-97. *Not eligible oucomes*
764. Huang X, Wolfe RA. A frailty model for informative censoring. Biometrics 2002 Sep; 58(3):510-20. *Not eligible outcomes*

765. Huang X, Wolfe RA, Hu C. A test for informative censoring in clustered survival data. Stat Med 2004 Jul 15; 23(13):2089-107. *Not eligible outcomes*
766. Huang ZB, Neufeld RR, Likourezos A, et al. Sociodemographic and health characteristics of older Chinese on admission to a nursing home: a cross-racial/ethnic study. J Am Geriatr Soc 2003 Mar; 51(3):404-9. *Not eligible outcomes*
767. Hubbard JS, Rohrmann S, Landis PK, et al. Association of prostate cancer risk with insulin, glucose, and anthropometry in the Baltimore longitudinal study of aging. Urology 2004 Feb; 63(2):253-8. *Not eligible exposure*
768. Hubbard RE, Searle SD, Mitnitski A, et al. Effect of smoking on the accumulation of deficits, frailty and survival in older adults: a secondary analysis from the Canadian Study of Health and Aging. J Nutr Health Aging 2009 May; 13(5):468-72. *Not eligible outcomes*
769. Hubbert AO, Hays BJ. Seniors' need for and use of Medicare home health services. Home Health Care Serv Q 2002; 21(2):19-34. *Not eligible outcomes*
770. Huber-Carol C, Vonta I. Frailty models for arbitrarily censored and truncated data. Lifetime Data Anal 2004 Dec; 10(4):369-88. *Not eligible outcomes*
771. Hughes SL, Edelman P, Naughton B, et al. Estimates and determinants of valid self-reports of musculoskeletal disease in the elderly. J Aging Health 1993 May; 5(2):244-63. *Not eligible outcomes*
772. Huikuri HV, Makikallio TH, Airaksinen KE, et al. Power-law relationship of heart rate variability as a predictor of mortality in the elderly. Circulation 1998 May 26; 97(20):2031-6. *Not eligible outcomes*
773. Hung WW, Wisnivesky JP, Siu AL, et al. Cognitive decline among patients with chronic obstructive pulmonary disease. American Journal of Respiratory & Critical Care Medicine 2009 Jul 15; 180(2):134-7. *Not eligible outcomes*
774. Hupfeld S. Rich and healthy-better than poor and sick? An empirical analysis of income, health, and the duration of the pension benefit spell. J Health Econ 2009 Mar; 28(2):427-43. *Not eligible outcomes*
775. Hutton B, Feine J, Morais J. Is there an association between edentulism and nutritional state? J Can Dent Assoc 2002 Mar; 68(3):182-7. *Not eligible outcomes*
776. Hybels CF, Blazer DG, Pieper CF. Toward a threshold for subthreshold depression: an analysis of correlates of depression by severity of symptoms using data from an elderly community sample. Gerontologist 2001 Jun; 41(3):357-65. *Not eligible outcomes*
777. Ide BA, Dahlen B, Gragert M, et al. Needs assessment of Standing Rock elders. J Cult Divers 2006 Winter; 13(4):186-9. *Not eligible outcomes*
778. Il'yasova D, Colbert LH, Harris TB, et al. Circulating levels of inflammatory markers and cancer risk in the health aging and body composition cohort. Cancer Epidemiology, Biomarkers & Prevention 2005 Oct; 14(10):2413-8. *Not eligible outcom*
779. Ingersoll-Dayton B, Starrels ME, Dowler D. Caregiving for parents and parents-in-law: is gender important? Gerontologist 1996 Aug; 36(4):483-91. *Not eligible outcomes*
780. Inouye SK. Delirium in hospitalized older patients: recognition and risk factors. J Geriatr Psychiatry Neurol 1998 Fall; 11(3):118-25; discussion 57-8. *Not eligible target population*
781. Inouye SK, Robison JT, Froehlich TE, et al. The time and change test: a simple screening test for dementia. J Gerontol A Biol Sci Med Sci 1998 Jul; 53(4):M281-6. *Not eligible outcomes*
782. Intrator O, Castle NG, Mor V. Facility characteristics associated with hospitalization of nursing home residents: results of a national study. Med Care 1999 Mar; 37(3):228-37. *Not eligible target population*
783. Ives DG, Bonino P, Traven ND, et al. Characteristics and comorbidities of rural older adults with hearing impairment. J Am Geriatr Soc 1995 Jul; 43(7):803-6. *Not eligible outcomes*
784. Iwao S, Iwao N, Muller DC, et al. Effect of aging on the relationship between multiple risk factors and waist circumference. J Am Geriatr Soc 2000 Jul; 48(7):788-94. *Not eligible exposure*
785. Izawa S, Kuzuya M, Okada K, et al. The nutritional status of frail elderly with care needs according to the mini-nutritional assessment. Clinical Nutrition 2006 Dec; 25(6):962-7. *Not eligible outcomes*
786. Izumi S, Ohtaki M. Incorporation of inter-individual heterogeneity into the multistage carcinogenesis model: approach to the analysis of cancer incidence data. Biom J 2007 Aug; 49(4):539-50. *Not eligible exposure*
787. Jach L. Alcohol and drug problems in the elderly. Perspect Addict Nurs 1995 Winter; 5(4):6-7. *Not eligible outcomes*
788. Jack CR, Jr., Petersen RC, Grundman M, et al. Longitudinal MRI findings from the vitamin E and donepezil treatment study for MCI. Neurobiology of aging 2008 Sep; 29(9):1285-95. *Not eligible outcomes*
789. Jackson JC, Obremskey W, Bauer R, et al. Long-term cognitive, emotional, and functional outcomes in trauma intensive care unit survivors without intracranial hemorrhage. Journal of Trauma-Injury Infection & Critical Care 2007 Jan; 62(1):80-8. *Not eligible outcomes*
790. Jackson KM, Sher KJ, Cooper ML, et al. Adolescent alcohol and tobacco use: onset, persistence and trajectories of use across two samples. Addiction 2002 May; 97(5):517-31. *Not eligible outcomes*
791. Jackson LA, Nelson JC, Benson P, et al. Functional status is a confounder of the association of influenza vaccine and risk of all cause mortality in seniors. Int J Epidemiol 2006 Apr; 35(2):345-52. *Review*
792. Jackson ME, Burwell B, Clark RF, et al. Eligibility for publicly financed home care. Am J Public Health 1992 Jun; 82(6):853-6. *Not eligible outcomes*

793. Jackson RA, Vittinghoff E, Kanaya AM, et al. Urinary incontinence in elderly women: findings from the Health, Aging, and Body Composition Study. Obstetrics & Gynecology 2004 Aug; 104(2):301-7. *Not eligible outcomes*
794. Jacqmin-Gadda H, Fourrier A, Commenges D, et al. Risk factors for fractures in the elderly. Epidemiology 1998 Jul; 9(4):417-23. *Not eligible outcomes*
795. Jaeger AA, Hlatky MA, Paul SM, et al. Functional capacity after cardiac surgery in elderly patients. Journal of the American College of Cardiology 1994 Jul; 24(1):104-8. *Not eligible outcomes*
796. James ML, Wiley E, Fries BE. Predicting nursing facility transition candidates using AID: a case study. Gerontologist 2007 Oct; 47(5):625-32. *Not eligible outcomes*
797. James NT, Miller CW, Brown KC, et al. Pain disability among older adults with arthritis. J Aging Health 2005 Feb; 17(1):56-69. *Not eligible outcomes*
798. James NT, Miller CW, Fos PJ, et al. Health status, physical disability, and obesity among adult Mississippians with chronic joint symptoms or doctor-diagnosed arthritis: findings from the Behavioral Risk Factor Surveillance System, 2003. Prev Chronic Dis 2008 Jul; 5(3):A85. *Not eligible outcomes*
799. Jang Y, Kim G, Chiriboga DA. Health perception and depressive symptoms among older Korean Americans. J Cross Cult Gerontol 2006 Sep-Dec; 21(3-4):91-102. *Not eligible outcomes*
800. Janssen B, Weinmann S, Berger M, et al. Validation of polypharmacy process measures in inpatient schizophrenia care. Schizophr Bull 2004; 30(4):1023-33. *Not eligible outcomes*
801. Janssen F, Nusselder WJ, Looman CW, et al. Stagnation in mortality decline among elders in the Netherlands. Gerontologist 2003 Oct; 43(5):722-34. *Not eligible exposure*
802. Janssen I, Katzmarzyk PT, Church TS, et al. The Cooper Clinic Mortality Risk Index: clinical score sheet for men. Am J Prev Med 2005 Oct; 29(3):194-203. *Not eligible outcome*
803. Jazwinski SM. Biological aging research today: potential, peeves, and problems. Exp Gerontol 2002 Oct-Nov; 37(10-11):1141-6. *Not eligible outcomes*
804. Jellinger KA, Jellinger KA. Accuracy of clinical criteria for AD in the Honolulu-Asia Aging Study, a population-based study.[comment]. Neurology 2002 Mar 26; 58(6):989-90; author reply 90. *comment*
805. Jenkins KR, Fultz NH. Functional impairment as a risk factor for urinary incontinence among older Americans. Neurourol Urodyn 2005; 24(1):51-5. *Not eligible Outcomes*
806. Jeste DV, Alexopoulos GS, Bartels SJ, et al. Consensus statement on the upcoming crisis in geriatric mental health: research agenda for the next 2 decades. Archives of General Psychiatry 1999 Sep; 56(9):848-53. *Review*
807. Jette AM, Branch LG. A ten-year follow-up of driving patterns among community-dwelling elderly. Hum Factors 1992 Feb; 34(1):25-31. *Not eligible outcomes*
808. Jette AM, Pinsky JL, Branch LG, et al. The Framingham Disability Study: physical disability among community-dwelling survivors of stroke. J Clin Epidemiol 1988; 41(8):719-26. *Not eligible outcomes*
809. Jiang H, Fine JP, Chappell R. Semiparametric analysis of survival data with left truncation and dependent right censoring. Biometrics 2005 Jun; 61(2):567-75. *Not eligible outcomes*
810. Johannesson M. On the discounting of gained life-years in cost-effectiveness analysis. Int J Technol Assess Health Care 1992 Spring; 8(2):359-64. *Not eligible outcomes*
811. Johannesson M. The cost-effectiveness of hypertension treatment in Sweden: an analysis of the criteria for intervention and the choice of drug treatment. J Hum Hypertens 1996 Feb; 10 Suppl 2:S23-6. *Not eligible outcomes*
812. Johannesson M, Meltzer D, O'Conor RM. Incorporating future costs in medical cost-effectiveness analysis: implications for the cost-effectiveness of the treatment of hypertension. Med Decis Making 1997 Oct-Dec; 17(4):382-9. *Not eligible outcomes*
813. Johansen KL, Chertow GM, Jin C, et al. Significance of frailty among dialysis patients. J Am Soc Nephrol 2007 Nov; 18(11):2960-7. *Not eligible target population*
814. Johanson JF, Lafferty J. Epidemiology of fecal incontinence: the silent affliction. American Journal of Gastroenterology 1996 Jan; 91(1):33-6. *Not eligible outcome*
815. Johnson BC. The case for a new medical cohort: teliatrics. Journal of Health & Social Policy 1995; 6(3):13-40. *Not eligible outcomes*
816. Johnson CD. Therapeutic recreation treats depression in the elderly. Home Health Care Serv Q 1999; 18(2):79-90. *Not eligible outcomes*
817. Johnson DK, Wilkins CH, Morris JC. Accelerated weight loss may precede diagnosis in Alzheimer disease. Arch Neurol 2006 Sep; 63(9):1312-7. *Not eligible outcomes*
818. Johnson MF, Kramer AM, Lin MK, et al. Outcomes of older persons receiving rehabilitation for medical and surgical conditions compared with hip fracture and stroke. J Am Geriatr Soc 2000 Nov; 48(11):1389-97. *Not eligible outcomes*
819. Johnson RJ, Wolinsky FD. The structure of health status among older adults: disease, disability, functional limitation, and perceived health. J Health Soc Behav 1993 Jun; 34(2):105-21. *Not eligible exposure*
820. Johnston JM, Nazar-Stewart V, Kelsey SF, et al. Relationships between cerebrovascular events, APOE polymorphism and Alzheimer's disease in a community sample. Neuroepidemiology 2000 Nov-Dec; 19(6):320-6. *Not eligible outcomes*
821. Johnston MV, Graves D, Greene M. The uniform postacute assessment tool: systematically evaluating the quality of measurement evidence. Arch Phys

Med Rehabil 2007 Nov; 88(11):1505-12. *Not eligible target population*
822. Johnston MV, Wood K, Stason WB, et al. Rehabilitative placement of poststroke patients: reliability of the Clinical Practice Guideline of the Agency for Health Care Policy and Research. Arch Phys Med Rehabil 2000 May; 81(5):539-48. *Not eligible outcomes*
823. Jones ED, Kennedy-Malone L, Wideman L. Early detection of type 2 diabetes among older African Americans. Geriatr Nurs 2004 Jan-Feb; 25(1):24-8. *Not eligible outcomes*
824. Jones GC, Sinclair LB. Multiple health disparities among minority adults with mobility limitations: san application of the ICF framework and codes. Disabil Rehabil 2008; 30(12-13):901-15. *Not eligible outcomes*
825. Jones RN. Racial bias in the assessment of cognitive functioning of older adults. Aging Ment Health 2003 Mar; 7(2):83-102. *Not eligible outcomes*
826. Jones RN, Fonda SJ, Jones RN, et al. Use of an IRT-based latent variable model to link different forms of the CES-D from the Health and Retirement Study. Social Psychiatry & Psychiatric Epidemiology 2004 Oct; 39(10):828-35. *Not eligible outcomes*
827. Joo MJ, Herdegen JJ, Joo MJ, et al. Sleep apnea in an urban public hospital: assessment of severity and treatment adherence. Journal of Clinical Sleep Medicine 2007 Apr 15; 3(3):285-8. *Not eligible outcomes*
828. Jordan JM, Helmick CG, Renner JB, et al. Prevalence of knee symptoms and radiographic and symptomatic knee osteoarthritis in African Americans and Caucasians: the Johnston County Osteoarthritis Project.[see comment]. Journal of Rheumatology 2007 Jan; 34(1):172-80. *Not eligible outcome*
829. Jorgensen T, Johansson S, Kennerfalk A, et al. Prescription drug use, diagnoses, and healthcare utilization among the elderly. Ann Pharmacother 2001 Sep; 35(9):1004-9. *Not eligible outcomes*
830. Jorm AF, Masaki KH, Petrovitch H, et al. Cognitive deficits 3 to 6 years before dementia onset in a population sample: the Honolulu-Asia aging study. J Am Geriatr Soc 2005 Mar; 53(3):452-5. *Not eligible outcomes*
831. Joseph J, Koka M, Aronow WS. Prevalence of a hemoglobin A1c less than 7.0%, of a blood pressure less than 130/80 mm Hg, and of a serum low-density lipoprotein cholesterol less than 100 mg/dL in older patients with diabetes mellitus in an academic nursing home. J Am Med Dir Assoc 2008 Jan; 9(1):51-4. *Not eligible population*
832. Jung S, Coleman A, Weintraub NT. Vision screening in the elderly. Journal of the American Medical Directors Association 2007 Jul; 8(6):355-62. *Review*
833. Justice AC, Landefeld CS, Asch SM, et al. Justification for a new cohort study of people aging with and without HIV infection. Journal of Clinical Epidemiology 2001 Dec; 54 Suppl 1:S3-8. *Not elgible target population*
834. Jylha M, Volpato S, Guralnik JM. Self-rated health showed a graded association with frequently used biomarkers in a large population sample. J Clin Epidemiol 2006 May; 59(5):465-71. *Not eligible outcomes*
835. Jyrkka J, Enlund H, Korhonen MJ, et al. Patterns of drug use and factors associated with polypharmacy and excessive polypharmacy in elderly persons: results of the Kuopio 75+ study: a cross-sectional analysis. Drugs Aging 2009; 26(6):493-503. *Not eligible outcomes*
836. Jyrkka J, Vartiainen L, Hartikainen S, et al. Increasing use of medicines in elderly persons: a five-year follow-up of the Kuopio 75+Study. Eur J Clin Pharmacol 2006 Feb; 62(2):151-8. *Not eligible outcomes*
837. Kado DM, Duong T, Stone KL, et al. Incident vertebral fractures and mortality in older women: a prospective study. Osteoporos Int 2003 Jul; 14(7):589-94. *Not eligible outcomes*
838. Kadushin G, Kulys R. Discharge planning revisited: what do social workers actually do in discharge planning? Soc Work 1993 Nov; 38(6):713-26. *Not eligible outcomes*
839. Kagansky N, Berner Y, Koren-Morag N, et al. Poor nutritional habits are predictors of poor outcome in very old hospitalized patients. Am J Clin Nutr 2005 Oct; 82(4):784-91; quiz 913-4. *Not eligible target population*
840. Kagansky N, Levy S, Keter D, et al. Non-alcoholic fatty liver disease--a common and benign finding in octogenarian patients. Liver International 2004 Dec; 24(6):588-94. *Not eligible target population*
841. Kahonen MH, Tilvis RS, Jolkkonen J, et al. Predictors and clinical significance of declining plasma dehydroepiandrosterone sulfate in old age. Aging (Milano) 2000 Aug; 12(4):308-14. *Not eligible outcomes*
842. Kalaydjian A, Zandi PP, Swartz KL, et al. How migraines impact cognitive function: findings from the Baltimore ECA.[see comment][summary for patients in Neurology. 2007 Apr 24;68(17):E23-4; PMID: 17452572]. Neurology 2007 Apr 24; 68(17):1417-24. *Not eliglble exposure*
843. Kalmijn S, Foley D, White L, et al. Metabolic cardiovascular syndrome and risk of dementia in Japanese-American elderly men. The Honolulu-Asia aging study. Arteriosclerosis, Thrombosis & Vascular Biology 2000 Oct; 20(10):2255-60. *Not eligible exposure*
844. Kalogeropoulos A, Georgiopoulou V, Kritchevsky SB, et al. Epidemiology of incident heart failure in a contemporary elderly cohort: the health, aging, and body composition study. Arch Intern Med 2009 Apr 13; 169(7):708-15. *Not eligible outcomes*
845. Kanagala R, Murali NS, Friedman PA, et al. Obstructive sleep apnea and the recurrence of atrial fibrillation. Circulation 2003 May 27; 107(20):2589-94. *Not eligible outcomes*
846. Kane RA, Wilson KB. Improving practice through research in and about assisted living: implications

for a research agenda. Gerontologist 2007; 47 Spec No 3:4-7. *Not eligible outcomes*
847. Kane RL, Chen Q, Finch M, et al. Functional outcomes of posthospital care for stroke and hip fracture patients under medicare. J Am Geriatr Soc 1998 Dec; 46(12):1525-33. *Not eligible outcomes*
848. Kane RL, Kane RA, eds. Assessing Older Persons: Measures, Meaning, and Practical Applications. New York: Oxford University Press; 2000. *Not eligible outcomes*
849. Kane RL, Ouslander JG, Abrass IB, et al. Essentials of Clinical Geriatrics. Sixth ed. New York: McGraw Hill; 2009. *Not eligible outcomes*
850. Kaneene JB, Miller R, Ross W, et al. Patterns of health maintenance on Michigan equine operations. Preventive Veterinary Medicine 1997 Jan; 29(3):201-20. *Not eligible outcomes*
851. Kang JH, Grodstein F, Kang JH, et al. Plasma carotenoids and tocopherols and cognitive function: a prospective study. Neurobiology of aging 2008 Sep; 29(9):1394-403. *Not eligible outcomes*
852. Kang JH, Weuve J, Grodstein F, et al. Postmenopausal hormone therapy and risk of cognitive decline in community-dwelling aging women. Neurology 2004 Jul 13; 63(1):101-7. *Not eligible exposure*
853. Kant AK, Schatzkin A, Graubard BI, et al. Frequency of eating occasions and weight change in the NHANES I Epidemiologic Follow-up Study. International Journal of Obesity & Related Metabolic Disorders: Journal of the International Association for the Study of Obesity 1995 Jul; 19(7):468-74. *Not eligible outcomes*
854. Karlamangla AS, Singer BH, Reuben DB, et al. Increases in serum non-high-density lipoprotein cholesterol may be beneficial in some high-functioning older adults: MacArthur studies of successful aging. J Am Geriatr Soc 2004 Apr; 52(4):487-94. *Not eligible outcomes*
855. Karp A, Andel R, Parker MG, et al. Mentally stimulating activities at work during midlife and dementia risk after age 75: follow-up study from the Kungsholmen Project. American Journal of Geriatric Psychiatry 2009 Mar; 17(3):227-36. *Not eligible outcomes*
856. Kasper JD, Shapiro S, Guralnik JM, et al. Designing a community study of moderately to severely disabled older women: the Women's Health and Aging Study. Ann Epidemiol 1999 Nov; 9(8):498-507. *Not eligible outcomes*
857. Katsiaras A, Newman AB, Kriska A, et al. Skeletal muscle fatigue, strength, and quality in the elderly: the Health ABC Study. Journal of Applied Physiology 2005 Jul; 99(1):210-6. *Not eligible outcomes*
858. Katz IR, Lesher E, Kleban M, et al. Clinical features of depression in the nursing home. Int Psychogeriatr 1989 Spring; 1(1):5-15. *Not eligible target population*
859. Kaufer DI, Williams CS, Braaten AJ, et al. Cognitive screening for dementia and mild cognitive impairment in assisted living: comparison of 3 tests. J Am Med Dir Assoc 2008 Oct; 9(8):586-93. *Not eligible outcomes*
860. Kausch O. Cocaine abuse in the elderly: a series of three case reports. J Nerv Ment Dis 2002 Aug; 190(8):562-5. *Not eligible outcomes*
861. Kearney MT, Nolan J, Lee AJ, et al. A prognostic index to predict long-term mortality in patients with mild to moderate chronic heart failure stabilised on angiotensin converting enzyme inhibitors. Eur J Heart Fail 2003 Aug; 5(4):489-97. *Not eligible outcomes*
862. Keefover RW, Rankin ED, Keyl PM, et al. Dementing illnesses in rural populations: the need for research and challenges confronting investigators. J Rural Health 1996 Summer; 12(3):178-87. *Not eligible outcomes*
863. Keller CR, Odden MC, Fried LF, et al. Kidney function and markers of inflammation in elderly persons without chronic kidney disease: the health, aging, and body composition study. Kidney Int 2007 Feb; 71(3):239-44. *Not eligible outcomes*
864. Kelley-Gillespie N. Mobile medical care units: an innovative use of Medicare funding. J Health Soc Policy 2005; 20(2):33-48. *Not eligible outcomes*
865. Kelley-Moore JA, Schumacher JG, Kahana E, et al. When do older adults become "disabled"? Social and health antecedents of perceived disability in a panel study of the oldest old. J Health Soc Behav 2006 Jun; 47(2):126-41. *Not eligible outcomes*
866. Kelsey SG, Laditka SB, Laditka JN. Transitioning dementia residents from assisted living to memory care units: a pilot study. American Journal of Alzheimer's Disease & Other Dementias 2008 Aug-Sep; 23(4):355-62. *Not eligible outcomes*
867. Kenefick AL, Kenefick AL. Patterns of symptom distress in older women after surgical treatment for breast cancer. Oncology Nursing Forum Online 2006 Mar; 33(2):327-35. *Not eligible outcomes*
868. Kennedy J. Unmet and undermet need for activities of daily living and instrumental activities of daily living assistance among adults with disabilities: estimates from the 1994 and 1995 disability follow-back surveys. Med Care 2001 Dec; 39(12):1305-12. *Not eligible population*
869. Kent R, Henary B, Matsuoka F. On the fatal crash experience of older drivers. Annu Proc Assoc Adv Automot Med 2005; 49:371-91. *Not eligible outcomes*
870. Kerber CS, Black DW, Buckwalter K. Comorbid psychiatric disorders among older adult recovering pathological gamblers. Issues Ment Health Nurs 2008 Sep; 29(9):1018-28. *Not eligible outcomes*
871. Kerber CS, Dyck MJ, Culp KR, et al. Antidepressant treatment of depression in rural nursing home residents. Issues Ment Health Nurs 2008 Sep; 29(9):959-73. *Not eligible target population*
872. Kevorkian CG, Nambiar SV, Rintala DH. Low ejection fraction: effect on the rehabilitation progress and outcome of stroke patients. Am J Phys Med Rehabil 2005 Sep; 84(9):655-61. *Not eligible outcomes*

Appendix B. Excluded Studies

873. Kezirian EJ, Harrison SL, Ancoli-Israel S, et al. Behavioral correlates of sleep-disordered breathing in older women. Sleep 2007 Sep 1; 30(9):1181-8. *Not eligible outcomes*
874. Khachaturian AS, Corcoran CD, Mayer LS, et al. Apolipoprotein E epsilon4 count affects age at onset of Alzheimer disease, but not lifetime susceptibility: The Cache County Study. Archives of General Psychiatry 2004 May; 61(5):518-24. *Not eligible outcomes*
875. Khokhar SR, Stern Y, Bell K, et al. Persistent mobility deficit in the absence of deficits in activities of daily living: a risk factor for mortality. J Am Geriatr Soc 2001 Nov; 49(11):1539-43. *Not eligible exposure*
876. Kim H, Capezuti E, Boltz M, et al. Factor structure of the geriatric care environment scale. Nurs Res 2007 Sep-Oct; 56(5):339-47. *Not eligible outcomes*
877. Kim I, Williamson DF, Byers T, et al. Vitamin and mineral supplement use and mortality in a US cohort.[see comment]. American Journal of Public Health 1993 Apr; 83(4):546-50. *Not eligible outcomes*
878. Kinder LS, Bryson CL, Sun H, et al. Alcohol screening scores and all-cause mortality in male Veterans Affairs patients. J Stud Alcohol Drugs 2009 Mar; 70(2):253-60. *Not eligible exposure*
879. Klarin I, Fastbom J, Wimo A. A population-based study of drug use in the very old living in a rural district of Sweden, with focus on cardiovascular drug consumption: comparison with an urban cohort. Pharmacoepidemiol Drug Saf 2003 Dec; 12(8):669-78. *Not eligible outcomes*
880. Klay M, Marfyak K. Use of a continence nurse specialist in an extended care facility. Urol Nurs 2005 Apr; 25(2):101-2, 7-8. *Not eligible target population*
881. Klein BE, Cruickshanks KJ, Nondahl DM, et al. Cataract and hearing loss in a population-based study: the Beaver Dam studies. American Journal of Ophthalmology 2001 Oct; 132(4):537-43. *Not eligible outcomes*
882. Klein BE, Klein R, Lee KE. Diabetes, cardiovascular disease, selected cardiovascular disease risk factors, and the 5-year incidence of age-related cataract and progression of lens opacities: the Beaver Dam Eye Study. American Journal of Ophthalmology 1998 Dec; 126(6):782-90. *Not eligible outcomes*
883. Klein BE, Klein R, Lee KE, et al. Performance-based and self-assessed measures of visual function as related to history of falls, hip fractures, and measured gait time. The Beaver Dam Eye Study. Ophthalmology 1998 Jan; 105(1):160-4. *Not eligible exposure*
884. Klein BE, Klein R, Lee KE, et al. Drug use and five-year incidence of age-related cataracts: The Beaver Dam Eye Study. Ophthalmology 2001 Sep; 108(9):1670-4. *Not eligible outcome*
885. Klein BE, Klein R, Lee KE, et al. Incidence of age-related cataract over a 10-year interval: the Beaver Dam Eye Study. Ophthalmology 2002 Nov; 109(11):2052-7. *Not eligible outcomes*
886. Klein BE, Knudtson MD, Lee KE, et al. Supplements and age-related eye conditions the beaver dam eye study. Ophthalmology 2008 Jul; 115(7):1203-8. *Not eligible outcomes*
887. Klein JP. Semiparametric estimation of random effects using the Cox model based on the EM algorithm. Biometrics 1992 Sep; 48(3):795-806. *Not eligible outcomes*
888. Klein R, Klein BE, Knudtson MD, et al. Fifteen-year cumulative incidence of age-related macular degeneration: the Beaver Dam Eye Study. Ophthalmology 2007 Feb; 114(2):253-62. *Not eligible outcome*
889. Klein WC, Jess C. One last pleasure? Alcohol use among elderly people in nursing homes. Health Soc Work 2002 Aug; 27(3):193-203. *Not eligible target population*
890. Klonoff-Cohen H, Barrett-Connor EL, Edelstein SL. Albumin levels as a predictor of mortality in the healthy elderly. J Clin Epidemiol 1992 Mar; 45(3):207-12. *Not eligible target population*
891. Klymko KW, Artinian NT, Washington OG, et al. Effect of impaired cognition on hypertension outcomes in older urban African Americans. Medsurg Nurs 2008 Dec; 17(6):405-10. *Not eligible outcomes*
892. Knutson KL, Knutson KL. Sex differences in the association between sleep and body mass index in adolescents. Journal of Pediatrics 2005 Dec; 147(6):830-4. *Not eligible outcomes*
893. Ko D, Wang Y, Berger AK, et al. Nonsteroidal antiinflammatory drugs after acute myocardial infarction. American Heart Journal 2002 Mar; 143(3):475-81. *Not eligible target population*
894. Kobayashi I, Sledjeski EM, Spoonster E, et al. Effects of early nightmares on the development of sleep disturbances in motor vehicle accident victims. Journal of Traumatic Stress 2008 Dec; 21(6):548-55. *Not eligible outcomes*
895. Koenig HG. Depression in hospitalized older patients with congestive heart failure. General Hospital Psychiatry 1998 Jan; 20(1):29-43. *Not eligible outcomes*
896. Koenig HG, George LK, Titus P. Religion, spirituality, and health in medically ill hospitalized older patients. J Am Geriatr Soc 2004 Apr; 52(4):554-62. *Not eligible outcomes*
897. Koenig HG, Meador KG, Cohen HJ, et al. Screening for depression in hospitalized elderly medical patients: taking a closer look. J Am Geriatr Soc 1992 Oct; 40(10):1013-7. *Not elgible target population*
898. Koepsell TD, Wolf ME, Buchner DM, et al. Footwear style and risk of falls in older adults. J Am Geriatr Soc 2004 Sep; 52(9):1495-501. *Not eligible outcomes*
899. Kogut SJ, El-Maouche D, Abughosh SM. Decreased persistence to cholinesterase inhibitor therapy with concomitant use of drugs that can impair cognition. Pharmacotherapy 2005 Dec; 25(12):1729-35. *Not eligible outcomes*

Appendix B. Excluded Studies

900. Kohout FJ, Berkman LF, Evans DA, et al. Two shorter forms of the CES-D (Center for Epidemiological Studies Depression) depression symptoms index. J Aging Health 1993 May; 5(2):179-93. *Not eligible outcomes*
901. Kominski G, Andersen R, Bastani R, et al. UPBEAT: the impact of a psychogeriatric intervention in VA medical centers. Unified Psychogeriatric Biopsychosocial Evaluation and Treatment. Med Care 2001 May; 39(5):500-12. *Not eligible outcomes*
902. Konig HH, Gunther OH, Angermeyer MC, et al. Utility assessment in patients with mental disorders: validity and discriminative ability of the time trade-off method. Pharmacoeconomics 2009; 27(5):405-19. *Not eligible outcomes*
903. Kontodimopoulos N, Niakas D. An estimate of lifelong costs and QALYs in renal replacement therapy based on patients' life expectancy. Health Policy 2008 Apr; 86(1):85-96. *Not eligible outcomes*
904. Koopman K, Uyttenboogaart M, Vroomen PC, et al. Long-term sequelae after cerebral venous thrombosis in functionally independent patients. Journal of Stroke & Cerebrovascular Diseases 2009 May-Jun; 18(3):198-202. *Not eligible outcomes*
905. Korf ES, White LR, Scheltens P, et al. Brain aging in very old men with type 2 diabetes: the Honolulu-Asia Aging Study. Diabetes Care 2006 Oct; 29(10):2268-74. *Not eligible outcomes*
906. Koroukian SM, Murray P, Madigan E. Comorbidity, disability, and geriatric syndromes in elderly cancer patients receiving home health care. J Clin Oncol 2006 May 20; 24(15):2304-10. *Not eligible outcomes*
907. Kotz K, Deleger S, Cohen R, et al. Osteoporosis and health-related quality-of-life outcomes in the Alameda County Study population. Prev Chronic Dis 2004 Jan; 1(1):A05. *Not eligible exposure*
908. Kovar MG. Functional ability and the need for care: issues for measurement research. Vital Health Stat 5 1991 Aug; (6):97-103. *Not eligible outcomes*
909. Kozauer NA, Mielke MM, Chan GK, et al. Apolipoprotein E genotype and lifetime cognitive decline. International Psychogeriatrics 2008 Feb; 20(1):109-23. *Not eligible outcomes*
910. Krahenbuhl JM, Decollogny A, Bugnon O. Using the costs of drug therapy to screen patients for a community pharmacy-based medication review program. Pharm World Sci 2008 Dec; 30(6):816-22. *Not eligible outcomes*
911. Krall EA, Garvey AJ, Garcia RI, et al. Smoking relapse after 2 years of abstinence: findings from the VA Normative Aging Study. Nicotine & Tobacco Research 2002 Feb; 4(1):95-100. *Not elgible target population*
912. Krause JS, Broderick L. A 25-year longitudinal study of the natural course of aging after spinal cord injury. Spinal Cord 2005 Jun; 43(6):349-56. *Not eligible outcomes*
913. Krause N. Age and decline in role-specific feelings of control. J Gerontol B Psychol Sci Soc Sci 2007 Jan; 62(1):S28-35. *Not eligible outcomes*
914. Kravitz HM, Janssen I, Santoro N, et al. Relationship of day-to-day reproductive hormone levels to sleep in midlife women. Archives of Internal Medicine 2005 Nov 14; 165(20):2370-6. *Not eligible outcomes*
915. Kress D. Hospital and physician partnership succeeds with Medicare managed care. Med Manag Netw 1998 Nov; 6(11):1-4. *Not eligible outcomes*
916. Kressin NR, Atchison KA, Miller DR. Comparing the impact of oral disease in two populations of older adults: application of the geriatric oral health assessment index. J Public Health Dent 1997 Fall; 57(4):224-32. *Not eligible outcomes*
917. Kroenke CH, Kubzansky LD, Adler N, et al. Prospective change in health-related quality of life and subsequent mortality among middle-aged and older women. American Journal of Public Health 2008 Nov; 98(11):2085-91. *Not eligible target population*
918. Kroenke CH, Rosner B, Chen WY, et al. Functional impact of breast cancer by age at diagnosis. Journal of Clinical Oncology 2004 May 15; 22(10):1849-56. *Not eligible outcomes*
919. Krumholz HM, Parent EM, Tu N, et al. Readmission after hospitalization for congestive heart failure among Medicare beneficiaries. Arch Intern Med 1997 Jan 13; 157(1):99-104. *Not eligible outcomes*
920. Kruse RL, Mehr DR, Boles KE, et al. Does hospitalization impact survival after lower respiratory infection in nursing home residents? Med Care 2004 Sep; 42(9):860-70. *Not eligible outcomes*
921. Ku PW, Fox KR, Chen LJ. Physical activity and depressive symptoms in Taiwanese older adults: a seven-year follow-up study. Preventive medicine 2009 Mar; 48(3):250-5. *Not eligible outcomes*
922. Kubzansky LD, Kawachi I, Sparrow D. Socioeconomic status, hostility, and risk factor clustering in the Normative Aging Study: any help from the concept of allostatic load? Annals of Behavioral Medicine 1999 Fall; 21(4):330-8. *Not eligible outcomes*
923. Kubzansky LD, Koenen KC, Spiro A, 3rd, et al. Prospective study of posttraumatic stress disorder symptoms and coronary heart disease in the Normative Aging Study. Archives of General Psychiatry 2007 Jan; 64(1):109-16. *Not eligible outcomes*
924. Kucharska-Newton AM, Couper DJ, Pankow JS, et al. Hemostasis, inflammation, and fatal and nonfatal coronary heart disease: long-term follow-up of the atherosclerosis risk in communities (ARIC) cohort. Arteriosclerosis, Thrombosis & Vascular Biology 2009 Dec; 29(12):2182-90. *Not eligible outcomes*
925. Kuchel GA. Chapter 51. Aging and Homeostatic Regulation. In: Halter JB, Hazzard W, Ouslander JG, et al., eds. Hazzard's Geriatric Medicine and Gerontology. 6th ed. New York: McGraw-Hill; 2009. *Not eligible outcomes*
926. Kulminski A, Ukraintseva SV, Arbeev KG, et al. Association between APOE epsilon 2/epsilon 3/epsilon 4 polymorphism and disability severity in a national long-term care survey sample. Age

Ageing 2008 May; 37(3):288-93. *Not eligible outcomes*
927. Kulminski A, Yashin A, Ukraintseva S, et al. Accumulation of health disorders as a systemic measure of aging: Findings from the NLTCS data. Mech Ageing Dev 2006 Nov; 127(11):840-8. *Not eligible population*
928. Kunin CM, Douthitt S, Dancing J, et al. The association between the use of urinary catheters and morbidity and mortality among elderly patients in nursing homes. Am J Epidemiol 1992 Feb 1; 135(3):291-301. *Not eligible target population*
929. Kupari M, Lindroos M, Iivanainen AM, et al. Congestive heart failure in old age: prevalence, mechanisms and 4-year prognosis in the Helsinki Ageing Study. J Intern Med 1997 May; 241(5):387-94. *Not eligible outcomes*
930. Kuriacose R, Olive KE, Kuriacose R, et al. Prevalence of vitamin D deficiency and insufficiency in northeast Tennessee. Southern Medical Journal 2008 Sep; 101(9):906-9. *Not eligible outcomes*
931. Kurlowicz LH, Outlaw FH, Ratcliffe SJ, et al. An exploratory study of depression among older African American users of an academic outpatient rehabilitation program. Arch Psychiatr Nurs 2005 Feb; 19(1):3-9. *Not eligibe outcomes*
932. Kurtz ME, Kurtz JC, Given CW, et al. Utilization of services among elderly cancer patients--relationship to age, symptoms, physical functioning, comorbidity, and survival status. Ethn Dis 2005 Spring; 15(2 Suppl 2):S17-22. *Not eligible outcomes*
933. Kutner NG, Ory MG, Baker DI, et al. Measuring the quality of life of the elderly in health promotion intervention clinical trials. Public Health Rep 1992 Sep-Oct; 107(5):530-9. *Not eligible outcomes*
934. Kuzuya M, Kanda S, Koike T, et al. Evaluation of Mini-Nutritional Assessment for Japanese frail elderly. Nutrition 2005 Apr; 21(4):498-503. *Not eligible target population*
935. Lachs MS, Feinstein AR, Cooney LM, Jr., et al. A simple procedure for general screening for functional disability in elderly patients. Ann Intern Med 1990 May 1; 112(9):699-706. *Not eligible outcomes*
936. LaClair RE, Hellman RN, Karp SL, et al. Prevalence of calcidiol deficiency in CKD: a cross-sectional study across latitudes in the United States.[see comment]. American Journal of Kidney Diseases 2005 Jun; 45(6):1026-33. *Not eligible outcomes*
937. Laditka JN, Laditka SB, Eleazer GP, et al. High variation in Alzheimer's disease prevalence among South Carolina counties. J S C Med Assoc 2008 Oct; 104(7):215-8. *Not eligible outcomes*
938. LaFleur J, McBeth C, Gunning K, et al. Prevalence of drug-related problems and cost-savings opportunities in medicaid high utilizers identified by a pharmacist-run drug regimen review center. J Manag Care Pharm 2006 Oct; 12(8):677-85. *Not eligible outcomes*
939. Laforge RG, Mignon SI. Alcohol use and alcohol problems among the elderly. R I Med 1993 Jan; 76(1):21-6. *Not eligible outcomes*
940. Lagergren M, Fratiglioni L, Hallberg IR, et al. A longitudinal study integrating population, care and social services data. The Swedish National study on Aging and Care (SNAC). Aging Clin Exp Res 2004 Apr; 16(2):158-68. *Not eligible outcomes*
941. Lai DW. Measuring depression of elderly Chinese Americans: a replication study. Home Health Care Serv Q 2003; 22(2):69-85. *Not eligible outcomes*
942. Lakey SL, Gray SL, Sales AE, et al. Psychotropic use in community residential care facilities: A prospective cohort study. American Journal Geriatric Pharmacotherapy 2006 Sep; 4(3):227-35. *Not eligible target population*
943. Lally F, Crome P. Understanding frailty. Postgrad Med J 2007 Jan; 83(975):16-20. *Not eligible outcomes*
944. Lamb SE, McCabe C, Becker C, et al. The optimal sequence and selection of screening test items to predict fall risk in older disabled women: the Women's Health and Aging Study. J Gerontol A Biol Sci Med Sci 2008 Oct; 63(10):1082-8. *Not eligible outcomes*
945. Landgraff NC, Whitney SL, Rubinstein EN, et al. Use of the physical performance test to assess preclinical disability in subjects with asymptomatic carotid artery disease. Phys Ther 2006 Apr; 86(4):541-8. *Not eligible outcomes*
946. Landi F, Gambassi G, Lapane KL, et al. Comorbidity and drug use in cognitively impaired elderly living in long-term care. Dement Geriatr Cogn Disord 1998 Nov-Dec; 9(6):347-56. *Not eligible target population*
947. Landi F, Onder G, Cattel C, et al. Functional status and clinical correlates in cognitively impaired community-living older people. J Geriatr Psychiatry Neurol 2001 Spring; 14(1):21-7. *Not eligibe outcomes*
948. Landi F, Russo A, Danese P, et al. Anemia status, hemoglobin concentration, and mortality in nursing home older residents. J Am Med Dir Assoc 2007 Jun; 8(5):322-7. *Not eligible target population*
949. Landrigan CP, Barger LK, Cade BE, et al. Interns' compliance with accreditation council for graduate medical education work-hour limits. JAMA 2006 Sep 6; 296(9):1063-70. *Not eligible outcomes*
950. Lang IA, Guralnik JM, Melzer D. Physical activity in middle-aged adults reduces risks of functional impairment independent of its effect on weight. J Am Geriatr Soc 2007 Nov; 55(11):1836-41. *Not eligible outcomes*
951. Lang PO, Heitz D, Hedelin G, et al. Early markers of prolonged hospital stays in older people: a prospective, multicenter study of 908 inpatients in French acute hospitals. J Am Geriatr Soc 2006 Jul; 54(7):1031-9. *Not eligible target population*
952. Lang W. Frailty selection and HIV. Lancet 1989 Jun 17; 1(8651):1397. *Not eligible outcomes*
953. Langa KM, Plassman BL, Wallace RB, et al. The Aging, Demographics, and Memory Study: study

design and methods. Neuroepidemiology 2005; 25(4):181-91. *Not eligible outcomes*
954. Laniece I, Couturier P, Drame M, et al. Incidence and main factors associated with early unplanned hospital readmission among French medical inpatients aged 75 and over admitted through emergency units. Age Ageing 2008 Jul; 37(4):416-22. *Not eligible outcomes*
955. Lapid MI, Rummans TA. Evaluation and management of geriatric depression in primary care. Mayo Clinic proceedings 2003 Nov; 78(11):1423-9. *Not eligible outcomes*
956. Lappe JM, Davies KM, Travers-Gustafson D, et al. Vitamin D status in a rural postmenopausal female population. Journal of the American College of Nutrition 2006 Oct; 25(5):395-402. *Not eligible exposure*
957. Larsen WI, Yavorek TA, Larsen WI, et al. Pelvic organ prolapse and urinary incontinence in nulliparous women at the United States Military Academy. International Urogynecology Journal 2006 May; 17(3):208-10. *Not eligible outcomes*
958. Larue S, Verreault S, Gould P, et al. A case of familial Creutzfeldt-Jakob disease presenting with dry cough. Canadian Journal of Neurological Sciences 2006 May; 33(2):243-5. *Not eligible outcomes*
959. Lauderdale DS, Cagney KA. Limitations to the use of education as an SES indicator in studies of the elderly. Confounding by cognition. Ann N Y Acad Sci 1999; 896:373-5. *Not eligible outcomes*
960. Lauer MS, Pashkow FJ, Snader CE, et al. Age and referral to coronary angiography after an abnormal treadmill thallium test. American Heart Journal 1997 Feb; 133(2):139-46. *Not eligible outcomes*
961. Laughlin A, Parsons M, Kosloski KD, et al. Predictors of mortality following involuntary interinstitutional relocation. J Gerontol Nurs 2007 Sep; 33(9):20-6; quiz 8-9. *Not eligible target population*
962. Launer LJ, Ross GW, Petrovitch H, et al. Midlife blood pressure and dementia: the Honolulu-Asia aging study. Neurobiology of aging 2000 Jan-Feb; 21(1):49-55. *Not eligible exposure*
963. Laurin D, David Curb J, Masaki KH, et al. Midlife C-reactive protein and risk of cognitive decline: a 31-year follow-up. Neurobiol Aging 2009 Nov; 30(11):1724-7. *Not eligible outcome*
964. Laurin D, Masaki KH, White LR, et al. Ankle-to-brachial index and dementia: the Honolulu-Asia Aging Study. Circulation 2007 Nov 13; 116(20):2269-74. *Not eligible exposure*
965. Lavery LL, Starenchak SM, Flynn WB, et al. The clock drawing test is an independent predictor of incident use of 24-hour care in a retirement community. J Gerontol A Biol Sci Med Sci 2005 Jul; 60(7):928-32. *Not eligible population*
966. Lawhorne L. Depression in the older adult. Primary Care; Clinics in Office Practice 2005 Sep; 32(3):777-92. *Not eligible outcomes*
967. Lawhorne LW, Ouslander JG, Parmelee PA, et al. Urinary incontinence: a neglected geriatric syndrome in nursing facilities. Journal of the American Medical Directors Association 2008 Jan; 9(1):29-35. *Not eligible outcomes*
968. Lawrence HP, Garcia RI, Essick GK, et al. A longitudinal study of the association between tooth loss and age-related hearing loss. Special Care in Dentistry 2001 Jul-Aug; 21(4):129-40. *Not eligible outcomes*
969. Layton D, Pearce GL, Shakir SA. Safety profile of tolterodine as used in general practice in England: results of prescription-event monitoring. Drug Saf 2001; 24(9):703-13. *Not eligible outcomes*
970. LeBrasseur NK, Sayers SP, Ouellette MM, et al. Muscle impairments and behavioral factors mediate functional limitations and disability following stroke. Phys Ther 2006 Oct; 86(10):1342-50. *Not eligible outcomes*
971. Ledikwe JH, Smiciklas-Wright H, Mitchell DC, et al. Nutritional risk assessment and obesity in rural older adults: a sex difference. American Journal of Clinical Nutrition 2003 Mar; 77(3):551-8. *Not eligible outcomes*
972. Ledwidge M, Travers B, Ryder M, et al. Specialist care of heart failure improves appropriate pharmacotherapy at the expense of greater polypharmacy and drug-interactions. Eur J Heart Fail 2004 Mar 1; 6(2):235-43. *Not eligible outcomes*
973. Lee AG, Beaver HA, Jogerst G, et al. Screening elderly patients in an outpatient ophthalmology clinic for dementia, depression, and functional impairment. Ophthalmology 2003 Apr; 110(4):651-7; discussion 7. *Not eligible outcomes*
974. Lee IM, Paffenbarger RS, Jr. Change in body weight and longevity.[see comment]. JAMA 1992 Oct 21; 268(15):2045-9. *Not eligible outcomes*
975. Lee JS, Frongillo EA, Jr. Understanding needs is important for assessing the impact of food assistance program participation on nutritional and health status in U.S. elderly persons. Journal of Nutrition 2001 Mar; 131(3):765-73. *Not eligible outcomes*
976. Lee JS, Kritchevsky SB, Harris TB, et al. Short-term weight changes in community-dwelling older adults: the Health, Aging, and Body Composition Weight Change Substudy. Am J Clin Nutr 2005 Sep; 82(3):644-50. *Not eligible outcomes*
977. Lee JS, Kritchevsky SB, Tylavsky F, et al. Weight change, weight change intention, and the incidence of mobility limitation in well-functioning community-dwelling older adults. J Gerontol A Biol Sci Med Sci 2005 Aug; 60(8):1007-12. *Not eligible exposure*
978. Lee JS, Kritchevsky SB, Tylavsky FA, et al. Weight-loss intention in the well-functioning, community-dwelling elderly: associations with diet quality, physical activity, and weight change. Am J Clin Nutr 2004 Aug; 80(2):466-74. *Not eligible outcomes*
979. Lee KE, Klein BE, Klein R. Changes in refractive error over a 5-year interval in the Beaver Dam Eye Study. Investigative Ophthalmology & Visual Science 1999 Jul; 40(8):1645-9. *Not eligible outcomes*

Appendix B. Excluded Studies

980. Lee KE, Klein BE, Klein R, et al. Changes in refraction over 10 years in an adult population: the Beaver Dam Eye study. Investigative Ophthalmology & Visual Science 2002 Aug; 43(8):2566-71. *Not eligible outcome*
981. Lee ML, Rosner BA, Weiss ST. Relationship of blood pressure to cardiovascular death: the effects of pulse pressure in the elderly. Annals of Epidemiology 1999 Feb; 9(2):101-7. *Not eligible outcomes*
982. Lee PG, Cigolle C, Blaum C. The co-occurrence of chronic diseases and geriatric syndromes: the health and retirement study. Journal of the American Geriatrics Society 2009 Mar; 57(3):511-6. *Not eligible outcomes*
983. Lee PP, Feldman ZW, Ostermann J, et al. Longitudinal prevalence of major eye diseases. Archives of Ophthalmology 2003 Sep; 121(9):1303-10. *Not eligible outcomes*
984. Lee R, Tuljapurkar S. Death and taxes: longer life, consumption, and social security. Demography 1997 Feb; 34(1):67-81. *Not eligible outcomes*
985. Lee W, Eng C, Fox N, et al. PACE: a model for integrated care of frail older patients. Program of All-inclusive Care for the Elderly. Geriatrics 1998 Jun; 53(6):62, 5-6, 9, 73; quiz 4. *Not eligible outcomes*
986. Lee YS. Awareness of blood pressure among older adults: a cross-sectional descriptive study. Int J Nurs Stud 2007 Jul; 44(5):796-804. *Not eligible outcomes*
987. Legrand C, Duchateau L, Janssen P, et al. Validation of prognostic indices using the frailty model. Lifetime Data Anal 2009 Mar; 15(1):59-78. *Not eligible outcomes*
988. Lehtimaki T, Hervonen A, Rontu R, et al. Survival related to plasma C-reactive-protein in nonagenarians is modified by apolipoprotein E genotype. Clinical Chemistry 2007 Feb; 53(2):365-7. *Comment*
989. Leibson CL, Tosteson AN, Gabriel SE, et al. Mortality, disability, and nursing home use for persons with and without hip fracture: a population-based study. J Am Geriatr Soc 2002 Oct; 50(10):1644-50. *Not eligible exposure*
990. Leng S, Chaves P, Koenig K, et al. Serum interleukin-6 and hemoglobin as physiological correlates in the geriatric syndrome of frailty: a pilot study. J Am Geriatr Soc 2002 Jul; 50(7):1268-71. *Not eligible outcomes*
991. Leng SX, Yang H, Walston JD. Decreased cell proliferation and altered cytokine production in frail older adults. Aging Clin Exp Res 2004 Jun; 16(3):249-52. *Not eligible outcomes*
992. Leroi I, Sheppard JM, Lyketsos CG, et al. Cognitive function after 11.5 years of alcohol use: relation to alcohol use.[see comment]. American Journal of Epidemiology 2002 Oct 15; 156(8):747-52. *not eligible outcome*
993. Lethbridge-Cejku M, Tobin JD, Scott WW, Jr., et al. The relationship of age and gender to prevalence and pattern of radiographic changes of osteoarthritis of the knee: data from Caucasian participants in the Baltimore Longitudinal Study of Aging. Aging-Clinical & Experimental Research 1994 Oct; 6(5):353-7. *Not eligible exposure*
994. Leung KK, Tang LY, Chie WC, et al. Mortality trends of elderly people in Taiwan from 1974 to 1994. Age Ageing 1999 Mar; 28(2):199-203. *Not eligible outcomes*
995. Leutz W, Brody KK, Nonnenkamp LL, et al. Selection bias between 2 Medicare capitated benefit programs. Am J Manag Care 2007 Apr; 13(4):201-7. *Not eligible outcomes*
996. Leveille SG, Bean J, Bandeen-Roche K, et al. Musculoskeletal pain and risk for falls in older disabled women living in the community. Journal of the American Geriatrics Society 2002 Apr; 50(4):671-8. *Not eligible outcomes*
997. Leveille SG, Bean J, Ngo L, et al. The pathway from musculoskeletal pain to mobility difficulty in older disabled women. Pain 2007 Mar; 128(1-2):69-77. *Not eligible outcomes*
998. Leveille SG, Guralnik JM, Ferrucci L, et al. Aging successfully until death in old age: opportunities for increasing active life expectancy. American Journal of Epidemiology 1999 Apr 1; 149(7):654-64. *Not eligible outcomes*
999. Leveille SG, Penninx BW, Melzer D, et al. Sex differences in the prevalence of mobility disability in old age: the dynamics of incidence, recovery, and mortality. Journals of Gerontology Series B-Psychological Sciences & Social Sciences 2000 Jan; 55(1):S41-50. *Not eligible outcomes*
1000. Levenson SA, Saffel DA. The consultant pharmacist and the physician in the nursing home: roles, relationships, and a recipe for success. J Am Med Dir Assoc 2007 Jan; 8(1):55-64. *Not eligible target population*
1001. Levy BR, Slade MD, Kunkel SR, et al. Longevity increased by positive self-perceptions of aging. Journal of Personality & Social Psychology 2002 Aug; 83(2):261-70. *Not eligible exposure*
1002. Levy G, Tang MX, Cote LJ, et al. Motor impairment in PD: relationship to incident dementia and age. Neurology 2000 Aug 22; 55(4):539-44. *Not eligible exposure*
1003. Levy WC, Soine LA, Huth MM, et al. Thiamine deficiency in congestive heart failure.[comment]. American Journal of Medicine 1992 Dec; 93(6):705-6. *Not eligible outcomes*
1004. Lewis T. Assessing an older adult for alcohol use disorders. Nursing 2008 Jun; 38(6):60-1. *Not eligible outcomes*
1005. Li C, Friedman B, Conwell Y, et al. Validity of the Patient Health Questionnaire 2 (PHQ-2) in identifying major depression in older people. J Am Geriatr Soc 2007 Apr; 55(4):596-602. *Not eligible outcomes*
1006. Li Y, Healy EW, Drane JW, et al. Comorbidity between and risk factors for severe hearing and memory impairment in older Americans. Prev Med 2006 Nov; 43(5):416-21. *Not eligible outcomes*

Appendix B. Excluded Studies

1007. Liao S, Ferrell BA. Fatigue in an older population. J Am Geriatr Soc 2000 Apr; 48(4):426-30. *Not eligible outcomes*
1008. Lichtenstein MJ, Hazuda HP. Cross-cultural adaptation of the hearing handicap inventory for the Elderly-Screening Version (HHIE-S) for use with Spanish-speaking Mexican Americans. J Am Geriatr Soc 1998 Apr; 46(4):492-8. *Not eligible outcomes*
1009. Lichtman JH, Krumholz HM, Wang Y, et al. Risk and predictors of stroke after myocardial infarction among the elderly: results from the Cooperative Cardiovascular Project.[see comment]. Circulation 2002 Mar 5; 105(9):1082-7. *Not eligible exposure*
1010. Liebson CL, Petterson TM, Bailey KR, et al. Risk factors for venous thromboembolism in nursing home residents. Mayo Clin Proc 2008 Feb; 83(2):151-7. *Not eligible target population*
1011. Lifford KL, Townsend MK, Curhan GC, et al. The epidemiology of urinary incontinence in older women: incidence, progression, and remission. Journal of the American Geriatrics Society 2008 Jul; 56(7):1191-8. *Not eligible outcomes*
1012. Lin MY, Gutierrez PR, Stone KL, et al. Vision impairment and combined vision and hearing impairment predict cognitive and functional decline in older women. Journal of the American Geriatrics Society 2004 Dec; 52(12):1996-2002. *Not eligible outcomes*
1013. Lin WC, Lum TY, Mehr DR, et al. Measuring pain presence and intensity in nursing home residents. J Am Med Dir Assoc 2006 Mar; 7(3):147-53. *Not eligible target population*
1014. Lind BK, Goodwin JL, Hill JG, et al. Recruitment of healthy adults into a study of overnight sleep monitoring in the home: experience of the Sleep Heart Health Study. Sleep & Breathing 2003 Mar; 7(1):13-24. *Not eligible outcomes*
1015. Lindenbaum J, Rosenberg IH, Wilson PW, et al. Prevalence of cobalamin deficiency in the Framingham elderly population.[see comment]. American Journal of Clinical Nutrition 1994 Jul; 60(1):2-11. *Not eligible outcomes*
1016. Lindrooth RC, Hoerger TJ, Norton EC. Expectations among the elderly about nursing home entry. Health Serv Res 2000 Dec; 35(5 Pt 2):1181-202. *Not eligible outcomes*
1017. Lindsay J, Sykes E, McDowell I, et al. More than the epidemiology of Alzheimer's disease: contributions of the Canadian Study of Health and Aging. Can J Psychiatry 2004 Feb; 49(2):83-91. *Review*
1018. Linnebur SA, Vondracek SF, Vande Griend JP, et al. Prevalence of vitamin D insufficiency in elderly ambulatory outpatients in Denver, Colorado. American Journal Geriatric Pharmacotherapy 2007 Mar; 5(1):1-8. *Not eligible outcomes*
1019. Linton A, Garber M, Fagan NK, et al. Examination of multiple medication use among TRICARE beneficiaries aged 65 years and older. J Manag Care Pharm 2007 Mar; 13(2):155-62. *Not eligible outcomes*
1020. Liperoti R, Gambassi G, Lapane KL, et al. Cerebrovascular events among elderly nursing home patients treated with conventional or atypical antipsychotics. J Clin Psychiatry 2005 Sep; 66(9):1090-6. *Not eligible target population*
1021. Lipfert FW, Baty JD, Miller JP, et al. PM2.5 constituents and related air quality variables as predictors of survival in a cohort of U.S. military veterans. Inhalation Toxicology 2006 Aug; 18(9):645-57. *Not eligible exposure*
1022. Litonjua AA, Sparrow D, Guevarra L, et al. Serum interferon-gamma is associated with longitudinal decline in lung function among asthmatic patients: the Normative Aging Study. Annals of Allergy, Asthma, & Immunology 2003 Apr; 90(4):422-8. *Not eligible outcomes*
1023. Littner MR. Snoring in pregnancy. Disease or not?[comment]. Chest 1996 Apr; 109(4):859-61. *Not eligible outcomes*
1024. Liu L, Wolfe RA, Huang X. Shared frailty models for recurrent events and a terminal event. Biometrics 2004 Sep; 60(3):747-56. *Not eligible outcomes*
1025. Lloyd-Jones DM, Larson MG, Leip EP, et al. Lifetime risk for developing congestive heart failure: the Framingham Heart Study. Circulation 2002 Dec 10; 106(24):3068-72. *Not eligible outcomes*
1026. Lo D, Chiu E, Jassal SV. A prospective pilot study to measure changes in functional status associated with hospitalization in elderly dialysis-dependent patients. Am J Kidney Dis 2008 Nov; 52(5):956-61. *Not eligible outcomes*
1027. Loesche WJ, Abrams J, Terpenning MS, et al. Dental findings in geriatric populations with diverse medical backgrounds. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1995 Jul; 80(1):43-54. *Not eligible outcomes*
1028. Long HL, Miller WA. Oral status and well-being of home delivered meal recipients. Gerodontology 1994 Dec; 11(2):115-23. *Not eligible outcomes*
1029. Long JS, Pavalko E. Comparing alternative measures of functional limitation. Med Care 2004 Jan; 42(1):19-27. *Not eligible target population*
1030. Longstreth WT, Jr., Bernick C, Fitzpatrick A, et al. Frequency and predictors of stroke death in 5,888 participants in the Cardiovascular Health Study. Neurology 2001 Feb 13; 56(3):368-75. *Not eligible outcomes*
1031. Lopez L. Improving care for the frail elderly. Healthplan 1996 Sep-Oct; 37(5):38-46. *Not eligible outcomes*
1032. Lopez OL, Jagust WJ, Dulberg C, et al. Risk factors for mild cognitive impairment in the Cardiovascular Health Study Cognition Study: part 2. Archives of Neurology 2003 Oct; 60(10):1394-9. *Not eligible outcomes*
1033. Loukissa D. Under diagnosis of alcohol misuse in the older adult population. British Journal of Nursing 2007 Nov 8-21; 16(20):1254-8. *Review*
1034. Lu SE, Wang MC. Marginal analysis for clustered failure time data. Lifetime Data Anal 2005 Mar; 11(1):61-79. *Not eligible outcomes*

Appendix B. Excluded Studies

1035. Luchi RJ, Taffet GE, Teasdale TA. Congestive heart failure in the elderly. J Am Geriatr Soc 1991 Aug; 39(8):810-25. *Not eligible outcomes*
1036. Luchins DJ, Hanrahan P, Murphy K. Criteria for enrolling dementia patients in hospice. J Am Geriatr Soc 1997 Sep; 45(9):1054-9. *Not eligible outcomes*
1037. Luchsinger JA, Reitz C, Patel B, et al. Relation of diabetes to mild cognitive impairment. Archives of Neurology 2007 Apr; 64(4):570-5. *Not eligible exposure*
1038. Lucicesare A, Hubbard RE, Searle SD, et al. An index of self-rated health deficits in relation to frailty and adverse outcomes in older adults. Aging Clin Exp Res 2009 Nov 17. *Not eligible outcome*
1039. Luck T, Riedel-Heller SG, Kaduszkiewicz H, et al. Mild cognitive impairment in general practice: age-specific prevalence and correlate results from the German study on ageing, cognition and dementia in primary care patients (AgeCoDe). Dement Geriatr Cogn Disord 2007; 24(4):307-16. *Not eligible outcomes*
1040. Lunney JR, Lynn J, Hogan C. Profiles of older medicare decedents. J Am Geriatr Soc 2002 Jun; 50(6):1108-12. *Not eligible outcomes*
1041. Lupon J, Gonzalez B, Santaeugenia S, et al. Prognostic implication of frailty and depressive symptoms in an outpatient population with heart failure. Rev Esp Cardiol 2008 Aug; 61(8):835-42. *Not eligible outcomes*
1042. Lutz BJ, Chumbler NR, Lyles T, et al. Testing a home-telehealth programme for US veterans recovering from stroke and their family caregivers. Disabil Rehabil 2009; 31(5):402-9. *Not elgible target population*
1043. Lyketsos CG, Chen LS, Anthony JC. Cognitive decline in adulthood: an 11.5-year follow-up of the Baltimore Epidemiologic Catchment Area study. Am J Psychiatry 1999 Jan; 156(1):58-65. *Not eligible target population*
1044. Lyketsos CG, Steinberg M, Tschanz JT, et al. Mental and behavioral disturbances in dementia: findings from the Cache County Study on Memory in Aging. Am J Psychiatry 2000 May; 157(5):708-14. *Not eligible outcomes*
1045. Lyles A. The medicare drug benefit, prescribing variations, and drug utilization review. Clin Ther 2004 Jan; 26(1):100-1. *Not eligible outcomes*
1046. Lynch SM, Brown JS, Harmsen KG. The Effect of altering ADL thresholds on active life expectancy estimates for older persons. J Gerontol B Psychol Sci Soc Sci 2003 May; 58(3):S171-8. *Not eligible population*
1047. Lynch SM, George LK, Lynch SM, et al. Interlocking trajectories of loss-related events and depressive symptoms among elders. Journals of Gerontology Series B-Psychological Sciences & Social Sciences 2002 Mar; 57(2):S117-25. *Not eligible outcomes*
1048. Lyyra TM, Tormakangas TM, Read S, et al. Satisfaction with present life predicts survival in octogenarians. J Gerontol B Psychol Sci Soc Sci 2006 Nov; 61(6):P319-26. *Not eligible outcomes*
1049. MacAdam M, Capitman J, Yee D, et al. Case management for frail elders: the Robert Wood Johnson Foundation's Program for Hospital Initiatives in Long-Term Care. Gerontologist 1989 Dec; 29(6):737-44. *Not eligible outcomes*
1050. Mack W, Langholz B, Thomas DC. Survival models for familial aggregation of cancer. Environ Health Perspect 1990 Jul; 87:27-35. *Not eligible outcomes*
1051. Maddens M, Imam K, Ashkar A. Hypertension in the elderly. Primary Care; Clinics in Office Practice 2005 Sep; 32(3):723-53. *Not eligible outcomes*
1052. Madigan EA. A description of adverse events in home healthcare. Home Healthc Nurse 2007 Mar; 25(3):191-7. *Not eligible outcomes*
1053. Maestad O, Norheim OF. Eliciting people's preferences for the distribution of health: A procedure for a more precise estimation of distributional weights. J Health Econ 2009 May; 28(3):570-7. *Not eligible outcomes*
1054. Maffei P, Menegazzo C, Michelotto M, et al. Sudden death due to aortic rupture in acromegaly. Heart Vessels 2008 Jan; 23(1):71-4. *Not eligible outcomes*
1055. Magaziner J, German P, Zimmerman SI, et al. The prevalence of dementia in a statewide sample of new nursing home admissions aged 65 and older: diagnosis by expert panel. Epidemiology of Dementia in Nursing Homes Research Group. Gerontologist 2000 Dec; 40(6):663-72. *Not eligible outcomes*
1056. Maggio M, Cappola AR, Ceda GP, et al. The hormonal pathway to frailty in older men. J Endocrinol Invest 2005; 28(11 Suppl Proceedings):15-9. *Review*
1057. Mahoney JE, Palta M, Johnson J, et al. Temporal association between hospitalization and rate of falls after discharge. Arch Intern Med 2000 Oct 9; 160(18):2788-95. *Not eligible outcomes*
1058. Mahony SO, Blank A, Simpson J, et al. Preliminary report of a palliative care and case management project in an emergency department for chronically ill elderly patients. J Urban Health 2008 May; 85(3):443-51. *Not eligible outcomes*
1059. Maillet JM, Somme D, Hennel E, et al. Frailty after aortic valve replacement (AVR) in octogenarians. Arch Gerontol Geriatr 2009 May-Jun; 48(3):391-6. *Not eligible outcomes*
1060. Mailloux J, Finno M, Rainville J. Long-term exercise adherence in the elderly with chronic low back pain. Am J Phys Med Rehabil 2006 Feb; 85(2):120-6. *Not eligible outcomes*
1061. Malani PN, Rana MM, Banerjee M, et al. Staphylococcus aureus bloodstream infections: the association between age and mortality and functional status. J Am Geriatr Soc 2008 Aug; 56(8):1485-9. *Not eligible exposure*
1062. Mallett V, Burks D, Garely AD, et al. Solifenacin treatment for overactive bladder in black patients: patient-reported symptom bother and health-related quality of life outcomes. Curr Med Res Opin 2007 Apr; 23(4):821-31. *Not eligible outcomes*

1063. Maly RC, Hirsch SH, Reuben DB. The performance of simple instruments in detecting geriatric conditions and selecting community-dwelling older people for geriatric assessment. Age Ageing 1997 May; 26(3):223-31. *Not eligible outcomes*
1064. Mandelblatt JS, Bierman AS, Gold K, et al. Constructs of burden of illness in older patients with breast cancer: a comparison of measurement methods. Health Serv Res 2001 Dec; 36(6 Pt 1):1085-107. *Not eligible outcomes*
1065. Mandelblatt JS, Schechter CB, Yabroff KR, et al. Toward optimal screening strategies for older women. Costs, benefits, and harms of breast cancer screening by age, biology, and health status. J Gen Intern Med 2005 Jun; 20(6):487-96. *Not eligible outcomes*
1066. Manders K, van de Poll-Franse LV, Creemers GJ, et al. Clinical management of women with metastatic breast cancer: a descriptive study according to age group. BMC Cancer 2006; 6:179. *Noto eligible outcomes*
1067. Mangione CM, Marcantonio ER, Goldman L, et al. Influence of age on measurement of health status in patients undergoing elective surgery. J Am Geriatr Soc 1993 Apr; 41(4):377-83. *Not eligible outcomes*
1068. Mangione CM, Phillips RS, Seddon JM, et al. Development of the 'Activities of Daily Vision Scale'. A measure of visual functional status. Med Care 1992 Dec; 30(12):1111-26. *Not eligible outcomes*
1069. Mann WC, Kimble C, Justiss MD, et al. Problems with dressing in the frail elderly. Am J Occup Ther 2005 Jul-Aug; 59(4):398-408. *Not eligible outcomes*
1070. Mant A, King M, Saunders NA, et al. Four-year follow-up of mortality and sleep-related respiratory disturbance in non-demented seniors. Sleep 1995 Jul; 18(6):433-8. *Not eligible outcomes*
1071. Manton KG. Epidemiological, demographic, and social correlates of disability among the elderly. Milbank Q 1989; 67 Suppl 2 Pt 1:13-58. *Not eligible population*
1072. Manton KG. Demographic trends for the aging female population. Journal of the American Medical Womens Association 1997; 52(3):99-105. *Not eligible population*
1073. Manton KG, Gu X. Changes in the prevalence of chronic disability in the United States black and nonblack population above age 65 from 1982 to 1999. Proc Natl Acad Sci U S A 2001 May 22; 98(11):6354-9. *Not eligible population*
1074. Manton KG, Stallard E, Corder LS. The dynamics of dimensions of age-related disability 1982 to 1994 in the U.S. elderly population. Journals of Gerontology Series A-Biological Sciences & Medical Sciences 1998 Jan; 53(1):B59-70. *Not eligible population*
1075. Manton KG, Vaupel JW. Survival after the age of 80 in the United States, Sweden, France, England, and Japan.[see comment]. New England Journal of Medicine 1995 Nov 2; 333(18):1232-5. *Not eligible exposure*
1076. Mar J, Sainz-Ezkerra M, Miranda-Serrano E. Calculation of prevalence with Markov models: budget impact analysis of thrombolysis for stroke. Med Decis Making 2008 Jul-Aug; 28(4):481-90. *Not eligible outcomes*
1077. Maraldi C, Volpato S, Kritchevsky SB, et al. Impact of inflammation on the relationship among alcohol consumption, mortality, and cardiac events: the health, aging, and body composition study.[erratum appears in Arch Intern Med. 2006 Oct 9;166(18):2026]. Archives of Internal Medicine 2006 Jul 24; 166(14):1490-7. *Not eligible exposure*
1078. Maraldi C, Volpato S, Penninx BW, et al. Diabetes mellitus, glycemic control, and incident depressive symptoms among 70- to 79-year-old persons: the health, aging, and body composition study. Archives of Internal Medicine 2007 Jun 11; 167(11):1137-44. *Not eligible exposure*
1079. Marc LG, Raue PJ, Bruce ML. Screening performance of the 15-item geriatric depression scale in a diverse elderly home care population. Am J Geriatr Psychiatry 2008 Nov; 16(11):914-21. *Not eligible outcomes*
1080. Mariani E, Monastero R, Ercolani S, et al. Vascular risk factors in mild cognitive impairment subtypes. Findings from the ReGAl project. Dement Geriatr Cogn Disord 2007; 24(6):448-56. *Not eligible target population*
1081. Marin R, Cyhan T, Miklos W, et al. Sleep disturbance in patients with chronic low back pain. American Journal of Physical Medicine & Rehabilitation 2006 May; 85(5):430-5. *Not eligible outcomes*
1082. Markland AD, Goode PS, Burgio KL, et al. Correlates of urinary, fecal, and dual incontinence in older African-American and white men and women. J Am Geriatr Soc 2008 Feb; 56(2):285-90. *Not eligible outcomes*
1083. Marks R. Physical and psychological correlates of disability among a cohort of individuals with knee osteoarthritis. Can J Aging 2007 Winter; 26(4):367-77. *Not eligible exposure*
1084. Marottoli RA, Berkman LF, Leo-Summers L, et al. Predictors of mortality and institutionalization after hip fracture: the New Haven EPESE cohort. Established Populations for Epidemiologic Studies of the Elderly. Am J Public Health 1994 Nov; 84(11):1807-12. *Not eligible outcomes*
1085. Marottoli RA, de Leon CFM, Glass TA, et al. Consequences of driving cessation: decreased out-of-home activity levels. J Gerontol B Psychol Sci Soc Sci 2000 Nov; 55(6):S334-40. *Not eligible outcomes*
1086. Marshall D, Simpson KN, Earle CC, et al. Potential cost-effectiveness of one-time screening for lung cancer (LC) in a high risk cohort. Lung Cancer 2001 Jun; 32(3):227-36. *Not eligible outcomes*
1087. Marshall TA, Stumbo PJ, Warren JJ, et al. Inadequate nutrient intakes are common and are associated with low diet variety in rural, community-dwelling elderly. Journal of Nutrition 2001 Aug; 131(8):2192-6. *Not eligible outcomes*
1088. Marvel ME, Pratt DS, Marvel LH, et al. Occupational hearing loss in New York dairy

farmers. American Journal of Industrial Medicine 1991; 20(4):517-31. *Not eligible outcomes*
1089. Masaidi M, Cuspidi C, Negri F, et al. Left and right ventricular structural changes in obese hypertensives. Blood pressure 2009; 18(1-2):23-9. *Not eligible outcomes*
1090. Masaki KH, Schatz IJ, Burchfiel CM, et al. Orthostatic hypotension predicts mortality in elderly men: the Honolulu Heart Program. Circulation 1998 Nov 24; 98(21):2290-5. *Not eligible exposure*
1091. Maselko J, Kubzansky L, Kawachi I, et al. Religious service attendance and allostatic load among high-functioning elderly. Psychosom Med 2007 Jun; 69(5):464-72. *Not eligible outcomes*
1092. Mason H, Jones-Lee M, Donaldson C. Modelling the monetary value of a QALY: a new approach based on UK data. Health Econ 2009 Aug; 18(8):933-50. *Not eligible outcomes*
1093. Mast BT. Impact of cognitive impairment on the phenomenology of geriatric depression. Am J Geriatr Psychiatry 2005 Aug; 13(8):694-700. *Not eligible outcomes*
1094. Matheson JK. Sleep disorders in the elderly. Med Health R I 2008 May; 91(5):144-6. *Not eligible outcomes*
1095. Matteini AM, Walston JD, Fallin MD, et al. Markers of B-vitamin deficiency and frailty in older women. Journal of Nutrition, Health & Aging 2008 May; 12(5):303-8. *Not eligible outcomes*
1096. Matthias RE, Atchison KA, Lubben JE, et al. Factors affecting self-ratings of oral health. J Public Health Dent 1995 Fall; 55(4):197-204. *Not eligible outcomes*
1097. Mauk KL. Rooting out hypothyroidism in the elderly. Nursing 2005 Dec; 35(12):65-6. *Not eligible outcomes*
1098. Maurer MS, Cuddihy P, Weisenberg J, et al. The prevalence and impact of anergia (lack of energy) in subjects with heart failure and its associations with actigraphy. Journal of cardiac failure 2009 Mar; 15(2):145-51. *Not eligible outcomes*
1099. May JJ, Marvel M, Regan M, et al. Noise-induced hearing loss in randomly selected New York dairy farmers. American Journal of Industrial Medicine 1990; 18(3):333-7. *Not eligible outcomes*
1100. McAuley P, Pittsley J, Myers J, et al. Fitness and fatness as mortality predictors in healthy older men: the veterans exercise testing study. J Gerontol A Biol Sci Med Sci 2009 Jun; 64(6):695-9. *Not eligible outcomes*
1101. McAvay GJ, Van Ness PH, Bogardus ST, Jr., et al. Older adults discharged from the hospital with delirium: 1-year outcomes. J Am Geriatr Soc 2006 Aug; 54(8):1245-50. *Not eligible outcomes*
1102. McDermott MM, Ferrucci L, Guralnik JM, et al. Elevated levels of inflammation, d-dimer, and homocysteine are associated with adverse calf muscle characteristics and reduced calf strength in peripheral arterial disease. Journal of the American College of Cardiology 2007 Aug 28; 50(9):897-905. *Not eligible population*
1103. McDermott MM, Ferrucci L, Liu K, et al. D-dimer and inflammatory markers as predictors of functional decline in men and women with and without peripheral arterial disease. J Am Geriatr Soc 2005 Oct; 53(10):1688-96. *Not eligible outcome*
1104. McDermott MM, Guralnik JM, Greenland P, et al. Inflammatory and thrombotic blood markers and walking-related disability in men and women with and without peripheral arterial disease. J Am Geriatr Soc 2004 Nov; 52(11):1888-94. *Not eligible target population*
1105. McDonald M, Hertz RP, Unger AN, et al. Prevalence, awareness, and management of hypertension, dyslipidemia, and diabetes among United States adults aged 65 and older. J Gerontol A Biol Sci Med Sci 2009 Feb; 64(2):256-63. *Not eligible outcomes*
1106. McDougall GJ, Balyer J. Decreasing mental frailty in at-risk elders. Geriatr Nurs 1998 Jul-Aug; 19(4):220-4. *Review*
1107. McDougall GJ, Jr., Becker H, Arheart KL. Older adults in the SeniorWISE study at risk for mild cognitive impairment. Arch Psychiatr Nurs 2006 Jun; 20(3):126-34. *Not eligible outcomes*
1108. McDowell BJ, Burgio KL, Dombrowski M, et al. An interdisciplinary approach to the assessment and behavioral treatment of urinary incontinence in geriatric outpatients. J Am Geriatr Soc 1992 Apr; 40(4):370-4. *Not eligible outcomes*
1109. McGarry K, Schoeni RF. Social security, economic growth, and the rise in elderly widows' independence in the twentieth century. Demography 2000 May; 37(2):221-36. *Not eligible outcomes*
1110. McGowan JA, Pottern L. Commentary on the Women's Health Initiative. Maturitas 2000 Feb 15; 34(2):109-12. *Not eligible outcomes*
1111. McGuire LC, Strine TW, Allen RS, et al. The Patient Health Questionnaire 8: current depressive symptoms among U.S. older adults, 2006 Behavioral Risk Factor Surveillance System. American Journal of Geriatric Psychiatry 2009 Apr; 17(4):324-34. *Not eligible outcomes*
1112. McGwin G, Jr., Melton SM, May AK, et al. Long-term survival in the elderly after trauma. J Trauma 2000 Sep; 49(3):470-6. *Not eligible outcomes*
1113. McKenna MJ. Differences in vitamin D status between countries in young adults and the elderly. Am J Med 1992 Jul; 93(1):69-77. *Not eligible outcomes*
1114. McMahan S, Meyer J. Symptom prevalence and worry about high voltage transmission lines. Environmental Research 1995 Aug; 70(2):114-8. *Not eligible outcomes*
1115. McMahon PM, Kong CY, Johnson BE, et al. Estimating long-term effectiveness of lung cancer screening in the Mayo CT screening study. Radiology 2008 Jul; 248(1):278-87. *Not eligible exposure*
1116. McMahon PM, Zaslavsky AM, Weinstein MC, et al. Estimation of mortality rates for disease simulation models using Bayesian evidence synthesis. Med

Decis Making 2006 Sep-Oct; 26(5):497-511. *Not eligible outcomes*

1117. McMichael AJ. Vegetarians and longevity: imagining a wider reference population.[see comment][comment]. Epidemiology 1992 Sep; 3(5):389-91. *Not eligible outcomes*
1118. McMurtray A, Nakamoto B, Shikuma C, et al. Cortical atrophy and white matter hyperintensities in HIV: the Hawaii Aging with HIV Cohort Study. Journal of Stroke & Cerebrovascular Diseases 2008 Jul-Aug; 17(4):212-7. *Not eligible outcomes*
1119. McNamee P, Bond J, Buck D. Costs of dementia in England and Wales in the 21st century. Br J Psychiatry 2001 Sep; 179:261-6. *Not eligible outcomes*
1120. McQuaid JR, Stein MB, Laffaye C, et al. Depression in a primary care clinic: the prevalence and impact of an unrecognized disorder. J Affect Disord 1999 Sep; 55(1):1-10. *Not eligible outcomes*
1121. Mecocci P, von Strauss E, Cherubini A, et al. Cognitive impairment is the major risk factor for development of geriatric syndromes during hospitalization: results from the GIFA study. Dement Geriatr Cogn Disord 2005; 20(4):262-9. *Not eligible outcomes*
1122. Medland ME. The future of elder care. Hosp Top 1998 Fall; 76(4):13-6. *Not eligible outcomes*
1123. Mehta KM, Simonsick EM, Penninx BW, et al. Prevalence and correlates of anxiety symptoms in well-functioning older adults: findings from the health aging and body composition study. J Am Geriatr Soc 2003 Apr; 51(4):499-504. *not eligible outcomes*
1124. Meigs JB, Muller DC, Nathan DM, et al. The natural history of progression from normal glucose tolerance to type 2 diabetes in the Baltimore Longitudinal Study of Aging. Diabetes 2003 Jun; 52(6):1475-84. *Not eligible exposure*
1125. Meldon SW, Emerman CL, Moffa DA, et al. Utility of clinical characteristics in identifying depression in geriatric ED patients. Am J Emerg Med 1999 Oct; 17(6):522-5. *Not eligible outcomes*
1126. Melis RJ, Adang E, Teerenstra S, et al. Cost-effectiveness of a multidisciplinary intervention model for community-dwelling frail older people. Journals of Gerontology Series A-Biological Sciences & Medical Sciences 2008 Mar; 63(3):275-82. *Not eligible outcomes*
1127. Melton PE, Zlojutro M, Kimminau K, et al. Biological aging and Cox hazard analysis of mortality trends in a Mennonite community from south-central Kansas. Am J Hum Biol 2006 May-Jun; 18(3):387-401. *Not eligible outcomes*
1128. Meltzer D, Egleston B, Stoffel D, et al. Effect of future costs on cost-effectiveness of medical interventions among young adults: the example of intensive therapy for type 1 diabetes mellitus. Med Care 2000 Jun; 38(6):679-85. *Not eligible outcomes*
1129. Melzer D, Gardener E, Guralnik JM. Mobility disability in the middle-aged: cross-sectional associations in the English Longitudinal Study of Ageing. Age Ageing 2005 Nov; 34(6):594-602. *Not eligible outcomes*
1130. Melzer D, Izmirlian G, Leveille SG, et al. Educational differences in the prevalence of mobility disability in old age: the dynamics of incidence, mortality, and recovery. J Gerontol B Psychol Sci Soc Sci 2001 Sep; 56(5):S294-301. *Not eligible outcomes*
1131. Melzer D, Lan TY, Tom BD, et al. Variation in thresholds for reporting mobility disability between national population subgroups and studies. J Gerontol A Biol Sci Med Sci 2004 Dec; 59(12):1295-303. *Not eligible outcomes*
1132. Meng L, Maskarinec G, Lee J, et al. Lifestyle factors and chronic diseases: application of a composite risk index. Preventive medicine 1999 Oct; 29(4):296-304. *Not eligible exposure*
1133. Mentes JC. A typology of oral hydration problems exhibited by frail nursing home residents. J Gerontol Nurs 2006 Jan; 32(1):13-9; quiz 20-1. *Not eligible target population*
1134. Menzel P, Gold MR, Nord E, et al. Toward a broader view of values in cost-effectiveness analysis of health. Hastings Cent Rep 1999 May-Jun; 29(3):7-15. *Not eligible outcomes*
1135. Mermelstein R, Miller B, Prohaska T, et al. Health data on older Americans: United States, 1992. Measures of health. Vital Health Stat 3 1993 Jan; (27):9-21. *Not eligible outcomes*
1136. Merritt BK, Fisher AG. Gender differences in the performance of activities of daily living. Arch Phys Med Rehabil 2003 Dec; 84(12):1872-7. *Not eligible population*
1137. Metlay JP, Cohen A, Polsky D, et al. Medication safety in older adults: home-based practice patterns. Journal of the American Geriatrics Society 2005 Jun; 53(6):976-82. *Not eligible outcomes*
1138. Metter EJ, Schrager M, Ferrucci L, et al. Evaluation of movement speed and reaction time as predictors of all-cause mortality in men. Journals of Gerontology Series A-Biological Sciences & Medical Sciences 2005 Jul; 60(7):840-6. *Not eligible outcomes*
1139. Meuser TM, Carr DB, Ulfarsson GF. Motor-vehicle crash history and licensing outcomes for older drivers reported as medically impaired in Missouri. Accid Anal Prev 2009 Mar; 41(2):246-52. *Not eligible outcomes*
1140. Meyer JS, Xu G, Thornby J, et al. Is mild cognitive impairment prodromal for vascular dementia like Alzheimer's disease? Stroke 2002 Aug; 33(8):1981-5. *Not eligible outcomes*
1141. Meyer PM, Powell LH, Wilson RS, et al. A population-based longitudinal study of cognitive functioning in the menopausal transition.[see comment]. Neurology 2003 Sep 23; 61(6):801-6. *Not eligible target population*
1142. Meyer TJ, Eveloff SE, Kline LR, et al. One negative polysomnogram does not exclude obstructive sleep apnea. Chest 1993 Mar; 103(3):756-60. *Not eligible outcomes*

1143. Miceli DG, Strumpf NE, Reinhard SC, et al. Current approaches to postfall assessment in nursing homes. Journal of the American Medical Directors Association 2004 Nov-Dec; 5(6):387-94. *Not eligible target population*
1144. Michael KM, Allen JK, Macko RF. Fatigue after stroke: relationship to mobility, fitness, ambulatory activity, social support, and falls efficacy. Rehabil Nurs 2006 Sep-Oct; 31(5):210-7. *Not eligible outcomes*
1145. Miech RA, Eaton WW, Brennan K, et al. Mental health disparities across education and sex: a prospective analysis examining how they persist over the life course. Journals of Gerontology Series B-Psychological Sciences & Social Sciences 2005 Oct; 60 Spec No 2:93-8. *Not eligible outcomes*
1146. Mielenz T, Jackson E, Currey S, et al. Psychometric properties of the Centers for Disease Control and Prevention Health-Related Quality of Life (CDC HRQOL) items in adults with arthritis. Health Qual Life Outcomes 2006; 4:66. *Not eligible outcomes*
1147. Mielke MM, Rosenberg PB, Tschanz J, et al. Vascular factors predict rate of progression in Alzheimer disease. Neurology 2007 Nov 6; 69(19):1850-8. *Not eligible exposure*
1148. Milanese TR, Hartmann LC, Sellers TA, et al. Age-related lobular involution and risk of breast cancer.[see comment]. Journal of the National Cancer Institute 2006 Nov 15; 98(22):1600-7. *Not eligible outcomes*
1149. Miles TP, Briscoe BT, Kim SH. Age, gender, and impaired clock drawing in the generalist primary care setting. J Ky Med Assoc 2007 Feb; 105(2):59-65. *Not eligible outcomes*
1150. Miles TP, Palmer RF, Espino DV, et al. New-onset incontinence and markers of frailty: data from the Hispanic Established Populations for Epidemiologic Studies of the Elderly. Journals of Gerontology Series A-Biological Sciences & Medical Sciences 2001 Jan; 56(1):M19-24. *Not eligible outcomes*
1151. Milidonis MK, Greene BL. The impact of function on work status for community dwelling disabled persons with arthritis: an analysis of the National Health Interview Survey Disability Supplement. Work 2005; 24(1):71-6. *Not eligible outcomes*
1152. Milisen K, Braes T, Fick DM, et al. Cognitive assessment and differentiating the 3 Ds (dementia, depression, delirium). Nursing Clinics of North America 2006 Mar; 41(1):1-22. *Review*
1153. Miller JW, Garrod MG, Rockwood AL, et al. Measurement of total vitamin B12 and holotranscobalamin, singly and in combination, in screening for metabolic vitamin B12 deficiency. Clinical Chemistry 2006 Feb; 52(2):278-85. *Not eligible outcome*
1154. Miller JW, Green R, Ramos MI, et al. Homocysteine and cognitive function in the Sacramento Area Latino Study on Aging.[see comment]. American Journal of Clinical Nutrition 2003 Sep; 78(3):441-7. *Not eligible exposure*
1155. Miller SW. Evaluating medication regimens in the elderly. Consult Pharm 2008 Jul; 23(7):538-47. *Not eligible outcomes*
1156. Miller T. Increasing longevity and Medicare expenditures. Demography 2001 May; 38(2):215-26. *Not eligible outcomes*
1157. Millis SR, Straube D, Iramaneerat C, et al. Measurement properties of the National Institutes of Health Stroke Scale for people with right- and left-hemisphere lesions: further analysis of the clomethiazole for acute stroke study-ischemic (class-I) trial. Arch Phys Med Rehabil 2007 Mar; 88(3):302-8. *Not eligible target population*
1158. Mitchell AJ, Shiri-Feshki M. Rate of progression of mild cognitive impairment to dementia--meta-analysis of 41 robust inception cohort studies. Acta Psychiatrica Scandinavica 2009 Apr; 119(4):252-65. *Not eligible outcomes*
1159. Mitchell JL, Cruickshanks KJ, Klein BE, et al. Postmenopausal hormone therapy and its association with cognitive impairment. Archives of Internal Medicine 2003 Nov 10; 163(20):2485-90. *Not eligible outcomes*
1160. Mitnitski AB, Mogilner AJ, MacKnight C, et al. The mortality rate as a function of accumulated deficits in a frailty index. Mech Ageing Dev 2002 Sep; 123(11):1457-60. *Secondary data simulation*
1161. Mitnitski AB, Mogilner AJ, Rockwood K. Accumulation of deficits as a proxy measure of aging. ScientificWorldJournal 2001 Aug 8; 1:323-36. *Not eligible outcomes*
1162. Miyake K, Kusunoki M, Shinji Y, et al. Bisphosphonate increases risk of gastroduodenal ulcer in rheumatoid arthritis patients on long-term nonsteroidal antiinflammatory drug therapy. J Gastroenterol 2009; 44(2):113-20. *Not eligible target population*
1163. Mizrahi EH, Fleissig Y, Arad M, et al. The impact of previous strokes on the rehabilitation of elderly patients sustaining a hip fracture. Arch Phys Med Rehabil 2007 Sep; 88(9):1136-9. *Not eligible outcomes*
1164. Moffat SD, Zonderman AB, Metter EJ, et al. Free testosterone and risk for Alzheimer disease in older men.[see comment]. Neurology 2004 Jan 27; 62(2):188-93. *Not eligible exposure*
1165. Moger TA, Aalen OO. A distribution for multivariate frailty based on the compound Poisson distribution with random scale. Lifetime Data Anal 2005 Mar; 11(1):41-59. *Not eligible outcomes*
1166. Mohr BA, Bhasin S, Kupelian V, et al. Testosterone, sex hormone-binding globulin, and frailty in older men. J Am Geriatr Soc 2007 Apr; 55(4):548-55. *Not eligible outcome*
1167. Mohr BA, Bhasin S, Link CL, et al. The effect of changes in adiposity on testosterone levels in older men: longitudinal results from the Massachusetts Male Aging Study. European Journal of Endocrinology 2006 Sep; 155(3):443-52. *Not eligible outcomes*
1168. Mojtabai R, Olfson M. Cognitive deficits and the course of major depression in a cohort of middle-

aged and older community-dwelling adults. J Am Geriatr Soc 2004 Jul; 52(7):1060-9. *Not eligible outcomes*
1169. Molander U, Arvidsson L, Milsom I, et al. A longitudinal cohort study of elderly women with urinary tract infections. Maturitas 2000 Feb 15; 34(2):127-31. *Not eligible outcomes*
1170. Mold JW, Fryer GE, Thomas CH. Who are the uninsured elderly in the United States? J Am Geriatr Soc 2004 Apr; 52(4):601-6. *Not eligible outcomes*
1171. Molony SL. Monitoring medication use in older adults. Am J Nurs 2009 Jan; 109(1):68-78; quiz -9. *Not eligible outcomes*
1172. Monastero R, Palmer K, Qiu C, et al. Heterogeneity in risk factors for cognitive impairment, no dementia: population-based longitudinal study from the Kungsholmen Project. Am J Geriatr Psychiatry 2007 Jan; 15(1):60-9. *Not eligible outcomes*
1173. Monfardini S, Aversa SM, Zoli V, et al. Vinorelbine and prednisone in frail elderly patients with intermediate-high grade non-Hodgkin's lymphomas. Ann Oncol 2005 Aug; 16(8):1352-8. *Not eligible outcomes*
1174. Moore AA, Siu AL. Screening for common problems in ambulatory elderly: clinical confirmation of a screening instrument. Am J Med 1996 Apr; 100(4):438-43. *Not eligible outcomes*
1175. Moore H, Reams SM, Wiesen K, et al. National Kidney Foundation Council on Renal Nutrition survey: past-present clinical practices and future strategic planning. Journal of Renal Nutrition 2003 Jul; 13(3):233-40. *Not eligible target population*
1176. Mor V, Murphy J, Masterson-Allen S, et al. Risk of functional decline among well elders. J Clin Epidemiol 1989; 42(9):895-904. *Not eligible outcomes*
1177. Morey MC, Peterson MJ, Pieper CF, et al. Project LIFE--Learning to Improve Fitness and Function in Elders: methods, design, and baseline characteristics of randomized trial. J Rehabil Res Dev 2008; 45(1):31-42. *Not eligible outcomes*
1178. Moritz DJ, Ostfeld AM, Blazer D, 2nd, et al. The health burden of diabetes for the elderly in four communities. Public Health Rep 1994 Nov-Dec; 109(6):782-90. *Not eligible outcomes*
1179. Morley JEWM-MG. Management of geriatric syndromes : a practical guide. Totowa, N.J. : Humana: Oxford; 2004. *Not eligible outcomes*
1180. Mormino EC, Kluth JT, Madison CM, et al. Episodic memory loss is related to hippocampal-mediated beta-amyloid deposition in elderly subjects. Brain 2009 May; 132(Pt 5):1310-23. *Not eligible outcomes*
1181. Morrato EH, Dodd S, Oderda G, et al. Prevalence, utilization patterns, and predictors of antipsychotic polypharmacy: experience in a multistate Medicaid population, 1998-2003. Clin Ther 2007 Jan; 29(1):183-95. *Not eligible outcomes*
1182. Morris MC, Evans DA, Bienias JL, et al. Dietary folate and vitamin B12 intake and cognitive decline among community-dwelling older persons.[see comment]. Archives of Neurology 2005 Apr; 62(4):641-5. *Not eligible outcomes*
1183. Morris MC, Evans DA, Bienias JL, et al. Dietary fat intake and 6-year cognitive change in an older biracial community population. Neurology 2004 May 11; 62(9):1573-9. *Not eligible outcomes*
1184. Morrison RS, Meier DECC. Geriatric palliative care. New York, N.Y.: Oxford University Press [Internet Resource; Computer File Date of Entry: 20060110]. Available at: http://www.netLibrary.com/urlapi.asp?action=summary&v=1&bookid=146875 *Not eligible outcomes*
1185. Morrison S, Smith G, Morrison S, et al. Monogrammic determinism?[see comment]. Psychosomatic medicine 2005 Sep-Oct; 67(5):820-4. *Not eligible outcomes*
1186. Mosenthal AC, Livingston DH, Lavery RF, et al. The effect of age on functional outcome in mild traumatic brain injury: 6-month report of a prospective multicenter trial. J Trauma 2004 May; 56(5):1042-8. *Not eligible outcomes*
1187. Mosley TH, Jr., Knopman DS, Catellier DJ, et al. Cerebral MRI findings and cognitive functioning: the Atherosclerosis Risk in Communities study.[see comment]. Neurology 2005 Jun 28; 64(12):2056-62. *Not eligible exposure*
1188. Moss KL, Beck JD, Mauriello SM, et al. Risk indicators for third molar caries and periodontal disease in senior adults. J Oral Maxillofac Surg 2007 May; 65(5):958-63. *Not eligible outcomes*
1189. Mossaheb N, Weissgram S, Zehetmayer S, et al. Late-onset depression in elderly subjects from the Vienna Transdanube Aging (VITA) study. Journal of Clinical Psychiatry 2009 Apr; 70(4):500-8. *Not eligible outcomes*
1190. Mosterd A, Hoes AW, de Bruyne MC, et al. Prevalence of heart failure and left ventricular dysfunction in the general population; The Rotterdam Study. Eur Heart J 1999 Mar; 20(6):447-55. *Not eligible outcomes*
1191. Moultry AM, Poon IO. Perceived value of a home-based medication therapy management program for the elderly. Consult Pharm 2008 Nov; 23(11):877-85. *Not eligible outcomes*
1192. Mouton CP, Bazaldua OV, Pierce B, et al. Common infections in older adults. Health Care Food Nutr Focus 2001 Nov; 18(3):1, 3-7. *Not eligible outcomes*
1193. Moye J, Butz SW, Marson DC, et al. A conceptual model and assessment template for capacity evaluation in adult guardianship. Gerontologist 2007 Oct; 47(5):591-603. *Not eligible outcomes*
1194. Moye J, Wood S, Edelstein B, et al. Clinical evidence in guardianship of older adults is inadequate: findings from a tri-state study. Gerontologist 2007 Oct; 47(5):604-12. *Not eligible outcomes*
1195. Mroczek DK, Spiro A, 3rd, Mroczek DK, et al. Personality change influences mortality in older men. Psychological Science 2007 May; 18(5):371-6. *Not eligible outcomes*
1196. Muir SW, Berg K, Chesworth B, et al. Use of the Berg Balance Scale for predicting multiple falls in

community-dwelling elderly people: a prospective study. Phys Ther 2008 Apr; 88(4):449-59. *Not eligible outcomes*

1197. Mukamal KJ, Longstreth WT, Jr., Mittleman MA, et al. Alcohol consumption and subclinical findings on magnetic resonance imaging of the brain in older adults: the cardiovascular health study. Stroke 2001 Sep; 32(9):1939-46. *Not eligible outcomes*
1198. Mulsant BH, Reynolds CF, 3rd, Shear MK, et al. Comorbid anxiety disorders in late-life depression. Anxiety 1996; 2(5):242-7. *Not eligible outcomes*
1199. Muntner P, Garrett E, Klag MJ, et al. Trends in stroke prevalence between 1973 and 1991 in the US population 25 to 74 years of age. Stroke 2002 May; 33(5):1209-13. *Not eligible outcomes*
1200. Murabito JM, Yang Q, Fox CS, et al. Genome-wide linkage analysis to age at natural menopause in a community-based sample: the Framingham Heart Study. Fertility & Sterility 2005 Dec; 84(6):1674-9. *Not eligible outcomes*
1201. Murase T, Ishida H, Kiso M, et al. A facile, regio- and stereo-selective synthesis of ganglioside GM3. Carbohydr Res 1989 Jun 1; 188:71-80. *Not eligible outcome*
1202. Murphy KM, Topel RH. Black-white differences in the economic value of improving health. Perspect Biol Med 2005 Winter; 48(1 Suppl):S176-94. *Not eligible outcomes*
1203. Murray AM, Tupper DE, Knopman DS, et al. Cognitive impairment in hemodialysis patients is common.[see comment][erratum appears in Neurology. 2007 Jul 3;69(1):120]. Neurology 2006 Jul 25; 67(2):216-23. *Not eligible exposure*
1204. Murray MD, Lane KA, Gao S, et al. Preservation of cognitive function with antihypertensive medications: a longitudinal analysis of a community-based sample of African Americans. Archives of Internal Medicine 2002 Oct 14; 162(18):2090-6. *Not eligible outcomes*
1205. Myers SA, Johanning JM, Stergiou N, et al. Claudication distances and the Walking Impairment Questionnaire best describe the ambulatory limitations in patients with symptomatic peripheral arterial disease. J Vasc Surg 2008 Mar; 47(3):550-5. *Not eligible outcomes*
1206. Nahin RL, Pecha M, Welmerink DB, et al. Concomitant use of prescription drugs and dietary supplements in ambulatory elderly people. J Am Geriatr Soc 2009 Jul; 57(7):1197-205. *Not eligible outcome*
1207. Nakanishi N, Tatara K, Shinsho F, et al. Mortality in relation to urinary and faecal incontinence in elderly people living at home. Age Ageing 1999 May; 28(3):301-6. *Not eligible exposure*
1208. Narasimhan K, Rizvi AA, Narasimhan K, et al. Vitamin D levels in patients seen in the diabetes unit of an academic medical center. Southern Medical Journal 2008 Oct; 101(10):1069. *Comment*
1209. Needham BL, Needham BL. Gender differences in trajectories of depressive symptomatology and substance use during the transition from adolescence to young adulthood. Social science & medicine 2007 Sep; 65(6):1166-79. *Not eligible outcomes*
1210. Neeser K, Szucs T, Bulliard JL, et al. Cost-effectiveness analysis of a quality-controlled mammography screening program from the Swiss statutory health-care perspective: quantitative assessment of the most influential factors. Value in Health 2007 Jan-Feb; 10(1):42-53. *Not eligible outcomes*
1211. Nelson DE, Sattin RW, Langlois JA, et al. Alcohol as a risk factor for fall injury events among elderly persons living in the community. J Am Geriatr Soc 1992 Jul; 40(7):658-61. *Not eligible outcomes*
1212. Nelson JE, Tandon N, Mercado AF, et al. Brain dysfunction: another burden for the chronically critically ill. Archives of Internal Medicine 2006 Oct 9; 166(18):1993-9. *Not eligible outcomes*
1213. Ness J, Aronow WS. Prevalence of coexistence of coronary artery disease, ischemic stroke, and peripheral arterial disease in older persons, mean age 80 years, in an academic hospital-based geriatrics practice. J Am Geriatr Soc 1999 Oct; 47(10):1255-6. *Not eligible outcomes*
1214. Ness J, Hoth A, Barnett MJ, et al. Anticholinergic medications in community-dwelling older veterans: prevalence of anticholinergic symptoms, symptom burden, and adverse drug events. American Journal Geriatric Pharmacotherapy 2006 Mar; 4(1):42-51. *Not eligible outcomes*
1215. Neumann PJ, Araki SS, Arcelus A, et al. Measuring Alzheimer's disease progression with transition probabilities: estimates from CERAD. Neurology 2001 Sep 25; 57(6):957-64. *Not eligible outcomes*
1216. Neundorfer MM, McClendon MJ, Smyth KA, et al. A longitudinal study of the relationship between levels of depression among persons with Alzheimer's disease and levels of depression among their family caregivers. J Gerontol B Psychol Sci Soc Sci 2001 Sep; 56(5):P301-13. *Not eligible outcomes*
1217. Newman AB, Enright PL, Manolio TA, et al. Sleep disturbance, psychosocial correlates, and cardiovascular disease in 5201 older adults: the Cardiovascular Health Study. J Am Geriatr Soc 1997 Jan; 45(1):1-7. *Not eligible outcomes*
1218. Newman AB, Foster G, Givelber R, et al. Progression and regression of sleep-disordered breathing with changes in weight: the Sleep Heart Health Study. Archives of Internal Medicine 2005 Nov 14; 165(20):2408-13. *Not eligible outcomes*
1219. Newman AB, Lee JS, Visser M, et al. Weight change and the conservation of lean mass in old age: the Health, Aging and Body Composition Study. Am J Clin Nutr 2005 Oct; 82(4):872-8; quiz 915-6. *Not eligible outcomes*
1220. Newman AB, Nieto FJ, Guidry U, et al. Relation of sleep-disordered breathing to cardiovascular disease risk factors: the Sleep Heart Health Study. American Journal of Epidemiology 2001 Jul 1; 154(1):50-9. *Not eligible outcomes*
1221. Newman AB, Spiekerman CF, Enright P, et al. Daytime sleepiness predicts mortality and

cardiovascular disease in older adults. The Cardiovascular Health Study Research Group.[see comment]. Journal of the American Geriatrics Society 2000 Feb; 48(2):115-23. *Not eligible exposure*

1222. Newmann JP, Klein MH, Jensen JE, et al. Depressive symptom experiences among older women: a comparison of alternative measurement approaches. Psychol Aging 1996 Mar; 11(1):112-26. *Not eligible outcomes*
1223. Ng TP, Niti M, Zaw MH, et al. Depressive symptoms and incident cognitive impairment in cognitively well-functioning older men and women. Journal of the American Geriatrics Society 2009 Jun; 57(6):1058-63. *Not eligible outcomes*
1224. Ng YS, Stein J, Salles SS, et al. Clinical characteristics and rehabilitation outcomes of patients with posterior cerebral artery stroke. Arch Phys Med Rehabil 2005 Nov; 86(11):2138-43. *Not eligible target population*
1225. Nguyen JK, Fouts MM, Kotabe SE, et al. Polypharmacy as a risk factor for adverse drug reactions in geriatric nursing home residents. American Journal Geriatric Pharmacotherapy 2006 Mar; 4(1):36-41. *Not eligible target population*
1226. Nichols CL, Willis LA. The paired RAI/MDS specialist model. Improving outcomes in Veterans Affairs nursing home care units. J Gerontol Nurs 2004 Oct; 30(10):6-11. *Not eligible target population*
1227. Nicolas AS, Faisant C, Nourhashemi F, et al. The nutritional intake of a free-living healthy French population : a four-year follow-up. J Nutr Health Aging 2000; 4(2):77-80. *Not eligible outcomes*
1228. Niv N, Cohen AN, Sullivan G, et al. The MIRECC version of the Global Assessment of Functioning scale: reliability and validity. Psychiatr Serv 2007 Apr; 58(4):529-35. *Not eligible outcomes*
1229. Nondahl DM, Cruickshanks KJ, Dalton DS, et al. The use of hearing protection devices by older adults during recreational noise exposure. Noise & Health 2006 Oct-Dec; 8(33):147-53. *Not eligible outcomes*
1230. Novielli KD, Simpson Z, Hua G, et al. Urinary incontinence in primary care: a comparison of older African-American and Caucasian women. Int Urol Nephrol 2003; 35(3):423-8. *Not eligible outcomes*
1231. Nuotio M, Tammela TL, Luukkaala T, et al. Urgency and urge incontinence in an older population: ten-year changes and their association with mortality. Aging Clin Exp Res 2002 Oct; 14(5):412-9. *Not eligible outcomes*
1232. Nusbaum NJ. Improving elder care by integrating geriatric expertise into medicare: a proposal. Drugs Aging 2005; 22(5):371-4. *Review*
1233. Nusbaum NJ, Cheung VM, Cohen J, et al. Role of first responders in detecting and evaluating elders at risk. Arch Gerontol Geriatr 2006 Nov-Dec; 43(3):361-7. *Not eligible outcomes*
1234. Nusselder WJ, Mackenbach JP. Lack of improvement of life expectancy at advanced ages in The Netherlands. Int J Epidemiol 2000 Feb; 29(1):140-8. *Not eligible outcomes*
1235. Nygaard IE, Lemke JH. Urinary incontinence in rural older women: prevalence, incidence and remission. Journal of the American Geriatrics Society 1996 Sep; 44(9):1049-54. *Not eligible outcomes*
1236. O'Connor GT, Caffo B, Newman AB, et al. Prospective study of sleep-disordered breathing and hypertension: the Sleep Heart Health Study.[see comment]. American Journal of Respiratory & Critical Care Medicine 2009 Jun 15; 179(12):1159-64. *Not eligible outcomes*
1237. O'Donnell BF, Drachman DA, Barnes HJ, et al. Incontinence and troublesome behaviors predict institutionalization in dementia. Journal of Geriatric Psychiatry & Neurology 1992 Jan-Mar; 5(1):45-52. *Not eligible outcomes*
1238. O'Fallon E, Pop-Vicas A, D'Agata E. The emerging threat of multidrug-resistant gram-negative organisms in long-term care facilities. J Gerontol A Biol Sci Med Sci 2009 Jan; 64(1):138-41. *Not eligible target population*
1239. Ohayon MM, Ohayon MM. Severe hot flashes are associated with chronic insomnia. Archives of Internal Medicine 2006 Jun 26; 166(12):1262-8. *Not eligible outcomes*
1240. Ojo F, Al Snih S, Ray LA, et al. History of fractures as predictor of subsequent hip and nonhip fractures among older Mexican Americans. J Natl Med Assoc 2007 Apr; 99(4):412-8. *Not eligible exposure*
1241. Oka RK, Szuba A, Giacomini JC, et al. Predictors of physical function in patients with peripherial arterial disease and claudication. Prog Cardiovasc Nurs 2004 Summer; 19(3):89-94. *Not eligible outcomes*
1242. Okereke OI, Kang JH, Cook NR, et al. Type 2 diabetes mellitus and cognitive decline in two large cohorts of community-dwelling older adults. Journal of the American Geriatrics Society 2008 Jun; 56(6):1028-36. *Not eligible outcomes*
1243. Okereke OI, Pollak MN, Hu FB, et al. Plasma C-peptide levels and rates of cognitive decline in older, community-dwelling women without diabetes. Psychoneuroendocrinology 2008 May; 33(4):455-61. *Not eligible outcomes*
1244. Okumiya K, Matsubayashi K, Wada T, et al. A U-shaped association between home systolic blood pressure and four-year mortality in community-dwelling older men. J Am Geriatr Soc 1999 Dec; 47(12):1415-21. *Not eligible exposure*
1245. Oliver DP, Bickel-Swenson D, Zweig S, et al. Experience with implementation of a quality improvement project for the care of nursing home residents. Journal of Nursing Care Quality 2009 Apr-Jun; 24(2):100-4. *Not eligible target population*
1246. Oliveria SA, Liperoti R, L'Italien G, et al. Adverse events among nursing home residents with Alzheimer's disease and psychosis. Pharmacoepidemiol Drug Saf 2006 Nov; 15(11):763-74. *Not eligible target population*
1247. Ondo WG, Sutton L, Dat Vuong K, et al. Hearing impairment in essential tremor. Neurology 2003 Oct 28; 61(8):1093-7. *Not eligible outcomes*

Appendix B. Excluded Studies

1248. Opotowsky AR, Su BW, Bilezikian JP, et al. Height and lower extremity length as predictors of hip fracture: results of the NHANES I Epidemiologic Follow-up Study. Journal of Bone & Mineral Research 2003 Sep; 18(9):1674-81. *Not eligible outcomes*
1249. Oran B, Giralt S, Saliba R, et al. Allogeneic hematopoietic stem cell transplantation for the treatment of high-risk acute myelogenous leukemia and myelodysplastic syndrome using reduced-intensity conditioning with fludarabine and melphalan. Biol Blood Marrow Transplant 2007 Apr; 13(4):454-62. *Not eligible outcomes*
1250. Ory MG, Schechtman KB, Miller JP, et al. Frailty and injuries in later life: the FICSIT trials. J Am Geriatr Soc 1993 Mar; 41(3):283-96. *Not eligible outcomes*
1251. Ostermann J, Sloan FA. Effects of alcohol consumption on disability among the near elderly: a longitudinal analysis. Milbank Q 2001; 79(4):487-515, iii. *Not eligible outcomes*
1252. Ostir GV, Markides KS, Black SA, et al. Emotional well-being predicts subsequent functional independence and survival. J Am Geriatr Soc 2000 May; 48(5):473-8. *Not eligible outcomes*
1253. Ostir GV, Raji MA, Ottenbacher KJ, et al. Cognitive function and incidence of stroke in older Mexican Americans. Journals of Gerontology Series A-Biological Sciences & Medical Sciences 2003 Jun; 58(6):531-5. *Not eligible outcomes*
1254. Ostir GV, Volpato S, Kasper JD, et al. Summarizing amount of difficulty in ADLs: a refined characterization of disability. Results from the women's health and aging study. Aging (Milano) 2001 Dec; 13(6):465-72. *Not eligible population*
1255. Otiniano ME, Du XL, Ottenbacher K, et al. The effect of diabetes combined with stroke on disability, self-rated health, and mortality in older Mexican Americans: results from the Hispanic EPESE. Arch Phys Med Rehabil 2003 May; 84(5):725-30. *Not eligible outcomes*
1256. Ouellet N, Morris DL. Sleep satisfaction of older adults living in the community: identifying associated behavioral and health factors. J Gerontol Nurs 2006 Oct; 32(10):5-11. *Not eligible outcomes*
1257. Ouslander JG, Simmons S, Schnelle J, et al. Effects of prompted voiding on fecal continence among nursing home residents. Journal of the American Geriatrics Society 1996 Apr; 44(4):424-8. *Not eligible target population*
1258. Overcash JA, Beckstead J. Predicting falls in older patients using components of a comprehensive geriatric assessment. Clin J Oncol Nurs 2008 Dec; 12(6):941-9. *Not eligible outcomes*
1259. Owen CG, Fletcher AE, Donoghue M, et al. How big is the burden of visual loss caused by age related macular degeneration in the United Kingdom? Br J Ophthalmol 2003 Mar; 87(3):312-7. *Not eligible outcomes*
1260. Owens JA, Avidan A, Baldwin D, et al. Improving sleep hygiene.[comment]. Archives of Internal Medicine 2008 Jun 9; 168(11):1229-30; author reply 30. *Not eligible outcomes*
1261. Owens JF, Matthews KA. Sleep disturbance in healthy middle-aged women. Maturitas 1998 Sep 20; 30(1):41-50. *Not eligible outcomes*
1262. Palmer AJ, Valentine WJ, Chen R, et al. A health economic analysis of screening and optimal treatment of nephropathy in patients with type 2 diabetes and hypertension in the USA. Nephrology Dialysis Transplantation 2008 Apr; 23(4):1216-23. *Not eligible outcomes*
1263. Palmer MH, Newman DK. Bladder matters: urinary incontinence in nursing homes. Am J Nurs 2004 Nov; 104(11):57-9. *Not eligible target population*
1264. Palmisano-Mills C. Common problems in hospitalized older adults. J Gerontol Nurs 2007 Jan; 33(1):48-54. *Not eligible target population*
1265. Pan W, Chappell R. A nonparametric estimator of survival functions for arbitrarily truncated and censored data. Lifetime Data Anal 1998; 4(2):187-202. *Not eligible outcomes*
1266. Pan W, Chappell R. Estimation in the cox proportional hazards model with left-truncated and interval-censored data. Biometrics 2002 Mar; 58(1):64-70. *Not eligible outcomes*
1267. Panza F, Capurso C, D'Introno A, et al. Effect of a clinical stroke on the risk of dementia in a prospective cohort.[comment]. Neurology 2007 May 15; 68(20):1748-9; author reply 479. *Not eligible exposure*
1268. Parazzini F, Chiaffarino F, Ricci E. The aging males' symptoms in the Italian population: results from a cross sectional study using the AMS scale. Arch Ital Urol Androl 2006 Sep; 78(3):87-91. *Not eligible outcomes*
1269. Parker AB, Naylor CD, Chong A, et al. Clinical prognosis, pre-existing conditions and the use of reperfusion therapy for patients with ST segment elevation acute myocardial infarction. Can J Cardiol 2006 Feb; 22(2):131-9. *Not eligible exposure*
1270. Parker M, Heiss DW, Harris MJ. Geriatric care management reduces Medicare losses. Healthc Financ Manage 1993 Oct; 47(10):22-4, 6. *Not eligible outcomes*
1271. Parker M, Lee Roff L, Klemmack DL, et al. Religiosity and mental health in southern, community-dwelling older adults. Aging Ment Health 2003 Sep; 7(5):390-7. *Not eligible outcomes*
1272. Parmelee PA, Lawton MP, Katz IR. The structure of depression among elderly institution residents: affective and somatic correlates of physical frailty. J Gerontol A Biol Sci Med Sci 1998 Mar; 53(2):M155-62. *Not eligible outcomes*
1273. Pasternak R, Rosenweig A, Booth B, et al. Morbidity of homebound versus inpatient elderly psychiatric patients. Int Psychogeriatr 1998 Jun; 10(2):117-25. *Not eligible population*
1274. Pathy MSJSA, Morely JE. Principles and practice of geriatric medicine. 2006:2 v. : ill. *Not eligible outcomes*
1275. Patten CA, Choi WS, Gillin JC, et al. Depressive symptoms and cigarette smoking predict

development and persistence of sleep problems in US adolescents. Pediatrics 2000 Aug; 106(2):E23. *Not eligible outcomes*

1276. Paudel ML, Taylor BC, Diem SJ, et al. Association between depressive symptoms and sleep disturbances in community-dwelling older men. J Am Geriatr Soc 2008 Jul; 56(7):1228-35. *Not eligible outcomes*
1277. Paulus AT, van Raak AJ, Maarse HJ. Is integrated nursing home care cheaper than traditional care? A cost comparison. International journal of nursing studies 2008 Dec; 45(12):1764-77. *Not eligible target population*
1278. Pawaskar MD, Anderson RT, Balkrishnan R. Self-reported predictors of depressive symptomatology in an elderly population with type 2 diabetes mellitus: a prospective cohort study. Health Qual Life Outcomes 2007; 5:50. *Not eligible outcomes*
1279. Payette H, Coulombe C, Boutier V, et al. Weight loss and mortality among free-living frail elders: a prospective study. J Gerontol A Biol Sci Med Sci 1999 Sep; 54(9):M440-5. *Not eligible population*
1280. Payne IR. Symptom syndromes among geriatric patients. *Not eligible outcomes*
1281. Payne JL, Sheppard JM, Steinberg M, et al. Incidence, prevalence, and outcomes of depression in residents of a long-term care facility with dementia. Int J Geriatr Psychiatry 2002 Mar; 17(3):247-53. *Not eligible target population*
1282. Pearce JD, Edwards MS, Craven TE, et al. Renal duplex parameters, blood pressure, and renal function in elderly people. American Journal of Kidney Diseases 2005 May; 45(5):842-50. *Not eligible outcomes*
1283. Pearlman RA. Quality of life factors in geriatric medicine decisions. Rockville, Md.: National Center for Health Services Research and Health Care Technology Assessment; 1987. *Not eligible outcomes*
1284. Pearlman RA. Quality of life factors in geriatric medical decisions : [executive summary. [Rockville, Md.?]: U.S. Dept. of Health and Human Services, Public Health Service, National Center for Health Services Research and Health Care Technology Assessment; 1987. *Not eligible outcomes*
1285. Peck CA, Moak MN. Is Medicare risk a feasible strategy for providers? Health Care Strateg Manage 1998 Nov; 16(11):1, 19-23. *Not eligible outcomes*
1286. Peek MK, Coward RT. Gender differences in the risk of developing disability among older adults with arthritis. J Aging Health 1999 May; 11(2):131-50. *Not eligible outcomes*
1287. Peila R, White LR, Petrovich H, et al. Joint effect of the APOE gene and midlife systolic blood pressure on late-life cognitive impairment: the Honolulu-Asia aging study. Stroke 2001 Dec 1; 32(12):2882-9. *Not eligible exposure*
1288. Peila R, Yucesoy B, White LR, et al. A TGF-beta1 polymorphism association with dementia and neuropathologies: the HAAS. Neurobiol Aging 2007 Sep; 28(9):1367-73. *Not eligible outcomes*
1289. Penninx BW, Guralnik JM, Onder G, et al. Anemia and decline in physical performance among older persons. American Journal of Medicine 2003 Aug 1; 115(2):104-10. *Not eligible exposure*
1290. Penninx BW, Leveille S, Ferrucci L, et al. Exploring the effect of depression on physical disability: longitudinal evidence from the established populations for epidemiologic studies of the elderly. Am J Public Health 1999 Sep; 89(9):1346-52. *Not eligible outcomes*
1291. Pennypacker LC, Allen RH, Kelly JP, et al. High prevalence of cobalamin deficiency in elderly outpatients.[see comment]. Journal of the American Geriatrics Society 1992 Dec; 40(12):1197-204. *Not eligible outcomes*
1292. Penrod JD, Litke A, Hawkes WG, et al. Heterogeneity in hip fracture patients: age, functional status, and comorbidity. J Am Geriatr Soc 2007 Mar; 55(3):407-13. *Not eligible outcomes*
1293. Pepersack T. Minimum geriatric screening tools to detect common geriatric problems. J Nutr Health Aging 2008 May; 12(5):348-52. *Not eligible outcomes*
1294. Perera V, Bajorek BV, Matthews S, et al. The impact of frailty on the utilisation of antithrombotic therapy in older patients with atrial fibrillation. Age Ageing 2009 Mar; 38(2):156-62. *Not eligible target population*
1295. Perls T, Kohler IV, Andersen S, et al. Survival of parents and siblings of supercentenarians. Journals of Gerontology Series A-Biological Sciences & Medical Sciences 2007 Sep; 62(9):1028-34. *Not eligible outcomes*
1296. Perperoglou A, le Cessie S, van Houwelingen HC. Reduced-rank hazard regression for modelling non-proportional hazards. Stat Med 2006 Aug 30; 25(16):2831-45. *Not eligible outcomes*
1297. Perperoglou A, van Houwelingen HC, Henderson R. A relaxation of the gamma frailty (Burr) model. Stat Med 2006 Dec 30; 25(24):4253-66. *Not eligible outcomes*
1298. Perri M, 3rd, Menon AM, Deshpande AD, et al. Adverse outcomes associated with inappropriate drug use in nursing homes. Ann Pharmacother 2005 Mar; 39(3):405-11. *Not eligible target population*
1299. Perrin PB, Heesacker M, Hinojosa MS, et al. Identifying at-risk, ethnically diverse stroke caregivers for counseling: a longitudinal study of mental health. Rehabilitation Psychology 2009 May; 54(2):138-49. *Not eligible outcomes*
1300. Perroco TR, Bustamante SE, Moreno Mdel P, et al. Performance of Brazilian long and short IQCODE on the screening of dementia in elderly people with low education. International Psychogeriatrics 2009 Jun; 21(3):531-8. *Not eligible outcomes*
1301. Persson RE, Hollender LG, Powell LV, et al. Assessment of periodontal conditions and systemic disease in older subjects. I. Focus on osteoporosis. J Clin Periodontol 2002 Sep; 29(9):796-802. *Not eligible outcomes*
1302. Persson RE, Hollender LG, Powell VL, et al. Assessment of periodontal conditions and systemic

disease in older subjects. II. Focus on cardiovascular diseases. J Clin Periodontol 2002 Sep; 29(9):803-10. *Not eligible outcomes*

1303. Persson RE, Persson GR, Kiyak HA, et al. Oral health and medical status in dentate low-income older persons. Spec Care Dentist 1998 Mar-Apr; 18(2):70-7. *Not eligible outcomes*
1304. Pertchik K, Shaffer TW, Erdberg P, et al. Rorschach Comprehensive System data for a sample of 52 older adult nonpatients from the United States. J Pers Assess 2007; 89 Suppl 1:S166-73. *Not eligible outcomes*
1305. Peters TG, Charlton RK, Jones KW, et al. Kidney transplantation in the older patient. Journal of the Florida Medical Association 1994 Aug; 81(8):535-8. *Not eligible outcomes*
1306. Petersen JH. An additive frailty model for correlated life times. Biometrics 1998 Jun; 54(2):646-61. *Not eligible outcomes*
1307. Petersen L, Sorensen TI, Nielsen GG, et al. Inference methods for correlated left truncated lifetimes: parent and offspring relations in an adoption study. Lifetime Data Anal 2006 Mar; 12(1):5-20. *Not eligible outcomes*
1308. Petrea RE, Beiser AS, Seshadri S, et al. Gender differences in stroke incidence and poststroke disability in the Framingham heart study. Stroke 2009 Apr; 40(4):1032-7. *Not eligible outcomes*
1309. Petrie MC, Berry C, Stewart S, et al. Failing ageing hearts. Eur Heart J 2001 Nov; 22(21):1978-90. *Not eligible outcomes*
1310. Pfeifer LA, White LR, Ross GW, et al. Cerebral amyloid angiopathy and cognitive function: the HAAS autopsy study.[see comment]. Neurology 2002 Jun 11; 58(11):1629-34. *Not eligible exposure*
1311. Phan HM, Alpert JS, Fain M. Frailty, inflammation, and cardiovascular disease: evidence of a connection. Am J Geriatr Cardiol 2008 Mar-Apr; 17(2):101-7. *Review*
1312. Phelan CH, Heidrich SM, Phelan CH, et al. Patterns of pain and well-being in older women: a 10-year longitudinal study. Journal of Women & Aging 2007; 19(3-4):21-35. *Not eligible outcomes*
1313. Phelan EA, Williams B, Snyder SJ, et al. A five state dissemination of a community-based disability prevention program for older adults. Clin Interv Aging 2006; 1(3):267-74. *Not eligible outcomes*
1314. Phibbs CS, Holty JE, Goldstein MK, et al. The effect of geriatrics evaluation and management on nursing home use and health care costs: results from a randomized trial. Med Care 2006 Jan; 44(1):91-5. *Not eligible outcomes*
1315. Phillips B, Mannino DM, Phillips B, et al. Do insomnia complaints cause hypertension or cardiovascular disease? Journal of Clinical Sleep Medicine 2007 Aug 15; 3(5):489-94. *Not eligible exposure*
1316. Phillips SL, Phillips JV, Branaman-Phillips J, et al. Geriatric versus non-geriatric approach of care to moderate Pra risk senior population. J Am Med Dir Assoc 2005 Nov-Dec; 6(6):396-9. *Not eligible outcomes*
1317. Phoha RL, Dickel MJ, Mosko SS. Preliminary longitudinal assessment of sleep in the elderly. Sleep 1990 Oct; 13(5):425-9. *Not eligible outcomes*
1318. Pickens S, Burnett J, Naik AD, et al. Is pain a significant factor in elder self-neglect? J Elder Abuse Negl 2006; 18(4):51-61. *Not eligible outcomes*
1319. Pierce CA. Program of All-inclusive Care for the Elderly in 2002. Geriatr Nurs 2002 May-Jun; 23(3):173-4. *Comment*
1320. Pilz S, Henry RM, Snijder MB, et al. 25-hydroxyvitamin D is not associated with carotid intima-media thickness in older men and women. Calcified tissue international 2009 May; 84(5):423-4. *Not eligible outcomes*
1321. Pincus T, Keysor J, Sokka T, et al. Patient questionnaires and formal education level as prospective predictors of mortality over 10 years in 97% of 1416 patients with rheumatoid arthritis from 15 United States private practices. Journal of Rheumatology 2004 Feb; 31(2):229-34. *Not eligible exposure*
1322. Pinsky JL, Branch LG, Jette AM, et al. Framingham Disability Study: relationship of disability to cardiovascular risk factors among persons free of diagnosed cardiovascular disease. Am J Epidemiol 1985 Oct; 122(4):644-56. *Not eligible outcomes*
1323. Pinsky JL, Jette AM, Branch LG, et al. The Framingham Disability Study: relationship of various coronary heart disease manifestations to disability in older persons living in the community. Am J Public Health 1990 Nov; 80(11):1363-7. *Duplicate report of 7294262*
1324. Pittock SJ, Mayr WT, McClelland RL, et al. Change in MS-related disability in a population-based cohort: a 10-year follow-up study. Neurology 2004 Jan 13; 62(1):51-9. *Not eligible outcomes*
1325. Pittock SJ, McClelland RL, Mayr WT, et al. Prevalence of tremor in multiple sclerosis and associated disability in the Olmsted County population. Mov Disord 2004 Dec; 19(12):1482-5. *Not eligible outcomes*
1326. Podewils LJ, Guallar E, Beauchamp N, et al. Physical activity and white matter lesion progression: assessment using MRI. Neurology 2007 Apr 10; 68(15):1223-6. *Not eligible outcomes*
1327. Podewils LJ, Lyketsos CG, Podewils LJ, et al. Tricyclic antidepressants and cognitive decline. Psychosomatics 2002 Jan-Feb; 43(1):31-5. *Not eligible outcomes*
1328. Podewils LJ, McLay RN, Rebok GW, et al. Relationship of self-perceptions of memory and worry to objective measures of memory and cognition in the general population. Psychosomatics 2003 Nov-Dec; 44(6):461-70. *Not eligible outcomes*
1329. Polich CL, Parker M. Geriatric care management saves money, improves care. Trustee 1991 Jan; 44(1):18-9. *Not eligible outcomes*
1330. Ponzetto M, Zanocchi M, Maero B, et al. Post-hospitalization mortality in the elderly. Arch Gerontol Geriatr 2003 Jan-Feb; 36(1):83-91. *Not eligible outcomes*

Appendix B. Excluded Studies

1331. Popa MA, Reynolds SL, Small BJ. Is the effect of reported physical activity on disability mediated by cognitive performance in white and african american older adults? J Gerontol B Psychol Sci Soc Sci 2009 Jan; 64(1):4-13. *Not eligible exposure*
1332. Popelka MM, Cruickshanks KJ, Wiley TL, et al. Moderate alcohol consumption and hearing loss: a protective effect. Journal of the American Geriatrics Society 2000 Oct; 48(10):1273-8. *Not eligible outcomes*
1333. Porell FW, Miltiades HB. Access to care and functional status change among aged Medicare beneficiaries. J Gerontol B Psychol Sci Soc Sci 2001 Mar; 56(2):S69-83. *Not eligible outcomes*
1334. Porello PT, Madsen L, Futterman A, et al. Description of a geriatric medical/psychiatry unit in a small community general hospital. J Ment Health Adm 1995 Winter; 22(1):38-48. *Not eligible outcomes*
1335. Porensky EK, Dew MA, Karp JF, et al. The burden of late-life generalized anxiety disorder: effects on disability, health-related quality of life, and healthcare utilization. American Journal of Geriatric Psychiatry 2009 Jun; 17(6):473-82. *Not eligible outcomes*
1336. Porock D, Oliver DP, Zweig S, et al. Predicting death in the nursing home: development and validation of the 6-month Minimum Data Set mortality risk index. Journals of Gerontology Series A-Biological Sciences & Medical Sciences 2005 Apr; 60(4):491-8. *Not eligible target population*
1337. Previtali M, Repetto A, Panigada S, et al. Left ventricular apical ballooning syndrome: prevalence, clinical characteristics and pathogenetic mechanisms in a European population. International journal of cardiology 2009 May 1; 134(1):91-6. *Not eligible outcomes*
1338. Prohaska T, Mermelstein R, Miller B, et al. Health data on older Americans: United States, 1992. Functional status and living arrangements. Vital Health Stat 3 1993 Jan; (27):23-39. *Not eligible outcomes*
1339. Pugh MJ, Palmer RF, Parchman ML, et al. Association of suboptimal prescribing and change in lower extremity physical function over time. Gerontology 2007; 53(6):445-53. *Not eligible outcomes*
1340. Purchase-Helzner EL, Cauley JA, Faulkner KA, et al. Hearing sensitivity and the risk of incident falls and fracture in older women: the study of osteoporotic fractures.[erratum appears in Ann Epidemiol. 2004 Sep;14(8):625]. Annals of Epidemiology 2004 May; 14(5):311-8. *Not eligible outcomes*
1341. Putzke JD, Richards JS, Hicken BL, et al. Interference due to pain following spinal cord injury: important predictors and impact on quality of life. Pain 2002 Dec; 100(3):231-42. *Not eligible outcomes*
1342. Pynsent PB, Carter SR, Bulstrode CJ. The total cost of hip-joint replacement; a model for purchasers. J Public Health Med 1996 Jun; 18(2):157-68. *Not eligible outcomes*
1343. Qu T, Walston JD, Yang H, et al. Upregulated ex vivo expression of stress-responsive inflammatory pathway genes by LPS-challenged CD14(+) monocytes in frail older adults. Mech Ageing Dev 2009 Mar; 130(3):161-6. *Not eligible target population*
1344. Quan SF, O'Connor GT, Quan JS, et al. Association of physical activity with sleep-disordered breathing. Sleep & Breathing 2007 Sep; 11(3):149-57. *Not eligible outcomes*
1345. Quander CR, Morris MC, Melson J, et al. Prevalence of and factors associated with fecal incontinence in a large community study of older individuals. Am J Gastroenterol 2005 Apr; 100(4):905-9. *Not eligible outcomes*
1346. Quigley KK, Hermann JR, Warde WD. Factors associated with Oklahoma Older Americans Act Nutrition Program participants ability to shop, cook, and feed themselves. J Nutr Elder 2005; 25(2):69-82. *Not eligible outcomes*
1347. Quinn ME, Johnson MA, Andress EL, et al. Health characteristics of elderly residents in personal care homes. Dementia, possible early dementia, and no dementia. J Gerontol Nurs 2003 Aug; 29(8):16-23. *Not eligible outcomes*
1348. Rabbitt P, Lunn M, Wong D. Neglect of dropout underestimates effects of death in longitudinal studies. J Gerontol B Psychol Sci Soc Sci 2005 Mar; 60(2):P106-9. *Not eligible outcomes*
1349. Raccio-Robak N, McErlean MA, Fabacher DA, et al. Socioeconomic and health status differences between depressed and nondepressed ED elders. Am J Emerg Med 2002 Mar; 20(2):71-3. *Not eligible outcomes*
1350. Raji MA, Al Snih S, Ray LA, et al. Early mental ability may predict future ability to live independently. Ethn Dis 2004 Winter; 14(1):158-9. *Patient Education Handout*
1351. Rakel RE. Clinical and societal consequences of obstructive sleep apnea and excessive daytime sleepiness. Postgraduate medicine 2009 Jan; 121(1):86-95. *Not eligible outcomes*
1352. Rakowski W, Mor V, Hiris J. The association of self-rated health with two-year mortality in a sample of well elderly. Journal of Aging & Health 1991; 3(4):527-45. *Not eligible exposure*
1353. Rakowski W, Mor V, Hiris J. An investigation of nonresponse to self-assessment of health by older persons. Associations with mortality. J Aging Health 1994 Nov; 6(4):469-88. *Not eligible outcomes*
1354. Ramos MI, Allen LH, Mungas DM, et al. Low folate status is associated with impaired cognitive function and dementia in the Sacramento Area Latino Study on Aging. American Journal of Clinical Nutrition 2005 Dec; 82(6):1346-52. *Not eligible exposure*
1355. Ramulu PY, West SK, Munoz B, et al. Glaucoma and reading speed: the Salisbury Eye Evaluation project. Arch Ophthalmol 2009 Jan; 127(1):82-7. *Not eligible outcomes*

Appendix B. Excluded Studies

1356. Rantanen T, Sakari-Rantala R, Heikkinen E. Muscle strength before and mortality after a bone fracture in older people. Scand J Med Sci Sports 2002 Oct; 12(5):296-300. *Not eligibe exposure*
1357. Rantanen T, Volpato S, Ferrucci L, et al. Handgrip strength and cause-specific and total mortality in older disabled women: exploring the mechanism. J Am Geriatr Soc 2003 May; 51(5):636-41. *Not eligible exposure*
1358. Rantz MJ, Aud MA, Alexander G, et al. Falls, technology, and stunt actors: new approaches to fall detection and fall risk assessment. J Nurs Care Qual 2008 Jul-Sep; 23(3):195-201. *Not eligible outcomes*
1359. Rao SV, Schulman KA, Curtis LH, et al. Socioeconomic status and outcome following acute myocardial infarction in elderly patients. Arch Intern Med 2004 May 24; 164(10):1128-33. *Not eligible exposure*
1360. Rao V, Spiro JR, Samus QM, et al. Sleep disturbances in the elderly residing in assisted living: findings from the Maryland Assisted Living Study. Int J Geriatr Psychiatry 2005 Oct; 20(10):956-66. *Not eligible outcomes*
1361. Rapp SR, Espeland MA, Hogan P, et al. Baseline experience with Modified Mini Mental State Exam: The Women's Health Initiative Memory Study (WHIMS). Aging Ment Health 2003 May; 7(3):217-23. *Not eligible outcomes*
1362. Rasch EK, Hochberg MC, Magder L, et al. Health of community-dwelling adults with mobility limitations in the United States: prevalent health conditions. Part I. Arch Phys Med Rehabil 2008 Feb; 89(2):210-8. *Not eligible outcomes*
1363. Rasu RS, Jayawant SS, Abercrombie M, et al. Treatment of anemia among women with chronic kidney disease in United States outpatient settings. Womens Health Issues 2009 May-Jun; 19(3):211-9. *Not eligible outcomes*
1364. Ratcliffe SJ, Guo W, Ten Have TR. Joint modeling of longitudinal and survival data via a common frailty. Biometrics 2004 Dec; 60(4):892-9. *Not eligible outcomes*
1365. Rathore SS, Hinn AR, Cooper LS, et al. Characterization of incident stroke signs and symptoms: findings from the atherosclerosis risk in communities study. Stroke 2002 Nov; 33(11):2718-21. *Not eligible exposure*
1366. Raz N, Rodrigue KM, Head D, et al. Differential aging of the medial temporal lobe: a study of a five-year change. Neurology 2004 Feb 10; 62(3):433-8. *Not eligible outcomes*
1367. Rehm CG, Ross SE. Elderly drivers involved in road crashes: a profile. American Surgeon 1995 May; 61(5):435-7. *Not eligible outcomes*
1368. Reid KF, Naumova EN, Carabello RJ, et al. Lower extremity muscle mass predicts functional performance in mobility-limited elders. J Nutr Health Aging 2008 Aug-Sep; 12(7):493-8. *Not eligible exposure*
1369. Reisberg B, Ferris SH, Franssen EH, et al. Mortality and temporal course of probable Alzheimer's disease: a 5-year prospective study. Int Psychogeriatr 1996 Summer; 8(2):291-311. *Not eligible population*
1370. Reitz C, Brickman AM, Luchsinger JA, et al. Frequency of subclinical heart disease in elderly persons with dementia. Am J Geriatr Cardiol 2007 May-Jun; 16(3):183-8. *Not eligible outcomes*
1371. Rejeski WJ, Ip EH, Marsh AP, et al. Obesity influences transitional states of disability in older adults with knee pain. Arch Phys Med Rehabil 2008 Nov; 89(11):2102-7. *Not eligible outcomes*
1372. Rejeski WJ, Miller ME, King AC, et al. Predictors of adherence to physical activity in the Lifestyle Interventions and Independence for Elders pilot study (LIFE-P). Clin Interv Aging 2007; 2(3):485-94. *Not eligible outcomes*
1373. Repetto L, Venturino A, Fratino L, et al. Geriatric oncology: a clinical approach to the older patient with cancer. Eur J Cancer 2003 May; 39(7):870-80. *Not eligible outcomes*
1374. Resnick B. Alcohol use in a continuing care retirement community. J Gerontol Nurs 2003 Oct; 29(10):22-9. *Not eligible outcomes*
1375. Resnick B, Perry D, Applebaum G, et al. The impact of alcohol use in community-dwelling older adults. J Community Health Nurs 2003 Fall; 20(3):135-45. *Not eligible outcomes*
1376. Reuben DB, Keeler E, Seeman TE, et al. Identification of risk for high hospital use: cost comparisons of four strategies and performance across subgroups. J Am Geriatr Soc 2003 May; 51(5):615-20. *Not eligible exposure*
1377. Reuben DB, Zwanziger J, Bradley TB, et al. How many physicians will be needed to provide medical care for older persons? Physician manpower needs for the twenty-first century. J Am Geriatr Soc 1993 Apr; 41(4):444-53. *Not eligible outcomes*
1378. Reuser M, Bonneux LG, Willekens FJ. Smoking kills, obesity disables: a multistate approach of the US Health and Retirement Survey. Obesity 2009 Apr; 17(4):783-9. *Not eligible outcomes*
1379. Reyes-Ortiz CA, Kuo YF, DiNuzzo AR, et al. Near vision impairment predicts cognitive decline: data from the Hispanic Established Populations for Epidemiologic Studies of the Elderly. Journal of the American Geriatrics Society 2005 Apr; 53(4):681-6. *Not eligible outcomes*
1380. Reynolds MW, Fredman L, Langenberg P, et al. Weight, weight change, mortality in a random sample of older community-dwelling women.[see comment]. Journal of the American Geriatrics Society 1999 Dec; 47(12):1409-14. *Not eligible outcomes*
1381. Reynolds SL, McIlvane JM. The impact of obesity and arthritis on active life expectancy in older Americans. Obesity 2009 Feb; 17(2):363-9. *Not eligible outcomes*
1382. Rhoades DA, Welty TK, Wang W, et al. Aging and the prevalence of cardiovascular disease risk factors in older American Indians: the Strong Heart Study. Journal of the American Geriatrics Society 2007 Jan; 55(1):87-94. *Not eligible outcomes*

Appendix B. Excluded Studies

1383. Rhoads J, Clayman A, Nelson S. The relationship of urinary tract infections and falls in a nursing home. Director 2007 Winter; 15(1):22-6. *Not eligible target population*
1384. Ricci JA, Stewart WF, Chee E, et al. Pain exacerbation as a major source of lost productive time in US workers with arthritis. Arthritis Rheum 2005 Oct 15; 53(5):673-81. *Not eligible outcomes*
1385. Rice SC, Zonderman AB, Metter EJ, et al. Absence of relation between depressive symptoms and carotid intimal medial thickness in the Baltimore Longitudinal Study of Aging. Psychosomatic medicine 2009 Jan; 71(1):70-6. *Not eligible exposure*
1386. Richard E, Kuiper R, Dijkgraaf MG, et al. Vascular care in patients with Alzheimer's disease with cerebrovascular lesions-a randomized clinical trial. Journal of the American Geriatrics Society 2009 May; 57(5):797-805. *Not eligible outcomes*
1387. Richter HE, Redden DT, Duxbury AS, et al. Pelvic floor surgery in the older woman: enhanced compared with usual preoperative assessment. Obstet Gynecol 2005 Apr; 105(4):800-7. *Not eligible outcomes*
1388. Riekse RG, Leverenz JB, McCormick W, et al. Effect of vascular lesions on cognition in Alzheimer's disease: a community-based study. J Am Geriatr Soc 2004 Sep; 52(9):1442-8. *Not eligible outcomes*
1389. Riggs BL, Melton LJ, Robb RA, et al. A population-based assessment of rates of bone loss at multiple skeletal sites: evidence for substantial trabecular bone loss in young adult women and men. Journal of Bone & Mineral Research 2008 Feb; 23(2):205-14. *Not eligible outcomes*
1390. Riggs JE. Mortality from accidental falls among the elderly in the United States, 1962-1988: demonstrating the impact of improved trauma management. J Trauma 1993 Aug; 35(2):212-9. *Not eligible outcomes*
1391. Ringland C, Mant A, McGettigan P, et al. Uncovering the potential risk of serotonin toxicity in Australian veterans using pharmaceutical claims data. Br J Clin Pharmacol 2008 Nov; 66(5):682-8. *Not eligible outcomes*
1392. Rinkel GJ, Djibuti M, Algra A, et al. Prevalence and risk of rupture of intracranial aneurysms: a systematic review. Stroke 1998 Jan; 29(1):251-6. *Not eligible outcomes*
1393. Ripatti S, Gatz M, Pedersen NL, et al. Three-state frailty model for age at onset of dementia and death in Swedish twins. Genet Epidemiol 2003 Feb; 24(2):139-49. *Not eligible outcomes*
1394. Rivenes AC, Harvey SB, Mykletun A. The relationship between abdominal fat, obesity, and common mental disorders: results from the HUNT study. Journal of psychosomatic research 2009 Apr; 66(4):269-75. *Not eligible outcomes*
1395. Rivera JA, Fried LP, Weiss CO, et al. At the tipping point: predicting severe mobility difficulty in vulnerable older women. J Am Geriatr Soc 2008 Aug; 56(8):1417-23. *Not eligible outcomes*
1396. Robert SA, Cherepanov D, Palta M, et al. Socioeconomic status and age variations in health-related quality of life: results from the national health measurement study. J Gerontol B Psychol Sci Soc Sci 2009 May; 64(3):378-89. *Not eligible outcomes*
1397. Roberts C, Horton AM, Jr. Demographic effects on the Trail Making Test in amphetamine abusers. International Journal of Neuroscience 2001; 110(3-4):181-7. *Not eligible outcomes*
1398. Roberts C, Horton AR, Jr. Demographic effects on the Trail Making Test in sedatives abusers. International Journal of Neuroscience 2001; 110(3-4):189-95. *Not eligible target population*
1399. Roberts RE, Shema SJ, Kaplan GA. Prospective data on sleep complaints and associated risk factors in an older cohort. Psychosomatic medicine 1999 Mar-Apr; 61(2):188-96. *Not eligible outcomes*
1400. Roberts RE, Shema SJ, Kaplan GA, et al. Sleep complaints and depression in an aging cohort: A prospective perspective. American Journal of Psychiatry 2000 Jan; 157(1):81-8. *Not eligible exposure*
1401. Roberts RO, Jacobsen SJ, Rhodes T, et al. Urinary incontinence in a community-based cohort: prevalence and healthcare-seeking. J Am Geriatr Soc 1998 Apr; 46(4):467-72. *Not eligible outcomes*
1402. Rocca WA, Grossardt BR, Geda YE, et al. Long-term risk of depressive and anxiety symptoms after early bilateral oophorectomy.[see comment]. Menopause 2008 Nov-Dec; 15(6):1050-9. *Not eligible outcomes*
1403. Rocca WA, Grossardt BR, Peterson BJ, et al. The Mayo Clinic cohort study of personality and aging: design and sampling, reliability and validity of instruments, and baseline description. Neuroepidemiology 2006; 26(3):119-29. *Not eligible outcomes*
1404. Roccaforte WH, Burke WJ, Bayer BL, et al. Validation of a telephone version of the mini-mental state examination. J Am Geriatr Soc 1992 Jul; 40(7):697-702. *outcomes*
1405. Roccaforte WH, Burke WJ, Bayer BL, et al. Reliability and validity of the Short Portable Mental Status Questionnaire administered by telephone. J Geriatr Psychiatry Neurol 1994 Jan-Mar; 7(1):33-8. *outcomes*
1406. Rochtchina E, Mukesh BN, Wang JJ, et al. Projected prevalence of age-related cataract and cataract surgery in Australia for the years 2001 and 2021: pooled data from two population-based surveys. Clin Experiment Ophthalmol 2003 Jun; 31(3):233-6. *Not eligible outcomes*
1407. Rockwood K. What would make a definition of frailty successful? Age Ageing 2005 Sep; 34(5):432-4. *Comment*
1408. Rockwood K, Abeysundera MJ, Mitnitski A. How should we grade frailty in nursing home patients? J Am Med Dir Assoc 2007 Nov; 8(9):595-603. *Not eligible target population*
1409. Rockwood K, Davis HS, Merry HR, et al. Sleep disturbances and mortality: results from the

Canadian Study of Health and Aging. Journal of the American Geriatrics Society 2001 May; 49(5):639-41. *Not eligible outcomes*

1410. Rockwood K, Mogilner A, Mitnitski A. Changes with age in the distribution of a frailty index. Mech Ageing Dev 2004 Jul; 125(7):517-9. *Not eligible outcomes*
1411. Rockwood K, Nassar B, Mitnitski A. Apolipoprotein E-polymorphism, frailty and mortality in older adults. J Cell Mol Med 2008 Dec; 12(6B):2754-61. *Not eligible exposure*
1412. Rockwood K, Song X, MacKnight C, et al. A global clinical measure of fitness and frailty in elderly people. Canadian Medical Association Journal 2005; 173(5):489-95. *Not eligible outcomes*
1413. Rodriguez A, Muller DC, Engelhardt M, et al. Contribution of impaired glucose tolerance in subjects with the metabolic syndrome: Baltimore Longitudinal Study of Aging. Metabolism: Clinical & Experimental 2005 Apr; 54(4):542-7. *Not eligible exposure*
1414. Roebuck-Spencer TM, Yarboro C, Nowak M, et al. Use of computerized assessment to predict neuropsychological functioning and emotional distress in patients with systemic lupus erythematosus. Arthritis & Rheumatism 2006 Jun 15; 55(3):434-41. *Not eligible outcomes*
1415. Roff LL, Klemmack DL, Simon C, et al. Functional limitations and religious service attendance among African American and white older adults. Health Soc Work 2006 Nov; 31(4):246-55. *Not eligible outcomes*
1416. Rogers A, Rogers RG, Branch LG. A multistate analysis of active life expectancy. Public Health Rep 1989 May-Jun; 104(3):222-6. *Not eligible outcomes*
1417. Rogers MA, Plassman BL, Kabeto M, et al. Parental education and late-life dementia in the United States. Journal of Geriatric Psychiatry & Neurology 2009 Mar; 22(1):71-80. *Not eligible exposure*
1418. Rogers RG, Leeman LM, Migliaccio L, et al. Does the severity of spontaneous genital tract trauma affect postpartum pelvic floor function? International Urogynecology Journal 2008 Mar; 19(3):429-35. *Not eligible outcomes*
1419. Rolfson DB, Majumdar SR, Tsuyuki RT, et al. Validity and reliability of the Edmonton Frail Scale. Age Ageing 2006 Sep; 35(5):526-9. *Not eligible outcomes*
1420. Roman MW, Callen BL. Screening instruments for older adult depressive disorders: updating the evidence-based toolbox. Issues in Mental Health Nursing 2008 Sep; 29(9):924-41. *Review*
1421. Rondeau V, Filleul L, Joly P. Nested frailty models using maximum penalized likelihood estimation. Stat Med 2006 Dec 15; 25(23):4036-52. *Not eligible outcomes*
1422. Rondeau V, Mathoulin-Pelissier S, Jacqmin-Gadda H, et al. Joint frailty models for recurring events and death using maximum penalized likelihood estimation: application on cancer events. Biostatistics 2007 Oct; 8(4):708-21. *Simulation study*
1423. Rondinelli RD, Beller TA. Impairment rating and disability evaluation of the pulmonary system. Phys Med Rehabil Clin N Am 2001 Aug; 12(3):667-79, xi. *Review*
1424. Roos LL, Walld RK, Romano PS, et al. Short-term mortality after repair of hip fracture. Do Manitoba elderly do worse? Med Care 1996 Apr; 34(4):310-26. *Not eligible outcomes*
1425. Rosano C, Brach J, Longstreth Jr WT, et al. Quantitative measures of gait characteristics indicate prevalence of underlying subclinical structural brain abnormalities in high-functioning older adults. Neuroepidemiology 2006; 26(1):52-60. *Not eligible outcomes*
1426. Rose PG, Lappas PT. Analysis of the cost effectiveness of concurrent cisplatin-based chemoradiation in cervical cancer: implications from five randomized trials. Gynecol Oncol 2000 Jul; 78(1):3-6. *Not eligible outcomes*
1427. Rosen J, Mittal V, Degenholtz H, et al. Pressure ulcer prevention in black and white nursing home residents: A QI initiative of enhanced ability, incentives, and management feedback. Adv Skin Wound Care 2006 Jun; 19(5):262-8. *Not eligible target population*
1428. Rosen R, Altwein J, Boyle P, et al. Lower urinary tract symptoms and male sexual dysfunction: the multinational survey of the aging male (MSAM-7). European Urology 2003 Dec; 44(6):637-49. *Not eligible outcomes*
1429. Rosenberg PB, Mielke MM, Samus QM, et al. Transition to nursing home from assisted living is not associated with dementia or dementia-related problem behaviors. J Am Med Dir Assoc 2006 Feb; 7(2):73-8. *Not eligible outcomes*
1430. Rosenblatt A, Mehta KM, Romanoski A, et al. Major depression and cognitive decline after 11.5 years: findings from the ECA study. Journal of Nervous & Mental Disease 2003 Dec; 191(12):827-30. *Not eligible outcomes*
1431. Rosenthal MJ. Analyses of nursing home residents with diabetes at admission.[comment]. Journal of the American Medical Directors Association 2004 Sep-Oct; 5(5):353-5. *Not eligible target population*
1432. Rosero-Bixby L. The exceptionally high life expectancy of Costa Rican nonagenarians. Demography 2008 Aug; 45(3):673-91. *Not eligible outcomes*
1433. Rosero-Bixby L, Dow WH. Surprising SES Gradients in mortality, health, and biomarkers in a Latin American population of adults. J Gerontol B Psychol Sci Soc Sci 2009 Jan; 64(1):105-17. *Not eligible outcomes*
1434. Roush GC, McKay L, Holford TR. A reversal in the long-term increase in deaths attributable to malignant melanoma. Cancer 1992 Apr 1; 69(7):1714-20. *Not eligible outcomes*
1435. Rozario PA, Morrow-Howell N, Proctor E. Comparing the congruency of self-report and provider records of depressed elders' service use by provider type. Med Care 2004 Oct; 42(10):952-9. *Not eligible outcomes*

Appendix B. Excluded Studies

1436. Rozzini R, Frisoni GB, Ferrucci L, et al. Geriatric Index of Comorbidity: validation and comparison with other measures of comorbidity. Age Ageing 2002 Jul; 31(4):277-85. *Not eligible target population*
1437. Rozzini R, Frisoni GB, Franzoni S, et al. Change in functional status during hospitalization in older adults: a geriatric concept of frailty. J Am Geriatr Soc 2000 Aug; 48(8):1024-5. *Comment*
1438. Rozzini R, Sabatini T, Cassinadri A, et al. Relationship between functional loss before hospital admission and mortality in elderly persons with medical illness. J Gerontol A Biol Sci Med Sci 2005 Sep; 60(9):1180-3. *Not eligible outcomes*
1439. Rozzini R, Sabatini T, Frisoni GB, et al. Frailty is a strong modulator of heart failure-associated mortality. Arch Intern Med 2003 Mar 24; 163(6):737-8; author reply 8. *Not eligible outcomes*
1440. Rubenstein LZ, Solomon DH, Roth CP, et al. Detection and management of falls and instability in vulnerable elders by community physicians. J Am Geriatr Soc 2004 Sep; 52(9):1527-31. *Not eligible outcomes*
1441. Rubin CD, Sizemore MT, Loftis PA, et al. The effect of geriatric evaluation and management on Medicare reimbursement in a large public hospital: a randomized clinical trial. J Am Geriatr Soc 1992 Oct; 40(10):989-95. *Not eligible outcomes*
1442. Rubin GS, West SK, Munoz B, et al. A comprehensive assessment of visual impairment in a population of older Americans. The SEE Study. Salisbury Eye Evaluation Project. Investigative Ophthalmology & Visual Science 1997 Mar; 38(3):557-68. *Not eligible outcomes*
1443. Rudberg MA, Furner SE, Dunn JE, et al. The relationship of visual and hearing impairments to disability: an analysis using the longitudinal study of aging. J Gerontol 1993 Nov; 48(6):M261-5. *Not eligible exposure*
1444. Rudman D, Bross D, Mattson DE. Clinical indicators derived from the patient assessment instrument in the long-stay residents of 69 VA nursing homes. J Gen Intern Med 1994 May; 9(5):261-7. *Not eligible target population*
1445. Rudnicka AR, Mt-Isa S, Owen CG, et al. Variations in primary open-angle glaucoma prevalence by age, gender, and race: a Bayesian meta-analysis. Invest Ophthalmol Vis Sci 2006 Oct; 47(10):4254-61. *Not eligible outcomes*
1446. Rudy TE, Weiner DK, Lieber SJ, et al. The impact of chronic low back pain on older adults: a comparative study of patients and controls. Pain 2007 Oct; 131(3):293-301. *Not eligible outcomes*
1447. Ruggiero C, Cherubini A, Guralnik J, et al. The interplay between uric acid and antioxidants in relation to physical function in older persons. J Am Geriatr Soc 2007 Aug; 55(8):1206-15. *Not eligible outcome*
1448. Russell DW, Cutrona CE, de la Mora A, et al. Loneliness and nursing home admission among rural older adults. Psychology & Aging 1997 Dec; 12(4):574-89. *Not eligible exposure*
1449. Ryan EL, Morgello S, Isaacs K, et al. Neuropsychiatric impact of hepatitis C on advanced HIV.[see comment]. Neurology 2004 Mar 23; 62(6):957-62. *Not eligible outcomes*
1450. Rychnovsky J, Hunter LP, Rychnovsky J, et al. The relationship between sleep characteristics and fatigue in healthy postpartum women. Womens Health Issues 2009 Jan-Feb; 19(1):38-44. *Not eligible outcomes*
1451. Ryerson B, Tierney EF, Thompson TJ, et al. Excess physical limitations among adults with diabetes in the U.S. population, 1997-1999. Diabetes Care 2003 Jan; 26(1):206-10. *Not eligible population*
1452. Rywik TM, O'Connor FC, Gittings NS, et al. Role of nondiagnostic exercise-induced ST-segment abnormalities in predicting future coronary events in asymptomatic volunteers. Circulation 2002 Nov 26; 106(22):2787-92. *Not eligible exposure*
1453. Sa Carvalho M, Henderson R, Shimakura S, et al. Survival of hemodialysis patients: modeling differences in risk of dialysis centers. Int J Qual Health Care 2003 Jun; 15(3):189-96. *Not eligible outcomes*
1454. Sackett CS, Schenning S, Sackett CS, et al. The age-related eye disease study: the results of the clinical trial. Insight (American Society of Ophthalmic Registered Nurses) 2002 Jan-Mar; 27(1):5-7. *Not eligible outcomes*
1455. Sackett K, Smith T, D'Angelo L, et al. The Medicare health risk assessment program. Case Manager 2001 May-Jun; 12(3):52-5. *Not eligible outcomes*
1456. Sacks GS, Dearman K, Replogle WH, et al. Use of subjective global assessment to identify nutrition-associated complications and death in geriatric long-term care facility residents. J Am Coll Nutr 2000 Oct; 19(5):570-7. *Not eligible target population*
1457. Saczynski JS, Pfeifer LA, Masaki K, et al. The effect of social engagement on incident dementia: the Honolulu-Asia Aging Study. American Journal of Epidemiology 2006 Mar 1; 163(5):433-40. *Not eligible exposure*
1458. Salvatore S, Serati M, Digesu GA, et al. Efficacy of tolterodine in relation to different urodynamic findings of detrusor overactivity. International Urogynecology Journal 2008 May; 19(5):701-4. *Not eligible outcomes*
1459. Salvi F, Miller MD, Grilli A, et al. A manual of guidelines to score the modified cumulative illness rating scale and its validation in acute hospitalized elderly patients. J Am Geriatr Soc 2008 Oct; 56(10):1926-31. *Not eligible population*
1460. Samus QM, Rosenblatt A, Onyike C, et al. Correlates of caregiver-rated quality of life in assisted living: the Maryland Assisted Living study. J Gerontol B Psychol Sci Soc Sci 2006 Sep; 61(5):P311-4. *Not eligible outcomes*
1461. Sangi-Haghpeykar H, Mozayeni P, Young A, et al. Stress urinary incontinence and counseling and practice of pelvic floor exercises postpartum in low-income Hispanic women.[erratum appears in Int Urogynecol J Pelvic Floor Dysfunct. 2008 Oct;19(10):1459 Note: Sangi-Haphpeykar, Haleh

[corrected to Sangi-Haghpeykar, Haleh]]. International Urogynecology Journal 2008 Mar; 19(3):361-5. *Not eligible outcomes*
1462. Santin M, Trout JM, Fayer R, et al. A longitudinal study of cryptosporidiosis in dairy cattle from birth to 2 years of age. Veterinary Parasitology 2008 Aug 1; 155(1-2):15-23. *Not eligible outcomes*
1463. Santos-Eggimann B, Karmaniola A, Seematter-Bagnoud L, et al. The Lausanne cohort Lc65+: a population-based prospective study of the manifestations, determinants and outcomes of frailty. BMC Geriatr 2008; 8:20. *No associative hypothesis tested*
1464. Sarkisian CA, Liu H, Ensrud KE, et al. Correlates of attributing new disability to old age. Study of Osteoporotic Fractures Research Group. J Am Geriatr Soc 2001 Feb; 49(2):134-41. *Not eligible outcomes*
1465. Satz P, Forney DL, Zaucha K, et al. Depression, cognition, and functional correlates of recovery outcome after traumatic brain injury. Brain Injury 1998 Jul; 12(7):537-53. *Not eligible outcomes*
1466. Saunders R, Friedman B. Oral health conditions of community-dwelling cognitively intact elderly persons with disabilities. Gerodontology 2007 Jun; 24(2):67-76. *Not eligible outcomes*
1467. Savitz SI, Lew R, Bluhmki E, et al. Shift analysis versus dichotomization of the modified Rankin scale outcome scores in the NINDS and ECASS-II trials. Stroke 2007 Dec; 38(12):3205-12. *Not eligible outcomes*
1468. Sawaya GF, Guirguis-Blake J, LeFevre M, et al. Update on the methods of the U.S. Preventive Services Task Force: estimating certainty and magnitude of net benefit. Ann Intern Med 2007 Dec 18; 147(12):871-5. *Not eligible outcomes*
1469. Sayers SP, Jette AM, Haley SM, et al. Validation of the Late-Life Function and Disability Instrument. J Am Geriatr Soc 2004 Sep; 52(9):1554-9. *Not eligible outcomes*
1470. Schantz SL, Gasior DM, Polverejan E, et al. Impairments of memory and learning in older adults exposed to polychlorinated biphenyls via consumption of Great Lakes fish.[see comment]. Environmental Health Perspectives 2001 Jun; 109(6):605-11. *Not eligible exposure*
1471. Schatz IJ, Masaki K, Yano K, et al. Cholesterol and all-cause mortality in elderly people from the Honolulu Heart Program: a cohort study.[see comment]. Lancet 2001 Aug 4; 358(9279):351-5. *Not eligible exposure*
1472. Schaubel DE, Cai J. Analysis of clustered recurrent event data with application to hospitalization rates among renal failure patients. Biostatistics 2005 Jul; 6(3):404-19. *Not eligible exposure*
1473. Scheetz LJ, Zhang J, Kolassa JE. Using crash scene variables to predict the need for trauma center care in older persons. Res Nurs Health 2007 Aug; 30(4):399-412. *Not eligible outcomes*
1474. Scherr PA, LaCroix AZ, Wallace RB, et al. Light to moderate alcohol consumption and mortality in the elderly. J Am Geriatr Soc 1992 Jul; 40(7):651-7. *Not eligible outcomes*
1475. Schmitt J, Di Fabio RP. The validity of prospective and retrospective global change criterion measures. Arch Phys Med Rehabil 2005 Dec; 86(12):2270-6. *Not eligible outcomes*
1476. Schneeweiss S, Setoguchi S, Brookhart MA, et al. Assessing residual confounding of the association between antipsychotic medications and risk of death using survey data. CNS Drugs 2009; 23(2):171-80. *Not eligible outcomes*
1477. Schneider JA, Wilson RS, Cochran EJ, et al. Relation of cerebral infarctions to dementia and cognitive function in older persons. Neurology 2003 Apr 8; 60(7):1082-8. *Not eligible outcomes*
1478. Schnelle JF, Wood S, Schnelle ER, et al. Measurement sensitivity and the Minimum Data Set depression quality indicator. Gerontologist 2001 Jun; 41(3):401-5. *Not eligible target population*
1479. Schonknecht OD, Hunt A, Toro P, et al. Neural correlates of delayed episodic memory in patients with mild cognitive impairment--a FDG PET study. Neurosci Lett 2009 Dec 25; 467(2):100-4. *Not eligible outcomes*
1480. Schooling CM, Lam TH, Li ZB, et al. Obesity, physical activity, and mortality in a prospective chinese elderly cohort. Arch Intern Med 2006 Jul 24; 166(14):1498-504. *Not eligible exposure*
1481. Schootman M, Andresen EM, Wolinsky FD, et al. Neighborhood conditions and risk of incident lower-body functional limitations among middle-aged African Americans. American Journal of Epidemiology 2006 Mar 1; 163(5):450-8. *Not eligible outcomes*
1482. Schraeder C, Britt T, Shelton P. Integrated risk assessment and feedback reporting for clinical decision making in a Medicare Risk plan. J Ambul Care Manage 2000 Oct; 23(4):40-7. *Not eligible outcomes*
1483. Schraeder C, Shelton P, Britt T, et al. Case management in a capitated system: the community nursing organization. J Case Manag 1996 Summer; 5(2):58-64. *Not eligible outcomes*
1484. Schram MT, Euser SM, de Craen AJ, et al. Systemic markers of inflammation and cognitive decline in old age. J Am Geriatr Soc 2007 May; 55(5):708-16. *Not eligible outcomes*
1485. Schroeder SD. Quality focus: Welcome to Medicare exams--a great opportunity for South Dakota seniors. S D Med 2007 May; 60(5):207. *Not eligible outcomes*
1486. Schuler J, Duckelmann C, Beindl W, et al. Polypharmacy and inappropriate prescribing in elderly internal-medicine patients in Austria. Wien Klin Wochenschr 2008; 120(23-24):733-41. *Not eligible target population*
1487. Schulman E, Gairola G, Kuder L, et al. Depression and associated characteristics among community-based elderly people. J Allied Health 2002 Fall; 31(3):140-6. *Not eligible outcomes*
1488. Schulz R, Beach SR, Hebert RS, et al. Spousal suffering and partner's depression and

cardiovascular disease: the Cardiovascular Health Study. American Journal of Geriatric Psychiatry 2009 Mar; 17(3):246-54. *Not eligible outcomes*
1489. Schulz R, Mittelmark M, Kronmal R, et al. Predictors of perceived health status in elderly men and women. The Cardiovascular Health Study. J Aging Health 1994 Nov; 6(4):419-47. *Not eligible outcomes*
1490. Schulz R, Williamson GM. Psychosocial and behavioral dimensions of physical frailty. J Gerontol 1993 Sep; 48 Spec No:39-43. *Review*
1491. Schupf N, Costa R, Luchsinger J, et al. Relationship between plasma lipids and all-cause mortality in nondemented elderly. J Am Geriatr Soc 2005 Feb; 53(2):219-26. *Not eligible exposure*
1492. Schupf N, Costa R, Tang MX, et al. Preservation of cognitive and functional ability as markers of longevity. Neurobiology of aging 2004 Oct; 25(9):1231-40. *Not eligible exposure*
1493. Schwab TC. Social HMOs: lessons learned and future direction. Med Interface 1996 Dec; 9(12):106-10. *Not eligible outcomes*
1494. Schweitzer SO, Atchison KA, Lubben JE, et al. Health promotion and disease prevention for older adults: opportunity for change or preaching to the converted? Am J Prev Med 1994 Jul-Aug; 10(4):223-9. *Not eligible outcomes*
1495. Scott CM, Popovich DJ. Undiagnosed alcoholism & prescription drug misuse among the elderly. Special considerations for home assessment. Caring 2001 Jan; 20(1):20-3; quiz 4-5. *Not eligible outcomes*
1496. Scott LD, Hwang WT, Rogers AE, et al. The impact of multiple care giving roles on fatigue, stress, and work performance among hospital staff nurses. Journal of Nursing Administration 2006 Feb; 36(2):86-95. *Not eligible outcomes*
1497. Scott TE, Mendez MV, LaMorte WW, et al. Are varicose veins a marker for susceptibility to coronary heart disease in men? Results from the Normative Aging Study. Annals of Vascular Surgery 2004 Jul; 18(4):459-64. *Not eligible outcomes*
1498. Searle SD, Mitnitski A, Gahbauer EA, et al. A standard procedure for creating a frailty index. BMC Geriatr 2008; 8:24. *Not eligible outcomes*
1499. Seebacher C, Hillmann E, Roitzsch E, et al. [Yersinia enterocolitica as an aetiological factor of erythema nodosum and erythema exsudativum multiforme (author's transl)]. Dermatol Monatsschr 1978 Nov; 164(11):779-85. *Not eligible outcomes*
1500. Seeman I. Sampler of findings from the 1986 national mortality followback survey on risk factors, disability, and health care. Public Health Reports 1992 Nov-Dec; 107(6):707-12. *Not eligible outcomes*
1501. Seeman TE, Charpentier PA, Berkman LF, et al. Predicting changes in physical performance in a high-functioning elderly cohort: MacArthur studies of successful aging. J Gerontol 1994 May; 49(3):M97-108. *Not eligible outcomes*
1502. Seeman TE, Huang MH, Bretsky P, et al. Education and APOE-e4 in longitudinal cognitive decline: MacArthur Studies of Successful Aging. J Gerontol B Psychol Sci Soc Sci 2005 Mar; 60(2):P74-83. *Not eligible outcomes*
1503. Seeman TE, McEwen BS, Singer BH, et al. Increase in urinary cortisol excretion and memory declines: MacArthur studies of successful aging. Journal of Clinical Endocrinology & Metabolism 1997 Aug; 82(8):2458-65. *Not eligible outcomes*
1504. Seeman TE, Singer BH, Rowe JW, et al. Price of adaptation--allostatic load and its health consequences. MacArthur studies of successful aging. Arch Intern Med 1997 Oct 27; 157(19):2259-68. *Not eligible outcomes*
1505. Seeman TE, Singer BH, Ryff CD, et al. Social relationships, gender, and allostatic load across two age cohorts. Psychosom Med 2002 May-Jun; 64(3):395-406. *Not eligible outcomes*
1506. Sehl ME. Senescence, frailty and mortality: mathematical models of aging. Med Health R I 2001 Nov; 84(11):360-4. *Not eligible outcomes*
1507. Sellars C, Bowie L, Bagg J, et al. Risk factors for chest infection in acute stroke: a prospective cohort study. Stroke 2007 Aug; 38(8):2284-91. *Not eligible outcomes*
1508. Selmer R, Halvorsen S, Myhre KI, et al. Cost-effectiveness of primary percutaneous coronary intervention versus thrombolytic therapy for acute myocardial infarction. Scand Cardiovasc J 2005 Oct; 39(5):276-85. *Not eligible target population*
1509. Selnes OA, Grega MA, Bailey MM, et al. Cognition 6 years after surgical or medical therapy for coronary artery disease. Annals of Neurology 2008 May; 63(5):581-90. *Not eligible outcomes*
1510. Semba RD, Bandinelli S, Sun K, et al. Plasma carboxymethyl-lysine, an advanced glycation end product, and all-cause and cardiovascular disease mortality in older community-dwelling adults. J Am Geriatr Soc 2009 Oct; 57(10):1874-80. *Not eligible exposure*
1511. Semba RD, Bartali B, Zhou J, et al. Low serum micronutrient concentrations predict frailty among older women living in the community. Journals of Gerontology Series A-Biological Sciences & Medical Sciences 2006 Jun; 61(6):594-9. *Not eligible exposure*
1512. Semba RD, Blaum CS, Bartali B, et al. Denture use, malnutrition, frailty, and mortality among older women living in the community. J Nutr Health Aging 2006 Mar-Apr; 10(2):161-7. *Not eligible outcomes*
1513. Semba RD, Ferrucci L, Sun K, et al. Oxidative stress is associated with greater mortality in older women living in the community. Journal of the American Geriatrics Society 2007 Sep; 55(9):1421-5. *Not eligible outcomes*
1514. Semba RD, Margolick JB, Leng S, et al. T cell subsets and mortality in older community-dwelling women. Exp Gerontol 2005 Jan-Feb; 40(1-2):81-7. *Not eligible outcomes*
1515. Semba RD, Patel KV, Sun K, et al. Association between serum carboxymethyl-lysine, a dominant advanced glycation end product, and anemia in adults: the Baltimore longitudinal study of aging.

Journal of the American Geriatrics Society 2008 Nov; 56(11):2145-7. *Not eligible exposure*
1516. Semke J, Jensen J. High utilization of inpatient psychiatric services by older adults. Psychiatric Services 1997 Feb; 48(2):172-4. *Not eligible outcomes*
1517. Senni M, Tribouilloy CM, Rodeheffer RJ, et al. Congestive heart failure in the community: a study of all incident cases in Olmsted County, Minnesota, in 1991. Circulation 1998 Nov 24; 98(21):2282-9. *Not eligible outcomes*
1518. Senni M, Tribouilloy CM, Rodeheffer RJ, et al. Congestive heart failure in the community: trends in incidence and survival in a 10-year period. Arch Intern Med 1999 Jan 11; 159(1):29-34. *Not eligible outcomes*
1519. Seripa D, Forno GD, Matera MG, et al. Methylenetetrahydrofolate reductase and angiotensin converting enzyme gene polymorphisms in two genetically and diagnostically distinct cohort of Alzheimer patients. Neurobiology of aging 2003 Nov; 24(7):933-9. *Not eligible exposure*
1520. Service PM, Ochoa R, Valenzuela R, et al. Cohort size and maximum likelihood estimation of mortality parameters. Exp Gerontol 1998 Jun; 33(4):331-42. *Not eligible outcomes*
1521. Seshamani M, Gray A. Time to death and health expenditure: an improved model for the impact of demographic change on health care costs. Age Ageing 2004 Nov; 33(6):556-61. *Not eligible outcomes*
1522. Setiati S. Comprehensive geriatric assessment: important tool in evaluating health care problems in geriatric patient. Acta Med Indones 2008 Jan; 40(1):1-2. *Not eligible outcomes*
1523. Seton M, Jackson V, Lasser KE, et al. Low 25-hydroxyvitamin D and osteopenia are prevalent in persons > or =55 yr with fracture at any site: a prospective, observational study of persons fracturing in the community. Journal of Clinical Densitometry 2005; 8(4):454-60. *Not eligible outcomes*
1524. Shahar E, Redline S, Young T, et al. Hormone replacement therapy and sleep-disordered breathing.[see comment]. American Journal of Respiratory & Critical Care Medicine 2003 May 1; 167(9):1186-92. *Not eligible outcomes*
1525. Shamliyan T, Wyman J, Bliss DZ, et al. Prevention of urinary and fecal incontinence in adults. Evid Rep Technol Assess (Full Rep) 2007 Dec; (161):1-379. *Not eligible outcomes*
1526. Shardell M, Hicks GE, Miller RR, et al. Association of low vitamin D levels with the frailty syndrome in men and women. J Gerontol A Biol Sci Med Sci 2009 Jan; 64(1):69-75. *Not eligible outcomes*
1527. Sharkey JR. Variation in nutritional risk among Mexican American and non-Mexican American homebound elders who receive home-delivered meals. J Nutr Elder 2004; 23(4):1-19. *Not eligible target population*
1528. Sharp DS, Burchfiel CM, Curb JD, et al. The synergy of low lung function and low body mass index predicting all-cause mortality among older Japanese-American men. J Am Geriatr Soc 1997 Dec; 45(12):1464-71. *Not eligible outcomes*
1529. Shea D. Use of the electronic record in the home-based primary care programs of the Department of Veterans Affairs Health Care System. Home Healthc Nurse 2007 May; 25(5):323-6. *Not eligible outcomes*
1530. Shearer J. Improving oral medication management in home health agencies. Home Healthc Nurse 2009 Mar; 27(3):184-92. *Not eligible outcomes*
1531. Sheehan TJ, DeChello LM, Garcia R, et al. Measuring disability: application of the Rasch model to activities of daily living (ADL/IADL). J Outcome Meas 2000; 4(3):681-705. *Not eligible outcomes*
1532. Sheffield KM, Peek MK, Sheffield KM, et al. Neighborhood context and cognitive decline in older Mexican Americans: results from the Hispanic Established Populations for Epidemiologic Studies of the Elderly. American Journal of Epidemiology 2009 May 1; 169(9):1092-101. *Not eligible outcomes*
1533. Shemesh AA, Kohn R, Radomislensky I, et al. Emotional distress and other health-related dimensions among elderly survivors of the Shoa living in the community. Israel Journal of Psychiatry & Related Sciences 2008; 45(4):230-8. *Not eligible outcomes*
1534. Sherman FT. Medication nonadherence: a national epidemic among America's seniors. Geriatrics 2007 Apr; 62(4):5-6. *Not eligible outcomes*
1535. Sherman SE, D'Agostino RB, Cobb JL, et al. Does exercise reduce mortality rates in the elderly? Experience from the Framingham Heart Study. American Heart Journal 1994 Nov; 128(5):965-72. *Not eligible outcomes*
1536. Sherman SE, D'Agostino RB, Cobb JL, et al. Physical activity and mortality in women in the Framingham Heart Study. American Heart Journal 1994 Nov; 128(5):879-84. *Not eligible outcomes*
1537. Sherrill DL, Lebowitz MD, Knudson RJ, et al. Longitudinal methods for describing the relationship between pulmonary function, respiratory symptoms and smoking in elderly subjects: the Tucson Study.[see comment]. European Respiratory Journal 1993 Mar; 6(3):342-8. *Not eligible outcomes*
1538. Shih JH, Louis TA. Assessing gamma frailty models for clustered failure time data. Lifetime Data Anal 1995; 1(2):205-20. *Not eligible outcomes*
1539. Shin KR, Jung D, Jo I, et al. Depression among community-dwelling older adults in Korea: a prediction model of depression. Archives of Psychiatric Nursing 2009 Feb; 23(1):50-7. *Not eligible outcomes*
1540. Ship JA, Beck JD. Ten-year longitudinal study of periodontal attachment loss in healthy adults. Oral Surgery Oral Medicine Oral Pathology Oral Radiology & Endodontics 1996 Mar; 81(3):281-90. *Not eligible exposure*
1541. Shippy RA, Karpiak SE. The aging HIV/AIDS population: fragile social networks. Aging & Mental Health 2005 May; 9(3):246-54. *Not eligible outcomes*

Appendix B. Excluded Studies

1542. Short PF, Vasey JJ, Belue R. Work disability associated with cancer survivorship and other chronic conditions. Psychooncology 2008 Jan; 17(1):91-7. *Not eligible outcomes*
1543. Shum NC, Hui WW, Chu FC, et al. Prevalence of malnutrition and risk factors in geriatric patients of a convalescent and rehabilitation hospital. Hong Kong Med J 2005 Aug; 11(4):234-42. *Not eligible target population*
1544. Shumaker SA, Wyman JF, Uebersax JS, et al. Health-related quality of life measures for women with urinary incontinence: the Incontinence Impact Questionnaire and the Urogenital Distress Inventory. Continence Program in Women (CPW) Research Group. Qual Life Res 1994 Oct; 3(5):291-306. *Not eligible outcomes*
1545. Siddiqui A, Pena Sahdala HN, Nazario HE, et al. Obesity is associated with an increased prevalence of advanced adenomatous colon polyps in a male veteran population. Digestive Diseases & Sciences 2009 Jul; 54(7):1560-4. *Not eligible outcomes*
1546. Siem CA, Wipke-Tevis DD, Rantz MJ, et al. Skin assessment and pressure ulcer care in hospital-based skilled nursing facilities. Ostomy Wound Manage 2003 Jun; 49(6):42-4, 6, 8 passim, contd. *Not eligible target population*
1547. Sigurdson AJ, Hauptmann M, Alexander BH, et al. DNA damage among thyroid cancer and multiple cancer cases, controls, and long-lived individuals. Mutation Research 2005 Oct 3; 586(2):173-88. *Not eligible outcomes*
1548. Silverberg SJ, Shane E, Dempster DW, et al. The effects of vitamin D insufficiency in patients with primary hyperparathyroidism. American Journal of Medicine 1999 Dec; 107(6):561-7. *Not eligible outcomes*
1549. Simon SE, Bergmann MA, Jones RN, et al. Reliability of a structured assessment for nonclinicians to detect delirium among new admissions to postacute care. J Am Med Dir Assoc 2006 Sep; 7(7):412-5. *Not eligible target population*
1550. Sims RV, McGwin G, Jr., Allman RM, et al. Exploratory study of incident vehicle crashes among older drivers. J Gerontol A Biol Sci Med Sci 2000 Jan; 55(1):M22-7. *Not eligible outcomes*
1551. Sivakova D, Lajdova A, Basistova Z, et al. ACE insertion/deletion polymorphism and its relationships to the components of metabolic syndrome in elderly Slovaks. Anthropologischer Anzeiger 2009 Mar; 67(1):1-11. *Not eligible outcomes*
1552. Skarupski KA, de Leon CF, McCann JJ, et al. Is lower cognitive function in one spouse associated with depressive symptoms in the other spouse? Aging & Mental Health 2006 Nov; 10(6):621-30. *Not eligible outcomes*
1553. Skarupski KA, Mendes de Leon CF, Bienias JL, et al. Black-white differences in depressive symptoms among older adults over time. J Gerontol B Psychol Sci Soc Sci 2005 May; 60(3):P136-42. *Not eligible outcomes*
1554. Sloan FA, Ruiz D, Jr., Platt A. Changes in functional status among persons over age sixty-five undergoing total knee arthroplasty. Med Care 2009 Jul; 47(7):742-8. *Not eligible outcomes*
1555. Slovacek L, Slovackova B, Slanska I, et al. Cancer and depression: a prospective study. Neoplasma 2009; 56(3):187-93. *Not eligible outcomes*
1556. Sluka KA, Turk DC. Invited commentary. Phys Ther 2009 May; 89(5):470-2; author reply 2-3. *Not eligible outcomes*
1557. Smith AK, Maloney EM, Falkenberg VR, et al. An angiotensin-1 converting enzyme polymorphism is associated with allostatic load mediated by C-reactive protein, interleukin-6 and cortisol. Psychoneuroendocrinology 2009 May; 34(4):597-606. *Not eligible target population*
1558. Smith SL, Colenda CC. Mental health and health care utilization in geriatric primary care patients. International Journal of Psychiatry in Medicine 1997; 27(1):23-32. *Not eligible outcomes*
1559. Smola S, Justice AC, Wagner J, et al. Veterans aging cohort three-site study (VACS 3): overview and description. Journal of Clinical Epidemiology 2001 Dec; 54 Suppl 1:S61-76. *Not eligible outcomes*
1560. Smoliner C, Norman K, Scheufele R, et al. Effects of food fortification on nutritional and functional status in frail elderly nursing home residents at risk of malnutrition. Nutrition 2008 Nov-Dec; 24(11-12):1139-44. *Not eligible target population*
1561. Snowdon DA. Aging and Alzheimer's disease: lessons from the Nun Study.[see comment]. Gerontologist 1997 Apr; 37(2):150-6. *Not eligible outcomes*
1562. Soejono CH. The impact of 'comprehensive geriatric assessment (CGA)' implementation on the effectiveness and cost (CEA) of healthcare in an acute geriatric ward. Acta Medica Indonesiana 2008 Jan; 40(1):3-10. *Not eligible target population*
1563. Sokol KC, Knudsen JF, Li MM. Polypharmacy in older oncology patients and the need for an interdisciplinary approach to side-effect management. J Clin Pharm Ther 2007 Apr; 32(2):169-75. *Not eligible exposure*
1564. Solberg OG, Dahl M, Mowinckel P, et al. Derivation and validation of a simple risk score for predicting 1-year mortality in stroke. J Neurol 2007 Oct; 254(10):1376-83. *Not eligible outcomes*
1565. Solfrizzi V, Capurso C, D'Introno A, et al. Change of diagnoses in probable and possible mild cognitive impairment: the Italian Longitudinal Study on Aging. J Am Geriatr Soc 2007 Sep; 55(9):1480-2. *Comment*
1566. Solomon DH, Avorn J, Katz JN, et al. Compliance with osteoporosis medications. Arch Intern Med 2005 Nov 14; 165(20):2414-9. *Not eligible outcomes*
1567. Song HJ, Shim KN, Yoon SJ, et al. The prevalence and clinical characteristics of reflux esophagitis in koreans and its possible relation to metabolic syndrome. Journal of Korean medical science 2009 Apr; 24(2):197-202. *Not eligible outcomes*
1568. Song J, Chang HJ, Tirodkar M, et al. Racial/ethnic differences in activities of daily living disability in

older adults with arthritis: a longitudinal study. Arthritis Rheum 2007 Aug 15; 57(6):1058-66. *Not eligible population*
1569. Song K, Fendrick AM, Ladabaum U. Fecal DNA testing compared with conventional colorectal cancer screening methods: a decision analysis. Gastroenterology 2004 May; 126(5):1270-9. *Not eligible outcomes*
1570. Sonohara K, Kozaki K, Akishita M, et al. White matter lesions as a feature of cognitive impairment, low vitality and other symptoms of geriatric syndrome in the elderly. Geriatrics & gerontology international 2008 Jun; 8(2):93-100. *Not eligible outcomes*
1571. SoRelle R. Death rate higher in elderly with low cholesterol. Circulation 2001 Aug 14; 104(7):E9011-3. *Not eligible outcomes*
1572. Sorkin JD, Andres R, Muller DC, et al. Cholesterol as a risk factor for coronary heart disease in elderly men. The Baltimore Longitudinal Study of Aging. Annals of Epidemiology 1992 Jan-Mar; 2(1-2):59-67. *Not eligible exposure*
1573. Sorrell J. Struggling to do the right thing: stories from people living with Alzheimer's disease. J Psychosoc Nurs Ment Health Serv 2005 Jul; 43(7):13-6. *Not eligible outcomes*
1574. Spada RS, Toscano G, Cosentino FI, et al. Low total cholesterol predicts mortality in the nondemented oldest old. Arch Gerontol Geriatr 2007; 44 Suppl 1:381-4. *Not eligible outcomes*
1575. Sparrow D, O'Connor GT, Rosner B, et al. Predictors of longitudinal change in methacholine airway responsiveness among middle-aged and older men: the Normative Aging Study. American Journal of Respiratory & Critical Care Medicine 1994 Feb; 149(2 Pt 1):376-81. *Not eligible outcomes*
1576. Sparrow D, O'Connor GT, Young JB, et al. Relationship of urinary serotonin excretion to cigarette smoking and respiratory symptoms. The Normative Aging Study.[see comment]. Chest 1992 Apr; 101(4):976-80. *Not eligible outcomes*
1577. Srikanth VK, Anderson JF, Donnan GA, et al. Progressive dementia after first-ever stroke: a community-based follow-up study.[see comment]. Neurology 2004 Sep 14; 63(5):785-92. *Not eligible exposure*
1578. Srikanth VK, Fryer JL, Zhai G, et al. A meta-analysis of sex differences prevalence, incidence and severity of osteoarthritis. Osteoarthritis Cartilage 2005 Sep; 13(9):769-81. *Not eligible outcomes*
1579. Stamatiadis N, Deacon JA. Trends in highway safety: effects of an aging population on accident propensity. Accident Analysis & Prevention 1995 Aug; 27(4):443-59. *Not eligible outcomes*
1580. Stamler J, Dyer AR, Shekelle RB, et al. Relationship of baseline major risk factors to coronary and all-cause mortality, and to longevity: findings from long-term follow-up of Chicago cohorts. Cardiology 1993; 82(2-3):191-222. *Not eligible exposure*
1581. Staplin L, Gish KW, Wagner EK. MaryPODS revisited: updated crash analysis and implications for screening program implementation. J Safety Res 2003; 34(4):389-97. *Not eligible outcomes*
1582. Starr JM, McGurn B, Whiteman M, et al. Life long changes in cognitive ability are associated with prescribed medications in old age. Int J Geriatr Psychiatry 2004 Apr; 19(4):327-32. *Not eligible outcomes*
1583. Stefanacci RG, Lester PE, Kohen I. Nursing home resident smoking policies. Director 2008 Summer; 16(3):37-9, 41, 3. *Not eligible target population*
1584. Steffens DC, McQuoid DR, Potter GG. Outcomes of older cognitively impaired individuals with current and past depression in the NCODE study. J Geriatr Psychiatry Neurol 2009 Mar; 22(1):52-61. *Not eligible outcomes*
1585. Steiber AL, Handu DJ, Cataline DR, et al. The impact of nutrition intervention on a reliable morbidity and mortality indicator: the hemodialysis-prognostic nutrition index. Journal of Renal Nutrition 2003 Jul; 13(3):186-90. *Not eligible target population*
1586. Stein BE. Adult vaccinations: protecting your patients from avoidable illness. Geriatrics 1993 Sep; 48(9):46, 9-52, 5. *Not eligible outcomes*
1587. Stein PD, Beemath A, Meyers FA, et al. Pulmonary embolism as a cause of death in patients who died with cancer. Am J Med 2006 Feb; 119(2):163-5. *Not eligible outcomes*
1588. Steinman MA, Maaravi Y, Walter LC, et al. Evolution of medication use in Jerusalem elders: Results from the Jerusalem Longitudinal Study. Drugs Aging 2007; 24(2):133-45. *Not eligible outcomes*
1589. Steinman MA, Rosenthal GE, Landefeld CS, et al. Conflicts and concordance between measures of medication prescribing quality. Med Care 2007 Jan; 45(1):95-9. *Not eligible outcomes*
1590. Stellato RK, Feldman HA, Hamdy O, et al. Testosterone, sex hormone-binding globulin, and the development of type 2 diabetes in middle-aged men: prospective results from the Massachusetts male aging study. Diabetes Care 2000 Apr; 23(4):490-4. *Not eligible outcomes*
1591. Sternfeld B, Wang H, Quesenberry CP, Jr., et al. Physical activity and changes in weight and waist circumference in midlife women: findings from the Study of Women's Health Across the Nation. Am J Epidemiol 2004 Nov 1; 160(9):912-22. *Not eligible outcomes*
1592. Stewart R, White LR, Xue QL, et al. Twenty-six-year change in total cholesterol levels and incident dementia: the Honolulu-Asia Aging Study. Arch Neurol 2007 Jan; 64(1):103-7. *Not eligible outcomes*
1593. Stolk RP, Rosmalen JG, Postma DS, et al. Universal risk factors for multifactorial diseases: LifeLines: a three-generation population-based study. Eur J Epidemiol 2008; 23(1):67-74. *Not eligible review*
1594. Stookey JD, Pieper CF, Cohen HJ. Is the prevalence of dehydration among community-dwelling older adults really low? Informing current debate over the fluid recommendation for adults aged 70+years.

Public Health Nutr 2005 Dec; 8(8):1275-85. *Not eligible outcomes*
1595. Stranges S, Dorn JM, Shipley MJ, et al. Correlates of short and long sleep duration: a cross-cultural comparison between the United Kingdom and the United States: the Whitehall II Study and the Western New York Health Study.[see comment]. American Journal of Epidemiology 2008 Dec 15; 168(12):1353-64. *Not eligible outcomes*
1596. Strine TW, Hootman JM, Chapman DP, et al. Health-related quality of life, health risk behaviors, and disability among adults with pain-related activity difficulty. Am J Public Health 2005 Nov; 95(11):2042-8. *Not eligible outcomes*
1597. Strozyk D, Blennow K, White LR, et al. CSF Abeta 42 levels correlate with amyloid-neuropathology in a population-based autopsy study. Neurology 2003 Feb 25; 60(4):652-6. *Not eligible outcomes*
1598. Sturman MT, de Leon CF, Bienias JL, et al. Body mass index and cognitive decline in a biracial community population. Neurology 2008 Jan 29; 70(5):360-7. *Not eligible outcomes*
1599. Subramanian S, Surani S. Sleep disorders in the elderly. Geriatrics 2007 Dec; 62(12):10-32. *Not eligible outcomes*
1600. Sullivan DH. Risk factors for early hospital readmission in a select population of geriatric rehabilitation patients: the significance of nutritional status. J Am Geriatr Soc 1992 Aug; 40(8):792-8. *Not eligible target population*
1601. Sullivan G, Craske MG, Sherbourne C, et al. Design of the Coordinated Anxiety Learning and Management (CALM) study: innovations in collaborative care for anxiety disorders. Gen Hosp Psychiatry 2007 Sep-Oct; 29(5):379-87. *Not eligible outcomes*
1602. Sun X, Zhang S, Wang N, et al. Utility assessment among patients of primary angle closure/glaucoma in China: a preliminary study. British Journal of Ophthalmology 2009 Jul; 93(7):871-4. *Not eligible outcomes*
1603. Sung HY, Wang L, Jin S, et al. Economic burden of smoking in China, 2000. Tob Control 2006 Jun; 15 Suppl 1:i5-11. *Not eligible outcomes*
1604. Susser E, Terry MB, Matte T. The birth cohorts grow up: new opportunities for epidemiology. Paediatric and Perinatal Epidemiology 2000 Apr; 14(2):98-100. *Not eligible outcomes*
1605. Sussman D, Garely A. Treatment of overactive bladder with once-daily extended-release tolterodine or oxybutynin: the antimuscarinic clinical effectiveness trial (ACET). Curr Med Res Opin 2002; 18(4):177-84. *Not eligible outcomes*
1606. Sutaria N, Elder AT, Shaw TR. Long term outcome of percutaneous mitral balloon valvotomy in patients aged 70 and over. Heart 2000 Apr; 83(4):433-8. *Not eligible outcomes*
1607. Syddall H, Cooper C, Martin F, et al. Is grip strength a useful single marker of frailty? Age Ageing 2003 Nov; 32(6):650-6. *Not eligible exposure*
1608. Szklo-Coxe M, Young T, Finn L, et al. Depression: relationships to sleep paralysis and other sleep disturbances in a community sample. Journal of Sleep Research 2007 Sep; 16(3):297-312. *Not eligible outcomes*
1609. Szwast SJ, Hendrie HC, Lane KA, et al. Association of statin use with cognitive decline in elderly African Americans. Neurology 2007 Nov 6; 69(19):1873-80. *Not eligible exposure*
1610. Taaffe DR, Harris TB, Ferrucci L, et al. Cross-sectional and prospective relationships of interleukin-6 and C-reactive protein with physical performance in elderly persons: MacArthur studies of successful aging. J Gerontol A Biol Sci Med Sci 2000 Dec; 55(12):M709-15. *Not eligible outcome*
1611. Tager IB, Haight T, Sternfeld B, et al. Effects of physical activity and body composition on functional limitation in the elderly: application of the marginal structural model. Epidemiology 2004 Jul; 15(4):479-93. *Not eligible outcomes*
1612. Talbot LA, Morrell CH, Fleg JL, et al. Changes in leisure time physical activity and risk of all-cause mortality in men and women: the Baltimore Longitudinal Study of Aging. Prev Med 2007 Aug-Sep; 45(2-3):169-76. *Not eligible exposure*
1613. Talbott EO, Findlay RC, Kuller LH, et al. Noise-induced hearing loss: a possible marker for high blood pressure in older noise-exposed populations. Journal of Occupational Medicine 1990 Aug; 32(8):690-7. *Not eligible exposure*
1614. Talcott JA, Manola J, Clark JA, et al. Time course and predictors of symptoms after primary prostate cancer therapy. Journal of Clinical Oncology 2003 Nov 1; 21(21):3979-86. *Not eligible outcomes*
1615. Tavris DR, Rock PJ, Miesbauer K, et al. Depression in the elderly. Wis Med J 1997 Apr; 96(4):52-3. *Not eligible outcomes*
1616. Taylor A, Jacques PF, Chylack LT, Jr., et al. Long-term intake of vitamins and carotenoids and odds of early age-related cortical and posterior subcapsular lens opacities. American Journal of Clinical Nutrition 2002 Mar; 75(3):540-9. *Not eligible outcomes*
1617. Taylor BC, Schreiner PJ, Stone KL, et al. Long-term prediction of incident hip fracture risk in elderly white women: study of osteoporotic fractures. J Am Geriatr Soc 2004 Sep; 52(9):1479-86. *Not eligible outcomes*
1618. Taylor DH, Jr., Schenkman M, Zhou J, et al. The relative effect of Alzheimer's disease and related dementias, disability, and comorbidities on cost of care for elderly persons. J Gerontol B Psychol Sci Soc Sci 2001 Sep; 56(5):S285-93. *Not eligible population*
1619. Teno JM, Harrell FE, Jr., Knaus W, et al. Prediction of survival for older hospitalized patients: the HELP survival model. Hospitalized Elderly Longitudinal Project. J Am Geriatr Soc 2000 May; 48(5 Suppl):S16-24. *Not eligible outcomes*
1620. Teresi J. Overview of methodological issues in the study of chronic care populations. Alzheimer Disease & Associated Disorders 1994; 8 Suppl 1:S247-73. *Review*

Appendix B. Excluded Studies

1621. Terpenning MS, Taylor GW, Lopatin DE, et al. Aspiration pneumonia: dental and oral risk factors in an older veteran population. J Am Geriatr Soc 2001 May; 49(5):557-63. *Not elgible target population*
1622. Terry DF, Evans JC, Pencina MJ, et al. Characteristics of Framingham offspring participants with long-lived parents.[see comment]. Archives of Internal Medicine 2007 Mar 12; 167(5):438-44. *Not eligible outcomes*
1623. Thal LJ, Carta A, Doody R, et al. Prevention protocols for Alzheimer disease. Position paper from the International Working Group on Harmonization of Dementia Drug Guidelines. Alzheimer Dis Assoc Disord 1997; 11 Suppl 3:46-9. *Not eligible outcomes*
1624. Thamer M, Chan JK, Ray NF, et al. Drug use concomitant with cyclosporine immunosuppressive therapy for 3 years after renal transplantation. Am J Kidney Dis 1998 Feb; 31(2):283-92. *Not eligible outcomes*
1625. Thapa PB, Brockman KG, Gideon P, et al. Injurious falls in nonambulatory nursing home residents: a comparative study of circumstances, incidence, and risk factors. J Am Geriatr Soc 1996 Mar; 44(3):273-8. *Not eligible target population*
1626. Thein M, Ershler WB, Artz AS, et al. Diminished quality of life and physical function in community-dwelling elderly with anemia. Medicine 2009 Mar; 88(2):107-14. *Not eligible outcomes*
1627. Theodos P. Fall prevention in frail elderly nursing home residents: a challenge to case management: part I. Lippincotts Case Manag 2003 Nov-Dec; 8(6):246-51. *Not eligible target population*
1628. Thobaben M. Mistreatment of elders by family members. Home Care Provid 2001 Aug; 6(4):112-3. *Not eligible outcomes*
1629. Thom D. Variation in estimates of urinary incontinence prevalence in the community: effects of differences in definition, population characteristics, and study type. Journal of the American Geriatrics Society 1998 Apr; 46(4):473-80. *Not eligible outcomes*
1630. Thomas D. Why do estimates of the acute and chronic effects of air pollution on mortality differ? J Toxicol Environ Health A 2005 Jul 9-23; 68(13-14):1167-74. *Not eligible outcomes*
1631. Thomas DR, Kamel H, Azharrudin M, et al. The relationship of functional status, nutritional assessment, and severity of illness to in-hospital mortality. J Nutr Health Aging 2005; 9(3):169-75. *Not eligible target population*
1632. Thomas DR, Verdery RB, Gardner L, et al. A prospective study of outcome from protein-energy malnutrition in nursing home residents. Jpen: Journal of Parenteral & Enteral Nutrition 1991 Jul-Aug; 15(4):400-4.
1633. Thomas DR, Zdrowski CD, Wilson MM, et al. Malnutrition in subacute care. Am J Clin Nutr 2002 Feb; 75(2):308-13. *Not eligible target population*
1634. Thompson DL. Geriatric incontinence: the long-term care challenge. Urologic Nursing 2004 quiz 314, 2004 Aug; 24(4):305-13. *Not eligible target population*
1635. Thompson GW, Kreisel PS. The impact of the demographics of aging and the edentulous condition on dental care services. Journal of Prosthetic Dentistry 1998 Jan; 79(1):56-9. *No eligible outcomes*
1636. Thomson WM, Chalmers JM, Spencer AJ, et al. Medication and dry mouth: findings from a cohort study of older people. J Public Health Dent 2000 Winter; 60(1):12-20. *Not eligible outcomes*
1637. Thorpe RJ, Jr., Kasper JD, Szanton SL, et al. Relationship of race and poverty to lower extremity function and decline: findings from the Women's Health and Aging Study. Social science & medicine 2008 Feb; 66(4):811-21. *Not eligible outcomes*
1638. Thorpe RJ, Jr., Weiss C, Xue QL, et al. Transitions among disability levels or death in African American and white older women. J Gerontol A Biol Sci Med Sci 2009 Jun; 64(6):670-4. *Not eligible outcomes*
1639. Tinetti ME, Baker DI, McAvay G, et al. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. N Engl J Med 1994 Sep 29; 331(13):821-7. *Not eligible outcomes*
1640. Tinetti ME, McAvay GJ, Fried TR, et al. Development of a tool for eliciting patient priority from among competing cardiovascular disease, medication-symptoms, and fall injury outcomes. J Am Geriatr Soc 2008 Apr; 56(4):730-6. *Not eligible outcomes*
1641. Torres OH, Munoz J, Ruiz D, et al. Outcome predictors of pneumonia in elderly patients: importance of functional assessment. J Am Geriatr Soc 2004 Oct; 52(10):1603-9. *Not eligible outcomes*
1642. Tosteson AN, Gottlieb DJ, Radley DC, et al. Excess mortality following hip fracture: the role of underlying health status. Osteoporos Int 2007 Nov; 18(11):1463-72. *Not eligible outcomes*
1643. Touger M, Gennis P, Nathanson N, et al. Validity of a decision rule to reduce cervical spine radiography in elderly patients with blunt trauma. Ann Emerg Med 2002 Sep; 40(3):287-93. *Not eligible outcomes*
1644. Townsend MK, Curhan GC, Resnick NM, et al. Postmenopausal hormone therapy and incident urinary incontinence in middle-aged women. American Journal of Obstetrics & Gynecology 2009 Jan; 200(1):86.e1-5. *Not eligible outcomes*
1645. Townsend MK, Danforth KN, Rosner B, et al. Body mass index, weight gain, and incident urinary incontinence in middle-aged women. Obstetrics & Gynecology 2007 Aug; 110(2 Pt 1):346-53. *Not eligible outcomes*
1646. Tracy JI, Lippincott C, Mahmood T, et al. Are depression and cognitive performance related in temporal lobe epilepsy? Epilepsia 2007 Dec; 48(12):2327-35. *Not eligible outcomes*
1647. Travis SS, Buchanan RJ, Wang S, et al. Analyses of nursing home residents with diabetes at admission. J Am Med Dir Assoc 2004 Sep-Oct; 5(5):320-7. *Not eligible target population*
1648. Travison TG, Araujo AB, Kupelian V, et al. The relative contributions of aging, health, and lifestyle

factors to serum testosterone decline in men. Journal of Clinical Endocrinology & Metabolism 2007 Feb; 92(2):549-55. *Not eligible exposure*
1649. Treharne GJ, Douglas KM, Iwaszko J, et al. Polypharmacy among people with rheumatoid arthritis: the role of age, disease duration and comorbidity. Musculoskeletal Care 2007 Dec; 5(4):175-90. *Not eligible outcomes*
1650. Troncoso JC, Zonderman AB, Resnick SM, et al. Effect of infarcts on dementia in the Baltimore longitudinal study of aging. Annals of Neurology 2008 Aug; 64(2):168-76. *Not eligible exposure*
1651. Trygstad TK, Christensen D, Garmise J, et al. Pharmacist response to alerts generated from Medicaid pharmacy claims in a long-term care setting: results from the North Carolina polypharmacy initiative. J Manag Care Pharm 2005 Sep; 11(7):575-83. *Not eligible target population*
1652. Tucker D, Dirico L. Managing costly Medicare patients in the hospital. Geriatr Nurs 2003 Sep-Oct; 24(5):294-7. *Not eligible outcomes*
1653. Tucker KL, Hallfrisch J, Qiao N, et al. The combination of high fruit and vegetable and low saturated fat intakes is more protective against mortality in aging men than is either alone: the Baltimore Longitudinal Study of Aging. Journal of Nutrition 2005 Mar; 135(3):556-61. *Not eligible exposure*
1654. Tullai-McGuinness S, Madigan EA, Fortinsky RH. Validity testing the Outcomes and Assessment Information Set (OASIS). Home Health Care Serv Q 2009; 28(1):45-57. *Not eligible outcomes*
1655. Tulner LR, Frankfort SV, Gijsen GJ, et al. Drug-drug interactions in a geriatric outpatient cohort: prevalence and relevance. Drugs Aging 2008; 25(4):343-55. *Not eligible outcomes*
1656. Tumolo J. Caregivers who hurt. The tragedy of elder abuse. Adv Nurse Pract 2000 Oct; 8(10):63-5. *Not eligible outcomes*
1657. Tune L. Assessing psychiatric illness in geriatric patients. Clinical cornerstone 2001; 3(3):23-36. *Not eligible outcomes*
1658. Turner-Stokes L, Frank AO. Urinary incontinence among patients with arthritis--a neglected disability. J R Soc Med 1992 Jul; 85(7):389-93. *Not eligible outcomes*
1659. Turvey CL, Schultz SK, Arndt S, et al. Caregiver report of hallucinations and paranoid delusions in elders aged 70 or older. International Psychogeriatrics 2001 Jun; 13(2):241-9. *Not eligible outcomes*
1660. Ukoli FA, Lynch BS, Adams-Campbell LL. Radical prostatectomy and quality of life among African Americans. Ethnicity & disease 2006; 16(4):988-93. *Not eligible outcomes*
1661. Ulmer H, Kelleher C, Diem G, et al. Why Eve is not Adam: prospective follow-up in 149650 women and men of cholesterol and other risk factors related to cardiovascular and all-cause mortality. J Womens Health (Larchmt) 2004 Jan-Feb; 13(1):41-53. *Not eligible outcomes*
1662. Umberson D, Williams K, Umberson D, et al. Marital quality, health, and aging: gender equity? Journals of Gerontology Series B-Psychological Sciences & Social Sciences 2005 Oct; 60 Spec No 2:109-13. *Not eligible outcomes*
1663. Ungar A, Mussi C, Del Rosso A, et al. Diagnosis and characteristics of syncope in older patients referred to geriatric departments. Journal of the American Geriatrics Society 2006 Oct; 54(10):1531-6. *Not eligible outcomes*
1664. Unruh ML, Sanders MH, Redline S, et al. Subjective and objective sleep quality in patients on conventional thrice-weekly hemodialysis: comparison with matched controls from the sleep heart health study. American Journal of Kidney Diseases 2008 Aug; 52(2):305-13. *Not eligible outcomes*
1665. Valcour V, Shikuma C, Shiramizu B, et al. Higher frequency of dementia in older HIV-1 individuals: the Hawaii Aging with HIV-1 Cohort. Neurology 2004 Sep 14; 63(5):822-7. *Not eligible outcomes*
1666. Valcour V, Shikuma C, Shiramizu B, et al. Age, apolipoprotein E4, and the risk of HIV dementia: the Hawaii Aging with HIV Cohort. Journal of Neuroimmunology 2004 Dec; 157(1-2):197-202. *Not eligible outcomes*
1667. Valenti G, Denti L, Maggio M, et al. Effect of DHEAS on skeletal muscle over the life span: the InCHIANTI study. J Gerontol A Biol Sci Med Sci 2004 May; 59(5):466-72. *Not eligible outcomes*
1668. Valete-Rosalino CM, Rozenfeld S. Auditory screening in the elderly: comparison between self-report and audiometry. Braz J Otorhinolaryngol 2005 Mar-Apr; 71(2):193-200. *Not eligible outcomes*
1669. Valk M, Post MW, Cools HJ, et al. Measuring disability in nursing home residents: validity and reliability of a newly developed instrument. J Gerontol B Psychol Sci Soc Sci 2001 May; 56(3):P187-91. *Not eligible target population*
1670. van den Kommer TN, Dik MG, Comijs HC, et al. Total cholesterol and oxysterols: early markers for cognitive decline in elderly?[see comment]. Neurobiology of aging 2009 Apr; 30(4):534-45. *Not eligible outcomes*
1671. van der Steen JT, Mehr DR, Kruse RL, et al. Dementia, lower respiratory tract infection, and long-term mortality. J Am Med Dir Assoc 2007 Jul; 8(6):396-403. *Not eligible outcomes*
1672. van der Steen JT, Ooms ME, van der Wal G, et al. Withholding or starting antibiotic treatment in patients with dementia and pneumonia: prediction of mortality with physicians' judgment of illness severity and with specific prognostic models. Med Decis Making 2005 Mar-Apr; 25(2):210-21. *Not eligible outcomes*
1673. van Hout HP, Nijpels G, van Marwijk HW, et al. Design and pilot results of a single blind randomized controlled trial of systematic demand-led home visits by nurses to frail elderly persons in primary care [ISRCTN05358495]. BMC Geriatr 2005; 5:11. *Not eligible outcomes*

Appendix B. Excluded Studies

1674. Van Nostrand JF, Miller B, Furner SE. Selected issues in long-term care: profile of cognitive disability of nursing home residents and the use of informal and formal care by elderly in the community. Vital Health Stat 3 1993 Jan; (27):143-85. *Not eligible target population*
1675. VandenLangenberg GM, Mares-Perlman JA, Klein R, et al. Associations between antioxidant and zinc intake and the 5-year incidence of early age-related maculopathy in the Beaver Dam Eye Study. American Journal of Epidemiology 1998 Jul 15; 148(2):204-14. *Not eligible outcomes*
1676. Varadhan R, Chaves PH, Lipsitz LA, et al. Frailty and impaired cardiac autonomic control: new insights from principal components aggregation of traditional heart rate variability indices. J Gerontol A Biol Sci Med Sci 2009 Jun; 64(6):682-7. *Not eligible exposure*
1677. Varadhan R, Walston J, Cappola AR, et al. Higher levels and blunted diurnal variation of cortisol in frail older women. J Gerontol A Biol Sci Med Sci 2008 Feb; 63(2):190-5. *Not eligible outcomes*
1678. Varma RN. Risk for drug-induced malnutrition is unchecked in elderly patients in nursing homes. J Am Diet Assoc 1994 Feb; 94(2):192-4. *Not eligible target population*
1679. Vasan RS, Larson MG, Benjamin EJ, et al. Congestive heart failure in subjects with normal versus reduced left ventricular ejection fraction: prevalence and mortality in a population-based cohort. J Am Coll Cardiol 1999 Jun; 33(7):1948-55. *Not eligible outcomes*
1680. Vasunilashorn S, Coppin AK, Patel KV, et al. Use of the Short Physical Performance Battery Score to predict loss of ability to walk 400 meters: analysis from the InCHIANTI study. J Gerontol A Biol Sci Med Sci 2009 Feb; 64(2):223-9. *Not eligible outcomes*
1681. Vaupel JW, Manton KG, Stallard E. The impact of heterogeneity in individual frailty on the dynamics of mortality. Demography 1979 Aug; 16(3):439-54. *Simulation model*
1682. Vaz Fragoso CA, Gahbauer EA, Van Ness PH, et al. Sleep-wake disturbances and frailty in community-living older persons. J Am Geriatr Soc 2009 Nov; 57(11):2094-100. *Not eligible outcomes*
1683. Veehof LJ, Stewart RE, Meyboom-de Jong B, et al. Adverse drug reactions and polypharmacy in the elderly in general practice. Eur J Clin Pharmacol 1999 Sep; 55(7):533-6. *Not eligible outcomes*
1684. Verbrugge LM, Juarez L. Profile of arthritis disability. Public Health Rep 2001; 116 Suppl 1:157-79. *Not eligible outcomes*
1685. Verbrugge LM, Juarez L. Profile of arthritis disability: II. Arthritis Rheum 2006 Feb 15; 55(1):102-13. *Not eligible outcomes*
1686. Verghese J. Cognitive and mobility profile of older social dancers. J Am Geriatr Soc 2006 Aug; 54(8):1241-4. *Not eligible outcomes*
1687. Verghese J, Cuiling W, Katz MJ, et al. Leisure activities and risk of vascular cognitive impairment in older adults. Journal of Geriatric Psychiatry & Neurology 2009 Jun; 22(2):110-8. *Not eligible exposure*
1688. Verghese J, LeValley A, Hall CB, et al. Epidemiology of gait disorders in community-residing older adults. Journal of the American Geriatrics Society 2006 Feb; 54(2):255-61. *Not eligible outcomes*
1689. Vestergaard S, Nayfield SG, Patel KV, et al. Fatigue in a representative population of older persons and its association with functional impairment, functional limitation, and disability. J Gerontol A Biol Sci Med Sci 2009 Jan; 64(1):76-82. *Not eligible outcome*
1690. Vig EK, Brodkin KI, Raugi GJ, et al. Blue rubber bleb nevus syndrome in a patient with ataxia and dementia. Journal of Geriatric Psychiatry & Neurology 2002; 15(1):7-11. *Not eligible outcomes*
1691. Vincent HK, Vincent KR, Lee LW, et al. Effect of obesity on inpatient rehabilitation outcomes following total knee arthroplasty. Clin Rehabil 2007 Feb; 21(2):182-90. *Not eligible target population*
1692. Vischer UM, Safar ME, Safar H, et al. Cardiometabolic determinants of mortality in a geriatric population: is there a "reverse metabolic syndrome"? Diabetes Metab 2009 Apr; 35(2):108-14. *Not eligible outcomes*
1693. Vitagliano G, Curtis JP, Concato J, et al. Association between functional status and use and effectiveness of beta-blocker prophylaxis in elderly survivors of acute myocardial infarction. J Am Geriatr Soc 2004 Apr; 52(4):495-501. *Not eligible outcomes*
1694. Vitolins MZ, Quandt SA, Bell RA, et al. Quality of diets consumed by older rural adults. J Rural Health 2002 Winter; 18(1):49-56. *Not eligible outcomes*
1695. Vladutiu CJ, Casteel C, Runyan CW. Disability and risk of non-fatal residential injuries among adults. Inj Prev 2008 Oct; 14(5):302-5. *Not eligible outcomes*
1696. Vogt MT, Simonsick EM, Harris TB, et al. Neck and shoulder pain in 70- to 79-year-old men and women: findings from the Health, Aging and Body Composition Study. Spine J 2003 Nov-Dec; 3(6):435-41. *Not eligible outcomes*
1697. Volicer BJ, Hurley A, Fabiszewski KJ, et al. Predicting short-term survival for patients with advanced Alzheimer's disease. J Am Geriatr Soc 1993 May; 41(5):535-40. *Not eligible target population*
1698. Volkert D, Berner YN, Berry E, et al. ESPEN Guidelines on Enteral Nutrition: Geriatrics. Clin Nutr 2006 Apr; 25(2):330-60. *Not eligible outcomes*
1699. Volpato S, Zuliani G, Guralnik JM, et al. The inverse association between age and cholesterol level among older patients: the role of poor health status. Gerontology 2001 Jan-Feb; 47(1):36-45. *Not eligible outcomes*
1700. von Kanel R, Dimsdale JE, Mills PJ, et al. Effect of Alzheimer caregiving stress and age on frailty markers interleukin-6, C-reactive protein, and D-dimer. J Gerontol A Biol Sci Med Sci 2006 Sep; 61(9):963-9. *Not eligible target population*

Appendix B. Excluded Studies

1701. Von Korff M, Crane P, Lane M, et al. Chronic spinal pain and physical-mental comorbidity in the United States: results from the national comorbidity survey replication. Pain 2005 Feb; 113(3):331-9. *Not eligible outcomes*

1702. Vonta F, Karagrigoriou A. Variable selection strategies in survival models with multiple imputations. Lifetime Data Anal 2007 Sep; 13(3):295-315. *Not eligible outcomes*

1703. Vradenburg JA, Simoes EJ, Jackson-Thompson J, et al. The prevalence of arthritis and activity limitation and their predictors in Missouri. J Community Health 2002 Apr; 27(2):91-107. *Not eligible outcomes*

1704. Wackerbarth SB, Johnson MM, Markesbery WR, et al. Urban-rural differences in a memory disorders clinical population. J Am Geriatr Soc 2001 May; 49(5):647-50. *Not eligible target population*

1705. Wadley VG, McClure LA, Howard VJ, et al. Cognitive status, stroke symptom reports, and modifiable risk factors among individuals with no diagnosis of stroke or transient ischemic attack in the REasons for Geographic and Racial Differences in Stroke (REGARDS) Study. Stroke 2007 Apr; 38(4):1143-7. *Not eligible outcome*

1706. Waetjen LE, Liao S, Johnson WO, et al. Factors associated with prevalent and incident urinary incontinence in a cohort of midlife women: a longitudinal analysis of data: study of women's health across the nation. American Journal of Epidemiology 2007 Feb 1; 165(3):309-18. *Not eligible outcomes*

1707. Wagner L. Providers tame risks by: preventing falls. Provider 1997 Jun; 23(6):32-4, 6-7. *Not eligible outcomes*

1708. Wakefield BJ, Mentes J, Holman JE, et al. Risk factors and outcomes associated with hospital admission for dehydration. Rehabil Nurs 2008 Nov-Dec; 33(6):233-41. *Not eligible target population*

1709. Walsh PN. Health indicators and intellectual disability. Curr Opin Psychiatry 2008 Sep; 21(5):474-8. *Review*

1710. Walston J, Arking DE, Fallin D, et al. IL-6 gene variation is not associated with increased serum levels of IL-6, muscle, weakness, or frailty in older women. Exp Gerontol 2005 Apr; 40(4):344-52. *Not eligible exposure*

1711. Wang CY, Baldwin LM, Saver BG, et al. The contribution of longitudinal comorbidity measurements to survival analysis. Med Care 2009 Jul; 47(7):813-21. *Not eligible exposure*

1712. Wang J, Mentes JC. Detection of acute confusion in Taiwanese elderly individuals. Journal of Gerontological Nursing 2006 Jun; 32(6):7-12. *Review*

1713. Wang K, Yau KK, Lee AH, et al. Multilevel survival modelling of recurrent urinary tract infections. Comput Methods Programs Biomed 2007 Sep; 87(3):225-9. *Not eligible outcomes*

1714. Wang Y, Lim LL, Heller RF, et al. A prediction model of 1-year mortality for acute ischemic stroke patients. Arch Phys Med Rehabil 2003 Jul; 84(7):1006-11. *Not eligible outcomes*

1715. Wang YC, Byers KL, Velozo CA. Rasch analysis of Minimum Data Set mandated in skilled nursing facilities. J Rehabil Res Dev 2008; 45(9):1385-99. *Not elgible target population*

1716. Wang YC, Colditz GA, Kuntz KM. Forecasting the obesity epidemic in the aging U.S. population. Obesity 2007 Nov; 15(11):2855-65. *Not eligible outcomes*

1717. Warnick LD, Erb HN, White ME. The relationship of calfhood morbidity with survival after calving in 25 New York Holstein herds. Preventive Veterinary Medicine 1997 Aug; 31(3-4):263-73. *Not eligible outcomes*

1718. Warwick J, Tabar L, Vitak B, et al. Time-dependent effects on survival in breast carcinoma: results of 20 years of follow-up from the Swedish Two-County Study. Cancer 2004 Apr 1; 100(7):1331-6. *Not eligible outcomes*

1719. Wassell JT, Moeschberger ML. A bivariate survival model with modified gamma frailty for assessing the impact of interventions. Stat Med 1993 Feb; 12(3-4):241-8. *Not eligible outcomes*

1720. Wasserberg N, Haney M, Petrone P, et al. Morbid obesity adversely impacts pelvic floor function in females seeking attention for weight loss surgery. Diseases of the Colon & Rectum 2007 Dec; 50(12):2096-103. *Not eligible outcomes*

1721. Waterer GW, Wan JY, Kritchevsky SB, et al. Airflow limitation is underrecognized in well-functioning older people. J Am Geriatr Soc 2001 Aug; 49(8):1032-8. *Not eligible outcomes*

1722. Watson A. HIV and the elderly. J Pract Nurs 2004 Spring; 54(1):11-2. *Not eligible outcomes*

1723. Watters MR, Poff PW, Shiramizu BT, et al. Symptomatic distal sensory polyneuropathy in HIV after age 50. Neurology 2004 Apr 27; 62(8):1378-83. *Not eligible outcomes*

1724. Weale RA. On the age-related prevalence of anisometropia. Ophthalmic Res 2002 Nov-Dec; 34(6):389-92. *Not eligible outcomes*

1725. Weamer EA, Emanuel JE, Varon D, et al. The relationship of excess cognitive impairment in MCI and early Alzheimer's disease to the subsequent emergence of psychosis. Int Psychogeriatr 2009 Feb; 21(1):78-85. *Not eligible target population*

1726. Weber J, Kehoe T, Bakoss M, et al. Safety at home: a practical home-injury control program for independent seniors. Caring 1996 Jun; 15(6):62-6. *Not eligible outcomes*

1727. Weber V, White A, McIlvried R. An electronic medical record (EMR)-based intervention to reduce polypharmacy and falls in an ambulatory rural elderly population. J Gen Intern Med 2008 Apr; 23(4):399-404. *Not eligible outcomes*

1728. Webster JB, Bell KR, Hussey JD, et al. Sleep apnea in adults with traumatic brain injury: a preliminary investigation. Archives of Physical Medicine & Rehabilitation 2001 Mar; 82(3):316-21. *Not eligible outcomes*

Appendix B. Excluded Studies

1729. Weinberger J, Marin DB. Brain function in aging: solutions for significant challenges. Geriatrics 2002 Jan; 57(1):37. *Not eligible outcomes*
1730. Weiss KM. The biodemography of variation in human frailty. Demography 1990 May; 27(2):185-206. *Comment*
1731. Weiss ST, Segal MR, Sparrow D, et al. Relation of FEV1 and peripheral blood leukocyte count to total mortality. The Normative Aging Study. American Journal of Epidemiology 1995 Sep 1; 142(5):493-8; discussion 9-503. *Not eligible outcomes*
1732. Weisskopf MG, Proctor SP, Wright RO, et al. Cumulative lead exposure and cognitive performance among elderly men. Epidemiology 2007 Jan; 18(1):59-66. *Not eligible exposure*
1733. Weissman MM, Greenwald S, Nino-Murcia G, et al. The morbidity of insomnia uncomplicated by psychiatric disorders. General Hospital Psychiatry 1997 Jul; 19(4):245-50. *Not eligible outcomes*
1734. Wells SJ, Garber LP, Hill GW. Health status of preweaned dairy heifers in the United States. Preventive Veterinary Medicine 1997 Jan; 29(3):185-99. *Not eligible outcomes*
1735. Werblow A, Felder S, Zweifel P. Population ageing and health care expenditure: a school of 'red herrings'? Health Econ 2007 Oct; 16(10):1109-26. *Not eligible outcomes*
1736. West DS, Golden WE. Medicare part D and medication management in the elderly. J Ark Med Soc 2006 Jun; 102(12):320-1. *Not eligible outcomes*
1737. West JC, Wilk JE, Muszynski IL, et al. Medication access and continuity: the experiences of dual-eligible psychiatric patients during the first 4 months of the Medicare prescription drug benefit. Am J Psychiatry 2007 May; 164(5):789-96. *Not eligible target population*
1738. West NA, Haan MN, West NA, et al. Body adiposity in late life and risk of dementia or cognitive impairment in a longitudinal community-based study. Journals of Gerontology Series A-Biological Sciences & Medical Sciences 2009 Jan; 64(1):103-9. *Not eligible exposure*
1739. West SK, Munoz B, Rubin GS, et al. Compensatory strategy use identifies risk of incident disability for the visually impaired. Arch Ophthalmol 2005 Sep; 123(9):1242-7. *Not eligible outcomes*
1740. Wetter DW, Young TB. The relation between cigarette smoking and sleep disturbance. Preventive medicine 1994 May; 23(3):328-34. *Not eligible outcomes*
1741. Wetter DW, Young TB, Bidwell TR, et al. Smoking as a risk factor for sleep-disordered breathing. Archives of Internal Medicine 1994 Oct 10; 154(19):2219-24. *Not eligible outcomes*
1742. Weuve J, Ridker PM, Cook NR, et al. High-sensitivity C-reactive protein and cognitive function in older women. Epidemiology 2006 Mar; 17(2):183-9. *Not eligible outcomes*
1743. Weyant RJ, Jones JA, Hobbins M, et al. Oral health status of a long-term-care, veteran population. Community Dent Oral Epidemiol 1993 Aug; 21(4):227-33. *Not eligible target population*
1744. White L, Katzman R, Losonczy K, et al. Association of education with incidence of cognitive impairment in three established populations for epidemiologic studies of the elderly. Journal of Clinical Epidemiology 1994 Apr; 47(4):363-74. *Not eligible outcomes*
1745. Whitmer RA, Gustafson DR, Barrett-Connor E, et al. Central obesity and increased risk of dementia more than three decades later.[see comment]. Neurology 2008 Sep 30; 71(14):1057-64. *Not eligible exposure*
1746. Whooley MA, Cauley JA, Zmuda JM, et al. Depressive symptoms and bone mineral density in older men. Journal of Geriatric Psychiatry & Neurology 2004 Jun; 17(2):88-92. *Not eligible outcomes*
1747. Wieland D, Hedrick SC, Rubenstein LZ, et al. Inpatient geriatric evaluation and management units: organization and care patterns in the Department of Veterans Affairs. Gerontologist 1994 Oct; 34(5):652-7. *Not eligible outcomes*
1748. Wienke A, Christensen K, Holm NV, et al. Heritability of death from respiratory diseases: an analysis of Danish twin survival data using a correlated frailty model. Stud Health Technol Inform 2000; 77:407-11. *Not eligible outcomes*
1749. Wienke A, Herskind AM, Christensen K, et al. The heritability of CHD mortality in danish twins after controlling for smoking and BMI. Twin Res Hum Genet 2005 Feb; 8(1):53-9. *Not eligible outcomes*
1750. Wienke A, Holm NV, Christensen K, et al. The heritability of cause-specific mortality: a correlated gamma-frailty model applied to mortality due to respiratory diseases in Danish twins born 1870-1930. Stat Med 2003 Dec 30; 22(24):3873-87. *Not eligible outcomes*
1751. Wienke A, Holm NV, Skytthe A, et al. The heritability of mortality due to heart diseases: a correlated frailty model applied to Danish twins. Twin Res 2001 Aug; 4(4):266-74. *Not eligible outcomes*
1752. Wight RG, Cummings JR, Karlamangla AS, et al. Urban neighborhood context and change in depressive symptoms in late life. J Gerontol B Psychol Sci Soc Sci 2009 Mar; 64(2):247-51. *Not eligible outcomes*
1753. Wikby K, Ek AC, Christensson L. Nutritional status in elderly people admitted to community residential homes: comparisons between two cohorts. J Nutr Health Aging 2006 May-Jun; 10(3):232-8. *Not eligible target population*
1754. Wilkinson TJ, Sainsbury R. A census-based comparison of centenarians in New Zealand with those in the United States. J Am Geriatr Soc 1998 Apr; 46(4):488-91. *Not eligible outcomes*
1755. Wilkinson TJ, Warren MR. What is the prognosis of mild normocytic anaemia in older people? Intern Med J 2003 Jan-Feb; 33(1-2):14-7. *Not eligible outcomes*
1756. Williams AR, Meuleman JM, Shaw MM. Mortality one-year postdischarge from a Veterans Affairs geriatric evaluation and management unit: assessing

mortality risks. J Am Geriatr Soc 1999 Jul; 47(7):860-3. *Not eligible outcomes*
1757. Williams B. Comparison of services among different types of home health agencies. Med Care 1994 Nov; 32(11):1134-52. *Not eligible target population*
1758. Williams BC, Fitzgerald JT. Brief report: Brief instrument to assess geriatrics knowledge of surgical and medical subspecialty house officers. Journal of General Internal Medicine 2006 May; 21(5):490-3. *Not eligible outcomes*
1759. Williams FM, Wynne H, Woodhouse KW, et al. Plasma aspirin esterase: the influence of old age and frailty. Age Ageing 1989 Jan; 18(1):39-42. *Not eligible outcomes*
1760. Williams R, Bosnic N, Duncan AW, et al. Prevalence of opioid dispensings and concurrent gastrointestinal medications in an elderly population from Ontario, Canada. J Opioid Manag 2008 Jul-Aug; 4(4):193-200. *Not eligible outcomes*
1761. Williams SJ, Seidman RL, Drew JA, et al. Identifying depressive symptoms among elderly Medicare HMO enrollees. HMO Pract 1995 Dec; 9(4):168-73. *Not eligible outcomes*
1762. Wilson RS, Hebert LE, Scherr PA, et al. Educational attainment and cognitive decline in old age. Neurology 2009 Feb 3; 72(5):460-5. *not eligible exposure*
1763. Wilson RS, Li Y, Aggarwal NT, et al. Cognitive decline and survival in Alzheimer's disease. International Journal of Geriatric Psychiatry 2006 Apr; 21(4):356-62. *Not eligible target population*
1764. Wilson RS, Schneider JA, Boyle PA, et al. Chronic distress and incidence of mild cognitive impairment. Neurology 2007 Jun 12; 68(24):2085-92. *Not eligible exposure*
1765. Wipke-Tevis DD, Rantz MJ, Mehr DR, et al. Prevalence, incidence, management, and predictors of venous ulcers in the long-term-care population using the MDS. Adv Skin Wound Care 2000 Sep-Oct; 13(5):218-24. *Not eligible target population*
1766. Wirth R, Bauer JM, Sieber CC. Cognitive function, body weight and body composition in geriatric patients. Zeitschrift fur Gerontologie und Geriatrie 2007 Feb; 40(1):13-20. *Not eligible target population*
1767. Witham MD, Gillespie ND, Hutcheon SD, et al. B-type natriuretic peptide is associated with mortality in older functionally impaired patients. J Am Geriatr Soc 2005 Nov; 53(11):1991-5. *Not eligible exposure*
1768. Wittchen HU, Jacobi F. Size and burden of mental disorders in Europe--a critical review and appraisal of 27 studies. Eur Neuropsychopharmacol 2005 Aug; 15(4):357-76. *Not eligible outcomes*
1769. Wolf DA, Mendes de Leon CF, Glass TA. Trends in rates of onset of and recovery from disability at older ages: 1982-1994. J Gerontol B Psychol Sci Soc Sci 2007 Jan; 62(1):S3-S10. *Not eligible outcomes*
1770. Wolf SL, Barnhart HX, Kutner NG, et al. Reducing frailty and falls in older persons: an investigation of Tai Chi and computerized balance training. Atlanta FICSIT Group. Frailty and Injuries: Cooperative Studies of Intervention Techniques. J Am Geriatr Soc 1996 May; 44(5):489-97. *Not eligible outcomes*
1771. Wolfe F, Skevington SM. Measuring the epidemiology of distress: the rheumatology distress index. Journal of Rheumatology 2000 Aug; 27(8):2000-9. *Not eligible outcomes*
1772. Wolff JL, Meadow A, Weiss CO, et al. Medicare home health patients' transitions through acute and post-acute care settings. Med Care 2008 Nov; 46(11):1188-93. *Not eligible target population*
1773. Wolff JL, Roter DL. Hidden in plain sight: medical visit companions as a resource for vulnerable older adults. Arch Intern Med 2008 Jul 14; 168(13):1409-15. *Not eligible outcomes*
1774. Wolf-Klein GP, Levy AP, Silverstone FA, et al. Psychiatric profile of the noncompliant geriatric patient in the community. Int Psychogeriatr 1989 Fall; 1(2):177-84. *Not eligible outcomes*
1775. Wolinsky FD, Fitzgerald JF, Stump TE. The effect of hip fracture on mortality, hospitalization, and functional status: a prospective study. American Journal of Public Health 1997 Mar; 87(3):398-403. *Not eligible exposure*
1776. Wolinsky FD, Miller DK, Andresen EM, et al. Further evidence for the importance of subclinical functional limitation and subclinical disability assessment in gerontology and geriatrics. J Gerontol B Psychol Sci Soc Sci 2005 May; 60(3):S146-51. *Not eligible outcomes*
1777. Wolinsky FD, Miller DK, Andresen EM, et al. Effect of subclinical status in functional limitation and disability on adverse health outcomes 3 years later. J Gerontol A Biol Sci Med Sci 2007 Jan; 62(1):101-6. *Not eligible outcomes*
1778. Wolinsky FD, Miller TR, Geweke JF, et al. An interpersonal continuity of care measure for Medicare Part B claims analyses. J Gerontol B Psychol Sci Soc Sci 2007 May; 62(3):S160-8. *Not eligible outcomes*
1779. Wolinsky FD, Overhage JM, Stump TE, et al. The risk of hospitalization for congestive heart failure among older adults. Med Care 1997 Oct; 35(10):1031-43. *Not eligible exposure*
1780. Wolinsky FD, Stump TE. A measurement model of the Medical Outcomes Study 36-Item Short-Form Health Survey in a clinical sample of disadvantaged, older, black, and white men and women. Med Care 1996 Jun; 34(6):537-48. *Not eligible outcomes*
1781. Won A, Lapane K, Gambassi G, et al. Correlates and management of nonmalignant pain in the nursing home. SAGE Study Group. Systematic Assessment of Geriatric drug use via Epidemiology. J Am Geriatr Soc 1999 Aug; 47(8):936-42. *Not eligible target population*
1782. Woo J, Ho SC, Yu AL. Walking speed and stride length predicts 36 months dependency, mortality, and institutionalization in Chinese aged 70 and older. J Am Geriatr Soc 1999 Oct; 47(10):1257-60. *Not eligible population*
1783. Woo J, Tang NL, Suen E, et al. Telomeres and frailty. Mech Ageing Dev 2008 Nov; 129(11):642-8. *Not eligible outcomes*

Appendix B. Excluded Studies

1784. Wood RY, Giuliano KK, Bignell CU, et al. Assessing cognitive ability in research: use of MMSE with minority populations and elderly adults with low education levels. J Gerontol Nurs 2006 Apr; 32(4):45-54. *Not eligible outcomes*
1785. Woolf SH, Kamerow DB, Lawrence RS, et al. The periodic health examination of older adults: the recommendations of the U.S. Preventive Services Task Force. Part II. Screening tests. J Am Geriatr Soc 1990 Aug; 38(8):933-42. *Not eligible outcomes*
1786. Wray LA, Alwin DF, McCammon RJ, et al. Social status and risky health behaviors: results from the health and retirement study. Journals of Gerontology Series B-Psychological Sciences & Social Sciences 2005 Oct; 60 Spec No 2:85-92. *Not eligible outcomes*
1787. Wright CB, Elkind MS, Luo X, et al. Reported alcohol consumption and cognitive decline: The northern Manhattan study. Neuroepidemiology 2006; 27(4):201-7. *Not eligible outcomes*
1788. Wu AH, Eagle KA, Montgomery DG, et al. Relation of body mass index to mortality after development of heart failure due to acute coronary syndrome. American Journal of Cardiology 2009 Jun 15; 103(12):1736-40. *Not eligible outcomes*
1789. Wu CY, Yu TJ, Chen MJ. Age related testosterone level changes and male andropause syndrome. Chang Gung Med J 2000 Jun; 23(6):348-53. *Not eligible outcomes*
1790. Wu JY, Leung WY, Chang S, et al. Effectiveness of telephone counselling by a pharmacist in reducing mortality in patients receiving polypharmacy: randomised controlled trial. BMJ 2006 Sep 9; 333(7567):522. *Not eligible outcomes*
1791. Wuthrich P, Gervaz P, Ambrosetti P, et al. Functional outcome and quality of life after restorative proctocolectomy and ileo-anal pouch anastomosis. Swiss Medical Weekly 2009 Apr 4; 139(13-14):193-7. *Not eligible outcomes*
1792. Xiong GL, Plassman BL, Helms MJ, et al. Vascular risk factors and cognitive decline among elderly male twins.[see comment]. Neurology 2006 Nov 14; 67(9):1586-91. *Not eligible exposure*
1793. Xu R, Harrington DP. A semiparametric estimate of treatment effects with censored data. Biometrics 2001 Sep; 57(3):875-85. *Not eligible outcomes*
1794. Xu X, Weiss ST, Dockery DW, et al. Comparing FEV1 in adults in two community-based studies. Chest 1995 Sep; 108(3):656-62. *Not eligible outcomes*
1795. Yaffe K, Barnes D, Nevitt M, et al. A prospective study of physical activity and cognitive decline in elderly women: women who walk.[see comment]. Archives of Internal Medicine 2001 Jul 23; 161(14):1703-8. *Not eligible outcomes*
1796. Yaghoubian A, de Virgilio C, White RA, et al. Increased incidence of renal cysts in patients with abdominal aortic aneurysms: a common pathogenesis? Annals of Vascular Surgery 2006 Nov; 20(6):787-91. *Not eligible outcomes*
1797. Yancik R, Havlik RJ, Wesley MN, et al. Cancer and comorbidity in older patients: a descriptive profile. Ann Epidemiol 1996 Sep; 6(5):399-412. *Not eligible outcomes*
1798. Yao Y, Yao SL, Yao SS, et al. Prevalence of vitamin B12 deficiency among geriatric outpatients.[see comment]. Journal of Family Practice 1992 Nov; 35(5):524-8. *Not eligible target population*
1799. Yasar S, Corrada M, Brookmeyer R, et al. Calcium channel blockers and risk of AD: the Baltimore Longitudinal Study of Aging. Neurobiology of aging 2005 Feb; 26(2):157-63. *Not eligible exposure*
1800. Yashin AI, Arbeev KG, Akushevich I, et al. Stochastic model for analysis of longitudinal data on aging and mortality. Mathematical Biosciences 2007; 208(2):538-51. *Not eligible outcomes*
1801. Yashin AI, Arbeev KG, Akushevich I, et al. Model of hidden heterogeneity in longitudinal data. Theoretical Population Biology 2008; 73(1):1-10. *Not eligible outcomes*
1802. Yashin AI, Arbeev KG, Kulminski A, et al. Cumulative index of elderly disorders and its dynamic contribution to mortality and longevity. Rejuvenation Res 2007 Mar; 10(1):75-86. *Not eligible outcomes*
1803. Yashin AI, De Benedictis G, Vaupel JW, et al. Genes, demography, and life span: the contribution of demographic data in genetic studies on aging and longevity. Am J Hum Genet 1999 Oct; 65(4):1178-93. *Not eligible outcomes*
1804. Yashin AI, Iachine IA. Genetic analysis of durations: correlated frailty model applied to survival of Danish twins. Genet Epidemiol 1995; 12(5):529-38. *Not eligible outcomes*
1805. Yashin AI, Iachine IA, Harris JR. Half of the variation in susceptibility to mortality is genetic: findings from Swedish twin survival data. Behav Genet 1999 Jan; 29(1):11-9. *Not eligible outcomes*
1806. Yashin AI, Manton KG, Vaupel JW. Mortality and aging in a heterogeneous population: a stochastic process model with observed and unobserved variables. Theor Popul Biol 1985 Apr; 27(2):154-75. *Not eligible outcomes*
1807. Yashin AI, Manton KG, Woodbury MA, et al. The effects of health histories on stochastic process models of aging and mortality. J Math Biol 1995; 34(1):1-16. *Not eligible outcomes*
1808. Yashin AI, Ukraintseva SV, Boiko SI, et al. Individual aging and mortality rate: how are they related? Soc Biol 2002 Fall-Winter; 49(3-4):206-17. *Not eligible outcomes*
1809. Yasmeen S, Romano PS, Pettinger M, et al. Incidence of cervical cytological abnormalities with aging in the women's health initiative: a randomized controlled trial. Obstetrics & Gynecology 2006 Aug; 108(2):410-9. *Not eligible outcomes*
1810. Yau KK, McGilchrist CA. ML and REML estimation in survival analysis with time dependent correlated frailty. Stat Med 1998 Jun 15; 17(11):1201-13. *Not eligible outcomes*
1811. Ye Y, Kalbfleisch JD, Schaubel DE. Semiparametric analysis of correlated recurrent and terminal events. Biometrics 2007 Mar; 63(1):78-87. *Not eligible outcomes*

Appendix B. Excluded Studies

1812. Yelin E, Trupin L, Wong B, et al. The impact of functional status and change in functional status on mortality over 18 years among persons with rheumatoid arthritis. Journal of Rheumatology 2002 Sep; 29(9):1851-7. *Not eligible outcomes*
1813. Yin G, Ibrahim JG. A class of Bayesian shared gamma frailty models with multivariate failure time data. Biometrics 2005 Mar; 61(1):208-16. *Not eligible outcomes*
1814. Young RF. Nursing home admission of female Alzheimer's patients: family care aspects. Womens Health Issues 2003 Jan-Feb; 13(1):2-7. *Not eligible outcomes*
1815. Young T. Analytic epidemiology studies of sleep disordered breathing--what explains the gender difference in sleep disordered breathing?[see comment]. Sleep 1993 Dec; 16(8 Suppl):S1-2. *Not eligible outcomes*
1816. Young T, Finn L, Austin D, et al. Menopausal status and sleep-disordered breathing in the Wisconsin Sleep Cohort Study.[see comment]. American Journal of Respiratory & Critical Care Medicine 2003 May 1; 167(9):1181-5. *Not eligible outcomes*
1817. Young T, Finn L, Palta M. Chronic nasal congestion at night is a risk factor for snoring in a population-based cohort study. Archives of Internal Medicine 2001 Jun 25; 161(12):1514-9. *Not eligible outcomes*
1818. Young T, Palta M, Dempsey J, et al. The occurrence of sleep-disordered breathing among middle-aged adults.[see comment]. New England Journal of Medicine 1993 Apr 29; 328(17):1230-5. *Not eligible outcomes*
1819. Yu EW, Blackwell T, Ensrud KE, et al. Acid-suppressive medications and risk of bone loss and fracture in older adults. Calcified tissue international 2008 Oct; 83(4):251-9. *Not eligible outcomes*
1820. Yu YF, Nichol MB, Yu AP, et al. Persistence and adherence of medications for chronic overactive bladder/urinary incontinence in the california medicaid program. Value in Health 2005 Jul-Aug; 8(4):495-505. *Not eligible outcomes*
1821. Yu Z, Lin X, Haas JD, et al. Obesity related metabolic abnormalities: distribution and geographic differences among middle-aged and older Chinese populations. Preventive medicine 2009 Mar; 48(3):272-8. *Not eligible exposure*
1822. Zandi PP, Sparks DL, Khachaturian AS, et al. Do statins reduce risk of incident dementia and Alzheimer disease? The Cache County Study. Arch Gen Psychiatry 2005 Feb; 62(2):217-24. *Not eligible outcomes*
1823. Zarowitz BJ. Medication overuse and misuse. Geriatr Nurs 2006 Jul-Aug; 27(4):204-6. *Not eligible outcomes*
1824. Zarowitz BJ. Fixed-dose combinations for improving medication adherence in assisted living environments. Geriatr Nurs 2007 Nov-Dec; 28(6):341-5. *Not eligible outcomes*
1825. Zarowitz BJ, Stefanacci R, Hollenack K, et al. The application of evidence-based principles of care in older persons (issue 1): management of osteoporosis. J Am Med Dir Assoc 2006 Feb; 7(2):102-8. *Not eligible outcomes*
1826. Zauber AG, Lansdorp-Vogelaar I, Knudsen AB, et al. Evaluating test strategies for colorectal cancer screening: a decision analysis for the U.S. Preventive Services Task Force. Ann Intern Med 2008 Nov 4; 149(9):659-69. *Not eligible outcomes*
1827. Zauszniewski JA, Morris DL, Preechawong S, et al. Reports on depressive symptoms in older adults with chronic conditions. Res Theory Nurs Pract 2004 Summer-Fall; 18(2-3):185-96. *Not eligible outcomes*
1828. Zdravkovic S, Wienke A, Pedersen NL, et al. Heritability of death from coronary heart disease: a 36-year follow-up of 20 966 Swedish twins. J Intern Med 2002 Sep; 252(3):247-54. *Not eligible outcomes*
1829. Zdravkovic S, Wienke A, Pedersen NL, et al. Genetic influences on CHD-death and the impact of known risk factors: comparison of two frailty models. Behav Genet 2004 Nov; 34(6):585-92. *Not eligible outcomes*
1830. Zhang W, Mason EE, Renquist KE, et al. Factors influencing survival following surgical treatment of obesity. Obes Surg 2005 Jan; 15(1):43-50. *Not eligible outcomes*
1831. Zhang Y, Niu J, Kelly-Hayes M, et al. Prevalence of symptomatic hand osteoarthritis and its impact on functional status among the elderly: The Framingham Study. Am J Epidemiol 2002 Dec 1; 156(11):1021-7. *Not eligible outcomes*
1832. Zhou H, Lawson AB, Hebert JR, et al. Joint spatial survival modeling for the age at diagnosis and the vital outcome of prostate cancer. Stat Med 2008 Aug 15; 27(18):3612-28. *Not eligible outcomes*
1833. Zhu CW, Leibman C, McLaughlin T, et al. The effects of patient function and dependence on costs of care in Alzheimer's disease. J Am Geriatr Soc 2008 Aug; 56(8):1497-503. *Not eligible outcomes*
1834. Zimmaro Bliss D, Zehrer C, Savik K, et al. Incontinence-associated skin damage in nursing home residents: a secondary analysis of a prospective, multicenter study. Ostomy Wound Management 2006 Dec; 52(12):46-55. *Not eligible target population*
1835. Zochling J, Chen JS, Seibel M, et al. Calcium metabolism in the frail elderly. Clin Rheumatol 2005 Nov; 24(6):576-82. *Not eligible target population*
1836. Zonderman AB, Zonderman AB. Predicting Alzheimer's disease in the Baltimore longitudinal study of aging. Journal of Geriatric Psychiatry & Neurology 2005 Dec; 18(4):192-5. *Review*
1837. Zuliani G, Volpatol S, Romagnoni F, et al. Combined measurement of serum albumin and high-density lipoprotein cholesterol strongly predicts mortality in frail older nursing-home residents. Aging Clin Exp Res 2004 Dec; 16(6):472-5. *Not eligible outcomes*
1838. Zweifel P, Felder S, Meier M. Reply to: Econometric issues in testing the age neutrality of health care expenditure. Health Econ 2001 Oct; 10(7):673-4. *Not eligible outcomes*

Appendix B. Excluded Studies

1839. Zweifel P, Felder S, Meiers M. Ageing of population and health care expenditure: a red herring? Health Econ 1999 Sep; 8(6):485-96. *Not eligible outcomes*
1840. Brogan D, Kutner NG, Flagg E. Survival differences among older dialysis patients in the southeast. Am J Kidney Dis 1992 Oct; 20(4):376-86. *Not eligible outcomes*
1841. Nichols CM, Gill EJ, Nguyen T, et al. Anal sphincter injury in women with pelvic floor disorders. Obstetrics & Gynecology 2004 Oct; 104(4):690-6. *Not eligible outcomes*
1842. Rockwood K, Rockwood MR, Andrew MK, et al. Reliability of the hierarchical assessment of balance and mobility in frail older adults. J Am Geriatr Soc 2008 Jul; 56(7):1213-7. *Not eligible outcomes*
1843. Vasquez MS. Preventing rehospitalization through effective home health nursing care. Home Healthc Nurse 2008 Feb; 26(2):75-81. *Secondary data analysis*
1844. Wilhelm-Leen ER, Hall YN, Tamura MK, et al. Frailty and chronic kidney disease: the Third National Health and Nutrition Evaluation Survey. Am J Med 2009 Jul; 122(7):664-71 e2. *Not eligible outcomes*
1845. Cress C. Handbook of geriatric care management: Toronto; 2007. *Not eligible outcomes*
1846. Minkler M, Fuller-Thomson E, Guralnik JM. Gradient of disability across the socioeconomic spectrum in the United States. N Engl J Med 2006 Aug 17; 355(7):695-703. *Not eligible outcomes*
1847. Barry LC, Allore HG, Bruce ML, et al. Longitudinal association between depressive symptoms and disability burden among older persons. J Gerontol A Biol Sci Med Sci 2009 Dec; 64(12):1325-32. *Not eligible outcomes*
1848. Gill TM, Van Ness PH, Gahbauer EA. Factors associated with accurate recall of prior disability in older persons. J Am Geriatr Soc 2009 Oct; 57(10):1897-901. *Not eligible outcomes*
1849. Naik AD, Concato J, Gill TM. Bathing disability in community-living older persons: common, consequential, and complex. J Am Geriatr Soc 2004 Nov; 52(11):1805-10. *Not eligible outcomes*
1850. Gill TM, Han L, Allore HG. Bath aids and the subsequent development of bathing disability in community-living older persons. J Am Geriatr Soc 2007 Nov; 55(11):1757-63. *Not eligible outcomes/ duplicate reporting*
1851. Cesari M, Pahor M, Marzetti E, et al. Self-assessed health status, walking speed and mortality in older Mexican-Americans. Gerontology 2009; 55(2):194-201. *Not eligible outcomes*
1852. Landi F, Russo A, Pahor M, et al. Serum high-density lipoprotein cholesterol levels and mortality in frail, community-living elderly. Gerontology 2008; 54(2):71-8. *Not eligible outcomes*
1853. Coppin AK, Ferrucci L, Lauretani F, et al. Low socioeconomic status and disability in old age: evidence from the InChianti study for the mediating role of physiological impairments. J Gerontol A Biol Sci Med Sci 2006 Jan; 61(1):86-91. *Not eligible outcomes*
1854. Penninx BW, Pahor M, Cesari M, et al. Anemia is associated with disability and decreased physical performance and muscle strength in the elderly. J Am Geriatr Soc 2004 May; 52(5):719-24. *Not eligible outcomes*
1855. Vestergaard S, Patel KV, Walkup MP, et al. Stopping to rest during a 400-meter walk and incident mobility disability in older persons with functional limitations. J Am Geriatr Soc 2009 Feb; 57(2):260-5. *Not eligible outcomes*
1856. Chevarley FM, Thierry JM, Gill CJ, et al. Health, preventive health care, and health care access among women with disabilities in the 1994-1995 National Health Interview Survey, Supplement on Disability. Womens Health Issues 2006 Nov-Dec; 16(6):297-312. *Not eligible outcomes*
1857. Atkinson HH, Cesari M, Kritchevsky SB, et al. Predictors of combined cognitive and physical decline. J Am Geriatr Soc 2005 Jul; 53(7):1197-202. *Not eligible outcomes*
1858. Bartali B, Semba RD, Frongillo EA, et al. Low micronutrient levels as a predictor of incident disability in older women. Archives of Internal Medicine 2006 Nov 27; 166(21):2335-40. *Not eligible outcomes*
1859. Jylha M, Guralnik JM, Balfour J, et al. Walking difficulty, walking speed, and age as predictors of self-rated health: the women's health and aging study. J Gerontol A Biol Sci Med Sci 2001 Oct; 56(10):M609-17. *Not eligible outcomes*
1860. Onder G, Penninx BW, Ferrucci L, et al. Measures of physical performance and risk for progressive and catastrophic disability: results from the Women's Health and Aging Study. J Gerontol A Biol Sci Med Sci 2005 Jan; 60(1):74-9. *Not eligible outcomes*
1861. Rantanen T, Guralnik JM, Ferrucci L, et al. Coimpairments as predictors of severe walking disability in older women. J Am Geriatr Soc 2001 Jan; 49(1):21-7. *Not eligible outcomes*
1862. Semba RD, Ferrucci L, Sun K, et al. Oxidative stress and severe walking disability among older women. Am J Med 2007 Dec; 120(12):1084-9. *Not eligible outcomes*
1863. Gersten O. Neuroendocrine biomarkers, social relations, and the cumulative costs of stress in Taiwan. Soc Sci Med 2008 Feb; 66(3):507-19; discussion 20-35.
1864. Ceresini G, Lauretani F, Maggio M, et al. Thyroid function abnormalities and cognitive impairment in elderly people: results of the Invecchiare in Chianti study. J Am Geriatr Soc 2009 Jan; 57(1):89-93.
1865. Shumway-Cook A, Guralnik JM, Phillips CL, et al. Age-associated declines in complex walking task performance: the Walking InCHIANTI toolkit. J Am Geriatr Soc 2007 Jan; 55(1):58-65.

Appendix C. Technical Expert Panel Members and Affiliations

TEP Member	Affiliation
Kathleen Buckwalter, PhD, RN	Gerontological Nursing Research The University of Iowa Iowa City, Iowa
Thomas Gill, MD	Department of Internal Medicine Yale School of Medicine New Haven, Connecticut
Jack Guralnik, MD, PhD	National Institute on Aging Bethesda, Maryland
Rosanne Leipzig, MD, PhD	Mount Sinai School of Medicine New York, New York
Joseph Ouslander, MD	Charles E. Schmidt College of Biomedical Science Florida Atlantic University Boca Raton, Florida
Barbara Resnick, PhD	School of Nursing University of Maryland Baltimore, Maryland
Albert L. Siu, MD, MSPH	Mount Sinai Medical Center New York, New York and James J. Peters VA Medical Center Bronx, New York
Gregg Warshaw, MD	College of Medicine University of Cincinnati Medical Center Cincinnati, Ohio

Appendix D. Abstraction Forms

Abstraction Form for Question 1

(Complete for each study)

Number of the study in the database (PubMed ID, Cochrane accession number, ISBN)_________
First author____
Year of the publication__________ Year when outcomes occurred__________
Purpose/aim of study____
Design of the study (check one)
☐ prospective cohort
☐ retrospective cohort
☐ cross-sectional
☐ descriptive study

Population variables (target population):
Data source for population variables (define) ______________________________

Settings:
Community (general population)___________
Clinic________________________

Location:
Country _______________

Subjects:
Sex_____________
Race __________________
African Continental Ancestry Group, %_________
Asian Continental Ancestry Group, %_________
European Continental Ancestry Group, %_________

Ethnicity:
Arabs, %___________
Asian Americans, %__________
Hispanic Americans, %_______

Age:
Mean age, years______ Standard deviation_________
Age intervals:________

Health status:
Primary health condition, diagnosis ____________________________________
Inclusion criteria:________________

Syndrome or non syndromic condition (dependent variable):
Definition____
Adjustment ___________________

Independent variable:
Age________
Sex__________
Race____________
Ethnicity________________
Comorbidity____________

Prevalence (%):
95% CI________________
Bias in the study_____________

Appendix D. Abstraction Forms

Abstraction Form for Question 2

(Complete for each study)

Number of the study in the database (PubMed ID, Cochrane accession number, ISBN)__________________
First author____
Year of the publication ___________
Purpose/aim of study ____
Design of the study (check one)
☐ prospective cohort
☐ retrospective cohort
☐ cross-sectional
☐ descriptive study

Year of the study____________________

Population variables (target population):
____

Settings:
Community (general population)____________
Health care_______

Subjects:
Age___________
Sex___________
Race________________________
African Continental Ancestry Group, %_________
Asian Continental Ancestry Group, %_________
European Continental Ancestry Group, %_________

Ethnicity:
African Americans, %________
Arabs, %___________
Asian Americans, %__________
Hispanic Americans, %_______

Age_________
Health status______________________________________
Inclusion criteria ____________________________________
Exclusion criteria ___________________________________

Clinical outcomes (dependent variable):
1. Provide the definition: Mortality, Morbidity, Institutionalization, Hospitalization, Disability
2. Provide the data source to measure the outcomes

Geriatric syndromes (independent variables):
Provide the definition of each syndrome

Syndrome (exposure)	Comparator	Outcomes Definition	Sample	Adjustment	Estimate	Mean	Lower 95% CI	Upper 95% CI	SE

Appendix D. Abstraction Forms

Abstraction Form for Question 3

(Complete for each study)

Number of the study in the database (PubMed ID, Cochrane accession number, ISBN)__________________
First author____
Year of the publication ___________
Purpose/aim of study ____

Perspective:
Societal, payer, personal and social services, other_____________

Study Design_____________

Subjects______________

Setting_______________

Model Validity______________

Quality of Data_________________
Alternative Strategies________________
Measure of Cost/Consequence_____________
Differential Timing Adjustment____________
Incremental Analysis Performed_______________
Uncertainty Allowance____________
Results__________________

For mortality indexes:
Predictors Evaluated________________
Predictor Name_________________
Category_____________________
Index/Measurement Used___________________
Purpose____________

Index Development________________
Prediction Outcome___________________
Index Component___________________
Weight__________________
Weight Method__________________
Risk Group________________
Score________________
Accuracy/Validation____________________

Appendix E. Evidence Tables

Appendix E. Evidence Tables

Appendix E. Evidence Tables

Appendix E Table 1. Epidemiologic Studies in Older Persons

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
Aging, Demographics, and Memory Study(ADAMS) sample from the Health and Retirement Study[1]	USA good	856	No	Yes	>71	Drawn from the larger HRS(Health and Retirement Study)	Not reported	Yes	No
AHEAD-Survey of Asset and Health Dynamics of the Oldest Old (AHEAD)[2]	USA good	7,447	No	Yes	>70	Older Americans who resided in the community at the time of the baseline interview	Under age 70, who did not fall into Black or White racial categories, and who responded that they did not perform an ADL or had missing information for any of the covariates used in this analysis	Yes	No
American Community Survey (US Census)[3,4]	USA good	202,956	American Indian/Alaska Native/Native Americans are oversampled	Yes	>55	Community-dwelling Americans	Nursing home residents	Yes	No
Baltimore Epidemiologic Catchment Area Program[5]	USA good	3,481	No	Yes	>18	Persons aged 18 years and older in Baltimore	Not reported	Yes	No
Beaver Dam Eye Study cohort[6]	USA good	2,515	No	Not reported	>53	Adults 43-86 years of age living in Beaver Dam, Wisconsin	Deaths within one year of examination	Yes	No
Census Public Use 5% Microdata sample[7]	USA Census	2,944,755	No	Yes	>55	Representative sample of housing units and their residents as well as individuals living in group quarters. The sample is a stratified subsample drawn from the full Census enumeration; housing units and individuals	Nursing home residents	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
						were randomly selected to receive the long form questionnaire.			
Duke Established Populations for Epidemiologic Studies of the Elderly, 1992; Third In-Person Survey Wilson, 2003 #1390}[8,9]	USA good	1,752	No	Yes	>65	65 years or older who were selected in a random household sample of a five-county area including and adjacent to Durham, North Carolina, in 1986. Blacks were oversampled to allow for comparison by race	Disability at baseline, did not give blood to study in 1992	Yes	No
EPESE Established Populations for Epidemiologic Studies of the Elderly - East Boston & New Haven Communities[10-17]	USA good	6,640	No	Not reported	>65	Community-living persons aged 65 years or older living in East Boston, 2 Iowa communities, New Haven, Connecticut	Not reported	Yes	No
Freedom House Study[18]	USA good	546 and 242 in analysis	No	Yes	>70	Initially non-institutionalized elderly CCRC (Continuing-Care Retirement Community) residents over the age of 70. CLOX was introduced in the second FHS wave and collected on 242 residents and these form the basis of the analysis'	No exclusions	Yes	No
Kaiser Permanente Inter-regional Committee on Aging Study[19]	USA good	5,810	No	Not reported	>65	The study population was drawn from the 1990 HSF (Health Status Form) respondents.	Nursing home residents	Yes	No
MacArthur	USA	598	No	Yes	>65	Men and women were	Medicare data were	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
Research Network on Successful Aging Community Study[20]	good					subsampled on the basis of age (70–79) and physical and cognitive functioning at the time of their 1988 EPESE interview, a score of 6 or more correct on the 9-point Pfeiffer Short Portable Mental-Status Questionnaire (SPMSQ), the ability to remember three or more of six elements of a delayed recall of a short story, no disability on the Katz activities of daily living scale, no more than one disability on an eight-item measure of gross mobility and physical performance based on items from two studies, the ability to maintain a semi-tandem balance for at least 10 seconds, and the ability to stand from a seated position five times within 20 seconds, agreed to participate in the MacArthur study and provided informed consent	not available		

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
MacArthur Studies of Successful Aging[20-25]	USA	657	No	Not reported	>70	High functioning men and women, aged 70-79 years community-based cohorts in Durham, NC, East Boston, MA, and New Haven, CT that were part of the Established Populations for Epidemiological Studies of the Elderly (EPESE).	Not reported	Yes	No
MOBILIZE[26,27]	USA good	765	No	Yes	>70	Aged 70 and older, ability to speak and understand English, ability to walk across a room, visual ability to read written material, and the expectation that the participant would be living in the area for at least 3 years		Yes	No
MROS - Osteoporotic Fractures in Men Study[28,29]	USA good		No	Not reported	>65	Men must be able to provide consent; be able to walk without assistance from another person or aid; be age 65 years and older; and not have had bilateral hip replacements.	Not reported	No	No
National Long-Term Care Survey[30]	USA good	17,658	No	Yes	>65	People >65 years of age drawn from national Medicare enrollment files. Both elderly in the community (including those not impaired) and those residing in institutions are represented in the samples	Not reported	Yes	Yes

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
National Survey on Self-Care and Aging[31]	USA good	3,485	Oversampling of the oldest old and males	Yes	>65	Community dwelling Medicare beneficiaries who were 65 years of age or older in 1990.	Not reported	Yes	No
Precipitating Events Project[32-44]	USA good	754	Persons who were physically frail were oversampled	Yes	>70	Members of an ongoing longitudinal study of 754 community-dwelling persons, aged 70 years or older, who were initially nondisabled in four key ADLs—bathing, dressing, walking inside the house, and transferring from a chair. Potential participants were members of a large health plan in greater New Haven, Connecticut.	Life expectancy of less than 12 months, planned to move out of the New Haven area, or were unable to speak English. Participants with significant cognitive impairment were excluded only if they had no available proxy.	Yes	No
NHANES III (National Health and Nutrition Examination Survey III) [45,46]	USA good	4,617	African American/Mexican American/Persons aged 60+,etc.	Yes	>60	Respondents aged ≥60 years who completed both the AHS(Adult Household Survey) and MEC(Mobile Examination Center)	Self-reported history of stroke.	Yes	No
Norwood - Montefiore Aging Study(NMAS) [47]	USA good	1,855	No	Yes	>65	At least 65 years of age, randomly selected from a list of Medicare beneficiaries living in a neighborhood in the Bronx.	Not reported	Yes	No
SITE Sources of Independence in the Elderly[48]	USA good	361	No	Yes	>70	Mild to moderate disability, as defined by self-reported difficulty with at least one but no more than three of four different	Those meeting criteria for depression or dementia, reported impairment in vision as a source of disability, were residing in a skilled	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
						domains of function: upper extremity, lower extremity, instrumental activities of daily living (IADL), or basic activities of daily living (BADL).	nursing facility, were receiving hospice services, required a wheelchair for indoor mobility, or planned to move out of the community within the year.		
Study of osteoporotic fractures[49-51]	USA good	6,724	No	No	>65	Women at least 65 years old from population-based listings in four areas of the United States	Black women were originally excluded from SOF because of their low incidence of hip fracture. In addition, women were excluded if they were unable to walk without assistance or had a history of bilateral hip replacement.	Yes	No
The 90+Study[52]	USA good	227	No	Not reported	>90	People aged 90 years and older. Cognitive diagnosis of no dementia (normal or CIND) from an in-person examination, serum CRP measurement from baseline examination, and cognitive diagnosis obtained at a followup in-person examination.	Subjects with less than one year of follow-up time were excluded	Yes	No
The Bronx Aging Study[53]	USA good	488	No	Yes	>75	Healthy, nondemented, community-dwelling individuals aged 75-85 years	Previous diagnoses of idiopathic Parkinson's disease, liver disease, alcoholism, or known terminal illness; severe visual and hearing impairment interfering with completion of neuropsychological tests; and the presence of dementia.	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
The Cardiovascular Health Study[54-64]	USA good	5,888	Supplemental African-American cohort recruited	Yes	>65	Potential participants were identified from a random sample stratified by age group (65-74, 75-84,>=85 years) from the Health Care Financing Administration (HCFA) Medicare Enrollment lists in 4 U.S. communities (Sacramento County, California; Washington County, Maryland, Forsyth County, North Carolina; and Allegheny County, (Pittsburgh), Pennsylvania); willing to reside in the community for at least 3 years.	Wheel-chair bound in the home, unable to participate in the examination at the field center, or undergoing active treatment for cancer.	Yes	No
The Cache County Study on Memory in Aging[65]	USA good	4683	No	Yes	>=65 years	All elderly residents aged 65 and older of Cache County, Utah.	Those who did not complete procedures sufficient for definitive classification or because they had developed dementia at a subsequent visit and may thus have had prodromal dementia when enrolled.	Yes	Yes
The Chicago Health and Aging Project[66]t	USA good	4,392		Yes	>65	All households in a geographically defined area on the south side of Chicago; persons aged 65 years and older	Not reported		
The Framingham Offspring Study[67]	USA good	1,926	No	Not reported	>35	Not reported	Neurologic condition that could substantively alter brain MRI measures	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
The Geisinger Rural Aging Study (GRAS) [68]	USA good	179	No	Not reported	>65	Rural Pennsylvanians aged 65 and older enrolled in a managed-risk Medicare program at Geisinger Health System.	Six were excluded because of depression, two as BMI outliers, and one because of poor cognitive function	Yes	No
The General Medicine Practice of the Regenstrief Health Center[69]	USA fair	3,861	No	Yes	>60	All patients aged 60 and older were screened for cognitive impairment, depression, and problem drinking during their regularly scheduled visits	Prisoners, patients residing in a nursing home, patients unable to speak English, and patients who had hearing impairment	Yes	No
The Geriatric Evaluation and Management(GEM) [70]	USA poor		No	Yes	78.4	Approximately 20% of subjects were physician-referred to the GEM clinic. An additional 22% were referred by either a social agency, home health service, or day care program. The remaining individuals were referred by family members who had heard about the program via word of mouth, brochures, or newspaper articles. Individuals with one or more of the following concerns were scheduled for evaluation: memory loss, depression, behavioral problems, paranoia, functional decline, weight loss, falls, incontinence, and concerns about overall health and safety.	Not reported	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
The Health and Retirement Study[71,72]	USA good	11,701	No	Yes	>50	Community dwelling adults aged 50 and older, representative of entire US	Nursing home residents	Yes	No
The Health, Aging and Body Composition(Health ABC) Study[73-79]	USA good	3,075(analytic sample:2984)	No	Yes	>70	3075 well-functioning men and women aged 70 to 79 recruited from a random sample of Medicare enrollees in Pittsburgh, Pennsylvania, and Memphis, Tennessee. Eligible participants had self-reported no difficulty walking one-quarter of a mile, climbing 10 steps, and performing activities of daily living (ADL); did not report a walking aid; and were free of cancer under active treatment. Analysis was conducted on 2984 participants who had complete data on body composition and physical function.	Not reported	Yes	No
The Honolulu-Asia Aging Study of the Honolulu Heart Program[80,81]	USA good	1,890(analytic sample)	No	Yes	>77	Japanese and American men, identified from selective service records, who were born between 1900 and 1919 and were living on the island of Oahu, Hawaii, in 1965.	Not reported	No	No
The Iowa 65+ Rural Health Study[82]	USA good	1,293	No	Not reported	>65	Healthy, nondisabled elderly	647 persons who needed help walking a half mile, climbing a flight of steps, moving	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
							from bed to chair, using a toilet, bathing, or walking across a small room.		
The Marshfield Epidemiologic Study Area (MESA) system[83]	USA fair	811	No	Not reported	Not reported	New cases of Alzheimer's disease and dementia were defined to first occur between 7/1/92 and 6/30/97by the ICD-9 code, people who did not receive a diagnosis of AD/OD were frequency- matched to cases by age.	Permanent residence in a nursing home at the time of diagnosis, a history of AD/OD prior to 7/1/92, no mention of a memory problem in the medical record, receiving less than 75% of their care through the Marshfield Clinic system, or death on the date of diagnosis	Yes	No
The Medical Expenditure Panel Survey(MEPS)[84]	USA good	35200	Oversampling of minorities	Yes	NR	US civilian non-institutionalized population	Individuals missing data on one or more responses are excluded from analyses.	Yes	No
The Monongahela Valley Independent Elders Survey[85]	USA good	1,064	No	Not reported	>67	Registered voters in Washington & Westmoreland Counties in PA, community residence (i.e., not already being in long-term care), 65 years or older, fluency in English, and at least sixth grade education	Not reported	Yes	No
The National Health Interview Survey[86]	USA good	approx 9,000	African-American and Hispanic	Yes	>70	Civilian non-institutionalized population of the United States	Not reported	Yes	No
The National Long-Term Care Survey (NLTCS)[87]	USA good	5,934	No	Yes	>65	Community-dwelling elderly	Not reported	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
The National Survey of Self-Care and Aging[88]	USA good	3,485	Oversampling of the oldest old (85 years and older)	Yes	>65	A stratified random sample of non-institutionalized Medicare beneficiaries 65 years of age and older, drawn from 50 primary sampling units	Not reported	Yes	No
The New England Centenarian Study[89]	USA poor	36	No	Not Reported	100-107 years	86% of all centenarians living within an eight-town area.	Not Reported	Yes	Yes
The New Mexico Elder Health Survey[90]	USA good	808	No	No	>65 years	Equal numbers of Hispanic and non-Hispanic white men and women were selected randomly from the Health Care Financing Administration's Medicare listings for Bernalillo County, New Mexico.	73 subjects were deleted because of missing anthropometric data. Two subjects with artificial limbs whose estimates of muscle mass had doubtful validity were also excluded.	Yes	No
The Northern Manhattan Aging Project[91]	USA good	2,130		Yes	>65	A random sample of Medicare beneficiaries, 65 years old or older, living in a bounded target geographic area	Not reported	Yes	No
The Nutrition Screening Initiative[92]e	USA good	324	No	Yes	>60	Participants >60 years in six congregate meal sites in a north Florida county	Not reported	Yes	No
The Older Americans Act Nutrition Program (OAANP) in northeast Georgia[93]	USA fair	158	No	Yes	>65	Low-income older adults receiving home-delivered or congregate meals in the OAANP (Older Americans Act Nutrition Program) in the Northeast Georgia Area Agency on Aging.	Not reported	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
The Religious Orders Study[94]	USA good	816	No	Not reported	>70	Older Catholic nuns, priests, and brothers. Participants without known dementia.	Not reported	Yes	No
The Rush Memory and Aging Project[95]	USA good	832	No	Yes	Mean age: 80.4years	Absence of clinical dementia based on the baseline clinical evaluation with a valid baseline and at least one follow-up composite frailty score.	Participants without valid follow-up data including: 24 persons who died before their first follow-up examination, 120 who have not been in the study long enough for their first follow-up examination and 36 with missing follow-up data.	Yes	No
The San Antonio Longitudinal Study of Aging[96]	USA good	749	No	Yes	65-80 years	Subjects were randomly sampled from low-, middle-, and high-income neighborhoods to provide a cohort with comparable numbers of Mexican-Americans and European-Americans and to maximize socio-cultural variation among Mexican-Americans in the study. Aged 65-80 years. Community-dwelling.	Not Reported	Yes	No
The Survey of Health,Aging and Retirement in Europe(SHARE) [97]	Multinational good	18227	No	Not Reported	>=50 years	Randomly selected community-dwelling individuals 50 years of age and older	674 spouses younger than 50 years, 295 individuals living in institutions, 61 with insufficient information on sampling characteristics, and 2 non-evaluable individuals	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
The Women's Health and Aging Study[98-111]	USA good	3,481	No	Yes	>65	The sampling frame was obtained from the Health Care Financing Administration Medicare Enrollment files for the eastern half of Baltimore City and County, consisting of 12 zip code areas. A random sample of older women was drawn, stratified by age (65-74, 75-84, and 85 and older).	Not reported	Yes	No
University of Connecticut Center on Aging Osteoporosis in Men Study[112]	USA good	392	No	Yes	>58	Community-dwelling elderly men	Men younger than 58 years of age; those receiving prescription medication for osteoporosis, were on testosterone or dihydroepiandosterone, had a history of elevated prostate specific antigen (PSA) level, had a history of prostate cancer, had sleep apnea, or had elevated hematocrit.	No	No
2-year longitudinal study of independent residents of a continuing care retirement community[113]	USA fair	152	No	Not reported	82.3	Alert, oriented, ambulatory, able to socialize appropriately with other members of the community, and have no acute or chronic medical problems which interfere with ability to function or require daily nursing supervision	Not reported	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
411 patients who participated as control patients in the Generalist Physician Initiative at the Carle Clinic site, Urbana, Illinois[114]	USA poor	411	No	Yes	>65	65 years of age or older, survived for 12 months after enrollment, had Medicare Part A and B coverage, were not enrolled in a Medicare risk product, were community dwelling, and had 1 or more of the following characteristics: hospitalized in the previous 6 months before entering the study, lived alone, lacked a caregiver, were taking 4 or more prescription medications, had difficulty walking, had limitations in activities of daily living (ADLs), had memory difficulties, were incontinent of urine or stool, or had multiple illnesses or disabilities	Not reported	Yes	No
7076 community-dwelling elderly patients with at least one chronic disease were surveyed[115]	USA poor	1,899	No	Not reported	>65	Had seen their primary care provider within 14 months, had a comorbidity score of 1 or higher, were enrolled in Medicare, and were living outside of an institution as of September 2002	Returned with incomplete survey forms	Yes	No
A prospective cohort from a large health maintenance	USA good	1,129	No	Yes	>65	Randomly from Group Health enrollees, aged 65 and over	Physical limitations, limited ability to perform certain activities of daily living	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
organization of (Group Health Cooperative (GHC) in Seattle, Washington)[116]							at baseline, and incomplete responses or data		
Ambulatory Care Groups (ACGs)[117]	USA fair	3,496	No	Yes	>60	Community-dwelling patients at least 60 years of age with a scheduled primary care appointment between July 15, 1999, and August 31, 2001, were eligible for the study.	Not reported	Yes	No
Applicants to the home- and community-based care (HCBC) programs[118]	USA fair	1,690	No	Yes	79.7	Individuals who satisfied the level of care criteria for the program (regardless of whether they met the financial eligibility criteria or “cost cap” of the program) and remained in the community following their HCBC assessment	Not reported	Yes	No
Consecutive patients were screened and recruited from primary care clinics of a Veteran’s Affairs network site and a Medicare Health[119] Management Organization serving a	USA poor	316	No	Yes	>65	65 years or older, lived within 20 miles of the provider site, had received care in the system for at least 1 year, were living in the community, and met screening criteria for mental status and mobility. Participants had to score 24 on the Folstein Mini-Mental State Examination (MMSE) to assure that	MMSE scores less than 16, persons who were unable to walk at least 12 feet or who were felt to be extremely fit (gait speed over 1.3 m/s) or extremely fragile	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
common geographic area						they could independently maintain a utilization diary; subjects with MMSE scores between 16 and 24 could participate if they had a caregiver who could maintain the diary			
Depression Among Caregivers of Impaired Elders Study[120]	USA good	4,185	No	Not reported	>70	A geographically stratified sample of older people was drawn in 2 stages, using town/cities of eastern Massachusetts as the primary sampling unit, and then randomly selecting individuals within these units from local census lists.	Not reported	Yes	No
Effects of Two Exercise Interventions Among Community-residing Older Adults Study[121]	USA good	84	No	Not reported	>60	60 years of age or older, living independently in the community, able to speak and read English, and sufficient vision to read large print.	Diagnosis of neurological diseases, arthritis with severe pain that prevented activity, or presence of major symptoms suggestive of cardiopulmonary or metabolic disease unless physician approval was obtained.	Yes	No
For the validation study: Pneumonia Pathways project of Qualidigm, Connecticut Peer Review	USA poor	Development cohort:525 and validation cohort:1,246	No	Yes	>70	In the development cohort: subjects aged ≥70 years admitted consecutively to the medicine service at Yale New Haven Hospital that serves a large community and referral population.	In the development cohort: inability to be interviewed as a result of intubation, coma, aphasia, severe dementia, or terminal condition; prior enrollment. In the validation cohort: prior	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
Organization and Connecticut Thoracic Society. For the Development cohort: NR[122]						The validation cohort was selected from discharges from 27 acute care hospitals in Connecticut, patients aged>=65 years with a principal discharge diagnosis of pneumonia.	admission within 10 days; transfer from another hospital; immunosuppressive therapy; and discharge or transfer to ICU within 24 h of admission		
Frailty Study of African Americans in South Central Los Angeles[123]	USA good	507	No	Yes	>60	African -American residents 60 years or older of South Central Los Angeles and adjacent communities.	Not reported	Yes	Yes
Henry Ford Medical Group[124]	USA fair	195,971	No	Not reported	Not reported	Patients who received prescription and medical care coverage through the Health Alliance Plan and who were treated by physicians in the Henry Ford Medical Group.	Not reported	Yes	No
Individuals enrolled in 2 randomized trials of an intervention to improve functional outcomes of hospitalized older adults[125]	USA good	1,495	No	Yes	>70	Aged 70 years or older and who were admitted to the general medical service	Patients admitted to intensive care units (ICUs) or subspecialty services or elective admissions and patients with lengths of stay fewer than 2 days	Yes	Yes
Massachusetts Health Care Panel Study (MHCPS) [126]	USA good	Not specified; approx 540	No	Yes	>70	Age 70+ in 1980, living in community	Anyone lost to follow-up, dead, or in a nursing home at Wave 4	Yes	No
Randomized trial of in-home comprehensive geriatric	USA fair	202	No	Not reported	>75	Randomly selected from a voter-registration list, community-dwelling,	Not reported	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
assessment and preventive care[127]						non-institutionalized, living in Santa Monica CA			
PACE-Program of All-Inclusive Care for the Elderly[128,129]	USA good	5,478	No	Yes	>55	Enrollment in PACE was limited to older persons aged >=55, who lived within the sites' service areas and who met the state's nursing home eligibility requirements, and were eligible for Medicaid	Not reported	Yes	Yes
Pooled analysis[130]	USA good	5,308	No	Yes	>65	Studies had to contribute data believed to be directly applicable to the US population and the determination of glaucoma was made using both visual field and photographically obtained optic nerve head data.	Not reported	Yes	No
Practices providing services to Medicare beneficiaries in the U.S. [131]	USA good	1,221,615	No	Yes	>65	Medicare beneficiaries, aged 65 years or older, living in the US, with fee-for-service coverage, who had both Medicare part A and part B coverage in fiscal year (FY) 1992	Beneficiaries enrolled in HMOs	Yes	No
The San Luis Valley Health and Aging Study[132]	USA good	1,006	No	Yes	>65	A geographically-based sample of rural, community-dwelling residents was identified from a household enumeration of 97.2% of all occupied residential structures in	Subjects who were unable to complete the full protocol by themselves (scores <18 on the Folstein Mini-Mental Status Examination, a measure of cognitive functioning; extreme	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
						Alamosa and Conejos counties in southern Colorado.	frailty; or any other reason necessitating proxy responses: n=184) and those without complete diet data (n=8) were excluded.		
The Medicare Current Beneficiary Survey[133,134]	USA good	20,227	No	Yes	>65	People living in the United States who were 65 years of age or older and who were solely community-based	Respondents who died during the calendar year, individuals who did not have any type of physician encounter (i.e., in any type of inpatient or outpatient setting) during the calendar year	Yes	No
The Nun Study[135]	USA good	470	No	Not reported	>75	From 1991 to 1993, all members of the School Sisters of Notre Dame born before 1917 and living in communities in the Midwestern, eastern, and southern United States.	Not reported	Yes	No
Two cohorts, each composed of approximately 3000 randomly selected members of Kaiser Foundation Health Plan of Northern California[136]	USA fair	5,986	No	Yes	>65	Had been KFHP members for at least 5 years	Not reported	Yes	No
Urban, working-class community in East Boston, Massachusetts	USA good	467	No	Not reported	>65	All non-institutionalized residents over the age of 65 years in East Boston, Mass., a geographically defined,	Participation through proxy respondents or refusal to respond to the memory test items.	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
137						urban, working-class community of approximately 32, 000 persons.			
Veterans Administrative (VA) outpatient clinics[138]	USA fair	130	No	Yes	>65	Community-dwelling older adults (n = 130), age 65 years and older, with a BMI <24 kg/m^2 residing in 3 rural counties in the Western United States	The diagnosis of dementia (Folstein Mini-Mental Examination score of 23 or less), congestive heart failure, or cancer; bedridden or unable to stand for measurement of height; currently hospitalized; hospitalized in the past 30 days; or residing in a skilled nursing facility and non-English speaking	Yes	No
American Community Survey (US Census) and National Nursing Home Survey[3,4]	USA good	512,768	American Indian/Alaska Native/Native American are oversampled in the ACS Survey	Yes	>65	ACS: community - living men and women 65 years and older. NNHS: nursing home residents	ACS: no nursing home residents. NNHS: community-dwelling residents	Yes	Yes
Australian Longitudinal study on aging[139]	Australia good	1,272	No	Not reported	>70	Randomly selected from State electoral database age 70+, community-dwelling	Not reported	Yes	No
All consecutive non-elective admissions of patients aged 75 yrs and above to the Rapid assessment medical unit (RAMU) under	Australia poor	110	No	Not reported	>75	All consecutive non-elective admissions of patients aged 75 yrs and above to the Rapid assessment medical unit (RAMU) under the General Internal Medicine unit	Patients from nursing homes, patients who were transferred to other units or hospitals, patients who were considered for palliative care on admission, patients not conversant in English and those who were	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
the General Internal Medicine unit[140]							discharged from hospital within 48 hours		
Domiciliary care services for elderly people with moderate or severe functional limitations[141]	Australia poor	250	No	Not reported	>67	Those registered with the Eastern Domiciliary Care Service in Adelaide between July 1999 and February 2000.	Subjects younger than 65 (16.2%), non-English speaking (7.9%), or with the diagnosis of dementia (11.2%) were excluded.	Yes	No
National Population Health Survey[142]	Canada good	2,740	No	Not reported	>65	Adults 65 - 102 years old at baseline		Yes	No
The Canadian Study of Health and Aging(CSHA)[143-152]	Canada good	8,949	No	Not reported	>65	CSHA-1 (Canadian Study of Health and Aging-wave 1) included people aged 65 and over on October 31, 1990 from 39 urban and surrounding rural areas in the ten Canadian provinces. The community sampling frame was based on the Canadian provincial universal health insurance plans, with the exception of Ontario where technical limitations with the health insurance plan list at the time prevented its use. In Ontario, the Enumeration Composite Record	Reasons for non-inclusion in analyses are: loss to follow up, refusal to participate, unable to participate, or missing data. Those who were excluded had lower Time 1 MMSE scores.	Yes	Yes

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
						was used that was based on a composite list of all citizens in Ontario based on electoral lists.			
The MGAT study[153]	Canada fair	170	No	Not reported	Not reported	Be frail, which was defined as ‘‘a vulnerable state of health, arising from the complex interaction of medical and social problems, resulting in a decreased ability to respond to stress, and associated with a decline in functional performance”	Not reported	Yes	No
Prospective cohort study of community-living, medical patients age 75 or over[154] admitted to acute care for elders units (ACE) at a teaching hospital	Canada poor	150	No	Not reported	>75	ACE patients who consented to participate. They were eligible if they were 75 years or over (our hospital used this age cut-off as a surrogate marker to determine ACE eligibility), lived in the community pre-hospitalization, and could comprehend simple three-step commands in English. We also included ACE patients who transitioned through a separate sub-acute medical (SAM) unit after their initial stay in ACE.	If they were transferred from/to critical care or palliative care because these populations are not normally serviced by ACE; residing at a long term care facility prior to hospitalization; residing outside the catchment of the hospital (greater than 100 km distance); or deemed medically unstable	Yes	No
Study participants were recruited	Canada poor	125	No	Not reported	>70	(i) age 70 years or older; (ii) referred for medical preoperative	(i) day surgical procedures; (ii) active cancer (defined as	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
at a preadmission clinic for preoperative assessment, at a tertiary care teaching hospital[155]						assessment for medical clearance; (iii) undergoing a single elective non-cardiac operation	having surgery for a possible malignancy or receiving treatment for cancer); (iii) undecided as to whether they would have surgery; (iv) no working understanding of English; (v) not cleared for surgery for unstable medical reasons; (vi) enrolled in randomized controlled trials of new (i.e. investigational) pharmacologic agents		
The Chinese Longitudinal Health Longevity Survey[156]	China good	15,919	No	Not reported	>65	Randomly selected counties/cities in 22 out of 31 provinces in China. Adults aged 65 to 109 years. For every centenarian with a pre-designated random code, interviews were conducted for nearby adults with a pre-designated age and sex who were randomly selected from the following age ranges: 65-79, 80-89, and 90-99.	Not reported	Yes	No
The Danish part of the 'Survey in Europe of Nutrition in the Elderly, a Concerted Action'(SENECA) [157]	Denmark good	202	No	Not reported	>73	74- to-79 years old elderly European men and women		Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
The Danish Centenarian Study Centenarian Study[158]	Denmark good	126	No	Not reported	>100	276 persons living in Denmark who celebrated their 100th birthday from April 1, 1995, to May 31, 1996	Not reported	Yes	Yes
The Glostrup Aging Study[159]	Denmark good	705	No	Not reported	>70	70 -year old adults of the 1914 birth cohort in Glostrup, Denmark	31 persons who were disabled at baseline.	Yes	No
ELSA - English Longitudinal Study of Aging[160]	England good	5,432	No	Not reported	>50	Individuals were eligible if they were living in a responding HSE (Health Survey for England) household in 1998, 1999, or 2001, were born on or before 29 February 1952, and were, at ELSA interview, still living at a private residential address in England.	Not reported	Yes	No
The Helsinki Aging Study[161,162]	Finland good	650	No	Not reported	>75	A random sample of persons born in 1904, 1909, and 1914 were selected from the census register in 1989.	Not reported	Yes	No
The second wave of the Tampere Longitudinal Study on Ageing (TamELSA) [163]	Finland good	775	No	Not reported	>60	Persons aged 60–99 years were eligible to be interviewed face to face	Subjects already living in institutions and 3 subjects without data on urinary symptoms	Yes	No
The Vitality 90+ Study[164]	Finland good	285	No	Not reported	>90	People aged 90 or older in Tampere, Finland. Included both community-dwelling and institutionalized persons.	Not reported	Yes	Yes

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
EPIDOS Epidémiologie de l'ostéoporose study[165]	France good	7,250	No	Not reported	>75	Community-dwelling French women	Inability to walk independently, institutionalized, previous history of hip fracture or bilateral hip replacement, inability to understand or answer study questionnaire, confined to bed for at least 2 months during past year, motor impairment i.e. stroke sequelae, disease leading to hospitalization during past year (stroke, HTN, DM, CHD, Parkinson's	Yes	No
The PAQUID(Personnes Agees QUID) Research Program[166,167]	France good	3,660	No	Not reported	>65	Community residents aged 65 years and older living in Southwestern France. Baseline data were collected in 1988-89 in Gironde and 1989-1990 in Dordogne. Three criteria had to meet for inclusion: participant had to be at least 65 years of age, to live at home at baseline time, and to give written informed consent.	Not reported	Yes	No
The Pathologies Oculaires Lie´es a` l'Age Study[168]	France good	1,441	No	Not reported	>60	Subjects aged 60 and older were recruited from the population of Sète, a harbor on the French Mediterranean.	A history of the following diseases was excluded: diabetes mellitus; coronary heart disease; or self-reported history of	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
							stroke, lower limb arterial disease, cancer, asthma, or respiratory disease. Subjects treated with non-steroidal anti-inflammatory drugs or with oral corticosteroid treatment were also excluded.		
The Three City Study[169-171]	France good	6,030	No	Not reported	>65	65 years old or older, initially non-institutionalized, random sample obtained from the electoral rolls of two French cities—Bordeaux (southwest) and Dijon (central east)	Those with conditions that could be a consequence of a single disease and not of generalized frailty as already proposed, or frailty status could not be determined (missing data)	Yes	No
The German Study on Aging, Cognition and Dementia in Primary Care Patients Study Group[172]	Germany good	2,415	No	Not reported	>75	Age 75 years or older, absence of dementia according to judgment of GP, and at least 1 contact with the GP within the last 12 months.	GP consultation by home visits only, residence in a nursing home, severe illness with an anticipated fatal outcome within 3 months, German-language insufficiency, deafness or blindness, and lack of ability to provide informed consent.	Yes	No
The Leipzig Longitudinal Study of the Aged(LEILA75+)[173]	Germany good	1,045	No	Not reported	>75	Community-dwelling individuals aged 75 and over residing in the Leipzig-South district of Germany were identified by systematic random sampling from an age-ordered list provided	Study subjects with Parkinson's disease, mental retardation, known brain cancer, and severe weakness or severe sensory impairment leading to invalid cognitive testing.	Yes	Yes

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
						by the local registry office. 192 institutionalized individuals (60 residential home residents and 132 nursing home residents) were included in the study by proportion.			
A family study sample: Patients with Alzheimer's disease and/or major depression (according to DSM-III-R criteria, APA 1987 39) over 60 years had been recruited from the Inpatient Departments of Psychiatry of the University of Mainz (recruitment from 1992 to 1995) and of the University of Bonn (recruitment from 1996 to 1998). Control subjects who were group-matched to the patient sample for age, gender,	Germany fair	757	No	Not reported	>55	All non-demented subjects(defined by the absence of dementia according to DSM-III-R criteria (American Psychiatric Association 1987) above the age of 55 years, who had been carefully examined for possible initial signs of dementia and for the presence of possible risk factors during a previous comprehensive family study.	Subjects with a MMSE score below 24, a Hachinski Ischemic score above 2, a history of dementia or other major medical disorder possible to cause depression, or depression.18 subjects who developed other dementing disorders according to personal or family history information were excluded	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
and educational background had been recruited with the support of the cities' census agencies. [174]									
ilSIRENTE Aging and Longevity in the Sirente Geographic Area[175]	Italy good	364	No	Not reported	>80	Community-dwelling Italian older adults	Not reported	Yes	No
InCHIANTI[176-181]	Italy good	1,020	No	Not reported	>65	Participants aged between 65 and 102 years, randomly selected from residents in two towns of the Chianti geographic area (Greve in Chianti and Bagno a Ripoli, Tuscany, Italy), using a multistage stratified sampling method.	Participants in whom inflammatory markers, physical performance tests, or hand-grip strength were not tested.	Yes	No
The Conselice Study of Brain Aging[182]	Italy good	804	No	Not reported	>65	In 1999-2000, 1016 of the 1353 individuals aged 65 years and older residing in the Italian municipality of Conselice (Emilia Romagna region) participated in the prevalence study.	Not reported	Yes	No
The European Challenge for Healthy Aging[183]	Italy good	211	No	Not reported	>65	Born in Calabria and their ancestry in the region had been ascertained up to the grandparents generation	Not reported	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
The Italian Group of Pharmacoepid emiology in the Elderly (GIFA) [184]	Italy good	6,984	No	Not reported	>65	All patients admitted to 81 clinical centers in Italy were enrolled and followed until discharge.	Those younger than 65 years and those with cancer. Subsequently excluded were patients for whom body mass index had not been collected.	Yes	No
The Italian Longitudinal Study on Aging[185]	Italy good	2,097	No	Not reported	>65	5,632 subjects, aged 65-84 years, independent or institutionalized. Randomly selected from the electoral rolls of eight Italian municipalities, after stratification for age and gender.	Not reported	Yes	Yes
The Verona Diabetes Study[186]	Italy good	754	No	Not reported	>65	Type 2 diabetic outpatients, who regularly attended the Diabetes Clinic of Verona main hospital, dedicated to the cure of diabetes and endocrinologic diseases, and who had at least one determination of BMI, BP and fasting plasma glucose per year during an observation period of 3 years	Not reported	Yes	No
ASSI, a prospective cohort study of persons aged 65 and older randomly abstracted from the	Italy good	5,396	No	Not reported	>65	Persons aged 65 and older randomly abstracted from the rosters of 98 PCPs in Florence, Italy	Not reported	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
rosters of 98 PCPs in Florence, Italy[187]									
Community-dwelling elderly people[188]	Italy poor	65	No	Not reported	>65	Community-dwelling elderly people who freely chose to come to a geriatric unit for general clinical evaluation as part of a comprehensive geriatric assessment program. 400 subjects aged 65 years and older were evaluated at the geriatric unit of the Ospedale Maggiore Instituto do Ricovero e Cura a Carattere Scientifico, Milan, Italy, to study memory impairment and other cognitive disorders.	Known or suspected history of alcohol abuse, head injury, depression, or other major medical illness.	Yes	No
Survey in Europe on Nutrition and the Elderly: a Concerted Action(SENECA) [189]	Multinational good	989	No	Not reported	Not reported	Approximately 2,600 elderly people born between 1913 and 1918 living in 19 "traditional" towns in 12 countries were included.	People living in psychogeriatric nursing homes, who were not fluent in the country's language, or who were not able to answer questions independently.	Yes	No
The Australian Longitudinal Study of Aging, the Canadian Study of Health and Aging screening(CSHA-screen) and community	Multinational good	2,087 in The Australian Longitudinal Study of Aging, 8,547 in the Canadian Study of Health and	No	Yes	>65	Not reported	Not reported	Yes	Yes

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
clinical examination(CSHA-examination), the Canadian National Population Health Survey, the U.S. National Health and Nutrition Examination Survey, the Sydney Older Persons Studies, CSHA institutional (CSHA-institute), the U.S. National Long-Term Care Survey institutional sample(NLTC-institute), the Improving Cardiac Outcomes in Nova Scotia(ICONS) Study in Canada, a breast cancer study in Canada, and the Gothenberg Study in Sweden. [190]		Aging screening (CSHA-screen) and 1,585 in community clinical examination(CSHA-examination), 16,481 in the Canadian National Population Health Survey, 3,639 in the U.S. National Health and Nutrition Examination Survey, 547 in the Sydney Older Persons Studies, 720 in CSHA institutional (CSHA-institute),1,036 in the U.S. National Long-Term Care Survey institutional sample(NLTC-institute), 687 in the Improving Cardiac Outcomes in Nova Scotia							

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
		(ICONS) Study in Canada,130 in the breast cancer study in Canada, and 965 in the Gothenberg Study in Sweden.							
Singapore Longitudinal Aging Study, SLAS[191]	Singapore good	1,407	No	Yes	>55	Elderly residents in five southeast districts of Singapore, aged 55 years and above identified from a door-to-door census.	Not reported	Yes	No
NONA Immune Study[192]	Sweden fair	138	No	Not reported	>85	Population-based sample of oldest-old individuals	Not reported	Yes	No
The Leiden 85 plus study[193]	The Netherlands good	551	No	Not reported	>85	All inhabitants of Leiden born between 1912 and 1914	Not reported	Yes	Yes
The Longitudinal Aging Study Amsterdam[194-197]	The Netherlands good	2,257	No	Not reported	72	Population registers of 11 municipalities	Not living independently at baseline, not providing a blood sample or had no measurement of serum 25(OH)D, missing contact information.	Yes	No
Patients 65 years or older acutely admitted from November 1, 2002, through July 1, 2005, to a 1024-bed tertiary university teaching hospital[198]	The Netherlands good	463	No	Not reported	>65	All consecutive patients aged 65 years or older acutely admitted to the Department of Internal Medicine	Inability to speak or understand Dutch, transferring from or to non medical ward, discharge from the hospital within 48 hours after admission	Yes	Yes

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
H-EPESE Hispanic Established Populations for Epidemiologic Studies of the Elderly[199-205]	USA	3,050	No	Yes	>65	Community-dwelling Mexican Americans	Refused to be re-interviewed or were lost to followup, or were confirmed dead through the National Death Index and reports from relatives	Yes	No
The Hertfordshire Cohort Study[206]	UK good	638	No	Not reported	>64	Community-dwelling young-old men and women	Not reported	Yes	No
The Medical Research Council Cognitive Function and Aging Study[207]	UK good	2,640	No	Not reported	>65	Participants aged 65 and older randomly selected from the Family Health Service Authority lists in five areas of England and Wales (two rural: Cambridgeshire and Gwynedd; and three urban: Newcastle, Nottingham, and Oxford).	Not reported	Yes	No
The Medical Research Council (MRC) Trial of the Assessment and Management of Older People in the Community[208]	UK good	14,621	No	Not reported	>75	Community-based cluster randomized controlled trial, comparing different methods of multidimensional screening of older people. One hundred and six general practices were selected from the MRC General Practice Framework in England, Scotland and Wales. The study population was all patients aged 75 years and over registered with the practice.	Anyone in long-stay hospitals, nursing homes or with terminal illness.	Yes	No

Appendix E Table 1. Epidemiologic Studies in Older Persons (continued)

Study, Reference	Country Quality	Sample Size	Oversampling	Minority Present	Inclusion Age	Inclusion	Exclusion	Women Included	Nursing Home Residents
The Nottingham Longitudinal Study of Activity and Ageing (NLSAA) [209]	UK good	1,042	No	Not reported	>65	Community-dwelling people aged 65 years and older in Nottingham, U.K.	Not reported	Yes	No
Systematic reviews and meta analyses									
EURODEM-Prevalence Research Group[210]	Multi-national good	23	No	Not reported	>65	Inclusion criteria were: (1) studies conducted in Europe; (2) studies completed or published after 1979 (1980-1990); (3) minimum sample of 300 subjects 65 years or older; (4) case finding through direct individual examination; (5) inclusion of institutionalized individuals; and (6) clinical diagnosis of dementia based on (DSM-III), or equivalent criteria.	Prevalence estimates for subjects over the age of 89 years were discarded.	Yes	Yes
A meta-analysis of 13 epidemiological studies of senile dementia[211]	Multi-national good	0	No	Not reported	>80	Only studies that used internationally recognized diagnostic methods for senile dementia were included. Data available over age 80 and sampling procedures from both community-dwelling and institutionalized population.	Of the 12 studies, three were rejected because information on the numbers of people in each age-group was incomplete.	Yes	Yes
Seven community-based studies[46]	Multi-national good	11,827	No	Yes	>65	The InCHIANTI Study, NHANES III, and WHAS I; the Health ABC Study; the East Boston, Iowa, and New Haven sites of the EPESE	Not reported	Yes	No

Appendix E Table 2. Prevalence of Comorbidities in Older Persons According to Definition

Reference	Study	Sample	Definition	Prevalence (95% CI)
Number of chronic diseases in elderly				
Schultz-Larsen, 2007[159]	The Glostrup Aging Study	705	Comorbidity in nondisabled 70-year old - hypertension, diabetes, bronchitis, osteoarthritis in lower limbs, arteriosclerosis in lower limbs, and an ankle/arm index below 90%	8.9 (7.0; 11.3)
Pressley, 1999[87]	National Long-Term Care Survey (NLTCS)	5,934	3	18.7 (17.7; 19.7)
2001[152]	Canadian Study of Health and Aging (CSHA)	8,949	3 or 4 in the GSS91 survey (General Social Surveys, 1991)	30.5 (29.6; 31.5)
			3 or 4 in the CSHA-1 survey (Canadian Study of Health and Aging)	30.7 (29.8; 31.7)
Pressley, 1999[87]	National Long-Term Care Survey (NLTCS)	5,934	≥4	10.8 (10.0; 11.6)
2001[152]	Canadian Study of Health and Aging (CSHA)	8,949	5 or 6 in the GSS91 survey (General Social Surveys, 1991)	8.2 (7.6; 8.8)
			5 or 6 in the CSHA-1 survey (Canadian Study of Health and Aging)	18.3 (17.5; 19.1)
			≥7 in the GSS91 survey (General Social Surveys, 1991)	1.9 (1.6; 2.2)
			≥7 or more in the CSHA-1 survey (Canadian Study of Health and Aging)	13.9 (13.2; 14.6)
Bruunsgaard, 2003[158]	Danish Centenarian Study	126	>5 diagnoses	23 (16.5; 31.1)
Eaker, 2002[83]	Marshfield Epidemiologic Study Area (MESA)	811	8-10	20.1 (17.5; 23.0)
			11+	23.7 (20.9; 26.7)
de Groot, 2004[189]	Survey in Europe on Nutrition and the Elderly: a Concerted Action (SENECA)	989	Suffering from chronic diseases	77.4 (74.6; 79.9)
Ambulatory Care Groups (ACGs)				
Perkins, 2004[117]	Ambulatory Care Groups(ACGs)	3,496	10 ADG combinations with ≥2 major ACG	0.7 (0.5; 1.0)
			4 -5 ADG combinations with ≥2 major ACG	4.5 (3.9; 5.2)
			6 -9 ADG combinations with ≥2 major ADGs	9.3 (8.4; 10.3)
Charlson Score				
Inouye, 2003[122]	Validation study	525	Charlson score ≥2 in development cohort	71.0 (67.0; 74.7)
			Charlson score ≥2 in validation cohort	60.8 (56.6; 64.9)
Number of chronic diseases in elderly women				
Schultz-Larsen, 2007[159]	Glostrup Aging Study	705	2 diseases	16.0 (13.5; 18.9)
			4-6 diseases	5.0 (3.6; 6.9)
Szanton, 2009[103]	Women's Health and Aging Studies	728	3 or more chronic diseases	16 (13.5; 18.8)
Fried, 1999[106]	Women's Health and Aging Study	3,481	3 chronic diseases and conditions	23.0 (21.6; 24.4)
			4 chronic diseases and conditions	16.0 (14.8; 17.3)
			5 chronic diseases and conditions	9.0 (8.1; 10.0)
			6 chronic diseases and conditions	4.5 (3.9; 5.2)

Appendix E Table 2. Prevalence of Comorbidities in Older Persons According to Definition (continued)

Reference	Study	Sample	Definition	Prevalence (95% CI)
			7 chronic diseases and conditions	2.0 (1.6; 2.5)
			8 chronic diseases and conditions	0.5 (0.3; 0.8)
Chang, 2010[104]	Women's Health and Aging Studies I and II and complementary cohorts	620	≥3 diseases	18.4 (15.5; 21.6)
			≥4 diseases	8.6 (6.6; 11.1)
			≥5 diseases	1.6 (0.9; 3.0)
Szanton, 2009[103]	Women's Health and Aging Studies	728	≥3 diseases in African Americans	13.4 (11.1; 16.1)
			≥3 diseases in Caucasians	9.5 (7.6; 11.9)
Number of chronic diseases in elderly men				
Schultz-Larsen, 2007[159]	Glostrup Aging Study	705	2 diseases	16.0 (13.5; 18.9)
			4-6 diseases	5.0 (3.6; 6.9)

Appendix E Table 3. Prevalence of Polypharmacy in Older Persons

Reference	Study	Sample	Definition of the Outcome	Prevalence (95% CI)
Zarowitz, 2005[124]	Henry Ford Medical Group	195,971	Overall polypharmacy - 5 or more different drugs concurrently for long-term use, rate/1,000 patients	29.0 (28.8; 29.2)
Veehof, 2000[212]	Registration Network of Groningen (RNG)	1,544	2-3 drugs, long-term drug use	40.7 (38.3; 43.2)
			4-5 drugs, long-term drug use	0.09 (0; 0.5)
			>5 drugs, long-term drug use	0.04 (0; 0.5)
Eaker, 2002[83]	Marshfield Epidemiologic Study Area (MESA)	811	5-9 prescription medicines	21.8 (19.1; 24.8)
			10+ prescription medicines	23.4 (20.6; 26.4)
Helmer, 1999[166]	PAQUID (Personnes Agees QUID) Research Program	3660	≥5 Number of medications in women at baseline	43.0 (41.4; 44.6)
			≥5 Number of medications in men at baseline	35.6 (34.1; 37.2)

Appendix E Table 4. Prevalence of Cognitive Impairment in Older Persons According to Definition: Medical Research Council Cognitive Function and Aging Study[207]

Definitions of Cognitive Impairment (Measure with Mini-Mental State Examination)	Prevalence (95% CI)
Moderate cognitive decline (a score of 7 or less of 10 on the 10-Item Mental Status Questionnaire from the Global Deterioration Scale)	0.10 (0.0; 0.2)
Mild cognitive decline (a score of at least 8 of 10 on the 10-Item Mental Status Questionnaire from the Global Deterioration Scale)	0.30 (0.1; 0.7)
Questionable dementia (dementia was defined as an AGECAT organic symptom level of 3 or greater (i.e., 03-05) which corresponds to a diagnosis of dementia as defined according to the DSM-III-R)	0.70 (0.5; 1.0)
Age-associated cognitive decline (self-report of a gradual decline in memory present for at least 6 months)	1.40 (1.0; 1.9)
Mild neurocognitive disorder	1.40 (1.0; 1.8)
Age-related cognitive decline	1.80 (1.3; 2.6)
Mild cognitive disorder	1.80 (1.4; 2.2)
Age-associated memory impairment	2.00 (1.3; 3.3)
Mild cognitive impairment (amnestic)	2.50 (1.7; 3.6)
Mild cognitive impairment (multiple)	2.60 (1.8; 3.5)
Limited cognitive disturbance	4.90 (3.9; 6.1)
Mild cognitive impairment (nonamnestic)	5.30 (4.2; 6.8)
Benign senescent forgetfulness (long-term memory score ≥16 centile)	8.20 (7.0; 9.5)
Age-consistent memory impairment	12.70 (10.8; 14.9)
Cognitive impairment no dementia	16.20 (14.4; 18.3)
Minimal dementia	16.70 (14.8; 18.7)
Mini-Mental State Examination	35.20 (32.6; 37.9)
Self-reported memory complaint	42.00 (39.3; 44.8)

Appendix E Table 5. Prevalence of Cognitive Impairment in Older Persons By Age Group and Definition

Study	Reference	Definition	Prevalence (95% CI)
	>65		
Canadian Study of Health and Aging	Graham, 1997[148]	Circumscribed memory impairment (3MSE <78)	9.4 (8.4; 10.5)
		Positive on 3MSE (3MSE <78)	46.3 (43.9; 48.7)
		Cognitive impairment, no dementia (3MSE <78)	16.8 (15.1; 18.7)
		Various categories of impairment (3MSE <78)	16.8 (15.5; 18.1)
	Fisk, 2003[151]	Mild cognitive impairment (3MSE <78), all amnestic MCI criteria met	1.0 (0.66; 1.40)
		Mild cognitive impairment (3MSE <78), IADL impairment allowed	1.5 (1.04; 1.92)
		Mild cognitive impairment (3MSE <78), no subjective memory complaints required	2.4 (1.84; 2.96)
	Fisk, 2003[151]	Mild cognitive impairment (3MSE <78), neither memory complaints nor intact IADL required	3.0 (2.40; 3.640
Cardiovascular Health Study All Stars Study	Newman, 2009[60]	African, 3MSE <80	17.0 (15.3; 18.90
	65-74		
Canadian Study of Health and Aging	Graham, 1997[148]	Various categories of impairment (3MSE <78)	11.0 (9.0; 13.0)
	No author listed, 2001[152]	Cognitive loss (3MSE <78)	9.0 (8.4; 9.6)
	>70		
Religious Orders Study	Aggarwal, 2006[94]	Mild CI	24.3 (21.4; 27.3)
	>74		
Canadian Study of Health and Aging	Rockwood, 1996[147]	Age associated memory impairment (3MSE <77)	1.6 (1.4; 1.9)
		Any cognitive impairment (3MSE <77)	10.0 (9.4; 10.6)
		Any cognitive impairment, without dementia (3MSE <77)	5.7 (5.2; 6.2)
		Other types of CIND	4.1 (3.7; 4.5)
	75-84		
	Graham, 1997[148]	Various categories of impairment (3MSE <78)	24.0 (21.7; 26.3)
	No author listed, 2001[152]	Cognitive loss 93MSE <78)	20.0 (19.2; 20.8)
	85+		
	Graham, 1997[148]	Various categories of impairment (3MSE <78)	30.3 (27.0; 33.6)
	No author listed, 2001[152]	Cognitive loss (3MSE <78)	41.0 (40.0; 42.0)

Appendix E Table 6. Prevalence of Dementia in Older Persons By Age Group and According to Definition and Severity

Reference	Study	Diagnosis	Prevalence (95% CI)
>65			
Graham, 1997[148]	Canadian Study of Health and Aging	Positive for dementia in 3MSE	31.6 (29.4; 33.9)
No author listed, 1994[146]		Alzheimer's Disease	5.1 (4.7; 5.5)
Graham, 1997[148]		All types of dementia combined	8.0 (6.8; 9.4)
No author listed, 1994[146]		Dementia	8.0 (7.5; 8.5)
Fitzpatrick, 2004[57]	Cardiovascular Health Study	Dementia at baseline	6.3 (5.6; 7.1)
Graham, 1997[148]	Canadian Study of Health and Aging	Mild dementia	2.3 (1.8; 2.8)
Wolfson, 2001[149]	Among all demented	Mild dementia	18.8 (16.3; 21.6)
Graham, 1997[148]		Moderate dementia	3.1 (2.5; 3.7)
Wolfson, 2001[149]	Among all demented	Moderate dementia	39.3 (36.0; 42.7)
Graham, 1997[148]		Severe dementia	2.6 (2.0; 3.2)
Wolfson, 2001[149]	Among all demented	Severe dementia	41.9 (38.6; 45.3)
No author listed, 1994[146]		Vascular dementia	1.5 (1.3; 1.8)
65-74			
Graham, 1997[148]		Mild dementia	1.0 (0.4; 1.6)
Graham, 1997[148]		Moderate dementia	0.9 (0.3; 1.5)
Graham, 1997[148]		Severe dementia	0.5 (0.0; 1.0)
>70			
Aggarwal, 2006[94]	Religious Orders Study	Alzheimer's Disease	7.35 (5.8; 9.4)
>74			
Rockwood, 1996[147]	Canadian Study of Health and Aging	Alzheimer's Disease	3.0 (2.7; 3.4)
Rockwood, 1995[147]		Any dementia	4.6 (4.2; 5)
Rockwood, 1996[147]		Vascular dementia	0.9 (0.7; 1.1)
75-84			
Graham, 1997[148]	Canadian Study of Health and Aging	Mild dementia	3.4 (2.4; 4.4)
Graham, 1997[148]		Moderate dementia	4.6 (3.5; 5.7)
Graham, 1997[148]		Severe dementia	3.2 (2.2; 4.2)
>85			
Wikby, 2005[192]	NONA Immune Study	Dementia	14.5 (9.6; 21.4)
Graham, 1997[148]	Canadian Study of Health and Aging	Mild dementia	7.2 (5.3; 9.1)
Graham, 1997[148]		Moderate dementia	12.9 (10.5; 15.3)
Graham, 1997[148]		Severe dementia	14.6 (12.1; 17.1)
>90			
Kravitz, 2009[52]	The 90+ Study	All cause dementia	36.1 (30.1; 42.6)

Appendix E Table 7. Differences in Prevalence of Frailty in Older Persons According to Definition of Frailty

Reference	Sample	Definition of Frailty	Mean (95% CI)
Alameda County Study			
Cigolle, 2009[72]	574	Frail according to functional domain model (>2 domains with deficiencies)	26.0 (22.6; 29.7)
Beaver Dam Eye Study Cohort			
Klein, 2005[6]	2,515	Frailty markers: gait time, handgrip strength, peak respiratory flow rate, ability to stand from a sitting position without using arms, best corrected visual acuity. Mild 1-2 markers, moderate 3 markers, severe 4-5 markers	44.7 (42.8; 46.7)
Canadian Study of Health and Aging			
Rockwood, 2007[145]	2,305	Frailty index based on; wt loss >10lbs or greater than 5% of body wt, subjective exhaustion, impaired walking, Timed Up and Go Test > 19s, abnormal strength on physical examination	16.5 (15.0; 18.1)
Gutman, 2001[143]	5,987	Rockwood frailty index: 1 - Healthy, 2 - Bladder incontinence, 3 - Mild/moderate frailty, 4 - severe frailty	21.2 (20.2; 22.3)
	3,925	Frail: mild/moderate, severe	8.9 (8.0; 9.8)
	8,914	Frail: mild/moderate, severe	21.2 (20.4; 22.1)
Cardiovascular Health Study			
Fried, 2001[55]	5,317	3 or more of criteria list	6.9 (6.2; 7.6)
Walston, 2002[56]	4,735	3 or more of criteria list	6.3 (5.6; 7.0)
Cigolle, 2009[72]	5,317	Frail according to Biologic Syndrome Model(>3 frailty defining criteria)	7.0 (6.3; 7.7)
Depression Among Caregivers of Impaired Elders Study			
Tennstedt, 1992[120]	4,185	HRCA vulnerability index	18.9 (17.7; 20.1)
Effects of Two Exercise Interventions Among Community-residing Older Adults Study			
Dayhott, 1998[121]	84	Frailty measurement based on two measures: WHOAFC and self-reported health status	17.9 (11.1; 27.6)
Kaiser Permanente Inter-regional Committee on Aging Study			
Brody, 1997[19]	5,810	Eligibility for nursing home placement or long-term placement	14.6 (13.7;15.5)
National Population Health Survey			
Song, 2010[142]	2,740	Frailty index based on the number of deficits divided by the number of variables considered (36). People with nine or more deficits were considered frail.	22.7 (21.0; 24.3)
New Haven Older Americans Independence Center Study			
Hardy, 2005[37]	754	Frail: a timed score of greater than 10 seconds on the rapid gait test (i.e., walking back and forth over a 10-foot (3.048-m) course as quickly as possible)	42.7 (39.2; 46.3)
The Health and Retirement Study			
Cigolle, 2009[72]	11,113	Frail according to at least one model (Functional Domains Model, Burden, or biologic syndrome model)	30.2 (29.4; 31.1)
		Frail according to all three models (Functional Domains Model, Burden, or biologic syndrome model)	3.1 (2.8; 3.4)
		Frail - >2 domains with deficiencies	29.0 (28.2; 29.90
		Frail according to Burden model	15.4 (14.7; 16.1)
		Frail according to functional domain model	20.3 (19.6; 21.1)
		Frail according to biologic syndrome model	10.9 (10.3; 11.5)
		Frail according to an Index of Deficit Accumulation (>0.2)	32.0 (31.1; 32.9)
		Frail according to Biologic Syndrome Model(>3 frailty defining criteria)	11.0 (10.4; 11.6)
	1,657	Frail according to functional domains (weighted for nonresponse percentages)	21.3 (19.4; 23.3)

Appendix E Table 7. Differences in Prevalence of Frailty in Older Persons According to Definition of Frailty (continued)

Reference	Sample	Definition of Frailty	Mean (95% CI)
		Frail according to Burden model (weighted (weighted for nonresponse percentages)	14.8 (13.2; 16.6)
		Frail according to Biologic Syndrome Model (weighted (weighted for nonresponse percentages)	13.3 (11.7; 15.0)
The MOBILIZE (Maintenance of Balance, Independent Living, Intellect, And Zest in the Elderly) Boston Study			
Kiely, 2009[26]	765	Frailty index based on; weight loss >10 pounds or greater than 5% of body weight, subjective exhaustion, impaired walking, Timed Up and Go Test >19 seconds, abnormal strength on physical examination	10.0 (8.1; 12.3)
		Cardiovascular Health Study Frailty Index	76.0 (72.8; 78.9)

Appendix E Table 8. Prevalence of Frailty in Older Persons According to Severity

Reference	Study	Definition	Prevalence (95% CI)
Passarino, 2007[183]	The European research program European Challenge for Healthy Aging (ECHA project http:/biologia.unical.it/echa/)	Very frail with no ADL disability (Katz' Index of ADL)	12.5 (7.6; 19.8)
		Very frail with at least one ADL disability (Katz' Index of ADL)	87.5 (80.2; 92.4)
		Very frail with ≥2 diseases	70.8 (61.9; 78.3)
Gutman, 2001[143]	The Canadian Study of Health and Aging	Severe frailty in males (Rockwood scale with >2 totally dependent in transfers or one or more ADLs, incontinent of bowel and bladder, diagnosed with dementia)	4.4 (4; 4.8)
		Severe frailty in females (Rockwood sale with >2 totally dependent in transfers or one or more ADLs, incontinent of bowel and bladder, diagnosed with dementia)	5.9 (5.4; 6.4)
		Severe frailty in total sample (Rockwood sale with >2 totally dependent in transfers or one or more ADLs, incontinent of bowel and bladder, diagnosed with dementia)	5.3 (4.9; 5.8)
		Mild/moderate frailty in 65-74 age group (Rockwood index that includes one of the following: assistance with mobility or one or more ADLs, cognitive impairment without dementia, bowel or bladder incontinence)	7.5 (7; 8.1)
		Mild/moderate frailty in 75-84 age group	18.4 (17.6; 19.2)
		Mild/moderate frailty in 85+ age group	34.5 (33.5; 35.5)
		Mild/moderate frailty in total sample	15.9 (15.2; 16.7)
		Severe frailty in 65-74 age group	1.4 (1.2; 1.7)
		Severe frailty in 75-84 age group	6.1 (5.6; 6.6)
		Severe frailty in 85+ age group	14.7 (14; 15.5)

Appendix E Table 9. Prevalence of ADL Disability in Older Persons

Reference	Country	Study	Year of Study	Sample Size	Disability Type 2	Prevalence (95% CI)	Sub-Population
Prevalence of Any ADL Disability							
Wiener, 1990[30]	USA	National Health Interview Survey, Supplement on Aging	1984	11,425	≥1 ADL (5 items)	5.0 4.6 (5.4)	Age 65+
Fuller-Thompson, 2009[3]	USA	American Community Survey (US Census)	2003	202,956	≥1 ADL (3 items)	5.4 (5.3; 5.5)	
Wiener, 1990[30]	USA	Survey on Income and Program Participation	1984	5,900	≥1 ADL (4 items)	5.8 (5.2; 6.4)	Age 65+
Fuller-Thompson, 2009[4]	USA	American Community Survey (US Census)	2000	512,768	≥1 ADL (3 items)	8.8 (8.8; 8.9)	
Goins, 2007[7]	USA	Census Public Use 5% Microdata sample	2000	2,944,755	≥1 ADL (3 items)	9.1%	
Raji, 2004[199]	USA	H-EPESE	1993-2001	2,731	≥1 ADL (7 items)	11.0 (9.9; 12.2)	
Bannerman, 2002[139]	Australia	Australian Longitudinal study on aging	1992-1994	1,272	≥1 ADL (# items not specified)	11.9%	
Chen, 2004[213]	USA	Longitudinal Study on Aging	1984	7,512	≥1 ADL (7 items)	12.1 (11.4; 12.8)	Age 70+
Corti, 1994[12]	USA	EPESE Boston, New Haven, Iowa sites Established Populations for Epidemiologic Studies of the Elderly	1987-1992	4,116	≥1 ADL (2 items)	12.2	
Tabbarah, 2001[2]	USA	Survey of Asset and Health Dynamics of the Oldest Old (AHEAD)	1994	7,447	≥1 ADL (6 items) "Receive help performing activity"	13.9 (13.1; 14.7)	
Lee, 2006[71]	USA	Health and Retirement Study	1998	11,701	≥1 ADL (6 items)	16.0 (15.3; 16.7)	Development cohort
				8,009	≥1 ADL (6 items)	18.0 (17.2; 18.9)	Validation cohort
Hanlon, 2002[11]	USA - North Carolina	EPESE - New Haven Site Established Populations for Epidemiologic Studies of the Elderly	1989/90 & 1992/93	3,234	≥1 ADL (5 items)	18.3 (17; 19.7)	
Newman, 2009[60]	USA	Cardiovascular Health Study All Star	1992-2006	1,677	≥1 ADL (5 items)	25.6%	
Prevalence of Moderate ADL Disability							
Gardener, 2006[160]	England	ELSA - English Longitudinal Study of Aging	2002	5,432	1-2 ADL (6 items)	20.5	
Rakowski, 1993[214]	USA	Longitudinal Study on Aging	1984	7,469	1-2 ADLs (7 items)	16.1 (15.3; 16.9)	

Appendix E Table 9. Prevalence of ADL Disability in Older Persons (continued)

Reference	Country	Study	Year of Study	Sample Size	Disability Type 2	Prevalence (95% CI)	Sub-Population
Prevalence of Severe ADL Disability							
Rakowski, 1993[214]	USA	Longitudinal Study on Aging	1984	7,469	3-4 ADLS (7 items)	6.0 (5.5; 6.6)	
Gardener, 2006[160]	England	ELSA - English Longitudinal Study of Aging	2002	5,432	≥3 ADLs (6 items)	7.8%	
Rakowski, 1993[214]	USA	Longitudinal Study on Aging	1984	7,469	5-7 ADLS (7 items)	4.8 (4.3; 5.3)	
Prevalence of Bathing ADL Disability							
Jette, 1990[126]	USA	Massachusetts Health Care Panel Study (MHCPS)	1980	535	Bathing	3.9 (2.6; 5.9)	
Wiener, 1990[30]	USA	National Health Interview Survey, Supplement on Aging	1984	11,425	Bathing	4.6 (4.2; 5)	Age 65+
Lee, 2006[71]	USA	Health and Retirement Study	1998	11,701	Bathing	6.0 (5.6; 6.4)	Development cohort
Albert , 2006[48]	USA - NYC	SITE Sources of Independence in the Elderly	1999-2001	361	Bathing	6.7%	Total population
Lee, 2006[71]	USA	Health and Retirement Study	1998	8,009	Bathing	8.0 (7.4; 8.6)	Validation cohort
Tabbarah, 2001[2]	USA	Survey of Asset and Health Dynamics of the Oldest Old (AHEAD)	1994	7,447	Bathing “Receive help performing activity”	8.8 (8.2; 9.5)	
Johnson, 2000[31]	USA	National Survey on Self-Care and Aging	1990-1991	3,485	Bathing	9.0 (8.1; 10)	
Jette, 1990[126]	USA	Massachusetts Health Care Panel Study (MHCPS)	1985	535	Bathing	14.7 (11.9; 18)	
Prevalence of Dressing/Hygeine ADL Disability							
Jette, 1990[126]	USA	Massachusetts Health Care Panel Study (MHCPS)	1980	535	Dressing	0.8 (0.3; 2)	
Wiener, 1990[30]	USA	National Health Interview Survey, Supplement on Aging	1984	11,425	Dressing	2.9 (2.6; 3.2)	Age 65+
Johnson, 2000[31]	USA	National Survey on Self-Care and Aging	1990-1991	3,485	Dressing	5.0 (4.3; 5.8)	
Tabbarah, 2001[2]	USA	Survey of Asset and Health Dynamics of the Oldest Old (AHEAD)	1994	7,447	Dressing “Receive help performing activity”	7.7 (7.1; 8.3)	

Appendix E Table 9. Prevalence of ADL Disability in Older Persons (continued)

Reference	Country	Study	Year of Study	Sample Size	Disability Type 2	Prevalence (95% CI)	Sub-Population
Lee, 2006[71]	USA	Health and Retirement Study	1998	11,701	Dressing	9.0 (8.5; 9.5)	Development cohort
Murtogh, 2004[215]	USA	Alumni Health Study	1999	1,348	Hygiene	9.2	Sample Age 73+ Mean age 79
Jette, 1990[126]	USA	Massachusetts Health Care Panel Study (MHCPS)	1985	535	Dressing	9.3 (7.1; 12.1)	
Lee, 2006[71]	USA	Health and Retirement Study	1998	8,009	Dressing	11.0 (10.3; 11.7)	Validation cohort
Prevalence of Eating ADL Disability							
Jette, 1990[126]	USA	Massachusetts Health Care Panel Study (MHCPS)	1980	533	Eating	0.4 (0.1; 1.5)	
Wiener, 1990[30]	USA	National Health Interview Survey, Supplement on Aging	1984	11,425	Eating	0.7 (0.6; 0.9)	Age 65+
Johnson, 2000[31]	USA	National Survey on Self-Care and Aging	1990/ 1991	3,485	Eating	1.0 (0.7; 1.4)	
Hays, 2005[13]	USA	EPESE-Duke Site-Established Populations for Epidemiologic Studies of the Elderly	1992-1993	1,920	Eating	1.1 (0.7; 1.7)	White women
						1.3 (0.9; 1.9)	White men
						1.5 (1; 2.2)	Black women
Jette, 1990[126]	USA	Massachusetts Health Care Panel Study (MHCPS)	1985	533	Eating	2.2 (1.2; 3.9)	
Lee, 2006[71]	USA	Health and Retirement Study	1998	11,701	Eating	3.0 (2.7; 3.3)	Development cohort
				8,009	Eating	4.0 (3.6; 4.5)	Validation cohort
Tabbarah, 2001[2]	USA	Survey of Asset and Health Dynamics of the Oldest Old (AHEAD)	1994	7,447	Eating “Receive help performing activity”	4.5 (4.1; 5)	
Murtogh, 2004[215]	USA	Alumni Health Study	1999	1,348	Eating	7.3	Sample Age 73+ Mean age 79
Prevalence of Toileting ADL Disability							
Wiener, 1990[30]	USA	National Health Interview Survey, Supplement on Aging	1984	11,425	Toileting	2.4 (2.1; 2.7)	Age 65+
Tabbarah, 2001[2]	USA	Survey of Asset and Health Dynamics of the Oldest Old (AHEAD)	1994	7,447	Toileting “Receive help performing activity”	2.5 (2.2; 2.9)	
Lee, 2006[71]	USA	Health and Retirement Study	1998	11,701	Toileting	5.0 (4.6; 5.4)	Development cohort
				8,009	Toileting	6.0 (5.5; 6.5)	Validation cohort

Appendix E Table 9. Prevalence of ADL Disability in Older Persons (continued)

Reference	Country	Study	Year of Study	Sample Size	Disability Type 2	Prevalence (95% CI)	Sub-Population
Prevalence of Transferring ADL Disability							
Jette, 1990[126]	USA	Massachusetts Health Care Panel Study (MHCPS)	1980	536	Transferring	0.4 (0.1; 1.5)	
Wiener, 1990[30]	USA	National Health Interview Survey, Supplement on Aging	1984	11,425	Transferring	2.6 (2.3; 2.9)	Age 65+
				5,900	Transferring	2.6 (2.2; 3)	Age 65+
Tabbarah, 2001[2]	USA	Survey of Asset and Health Dynamics of the Oldest Old (AHEAD)	1994	7,447	Transferring "Receive help performing activity"	3.3 (2.9; 3.7)	
Jette, 1990[126]	USA	Massachusetts Health Care Panel Study (MHCPS)	1985	536	Transferring	5.8 (4.1; 8.1)	
Lee, 2006[71]	USA	Health and Retirement Study	1998	11,701	Transferring	7.0 (6.6; 7.5)	Development cohort
				8,009	Transferring	9.0 (8.4; 9.6)	Validation cohort
Murtogh, 2004[215]	USA	Alumni Health Study	1999	1,348	Transferring	21.1	Sample Age 73+ Mean age 79
Prevalence of Walking ADL Disability							
Jette, 1990[126]	USA	Massachusetts Health Care Panel Study (MHCPS)	1980	535	Walking	0.8 (0.3; 2)	
Tabbarah, 2001[2]	USA	Survey of Asset and Health Dynamics of the Oldest Old (AHEAD)	1994	7,447	Walking "Receive help performing activity"	5.9 (5.4; 6.5)	
Jette, 1990[126]	USA	Massachusetts Health Care Panel Study (MHCPS)	1985	535	Walking	7.7 (5.7; 10.3)	
Lee, 2006[71]	USA	Health and Retirement Study	1998	11,701	Walking	11.0 (10.4; 11.6)	Development cohort
				8,009	Walking	13.0 (12.3; 13.8)	Validation cohort
Murtogh, 2004[215]	USA	Alumni Health Study	1999	1,348	Walking	20.6	Sample Age 73+ Mean age 79
Prevalence of ADL Disability in Women							
Crimmins, 1997[86]	USA	Longitudinal Study on Aging	1984	3,081	≥1 ADL (7 items)	8.1 (7.2; 9.1)	Women age 76+
			1988	2,842	≥1 ADL (7 items)	9.6 (8.6; 10.7)	Women age 76+
Fuller-Thompson, 2009[4]	USA	American Community Survey (US Census)	2000	512,768	≥1 ADL (3 items)	10.2 (10.1; 10.2)	Women
Crimmins, 1997[86]	USA	Longitudinal Study on Aging	1990	2,782	≥1 ADL (7 items)	10.2 (9.1; 11.4)	Women age 76+
			1986	2,904	≥1 ADL (7 items)	10.6 (9.5; 11.8)	Women age 76+
Corti, 1994[12]	USA	EPESE Boston, New	1987-	4,116	≥1 ADL (# items not	13.2 (12.2; 14.3)	Women

Appendix E Table 9. Prevalence of ADL Disability in Older Persons (continued)

Reference	Country	Study	Year of Study	Sample Size	Disability Type 2	Prevalence (95% CI)	Sub-Population
		Haven, Iowa sites Established Populations for Epidemiologic Studies of the Elderly	1992		specified)		
Bannerman, 2002[139]	Australia	Australian Longitudinal study on aging	1992-1994	1,272	≥1 ADL (# items not specified)	14.0 (12.2; 16)	
Newman, 2009[60]	USA	Cardiovascular Health Study All Stars	1992-2006	1,677	≥1 ADL (5 items)	24.7 (22.7; 26.8)	Women age 85-88
						24.8 (22.8; 26.9)	Women age ≤82
						27.3 (25.2; 29.5)	Women age 83-84
						29.4% 27.3 31.6	Women age 89+
Gardener, 2006[160]	England	ELSA - English Longitudinal Study of Aging	2002	5432	1-2 ADLs (6 items)	21.7	All women
					1-2 ADLs (6 items)	33.0 (31.8; 34.3)	Women age ≥80
					1-2 ADLs (6 items)	18.0 (17; 19)	Women age 65-79
					≥3 ADLs (6 items)	7.0%	All women
					≥3 ADLs (6 items)	10.0 (9.2; 10.8)	Women age ≥80
					≥3 ADLs (6 items)	6.0 (5.4; 6.7)	Women age 65-79
Albert, 2006[48]	USA - NYC	SITE Sources of Independence in the Elderly	1999-2001	361	Bathing	6.9 (4.7; 10)	Women age <75
						7.7	All women
						8.0 (5.6; 11.3)	Women age ≥75
Murtogh, 2004[215]	USA	Alumni Health Study	1999	1,348	Dressing/grooming	17.1 (15.2; 19.2)	Sample Age 73+ Mean age 79 Women
Hays, 2005[13]	USA	EPESE-Duke Site-Established Populations for Epidemiologic Studies of the Elderly	1992-1993	1,920	Eating	1.1 (0.7; 1.7)	White women
						1.2	All women
						1.5 (1; 2.2)	Black women
Murtogh, 2004[215]	USA	Alumni Health Study	1999	1,348	Eating	11.8 (10.2; 13.6)	Sample Age 73+ Mean age 79 Women
					Hygiene	12.8 (11.1; 14.7)	Sample Age 73+ Mean age 79 Women
					Transferring	27.6 (25.3; 30)	Sample Age 73+ Mean age 79 Women
					Walking	27.3 (25; 29.7)	Sample Age 73+ Mean age 79 Women
Prevalence of ADL Disability in Men							

Appendix E Table 9. Prevalence of ADL Disability in Older Persons (continued)

Reference	Country	Study	Year of Study	Sample Size	Disability Type 2	Prevalence (95% CI)	Sub-Population
Crimmins, 1997[86]	USA	Longitudinal Study on Aging	1984	3,081	≥1 ADL (7 items)	6.1 (5.3; 7)	Men age 76+
			1986	2,904	≥1 ADL (7 items)	6.5 (5.7; 7.5)	Men age 76+
Fuller-Thompson, 2009[4]	USA	American Community Survey (US Census)	2000	512,768	≥1 ADL (3 items)	7.1 (7; 7.1)	Men
Crimmins, 1997[86]	USA	Longitudinal Study on Aging	1990	2,782	≥1 ADL (7 items)	7.5 (6.6; 8.5)	Men age 76+
			1988	2,842	≥1 ADL (7 items)	7.9 (7; 9)	Men age 76+
Bannerman, 2002[139]	Australia	Australian Longitudinal study on aging	1992-1994	1,272	≥1 ADL (# items not specified)	10.0 (8.5; 11.8)	
Corti, 1994[12]	USA	EPESE Boston, New Haven, Iowa sites Established Populations for Epidemiologic Studies of the Elderly	1987-1992	4,116	≥1 ADL (2 items)	10.3 (9.4; 11.3)	Men
Newman, 2009[60]	USA	Cardiovascular Health Study All Stars	1992-2006	1,677	≥1 ADL (5 items)	12.8% 11.3 14.5	Men age 83-84
						16.7 (15; 18.6)	Men age ≤82
						22.8 (20.9; 24.9)	Men age 85-88
						23.7 (21.7; 25.8)	Men age 89+
Gardener, 2006[160]	England	ELSA - English Longitudinal Study of Aging	2002	5,432	1-2 ADL (6 items)	19.1	All men
					1-2 ADL (6 items)	28.0 (26.8; 29.2)	Men age ≥80
					1-2 ADL (6 items)	17.0 (16; 18)	Men age 65-79
					3+ ADLs (6 items)	7.0	All men
					3+ ADLs (6 items)	11.0 (10.2; 11.9)	Men age ≥80
					3+ ADLs (6 items)	6.0 (5.4; 6.7)	Men age 65-79
Albert , 2006[48]	USA - NYC	SITE Sources of Independence in the Elderly	1999-2001	361	Bathing	0.0 (0; 2.2)	Men age <75
						4.4	Sample age 73+ Mean age 79 All men
						6.7 (4.5; 9.80)	Men age ≥75
Murtogh, 2004[215]	USA	Alumni Health Study	1999	1,348	Dressing/grooming	13.2 (11.5; 15.1)	Sample age 73+ Mean age 79 men
Hays, 2005[13]	USA	EPESE-Duke Site-Established Populations for Epidemiologic Studies of the Elderly	1992-1993	1,920	Eating	.60	Black men
						1.2	All men
						1.3 (0.9; 1.9)	White men
Murtogh, 2004[215]	USA	Alumni Health Study	1999	1,348	Eating	6.0 (4.9; 7.4)	Sample age 73+ Mean age 79 Men

Appendix E Table 9. Prevalence of ADL Disability in Older Persons (continued)

Reference	Country	Study	Year of Study	Sample Size	Disability Type 2	Prevalence (95% CI)	Sub-Population
					Hygiene	8.1 (6.8; 9.7)	Sample age 73+ Mean age 79 Men
					Transferring	19.2 (17.2; 21.4)	Men
					Walking	18.6 (16.6; 20.8)	Sample age 73+ Mean age 79 Men
Prevalence of ADL Disability by Ethnicity							
Fuller-Thompson, 2009[3]	USA	American Community Survey (US Census)	2003	202,956	≥1 ADL (3 items)	7.5 (7.4; 7.6)	Black men age 65-74
						4.7 (4.6; 4.8)	White men age 65-74
						10.7 (10.6; 10.8)	Black women age 65-74
						5.2% (5.1; 5.3)	White women age 65-74
Goins, 2007[7]	USA	Census Public Use 5% Microdata sample	2000	2,944,755	≥1 ADL (3 items)	13.6 (13.6; 13.6)	African American
						11.6 (11.6; 11.6)	American Indian
						8.7 (8.7; 8.7)	White
Hays, 2005[13]	USA	EPESE-Duke Site-Established Populations for Epidemiologic Studies of the Elderly	1992-1993	1,920	Eating	.60	Black men
						1.1 (0.7; 1.7)	White men
						1.2	Black men & women
						1.2	White men & women
						1.3 (0.9; 1.9)	White women
						1.5 (1; 2.2)	Black women
Prevalence of ADL Disability by Age							
Newman, 2009[60]	USA	Cardiovascular Health Study All Star	1992-2006	1,677	≥1 ADL (5 items)	16.7 (15; 18.6)	Men age ≤82
						12.8 (11.3; 14.5)	Men age 83-84
						22.8 (20.9; 24.9)	Men age 85-88
						23.7 (21.7; 25.8)	Men age 89+
						24.8 (22.8; 26.9)	Women age ≤82
						27.3 (25.2; 29.5)	Women age 83-84
						24.7 (22.7; 26.8)	Women age 85-88
						29.4 (27.3; 31.6)	Women age 89+
Gardener, 2006[160]	England	ELSA - English Longitudinal Study of Aging	2002	5,432	1-2 ADLs (6 items)	33.0 (31.8; 34.3)	Women age ≥80
					1-2 ADLs (6 items)	18.0 (17; 19)	Women age 65-79
					1-2 ADL (6 items)	28.0 (26.8; 29.2)	Men age ≥80
					1-2 ADL (6 items)	17.0 (16; 18)	Men age 65-79
					≥3 ADLs (6 items)	10.0 (9.2; 10.8)	Women age ≥80
					≥3 ADLs (6 items)	6.0 (5.4; 6.7)	Women age 65-79
					≥3 ADLs (6 items)	11.0(10.2; 11.9)	Men age ≥80
					≥3 ADLs (6 items)	6.0 (5.4; 6.7)	Men age 65-79
Albert ,	USA - NYC	SITE Sources of	1999-	361	Bathing	0.0 (0; 2.2)	Men age <75

Appendix E Table 9. Prevalence of ADL Disability in Older Persons (continued)

Reference	Country	Study	Year of Study	Sample Size	Disability Type 2	Prevalence (95% CI)	Sub-Population
2006[48]		Independence in the Elderly	2001				
Wiener, 1990[30]	USA	National Health Interview Survey, Supplement on Aging	1984	7,054	Bathing	2.5 (2.2; 2.9)	Age 65-74
				11,425	Bathing	4.6(4.2; 5)	Age 65+
Albert , 2006[48]	USA - NYC	SITE Sources of Independence in the Elderly	1999-2001	361	Bathing	6.7 (4.5; 9.8)	Men age ≥75
						6.9 (4.7; 10)	Women age < 75
						8.0 (5.6; 11.3)	Women age ≥75
Wiener, 1990[30]	USA	National Health Interview Survey, Supplement on Aging	1984	7,054	Dressing	1.8 (1.5; 2.1)	Age 65-74
				11,425	Dressing	2.9 (2.6; 3.2)	Age 65+
				7,054	Eating	0.4 (0.3; 0.6)	Age 65-74
				11,425	Eating	0.7 (0.6; 0.9)	Age 65+
				7,054	Toileting	1.3 (1.1; 1.6)	Age 65-74
				11,425	Toileting	2.4 (2.1; 2.7)	Age 65+
				7,054	Transferring	1.5 (1.2; 1.8)	Age 65-74
				11,425	Transferring	2.6 (2.3; 2.9)	Age 65+
ADL Disability in Frail Population							
Wiener, 1990[30]	USA	National Long-Term Care Survey	1982	17,658	≥1 ADL (5 items)	7.8 (7.4; 8.2)	Age 65+
			1982	17,658	ADL bathing	6.3 (6; 6.7)	Age 65+
			1982	10,439	ADL bathing	4.0 (3.6; 4.4)	Age 65-74
			1982	17,658	Bathing	6.3 (6; 6.7)	Age 65+
			1982	17,658	Dressing	4.2 (3.9; 4.5)	Age 65+
			1982	17,658	Eating	2.5 (2.3; 2.7)	Age 65+
			1982	17,658	Toileting	3.4 (3.1; 3.7)	Age 65+
			1982	17,658	Transferring	4.2 (3.9; 4.5)	Age 65+
			1984	12,687	≥1 ADL (5 items)	4.9 (4.5; 5.3)	Age 65+
			1984	19,720	ADL bathing	6.3 (6; 6.6)	Age 65+
			1984	12,687	ADL bathing	3.8 (3.5; 4.1)	Age 65-74
			1984	19,720	Bathing	6.3 (6; 6.6)	Age 65+
			1984	19,720	Dressing	4.0 (3.7; 4.3)	Age 65+
			1984	19,720	Eating	2.3 (2.1; 2.5)	Age 65+
			1984	19,720	Toileting	3.3 (3.1; 3.6)	Age 65+
			1984	19,720	Transferring	4.0 (3.7; 4.3)	Age 65+
Carey, 2008[129]	USA	PACE Program of All-Inclusive Care for the Elderly	1988-1996	2,232	≥3 ADLs (6 items)	50.0 (47.9; 52.1)	Frail group development cohort
				1,667	≥3 ADLs (6 items)	52.0 (49.6; 54.4)	Frail group validation cohort
				1,667	Bathing	86.4 (84.7; 88)	Validation cohort
				2,232	Bathing	81.7 (80; 83.2)	Development cohort
				1,667	Dressing	69.8 (67.6; 72)	Validation cohort
				2,232	Dressing	62.6 (60.6; 64.6)	Development cohort

Appendix E Table 9. Prevalence of ADL Disability in Older Persons (continued)

Reference	Country	Study	Year of Study	Sample Size	Disability Type 2	Prevalence (95% CI)	Sub-Population
				2,232	Eating	21.4 (19.7; 23.2)	Development cohort
				1,667	Eating	28.9 (26.8; 31.1	Validation cohort
				2,232	Finances	58.1 (56.00; 60.10)	Development cohort
				1,667	Finances	68.5 (66.20; 70.70)	Validation cohort
				2,232	Heavy chores	94.6 (93.60; 95.50)	Development cohort
				1,667	Heavy chores	97.0 (96.10; 97.70)	Validation cohort
				2,232	Housework	79.3 (77.60; 80.90)	Development cohort
				1,667	Housework	74.8 (72.70; 76.80)	Validation cohort
				2,232	Laundry	83.0 (81.40; 84.50)	Development cohort
				1,667	Laundry	85.6 (83.80; 87.20)	Validation cohort
				2,232	Meal prep	74.8 (73.00; 76.60)	Development cohort
				1,667	Meal prep	65.7 (63.40; 67.90)	Validation cohort
				2,232	Medication management	37.3 (35.30; 39.30)	Development cohort
				1,667	Medication management	39.0 (36.70; 41.40)	Validation cohort
				2,232	Shopping	83.2 (81.60; 84.70)	Development cohort
				1,667	Shopping	85.9 (84.10; 87.50)	Validation cohort
				2,232	Toileting	46.3 (44.2; 48.4)	Development cohort
				1,667	Toileting	45.9 (43.5; 48.3)	Validation cohort
				1,667	Transferring	39.8 (37.5; 42.2)	Validation cohort
				2,232	Transferring	45.6 (43.5; 47.7)	Development cohort
				2,232	Transportation	79.6 (77.90; 81.20)	Development cohort
				1,667	Transportation	74.2 (72.00; 76.20)	Validation cohort
				1,667	Walking	42.0 (39.7; 44.4)	Validation cohort
				2,232	Walking	53.6 (51.5; 55.7)	Development cohort
Gill, 2008[43]	USA - New Haven CT	Precipitating Events Project	1998-2004	491	≥1 ADL (4 items)	31.2 (27.3; 35.4)	

Appendix E Table 10. Prevalence of Instrumental ADL Disability in Older Persons

Reference	Country	Study	Year of Study	Sample Size	Disability Type 2	Prevalence (95% CI)	Sub-Groups
Prevalence of Any IADL Disability							
Lee, 2006[71]	USA	Health and Retirement Study	1998	11,701	≥1 IADL (5 items)	12.0 (11.40; 12.60)	Development cohort
				8,009	≥1 IADL (5 items)	16.0 (15.20; 16.80)	Validation cohort
Ganguli, 2002[85]	USA	Monongahela Valley Independent Elders Survey	1987-1999	1,064	1-3 IADL (# items not specified OARS)	23.8 (21.30; 26.50)	
Tabbarah, 2001[2]	USA	Survey of Asset and Health Dynamics of the Oldest Old (AHEAD)	1994	7,447	≥1 IADL (5 items) "Need help performing activity"	26.5 (25.50; 27.50)	
Chen, 2004[213]	USA	Longitudinal Study on Aging	1984	7,512	≥1 IADL (6 items)	26.90 (25.90; 27.90)	
Hanlon, 2002[11]	USA	EPESE - New Haven Site Established Populations for Epidemiologic Studies of the Elderly	1989/90 & 1992/93	3,234	≥1 IADL (3 items)	35.5 (33.90; 37.20)	
Espino, 2006[200]	USA	H-EPESE Hispanic Established Populations for Epidemiologic Studies of the Elderly	1993-2001	3,050	≥1 IADL (# items not specified)	46.7 (44.90; 48.50)	
Prevalence of Moderate IADL Disability							
Rolland, 2006[165]	France	EPIDOS Epidemiologie de l'osteoporose study	1992-1998	7,250	2 IADL (8 items)	7.2 (6.60; 7.80)	
				7,250	1 IADL (8 items)	15.1 (14.30; 15.90)	
Rakowski, 1993[214]	USA	Longitudinal Study on Aging	1984	7,474	1-2 IADL (6 items)	21.3 (20.40; 22.20)	
Johnson, 2000[31]	USA	National Survey on Self-Care and Aging	1990/1991	3,485	≥2 IADL (6 items)	31.0 (29.50; 32.60)	
Prevalence of Severe IADL Disability							
Rakowski, 1993[214]	USA	Longitudinal Study on Aging	1984	7,474	5-6 IADL (6 items)	4.5 (4.00; 5.00)	
Ganguli, 2002[85]	USA - Washington & Westmorel and Counties in PA	Monongahela Valley Independent Elders Survey	1987-1999	1,064	≥4 IADL (# items not specified OARS)	5.7 (4.50; 7.30)	
Rakowski, 1993[214]	USA	Longitudinal Study on Aging	1984	7474	3-4 IADL (6 items)	6.2 (5.70; 6.80)	
Rolland, 2006[165]	France	EPIDOS Epidemiologie de l'osteoporose study	1992-1998	7250	≥3 IADL (8 items)	8.5 (7.90; 9.20)	
Kiely, 2009[26]	USA	MOBILIZE (Maintenance of Balance,	Not	765	3-4 IADL (3 items)	21.2 (18.40; 24.20)	

Appendix E Table 10. Prevalence of Instrumental ADL Disability in Older Persons (continued)

Reference	Country	Study	Year of Study	Sample Size	Disability Type 2	Prevalence (95% CI)	Sub-Groups
		Independent Living, Intellect, and Zest in the Elderly) Boston Study (MBS)	reported				
Prevalence of Finance IADL Disability							
Lee, 2006[71]	USA	Health and Retirement Study	1998	11701	Finances	8.0 (7.50; 8.50)	Development cohort
				8009	Finances	9.0 (8.40; 9.60)	Validation cohort
Tabbarah, 2001[2]	USA	Survey of Asset and Health Dynamics of the Oldest Old (AHEAD)	1994	7,447	Finances "Need help performing activity"	17.9 (17.00; 18.80)	
Jette, 1990[126]	USA	Massachusetts Health Care Panel Study (MHCPS)	1980	523	Finances	19.3 (16.10; 22.90)	
			1985	523	Finances	36.7 (32.70; 40.90)	
Prevalence of Housekeeping IADL Disability							
Jette, 1990[126]	USA	Massachusetts Health Care Panel Study (MHCPS)	1980	500	Housekeeping	35.8 (31.70; 40.10)	
			1985	500	Housekeeping	48.0 (43.60; 52.40)	
Albert , 2006[48]	USA - NYC	SITE Sources of Independence in the Elderly	1999-2001	361	Housekeeping	7.5	
Prevalence of Meal Preparation IADL Disability							
Hays, 2005[13]	USA	EPESE-Duke Site- Established Populations for Epidemiologic Studies of the Elderly	1992-1993	1920	Meal prep	10.1	
Lee, 2006[71]	USA	Health and Retirement Study	1998	11701	Meal prep	10.0 (9.50; 10.60)	Development cohort
				8009	Meal prep	12.0 (11.30; 12.70)	Validation cohort
Jette, 1990[126]	USA	Massachusetts Health Care Panel Study (MHCPS)	1980	530	Meal prep	32.4 (28.50; 36.50)	
			1985	530	Meal prep	34.1 (30.20; 38.20)	
Tabbarah, 2001[2]	USA	Survey of Asset and Health Dynamics of the Oldest Old (AHEAD)	1994	7,447	Meal prep "Need help performing activity"	7.1 (6.50; 7.70)	
Prevalence of Medication IADL Disability							
Lee, 2006[71]	USA	Health and Retirement Study	1998	11701	Medication management	3.0 (2.70; 3.30)	Development cohort
				8009	Medication management	3.0 (2.60; 3.40)	Validation cohort
Tabbarah, 2001[2]	USA	Survey of Asset and Health Dynamics of the Oldest Old (AHEAD)	1994	7,447	Medication management "Need help performing activity"	4.7 (4.20; 5.20)	

Appendix E Table 10. Prevalence of Instrumental ADL Disability in Older Persons (continued)

Reference	Country	Study	Year of Study	Sample Size	Disability Type 2	Prevalence (95% CI)	Sub-Groups
Prevalence of Shopping IADL Disability							
Hays, 2005[13]	USA	EPESE-Duke Site- Established Populations for Epidemiologic Studies of the Elderly	1992-1993	1920	Shopping	13.8	
Lee, 2006[71]	USA	Health and Retirement Study	1998	11701	Shopping	11.0 (10.40; 11.60)	Development cohort
				8009	Shopping	14.0 (13.30; 14.80)	Validation cohort
Jette, 1990[126]	USA	Massachusetts Health Care Panel Study (MHCPS)	1980	522	Shopping	32.9 (29.00; 37.00)	
			1985	522	Shopping	41.3 (37.10; 45.60)	
Tabbarah, 2001[2]	USA	Survey of Asset and Health Dynamics of the Oldest Old (AHEAD)	1994	7,447	Shopping "Need help performing activity"	14.6 (13.80; 15.40)	
Prevalence of Telephone IADL Disability							
Lee, 2006[71]	USA	Health and Retirement Study	1998	11701	Telephone	4.0 (3.70; 4.40)	Development cohort
				8009	Telephone	6.0 (5.50; 6.50)	Validation cohort
Tabbarah, 2001[2]	USA	Survey of Asset and Health Dynamics of the Oldest Old (AHEAD)	1994	7,447	Telephone "Need help performing activity"	4.5 (4.10; 5.00)	
Prevalence of Transportation IADL Disability							
Jette, 1990[126]	USA	Massachusetts Health Care Panel Study (MHCPS)	1980	513	Driving	54.3 (50.00; 58.60)	
			1985	513	Driving	67.6 (63.40; 71.50)	
Prevalence of IADL Disability by Frailty Status							
Cawthon, 2007[28]	USA	MROS - Osteoporotic Fractures in Men Study	2000-2002	5993	≥1 IADL (3 items)	7.4 (6.80; 8.10)	Robust
						19.6 (18.60; 20.60)	Pre-frail
						55.7 (54.40; 57.00)	Frail
Gender Difference							
Murtogh, 2004[215]	USA	Alumni Health Study	1999	1348	Chore	40.1 (37.50; 42.70)	Sample Age 73+ Mean age 79
Crimmins, 1997[86]	USA	Longitudinal Study on Aging	1984	3081	≥1 IADL (6 items)	12.7 (11.60; 13.90)	Women age 76+
			1986	2904	≥1 IADL (6 items)	12.6 (11.40; 13.90)	Women age 76+
			1988	2842	≥1 IADL (6 items)	12.8 (11.60; 14.10)	Women age 76+
			1990	2782	≥1 IADL (6 items)	11.6 (10.50; 12.80)	Women age 76+

Appendix E Table 10. Prevalence of Instrumental ADL Disability in Older Persons (continued)

Reference	Country	Study	Year of Study	Sample Size	Disability Type 2	Prevalence (95% CI)	Sub-Groups
Murtogh, 2004[215]	USA	Alumni Health Study	1999	1348	Chore	23.6 (21.40; 25.90)	Sample Age 73+ Mean age 79
Crimmins, 1997[86]	USA	Longitudinal Study on Aging	1984	3081	≥1 IADL (6 items)	9.2 (8.20; 10.30)	Men age 76+
			1986	2904	≥1 IADL (6 items)	12.5 (11.30; 13.80)	Men age 76+
			1988	2842	≥1 IADL (6 items)	11.2 (10.10; 12.40)	Men age 76+
			1990	2782	≥1 IADL (6 items)	10.7 (9.60; 11.90)	Men age 76+
Albert , 2006[48]	USA - NYC	SITE Sources of Independence in the Elderly	1999-2001	361	Housekeeping	2.6 (1.40; 4.90)	Men age <75
						5.3 (3.40; 8.10)	Men age ≥75
						8.3 (5.90; 11.60)	Women age <75
Hays, 2005[13]	USA	EPESE-Duke Site- Established Populations for Epidemiologic Studies of the Elderly	1992-1993	1920	Meal prep	10.2	Women
					Meal prep	9.8	Men
					Meal prep	11.9 (10.50; 13.40)	Black women
					Meal prep	7.5 (6.40; 8.80)	White women
					Meal prep	9.7 (8.50; 11.10)	Black men
					Meal prep	10.9 (9.60; 12.40)	White men
					Shopping	10.4	Women
					Shopping	20.5	Men
					Shopping	24.8 (22.90; 26.80)	Black women
					Shopping	15.6 (14.00; 17.30)	White women
					Shopping	12.1 (10.70; 13.60)	Black men
					Shopping	8.3 (7.10; 9.60)	White men
Albert , 2006[48]	USA - NYC	SITE Sources of Independence in the Elderly	1999-2001	361	Housekeeping	9.1 (6.50; 12.50)	Women age ≥75
Racial Difference							
Hays, 2005[13]	USA	EPESE-Duke Site- Established Populations for Epidemiologic Studies of the Elderly	1992-1993	1920	Meal prep	10.4	Black
					Meal prep	9.7	White
					Meal prep	11.9 (10.50; 13.40)	Black women
					Meal prep	7.5 (6.40; 8.80)	White women
					Meal prep	9.7 (8.50; 11.10)	Black men
					Meal prep	10.9 (9.60; 12.40)	White men
					Shopping	16.2	Black
					Shopping	10.9	White
					Shopping	24.8 (22.90; 26.80)	Black women
					Shopping	15.6 (14.00; 17.30)	White women
					Shopping	12.1 (10.70; 13.60)	Black men
					Shopping	8.3 (7.10; 9.60)	White men

Appendix E Table 11. Prevalence of Malnutrition in Older Persons Defined as Low Albumin Level, Low BMI, or Unintentional Weight Loss

Reference	Study	Country	Sample size	Age	Gender	Definition	Subgroup	Prevalence (95% CI)
Albumin								
Onder, 2003 [184]	Italian Group of Pharmacoepidemiology in the Elderly (GIFA)	Italy	6984	>65	Total	Serum albumin level <35 g/L		38.1 (37.0; 39.3)
Martin, 2007[138]	Veterans Administrative (VA) outpatient clinics	USA	130	>65	Total	Serum albumin <35 g/L	BMI <24 kg/m2	3.1 (1.2; 7.9)
Lesourd, 1996[216]	SENECA: Survey in Europe on Nutrition and the Elderly, a Concerted Action	8 European countries	1701	>73	Male	Albumin <35g/l		1.8 (1.3; 2.6)
					Female	Albumin <30g/l		0.2 (0.1; 0.6)
					Male	Albumin <35g/l		2.5 (1.9; 3.4)
					Female	Albumin <30g/l		0.7 (0.4; 1.2)
Anemia								
Lesourd, 1996[216]	SENECA: Survey in Europe on Nutrition and the Elderly, a Concerted Action	8 European countries	1701	>73	Male	Anemia, WHO criteria <130g/L		5.6 (4.6; 6.8)
					Female	Anemia, WHO criteria <120g/L		5.5 (4.5; 6.7)
					Male	Anemia, NHANES II criteria <126g/L		4.1 (3.3; 5.2)
					Female	Anemia, NHANES II criteria <117g/L		4.2 (3.3; 5.3)
Dallman, 1984[217]	Second National Health and Nutrition Examination Survey (NHANES II, 1976 to 1980)	USA	1013	>65	Male	Anemia, 126g/L		4.4 (3.3; 5.9)
			1013	>65	Male	Anemia, 126g/L	Caucasian	4.5 (3.4; 6.0)
			1682	>65	Female	Anemia, 117g/L		3.9 (3.1; 4.9)
			1682	>65	Female	Anemia, 117g/L	Caucasian	3.5 (2.7; 4.5)
Body mass index, kg/m2								
Onder, 2003[184]	Italian Group of Pharmacoepidemiology in the Elderly (GIFA)	Italy	6984	>65	Total	BMI < 18.5		5.8 (5.3; 6.4)
Shannon, 2007[29]	Osteoporotic Fractures in Men (MrOS)	USA	5928	>65	Male	BMI<20		1.0 (0.8; 1.3)
Stookey, 2004[8]	Duke Established Populations for Epidemiologic Studies of the Elderly	USA	705	>70	Total	BMI< 18.5		2.3 (1.4; 3.7)
Marshall, 1999[132]	San Luis Valley Health and Aging Study	USA	1,006	>65	Male	BMI<22	Hispanic	10.4 (8.7; 12.4)*
		USA	1,006	>65	Male	BMI<22	non Hispanic	5.9 (4.6; 7.5)*
		USA	1,006	>65	Female	BMI<22	Hispanic	9.8 (8.1; 11.8)*
		USA	1,006	>65	Female	BMI<22	non Hispanic	13.0 (11.1; 15.2)*
Martin, 2007[138]	Veterans Administrative (VA) outpatient clinics	USA	130	>65	Total	BMI <19		15.0 (9.8; 22.2)
Ledikwe,	Geisinger Rural Aging Study	USA	179	>65	Total	BMI <18.5		0.0 (0.0; 4.3)

Appendix E Table 11. Prevalence of Malnutrition in Older Persons Defined as Low Albumin Level, Low BMI, or Unintentional Weight Loss (continued)

Reference	Study	Country	Sample size	Age	Gender	Definition	Subgroup	Prevalence (95% CI)
2004[68]	(GRAS)							
Cesari, 2004[176]	InCHIANTI	Italy	1020	>65	Total	BMI<20		1.8 (1.1; 2.8)
de Groot, 2004[189]	Survey in Europe on Nutrition and the Elderly: a Concerted Action (SENECA)	Europe	989	>65	Female	BMI<20		10 (8.3;12)
					Men	BMI<20		0.1 (0;0.8)
Weight loss								
Beck, 1999[157]	Danish part of the 'Survey in Europe of Nutrition in the Elderly, a Concerted Action' (SENECA)	Denmark	202	>73	Total	Weight loss >5%	High Nutritional risk, NSI Score >6	21.0 (15.9; 27.2)
						Weight loss >5%	Risk of malnutrition by MNA 17–23.5	58.0 (51.1; 64.6)
Newman, 2001[64]	Cardiovascular Study Research Group	USA	4718	>65	Male	Weight loss of 5% in a 3-year		16.2 (15.2; 17.3)
					Male	Weight loss of 10% in a 3-year		4.1 (3.6; 4.7)
					Female	Weight loss of 5% in a 3-year		18.7 (17.6; 19.8)
					Female	Weight loss of 10% in a 3-year		6.3 (5.6; 7.0)
Kulminski, 2008[62]	Cardiovascular Health Study	USA	4721	>65		Weight loss (component of Phenotypic Frailty Index)		4.5 (3.9;5.1)
Marshall, 1999[132]	San Luis Valley Health and Aging Study	USA	1,006	>65	Male	Weight loss >10% in 6 months	Hispanic	6.6 (5.2; 8.3)*
					Male	Weight loss >10% in 6 months	Non Hispanic	7.2 (5.8; 9.0)*
					Female	Weight loss >10% in 6 months	Hispanic	8.3 (6.7; 10.2)*
					Female	Weight loss >10% in 6 months	Non Hispanic	8.9 (7.3; 10.8)*
Ensrud, 2009[51]	The Osteoporotic Fractures in Men Research Group	USA	3132	>65	Male	Weight loss		19.6 (18.2;21)
Graham, 2009[202]	Hispanic Established Population for the Epidemiological Study of the	USA	1996	>65	Total	Weight loss	Hispanic	18.8 (17.1;20.6)

Appendix E Table 11. Prevalence of Malnutrition in Older Persons Defined as Low Albumin Level, Low BMI, or Unintentional Weight Loss (continued)

Reference	Study	Country	Sample size	Age	Gender	Definition	Subgroup	Prevalence (95% CI)
	Elderly							
Syddall, 2010[206]	Hertfordshire Cohort Study	UK	638	>65	Male	Weight loss (>10 pounds over the past year)		5.3 (3.8;7.3)
					Female			3.5 (2.3;5.2)

*age adjusted prevalence

Appendix E Table 12. Prevalence of Malnutrition in Older Persons Defined as Micronutrients Deficit

Reference	Study	Country	Sample size	Age	Gender	Subgroup	Definition	Prevalence (95% CI)
Patel, 2010[46]	NHANES III	USA	4,198	>65	Total		Folate deficient	6.4 (5.7; 7.2)
	Women's Health and Aging Study I	USA	742	>70	Total		Folate deficient	1.0 (0.5; 2.0)
	InCHIANTI	USA	1,036	>65	Total		Folate deficient	18.2 (16.0; 20.7)
	NHANES III	USA	4,198	>65	Total		Iron deficient	5.6 (4.9; 6.3)
	Women's Health and Aging Study I	USA	742	>70	Total		Iron deficient	2.6 (1.7; 4.0)
	InCHIANTI	USA	1,036	>65	Total		Iron deficient	6.1 (4.8; 7.7)
	NHANES III	USA	4,198	>65	Total		Vitamin B12 deficient	5.4 (4.8; 6.1)
	Women's Health and Aging Study I	USA	742	>70	Total		Vitamin B12 deficient	6.6 (5.0; 8.6)
	InCHIANTI	USA	1,036	>65	Total		Vitamin B12 deficient	11.7 (9.9; 13.8)
Visser, 2006[196]	Longitudinal Aging Study Amsterdam (1995–1996)	The Netherlands	1260	>65	Total		Vitamin D deficiency [25 (OH)D < 25 nmol/L]	10.1 (8.6; 11.9)
				>65	Total		Vitamin D insufficiency [25 (OH)D 25–49.9 nmol/L]	36.7 (34.1; 39.4)
Johnson, 2008[93]	Older Americans Act Nutrition Program (OAANP) in northeast Georgia	USA	158	>65	Total		Vitamin D insufficiency (25 (OH)D 25-<50nmol/l)	36.7 (29.6; 44.5)
					Total		Vitamin D deficiency	8.2 (4.8; 13.6)
					Male		Vitamin D deficiency	10.0 (6.2; 15.7)
					Female		Vitamin D deficiency	8.0 (4.7; 13.4)
					Total	Caucasian	Vitamin D deficiency	8.0 (4.7; 13.4)
					Total	African American	Vitamin D deficiency	8.0 (4.7; 13.4)

Appendix E Table 13. Prevalence of Malnutrition in Older Persons Using Composite Nutritional Score

Reference	Study	Country	Sample size	Age	Gender	Definition	Subgroup	Prevalence (95% CI)
High nutritional risk								
de Groot, 1998[218]	SENECA: Survey in Europe on Nutrition and the Elderly, a Concerted Action	8 European countries	1701	>73	Total	High risk by Nutritional Health Checklist		48.0 (45.6; 50.4)
Marshall, 1999[132]	San Luis Valley Health and Aging Study	USA	1,006	>65	Male	High risk by Nutritional Health Checklist	Hispanic	19.1 (16.8; 21.6)*
					Male		Non Hispanic	14.0 (12.0; 16.3)*
					Female		Hispanic	30.0 (27.2; 32.9)*
					Female		Non Hispanic	17.0 (14.8; 19.4)*
Beck, 1999[157]	Danish part of 'Survey in Europe of Nutrition in the Elderly, a Concerted Action' (SENECA)	Denmark	202	>73	Total	High risk by Nutritional Health Checklist		19.3 (14.4; 25.3)
Yap, 2007[191]	Singapore Longitudinal Aging Study, SLAS	Singapore	1407	65-74 years	Total	High risk score (>3)		33.1 (30.7; 35.6)
				75+ years	Total			40.9 (38.4; 43.5)
Weatherspoon, 2004[92]	Nutrition Screening Initiative	USA	324	>60	Total	High risk score	Rural	29.0 (24.3; 34.2)
					Total		Urban	33.0 (28.1; 38.3)
					Male			24.0 (19.7; 29.0)
					Female			34.0 (29.0; 39.3)
				60-64	Total		60-64	21.0 (16.9; 25.8)
				65-74	Total		65-74	46.0 (40.6; 51.5)
				75-84	Total		75-84	25.0 (20.6; 30.0)
				>85	Total		>85	31.0 (26.2; 36.2)
				>60	Total		Caucasian	24.0 (19.7; 29.0)
				>60	Total		African American	38.0 (32.9; 43.4)
				>60	Total		Others/Hispanics	34.0 (29.0; 39.3)
High risk nutritional score by health perception								
Weatherspoon, 2004[92]		USA	324	>60	Total		Health perception: Excellent	16.0 (12.4; 20.4)
				>60	Total		Health perception: Good	22.0 (17.8; 26.8)
				>60	Total		Health perception: Fair	44.0 (38.7; 49.5)
				>60	Total		Health perception: Poor	53.0 (47.6; 58.4)
Moderate risk nutritional score								
de Groot, 1998[218]	SENECA: Survey in Europe on	8 European countries	1701	>73	Total	Moderate risk by Nutritional		41.0 (38.7; 43.4)

Appendix E Table 13. Prevalence of Malnutrition in Older Persons Using Composite Nutritional Score (continued)

Reference	Study	Country	Sample size	Age	Gender	Definition	Subgroup	Prevalence (95% CI)
	Nutrition and the Elderly, a Concerted Action					Health Checklist		
Beck, 1999[157]	Danish part of 'Survey in Europe of Nutrition in the Elderly, a Concerted Action' (SENECA)	Denmark	202	>73	Total			51.0 (44.1; 57.8)
Weatherspoon, 200[92]	Nutrition Screening Initiative	USA	324	>60	Total	Moderate risk l score		60.0 (54.6; 65.2)
					Total			39.0 (33.8; 44.4)
					Male			57.0 (51.5; 62.3)
					Female			42.0 (36.7; 47.4)
				60-64	Total		60-64	50.0 (44.6; 55.4)
				65-74	Total		65-74	43.0 (37.7; 48.5)
				75-84	Total		75-84	51.0 (45.6; 56.4)
				>85	Total		>85	39.0 (33.8; 44.4)
				>60	Total		Caucasian	47.0 (41.6; 52.4)
				>60	Total		African American	48.0 (42.6; 53.4)
				>60	Total		Others/Hispanics	42.0 (36.7; 47.4)
Moderate risk nutritional score by health perception								
Weatherspoon, 200[92]				>60	Total		Health perception: Excellent	49.0 (43.6; 54.4)
				>60	Total		Health perception: Good	50.0 (44.6; 55.4)
				>60	Total		Health perception: Fair	40.0 (34.8; 45.4)
				>60	Total		Health perception: Poor	38.0 (32.9; 43.4)
Risk of malnutrition								
de Groot, 1998[218]	SENECA: Survey in Europe on Nutrition and the Elderly, a Concerted Action	8 European countries	1701	>73	Total	Risk of malnutrition by The Mini Nutritional Assessment		44.0 (41.7; 46.4)
						Malnutrition by The Mini Nutritional Assessment		1.0 (0.6; 1.6)

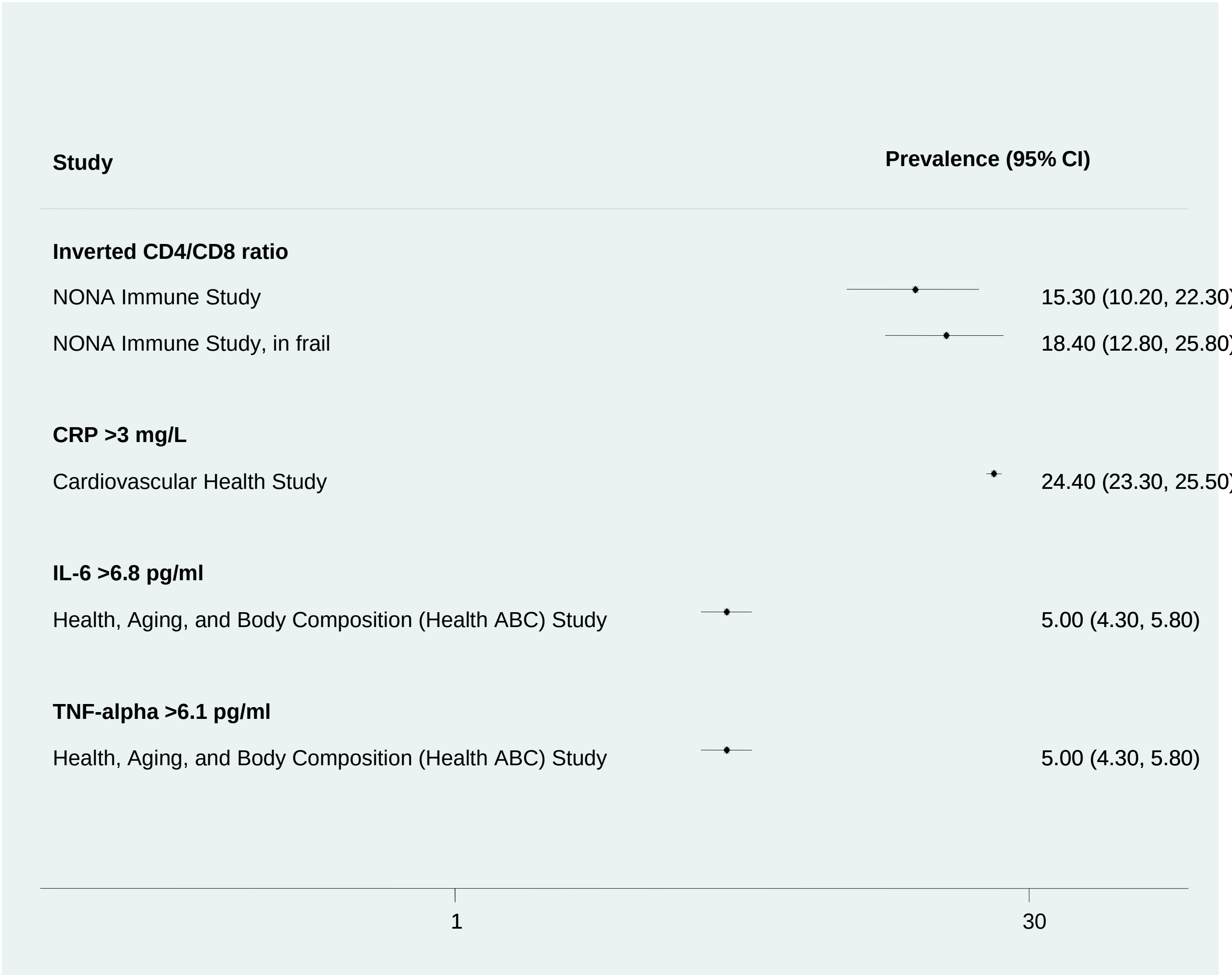
Appendix E Table 13. Prevalence of Malnutrition in Older Persons Using Composite Nutritional Score (continued)

Reference	Study	Country	Sample size	Age	Gender	Definition	Subgroup	Prevalence (95% CI)
Beck, 1999[157]	Danish part of 'Survey in Europe of Nutrition in the Elderly, a Concerted Action' (SENECA)	Denmark	202	>73	Total	Risk of malnutrition by The Mini Nutritional Assessment		21.6 (16.5; 27.8)
Visvanathan, 2003[141]	Domiciliary care services for elderly people with moderate or severe functional limitations	Australia	250	>67	Total	Risk of malnutrition	Moderate or severe functional limitations	38.4 (32.6; 44.6)
Visvanathan, 2003[141]	Domiciliary care services for elderly people with moderate or severe functional limitations	Australia	250	>67	Total	Malnutrition		4.8 (2.7; 8.3)

Appendix E Table 14. Prevalence of Impaired Homeostasis in Older Persons

Reference	Study	Measure of Impaired Homeostasis	Sample	Definition	Prevalence (95% CI)
Nelson, 2007[219]	National Health and Nutrition Examination Surveys (NHANES) 1999–2000 and 2001–2002	Allostatic load score (0-10) for high-risk systolic blood pressure (>138 mm Hg), diastolic blood pressure (>81 mm Hg, BMI 31.2 kg/m2), hemoglobin A1C >5.6%, albumin <4.47 g/dL, creatinine clearance <78.5 mL/min/1.73 m2, triglycerides >189.5 mg/dL, C-reactive protein >0.49 mg/dL, homocysteine >10.1 mmol/L, and total cholesterol >233.9 mg/dL.	5,083	Allostatic load score >4	1.4 (1.1; 1.8)
Stookey, 2004[8]	Duke Established Populations for Epidemiologic Studies of the Elderly	Plasma tonicity was estimated from plasma glucose, sodium, and potassium measures and used to classify subjects as normo- (285–294 mOsm/L) or hypertonic (>300 mOsm/L)	705	hypertonic plasma, >300 mOsm/L	10 (8; 12.4)

Appendix E Figure 1. Prevalence of Biomarkers of Chronic Inflammation in Older Persons[58,76,192]



Appendix E Table 15. Prevalence of Cognitive Impairment in Older Men According to Age and Measurement

Reference	Study	Method	Prevalence (95% CI)
>65			
Newman, 2009[60]	Cardiovascular Health Study All Stars Study	3MSE	36.0 (33.7; 38.3)
Helmer, 1999[166]	PAQUID (Personnes Agees QUID) Research Program	MMSE	16.9 (15.7; 18.1)
No author listed, 2001[152]	Canadian Study of Health and Aging (CSHA)	3MSE	16.0 (15.3; 16.8)
65-74			
Graham, 1997[148]	Canadian Study of Health and Aging	3MSE	16.1 (12.6; 19.6)
>70			
Pratt, 2008[220]	Health and Retirement Survey (HRS)	TICS	5.2 (4.4; 6.2)
>75			
Rait, 2005[208]	Medical Research Council (MRC) Trial of the Assessment and Management of Older People in the Community	MMSE	2.4 (1.9; 3.0)
75-79			
Pratt, 2008[220]	Cardiovascular Health Study	TICS	15.4 (14.6; 16.3)
Rait, 2005[208]	Medical Research Council (MRC) Trial of the Assessment and Management of Older People in the Community	MMSE	1.4 (1.0; 2.0)
75-84			
Graham, 1997[148]	Canadian Study of Health and Aging	3MSE	29.5 (25.6; 33.4)
80-84			
Pratt, 2008[220]	Cardiovascular Health Study	TICS	33.3 (32.2; 34.4)
<82			
Newman, 2009[60]	Cardiovascular Health Study All Stars Study	3MSE	10.8 (9.4; 12.4)
80-84			
Rait, 2005[208]	Medical Research Council (MRC) Trial of the Assessment and Management of Older People in the Community	MMSE	2.5 (1.8; 3.6)
80-85	SENECA study		
Pearson, 2001[221]	Hamme, Belgium	MMSE	31.0 (27.5; 34.7)
Pearson, 2001[221]	Denmark	MMSE	10.0 (7.9; 12.6)
Pearson, 2001[221]	Haguenau, France	MMSE	4.0 (2.7; 5.8)
Pearson, 2001[221]	Romans, France	MMSE	10.0 (7.9; 12.6)
Pearson, 2001[221]	Italy	MMSE	10.0 (7.9; 12.6)
Pearson, 2001[221]	The Netherlands	MMSE	4.0 (2.7; 5.8)
Pearson, 2001[221]	Portugal	MMSE	27.0 (23.7; 30.6)
Pearson, 2001[221]	Spain	MMSE	15.0 (12.4; 18.0)
Pearson, 2001[221]	Switzerland	MMSE	9.0 (7.0; 11.5)
Pearson, 2001[221]	Poland	MMSE	20.0 (17.1; 23.3)
Pearson, 2001[221]	SENECA study, total sample	MMSE	14.0 (11.5; 16.9)
83-84			
Newman, 2009[60]	Cardiovascular Health Study All Stars Study	3MSE	9.2 (7.9; 10.7)
>85			
Pratt, 2008[220]	Cardiovascular Health Study	TICS	42.9 (41.7; 44.1)
Graham, 1997[148]	Canadian Study of Health and Aging	3MSE	35.8 (29.5; 42.1)

Appendix E Table 15. Prevalence of Cognitive Impairment in Older Men According to Age and Measurement (continued)

Reference	Study	Method	Prevalence (95% CI)
85-88			
Newman, 2009[60]	Cardiovascular Health Study All Stars Study	3MSE	9.1 (7.8; 10.6)
Rait, 2005[208]	Medical Research Council (MRC) Trial of the Assessment and Management of Older People in the Community	MMSE	4.4 (3.0; 6.4)
>89			
Newman, 2009[60]	Cardiovascular Health Study All Stars Study	3MSE	14.9 (13.3; 16.7)
Rait, 2005[208]	Medical Research Council (MRC) Trial of the Assessment and Management of Older People in the Community	MMSE	10.3 (6.4; 16.2)

TICS=Telephone Interview of Cognitive Status; MMSE=Mini-Mental State Examination; 3MSE=Modified Mini-Mental Status Examination.

Appendix E Table E16. Association Between Cognitive and Behavioral Factors and Dementia in Healthy Older Persons[222,223]

Study	Reference	Comparison Groups	Sample Size	Predictors of Dementia
Demographic and cognitive factors				
Bronx Aging Study	Masur, 1994[224]	Normal vs. dementia	n=317	Selective Reminding Test delayed recall, Fuld Object Memory Test recall, category fluency, Wechsler Adult Intelligence Scale Digit Symbol
Prospective epidemiologic study of dementia	Jacobs, 1995[225]	Normal vs. Alzheimer's Disease	n=443	Gender (female), Boston Naming Test, Wechsler Adult Intelligence Scale-Revised Similarities, Selective Reminding Test immediate recall.
Framingham Study	Linn, 1995[226]	Normal vs. Alzheimer's Disease	n=1,045	Wechsler Memory Scale logical memory and Paired Associate Learning (but not Similarities or letter fluency), Digit Span(Alzheimer's Disease scoring higher)
Random sample of nondemented persons aged 75 years and older	Braekhus, 1995[227]	Normal vs. dementia	n=215	MMSE score of 24 or 25 (predictive at 3 years but not at 6 years)
Amsterdam Study of the Elderly (AMSTEL)	Schmand, 1996[228]	Normal vs. dementia	n=203	Age and Cambridge Mental Disorders in the Elderly Examination Cognitive subtest memory subscale
Bronx Aging Study	Crystal, 1996[229]	Normal vs. Alzheimer's Disease (Autopsy)	n=22	Greater rate of decline on neuropsychological tests
Canadian Study of Health and Aging (CSHA)	O'Rourke, 1997[230]	Nondemented vs. dementia	n=59	Deficits on one or more subsets of the Clock Test
	Small, 1997[231]	Nondemented vs. dementia	n=205	MMSE, word recall (organized list), face recognition test, letter fluency/Clock Test
	Fox, 1998[232]	Nondemented with familial history vs. Alzheimer's Disease	n=63	Recognition Memory Test-Words
	Katzman, 1989[233]	Normal vs. dementia	n=406	Age, gender (female), and baseline score on the Blessed Information Memory Concentration
	Fuld, 1990[234]	Normal vs. dementia	n=474	Fuld Object Memory Test immediate recall
	Masur, 1990[235]		n=422	Selective Reminding Test sum of recall and delayed recall
	Tuokko, 1991[236]	Nondemented vs. Alzheimer's Disease	n=45	Free recall from Buschke's cued recall paradigm
	Flicker, 1991[237]	Global Deterioration Scale ≤3 vs. Global Deterioration Scale>4	n=32	Memory (visual, verbal)receptive language
	Flicker, 1993[238]	Global Deterioration Scale<=2 vs. Global Deterioration Scale>3	n=50	Memory measures, object function recall
Behavioral risk factors				
	Physical activity			
Cardiovascular Risk Factors, Aging	Kivipelto, 2008[239]	Sedentary (<2 times/ week) vs. Active (≥2)	n=1,449	Sedentary life style increased dementia and Alzheimer's Disease

Appendix E Table E16. Association Between Cognitive and Behavioral Factors and Dementia in Healthy Older Persons[222,223] (continued)

Study	Reference	Comparison Groups	Sample Size	Predictors of Dementia
and Dementia Study (CAIDE)				
Honolulu-Asia Aging Study (HAAS)	Taafe, 2008[240]	Moderate (gardening, carpentry) vs. high (lifting, shoveling)	n=2,263 men	Moderate and high usual 24-hour activity levels reduced Alzheimer's Disease but not vascular dementia
Cardiovascular Risk Factors, Aging and Dementia Study (CAIDE)	Rovio, 2007[241]	Occupational physical activity vs. total daily commuting physical activity	n=1,449	No association
Adult Changes in Thought Study (ACT)	Larson, 2006[242]	≥3 times/week	n=1,619	Regular exercise reduced dementia but not Alzheimer's Disease
Dubbo Study	Simons, 2006[243]	Walking, gardening	n=2,805	Walking, gardening in men reduced dementia
Cardiovascular Health Cognition Study (CHCS)	Podewils, 2005[244]		n=3,375	>4 activities in the past two weeks reduced dementia and Alzheimer's Disease but not vascular Alzheimer's Disease
Whitehall II	Singh-Manoux, 2005[245]	High level (≥2.5 hours/ week of moderate or ≥1 hour/week of vigorous activity) vs. low level (<2 hours/week of moderate, <1 hour/ week of vigorous activity)	n=6.236	Low weekly activity increased dementia and Alzheimer's Disease
Honolulu-Asia Aging Study (HAAS)	Abbott, 2004[246]	Distance walked/day	n=1,495	Walking <0.25miles /day increased risk of dementia and Alzheimer's Disease but not vascular Alzheimer's Disease
Nurses' Health Study	Weuve, 2004[247]	Leisure time activity vs. Metabolic Equivalent-hours/week	n=16,466	High energy expenditure associated with better cognitive function
	Smoking			**Risk Factor**
Cardiovascular Risk Factors, Aging and Dementia Study (CAIDE)	Kivipelto, 2008[239]	Ever vs. never	n=1,449	Smoking was associated with increased risk of dementia and Alzheimer's Disease in apoE□4 carriers
Rotterdam Study	Reitz, 2007[248]	Current vs. past vs. never vs. pack years	n=6,868	Smoking was associated with increased risk of dementia and Alzheimer's Disease but not vascular dementia
Honolulu Heart Program (HHP), Honolulu-Asia Aging Study (HAAS)	Tyas, 2003[249]	Current vs. past vs. never vs. pack years [Light (≤26.7) vs. medium (>26.7-40.5) vs. heavy (>40.5-55.5) vs. very heavy (>55.5-156)	n=3,734	Smoking was associated with increased risk of dementia but not vascular dementia
Rotterdam Study	Ott, 1998[250]	Current vs. past vs. never	n=6,870	Smoking was associated with increased risk of dementia but not vascular dementia

Appendix E Table E16. Association Between Cognitive and Behavioral Factors and Dementia in Healthy Older Persons[222,223] (continued)

Study	Reference	Comparison Groups	Sample Size	Predictors of Dementia
	Alcohol drinking			**Risk Factor**
Cardiovascular Risk Factors, Aging and Dementia Study (CAIDE)	Kivipelto, 2008[239]	Frequent (≥once/month) vs. infrequent (<once/month) vs. never	n=1,449	Frequent alcohol drinking in apoE□4 carriers
Cardiovascular Risk Factors, Aging and Dementia Study (CAIDE)	Ngandu, 2007[251]	Frequent (≥once/month) vs. infrequent (<once/month) vs. never	n=1,341	Non drinkers had poorer cognitive performance
Kame Project	Dai, 2006[252]	Wine (sake)1-2 times/week vs. <once/week	n=1,589	No association
Dubbo Study	Simons, 2006[243]	Drinks/week	n=2,805	8-28 drinks/week vs. non reduced risk of dementia
Monongahela Valley Independent Elders Survey (MoVIES)	Ganguli, 2005[253]	None vs. minimal (≤once/month) vs. moderate (>once/month)	n=1,098	Alcohol drinking
Cardiovascular Risk Factors, Aging and Dementia Study (CAIDE)	Anttila, 2004[254]	Frequent (several times/month) vs. infrequent (<once/month) vs. never	n=1,018	Lesser decline in cognitive function in minimal and moderate drinkers
Washington Heights-Inwood Columbia Aging Project (WHICAP)	Luchsinger, 2004[255]	Beer, liquor, wine none vs. light (1 serving/month - 6 servings/week) vs. moderate (1-3 servings/day vs. heavy (>3 servings/day)	n=980	Light-moderate wine drinking reduced risk of dementia
Framingham Heart Study (FHS)	Elias, 1999[256]	Mean oz/week	n=1,940	Better cognitive functions in light drinkers
	Obesity			
Kaiser Permanente	Whitemer, 2007[257]	Underweight (<18.5) vs. normal (18.5-24.9) vs. overweight (25-29.9) vs. obese (≥30)	n=10,136	Over weight and obesity increased risk of dementia, vascular dementia, and Alzheimer's Disease
Framingham Heart Study (FHS)	Elias, 2005[258]	Non-obese (normal: 18.5-24.9, overweight: 25-29.9) vs. obese (>30)	n=2,000	Obese men had worse cognitive function
Cardiovascular Risk Factors, Aging and Dementia Study (CAIDE)	Kivipelto, 2005[259]	Normal (≤25) vs. overweight (25-30) vs. obese (>30)	n=1,449	No association
Multifactor Primary Prevention Study (MPPS)	Rosengren, 2005[260]	20-22.4 (reference) vs. 25-27.4 vs. 27.5-29.9 vs. ≥30	n=7,402	Dose response positive association with dementia

Appendix E Table E16. Association Between Cognitive and Behavioral Factors and Dementia in Healthy Older Persons[222,223] (continued)

Study	Reference	Comparison Groups	Sample Size	Predictors of Dementia
Göteborg	Gustafson, 2003[261]	Continuous	n=382	Dose response positive association with dementia and Alzheimer’s Disease in women (36% for additional 1 kg/m2 after 70 years of age)
Adult Health Study (AHS)	Yamada, 2003[262]	Continuous	n=1,774	No association
	Dietary factors			
Cardiovascular Risk Factors, Aging and Dementia Study (CAIDE)	Eskelinen, 2008[263]	Fat intake from milk, sour milk, and spreads (saturated fatty acids, polyunsaturated fatty acids, monounsaturated fatty acids), fish (≥2/week vs. <2/ week)	n=1,449	High saturated fatty acids intake was associated with mild cognitive impairment
Cardiovascular Risk Factors Aging and Dementia Study (CAIDE)	Kivipelto, 2008[239]	Polyunsaturated fatty acids, saturated fatty acids (g/day) from spreads	n=1,449	High saturated fatty acids intake was associated with mild cognitive impairment in apoE□ 4 carriers
Conselice Study of Brain Ageing (CSBA)	Ravaglia, 2008[264]	Mediterranean diet score (0-10)	n=615	Dose response reduction in dementia by increase tocopherols (plasma)
Kame Project	Dai, 2006[252]	Fruit & vegetable juices, Vitamin E, Vitamin C, -carotene	n=1,589	Negative association with juice, no association with tea, Vitamin E,C, beta-carotene
Cardiovascular Risk Factors, Aging and Dementia Study (CAIDE)	Laitenen, 2006[265]	Fat intake from milk, sour milk, and spreads (Polyunsaturated fatty acids, Saturated fatty acids, Monounsaturated fatty acids)	n=1,449	High polyunsaturated fatty acid intake reduced risk of dementia, high saturated fatty acid intakes increased risk of Alzheimer’s Disease
Chicago Health and Aging Project (CHAP)	Morris, 2006[266]	Vegetables, fruits (servings/day)	n=3,718	Slower cognitive decline after vegetables, no association with fruits
Cardiovascular Health Cognition Study (CHCS)	Huang, 2005[267]	Fish Servings/week	n=2,233	High intake reduced dementia and Alzheimer’s Disease
Chicago Health and Aging Project (CHAP)	Morris, 2005[268]	Fish Servings/week	n=3,718	Fish reduced speed of cognitive decline
Conselice Study of Brain Ageing (CSBA)	Ravaglia, 2005[269]	Folate, Vitamin B_{12} (serum)	n=816	Low folate increased risk of dementia
Honolulu-Asia	Laurin, 2004[270]	β- carotene (µg/day),	n=2,459	No association

Appendix E Table E16. Association Between Cognitive and Behavioral Factors and Dementia in Healthy Older Persons[222,223] (continued)

Study	Reference	Comparison Groups	Sample Size	Predictors of Dementia
Aging Study (HAAS)		flavonoids, Vitamin E, Vitamin C (mg/day)		
Chicago Health and Aging Project (CHAP)	Morris, 2004[271]	Niacin (mg/day)	n=3,718	Niacin administration slowed cognitive decline
Nurses' Health Study	Grodstein, 2003[272]	Vitamin E, Vitamin C (mg/day)	n=14,968	Better cognitive function with higher intake
Washington Heights-Inwood Columbia Aging Project (WHICAP)	Luchsinger, 2003[273]	Carotenes (IU/day), Vitamin C (mg/day), Vitamin E (IU/day)	n=980	No association
Rotterdam Study	Englehart, 2002[274]	β-carotene, flavonoids, Vitamin C, Vitamin E (mg/day)	n=5,395	Vitamin E reduced risk of Alzheimer's Disease
Canadian Study of Health and Aging (CSHA)	Maxwell, 2002[275]	Folate (serum)	n=369	No association

BIMC=Blessed Information Memory Concentration; FOME=Fuld Object Memory Test; CLT=California Verbal Learning Test; MMSE=Mini-Mental State Examination; MDRS=Mattis Dementia Rating Scale; WAIS=Wechsler Adult Intelligence Scale; WMS-R=Wechsler Memory Scale-Revised; LM=logical memory; SRT=Selective Reminding Test; BNT=Boston Naming Test; WAIS-R=Wechsler Adult Intelligence Scale-Revised; WMS=Wechsler Memory Scale; PAL=Paired Associate Learning; CAMCOG=Cambridge Mental Disorders in the Elderly Examination Cognitive subtest; FH=familial history of AD.

Appendix E Table 17. Proportion of Older Persons With Cognitive Impairment Who Developed Dementia[276]

Reference	Inclusion Criteria	Sample Size	Followup, Years	% Developing Dementia
O'Connor, 1990[277]	Cambridge Mental Disorders in the Elderly Examination rating of minimal dementia; age 75 years; excluded: none	44 community-dwelling volunteers recruited from a general medical practice	1.1 years	20.7% progressed to Cambridge Mental Disorders in the Elderly Examination mild or moderate dementia (6/29)
Petersen, 1995[278]	Clinical Dementia Rating = 0.5; cognitive complaint reported by the individual, informant or physician; normal score on cognitive screening measures; performance >1.5 SDs below age appropriate levels on measures of memory; excluded: persons with dementia using DSM-III-R criteria	66 individuals from the Mayo Clinic Alzheimer's Disease Center and Alzheimer's Disease Patient Registry	1.5 years	24.2% progressed to probable Alzheimer's Disease (16/66)
Tierney, 1996[279]	Global Deterioration Scale = 2 or 3; MMSE 24 or DRS 123; 3 or more months of symptomatic memory problems that interfered with daily functioning; excluded: persons with dementia using DSM-III-R criteria and persons with neurologic, psychiatric, and medical disorders	123 individuals referred by a family physician for memory problems	2.0 years	23.6% progressed to probable Alzheimer's Disease (29/123)
Johansson, 1997[280]	Mild impairment on cognitive measures and age between 84 and 90 years; excluded: persons with dementia using DSM-III-R criteria	70 persons from a population-based sample in Sweden of the oldest-old	2.0 years	50.0% progressed to dementia (25/50)
Johnson, 1998[281]	Clinical Dementia Rating = 0.5; excluded: persons with history of significant head trauma, neurologic disorder, psychiatric disorder, major medical disease, or use of medication with psychoactive properties	45 volunteers recruited primarily through the print media	2.0 years	40.0% progressed to probable Alzheimer's Disease (18/45)
Flicker, 1991[237]	Global Deterioration Scale = 3; excluded: persons with past or current neurologic, psychiatric, or medical disorders	32 memory-clinic patients	2.1 years	71.9% progressed to Global Deterioration Scale 4 (23/32)
Devanand, 1997[282]	Clinical Dementia Rating = 0 or 0.5; age >40, impairment present between 6 months and 10 years; evidence of cognitive impairment on clinical or neuropsychological evaluation; modified Mini Mental Status score >30, excluded: persons with dementia using DSM-III-R criteria, current thought or affective disorder, recent electroconvulsive therapy, current or recent substance dependence, stroke, and current medications that affect cognition, mental retardation, or neurologic conditions	127 memory-clinic outpatients including persons with prior history of major affective disorder, substance abuse, and small vascular subcortical lesions	2.5 years	41.3% progressed to dementia (31/75)
Jack, 1999[283]	Clinical Dementia Rating = 0.5; age 60 to 89 years; memory complaint by patient or collateral source; normal general cognitive function; normal ADLs; objective memory impairment with	80 persons from the Mayo Clinic Alzheimer's Disease Center and Alzheimer's Disease Patient Registry	2.7 years	33.8% progressed to probable Alzheimer's Disease (27/80)

Appendix E Table 17. Proportion of Older Persons With Cognitive Impairment Who Developed Dementia[276] (continued)

Reference	Inclusion Criteria	Sample Size	Followup, Years	% Developing Dementia
	performance >1.5 SDs below age- and education appropriate levels; excluded: persons with dementia using DSM-III-R criteria and National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association criteria for probable Alzheimer's Disease			
Herlitz, 1997[284]	Impaired cognitive test performance and age 75 years; excluded: persons with dementia using DSM-III-R criteria	22 community-dwelling individuals	3.0 years	71.4% progressed to dementia (10/14)
Christensen, 1997[285]	History of cerebral dysfunction or presence of a physical disorder known to cause cerebral dysfunction; cognitive dysfunction reported by self or informant; abnormality on cognitive measures (i.e., >1.5 SDs below average); excluded: persons with drinking problems, DSM-III-R delirium or amnestic syndromes, and International Classification of Diseases- 10th edition dementia or probable dementia	36 community-dwelling volunteers	3.6 years	12.0% progressed to dementia (3/25)
Clarke, 1996[286]	Clifton Assessment Procedures for the Elderly Information/ Orientation score = 8 or 9; age 65 years	24 elderly individuals recruited from a representative community sample	4.0 years	100% evidenced ''cognitive decline'' (6/6)
Bowen, 1997[287]	Isolated memory loss presumably based upon neuropsychological test performance (no specific criteria provided); excluded: persons with dementia using DSMIII- R criteria	25 persons with complaints of cognitive impairment from an Alzheimer's Disease registry	4.0 years	47.6% progressed to dementia (10/21)
Johansson, 1997[280]	Mild impairment on cognitive measures and age between 84 and 90 years; excluded: persons with dementia using DSM-III-R criteria	31 individuals with stable ''mild dysfunction'' in second wave of the study	4.0 years	43.8% progressed to dementia (7/16)
Petersen, 1995[278]	Clinical Dementia Rating = 0.5; cognitive complaint reported by the individual, informant or physician; normal score on cognitive screening measures; performance >1.5 SDs below age appropriate levels on measures of memory; excluded: persons with dementia using DSM-III-R criteria	66 individuals from the Mayo Clinic Alzheimer's Disease Center and Alzheimer's Disease Patient Registry	Every 1.5 years	37.9% progressed to probable Alzheimer's Disease (25/66)
Rubin, 1989[288]	Clinical Dementia Rating = 0.5; age 64 and 81 years; excluded: persons with neurological, psychiatric, and serious medical disorders	16 community-dwelling volunteers recruited through public ads and physician referrals	5.4 years	68.8% progressed to Clinical Dementia Rating = 1 or autopsy confirmed Alzheimer's Disease (7/16)

Appendix E Table 18. Association Between Cognitive Impairment and Dementia in Older Persons

Reference	Study	Adjustment	Exposure	Type of Estimate	Mean (95% CI)
	Alzheimer's Disease				
Heun, 2006[174]	Case control study: patients with Alzheimer's disease and population based control subjects group-matched to the patient sample for age, gender, and educational background	Adjusted for duration of individual followup and source of information during the followup investigation (i.e., .personal interview vs. family history information only)	Cognitive impairment, MMSE	OR	2.51 (1.08l 5.81
Aggarwal, 2005[289]	Religious Orders Study	Adjusted for age, sex, and education	Cognitive impairment, MMSE	RR	2.45 (1.53; 3.92)
Jessen, 2010[172]	German Study on Aging, Cognition and Dementia in Primary Care Patients Study Group	Adjusted for age, sex, education, baseline SISCO score, Geriatric Depression Scale score, and ApoE4 genotype	Subjective memory impairment, no mild cognitive impairment	OR	3.44 (0.97; 12.16)
			Subjective memory impairment + mild cognitive impairment, MMSE	OR	19.33 (5.29; 70.81)
			Amnestic cognitive impairment (SISCO + MMSE)	OR	60.28 (12.23; 297.1)
			Nonamnestic cognitive impairment, MMSE	OR	13.8 (3.53; 53.99)
	Any dementia				
Jessen, 2010[172]	German Study on Aging, Cognition and Dementia in Primary Care Patients Study Group	Adjusted for age, sex, education, baseline SISCO score, Geriatric Depression Scale score, and ApoE4 genotype.	Subjective memory impairment, no mild cognitive impairment	OR	2.22 (0.97; 4.97)
			Subjective memory impairment + mild cognitive impairment (MMSE)	OR	8.92 (3.69; 21.6)
			Amnestic cognitive impairment (SISCO + MMSE)	OR	29.24 (8.75; 97.78)
	Vascular dementia				
Jessen, 2010[172]	German Study on Aging, Cognition and Dementia in Primary Care Patients Study Group	Adjusted for age, sex, education, baseline SISCO score, Geriatric Depression Scale score, and ApoE4 genotype.	Subjective memory impairment, no mild cognitive impairment	OR	1.64 (0.41; 6.53)
			Subjective memory impairment + mild cognitive impairment (MMSE)	OR	1.05 (0.1; 11.08)
			Nonamnestic cognitive impairment	OR	6.26 (2.41; 16.28

Appendix E Table 19. Predictors of Dementia in Older Persons With Cognitive Impairment[222,276]

Author, year	Comparison Groups	Sample Size	Predictors of Dementia
Rubin, 1989[288]	Clinical dementia rating=0.5 vs. Clinical dementia rating>=1	n=16	None (including Blessed, Short Portable Mental Status Questionnaire, aphasia battery)
Petersen, 1993[290]	MCCI (stable) vs. Alzheimer's Disease	n=73	Selective Reminding Test learning and semantic cues
Haenninen, 1995[291]	Age associated memory impairment vs. dementia	n=176	Memory(Selective Reminding Test, BVRT, Wechsler Memory Scale VR+ Paired Associate Learning), and word fluency (letter and category)
Petersen, 1995[278]	Mild cognitive impairment (stable) vs. dementia	n=66	MMSE, Mattis Dementia Rating Scale, Selective Reminding Test learning and semantic cues
Tierney, 1996[292]	Global Deterioration Scale-2-3 vs. dementia	n=107	Rey Auditory Verbal Learning Test delayed recall (age- and-education-corrected)
Tierney, 1996[279]	Global Deterioration Scale-2-3 vs. dementia	n=123	Rey Auditory Verbal Learning Test delayed recall and Wechsler Memory Scale Mental Control (age-and-education corrected)
Tierney, 1996[293]	Global Deterioration Scale-2-3 vs. dementia	n=120	Rey Auditory Verbal Learning Test, Wechsler Memory Scale Mental Control and Informant perceptions (Cambridge Mental Disorders in the Elderly Examination)
Devanand, 1997[282]	Clinical Dementia Rating 0-0.5 vs. dementia	n=62	Wechsler Adult Intelligence Scale-Revised(Digit Symbol, Picture Arrangement, Block Design),Selective Reminding Test LRT, category fluency, memory items from modified MMSE, age
Bowen, 1997[287]	Isolated memory loss vs. dementia	n=21	None (including MMSE, Mattis Dementia Rating Scale, Fuld Object Memory Test, Boston Naming Test, Wechsler Adult Intelligence Scale- Revised, and Wechsler Adult Intelligence Scale Revised Logical Memory I, Logical Memory II, VR I, VR II)
Johansson, 1997[280]	Mild dysfunction vs. dementia	n=70	Lower baseline scores on more demanding tasks
Johnson, 1998[281]	Clinical Dementia Rating=0.5 vs. dementia	n=45	Single photon emission computed tomography, California Verbal Learning Test, Wechsler Memory Scale VR II, Trails B
Jack, 1999[283]	Mild Cognitive Impairment (stable) vs. dementia	n=80	Hippocampal volume (MRI),Mattis Dementia Rating Scale, Selective Reminding Test free recall and age(but not APOE, MMSE, Wechsler Memory Scale-Revised, Rey Auditory Verbal Learning Test, or letter fluency.
Flicker, 1991[237]	Global Deterioration Scale ≤3 vs. Global Deterioration Scale ≥4	n=32	Shopping list verbal recall, misplaced object recall, object function recognition, and object identification

Appendix E Table 20. Differences in Prevalence of Frailty in Older Persons According to Definition of Frailty

Reference	Sample	Definition of Frailty	Mean (95% CI)
Alameda County Study			
Cigolle, 2009[72]	574	Frail according to functional domain model (>2 domains with deficiencies)	26.0 (22.6; 29.7)
Beaver Dam Eye Study Cohort			
Klein, 2005[6]	2,515	Frailty markers: gait time, handgrip strength, peak respiratory flow rate, ability to stand from a sitting position without using arms, best corrected visual acuity. Mild 1-2 markers, moderate 3 markers, severe 4-5 markers	44.7 (42.8; 46.7)
Canadian Study of Health and Aging			
Rockwood, 2007[145]	2,305	Frailty index based on; wt loss >10lbs or greater than 5% of body wt, subjective exhaustion, impaired walking, Timed Up and Go Test > 19s, abnormal strength on physical examination	16.5 (15.0; 18.1)
Gutman, 2001[143]	5,987	Rockwood frailty index: 1 - Healthy, 2 - Bladder incontinence, 3 - Mild/moderate frailty, 4 - severe frailty	21.2 (20.2; 22.3)
	3,925	Frail: mild/moderate, severe	8.9 (8.0; 9.8)
	8,914	Frail: mild/moderate, severe	21.2 (20.4; 22.1)
Cardiovascular Health Study			
Fried, 2001[55]	5,317	3 or more of criteria list	6.9 (6.2; 7.6)
Walston, 2002[56]	4,735	3 or more of criteria list	6.3 (5.6; 7.0)
Cigolle, 2009[72]	5,317	Frail according to Biologic Syndrome Model(>3 frailty defining criteria)	7.0 (6.3; 7.7)
Depression Among Caregivers of Impaired Elders Study			
Tennstedt, 1992[120]	4,185	HRCA vulnerability index	18.9 (17.7; 20.1)
Effects of Two Exercise Interventions Among Community-residing Older Adults Study			
Dayhott, 1998[121]	84	Frailty measurement based on two measures: WHOAFC and self-reported health status	17.9 (11.1; 27.6)
Kaiser Permanente Inter-regional Committee on Aging Study			
Brody, 1997[19]	5,810	Eligibility for nursing home placement or long-term placement	14.6 (13.7;15.5)
National Population Health Survey			
Song, 2010[142]	2,740	Frailty index based on the number of deficits divided by the number of variables considered (36). People with nine or more deficits were considered frail.	22.7 (21.0; 24.3)
New Haven Older Americans Independence Center Study			
Hardy, 2005[37]	754	Frail: a timed score of greater than 10 seconds on the rapid gait test (i.e., walking back and forth over a 10-foot (3.048-m) course as quickly as possible)	42.7 (39.2; 46.3)
The Health and Retirement Study			
Cigolle, 2009[72]	11,113	Frail according to at least one model (Functional Domains Model, Burden, or biologic syndrome model)	30.2 (29.4; 31.1)
		Frail according to all three models (Functional Domains Model, Burden, or biologic syndrome model)	3.1 (2.8; 3.4)
		Frail - >2 domains with deficiencies	29.0 (28.2; 29.90
		Frail according to Burden model	15.4 (14.7; 16.1)
		Frail according to functional domain model	20.3 (19.6; 21.1)
		Frail according to biologic syndrome model	10.9 (10.3; 11.5)
		Frail according to an Index of Deficit Accumulation (>0.2)	32.0 (31.1; 32.9)
		Frail according to Biologic Syndrome Model(>3 frailty defining criteria)	11.0 (10.4; 11.6)
	1,657	Frail according to functional domains (weighted for nonresponse percentages)	21.3 (19.4; 23.3)

Appendix E Table 20. Differences in Prevalence of Frailty in Older Persons According to Definition of Frailty (continued)

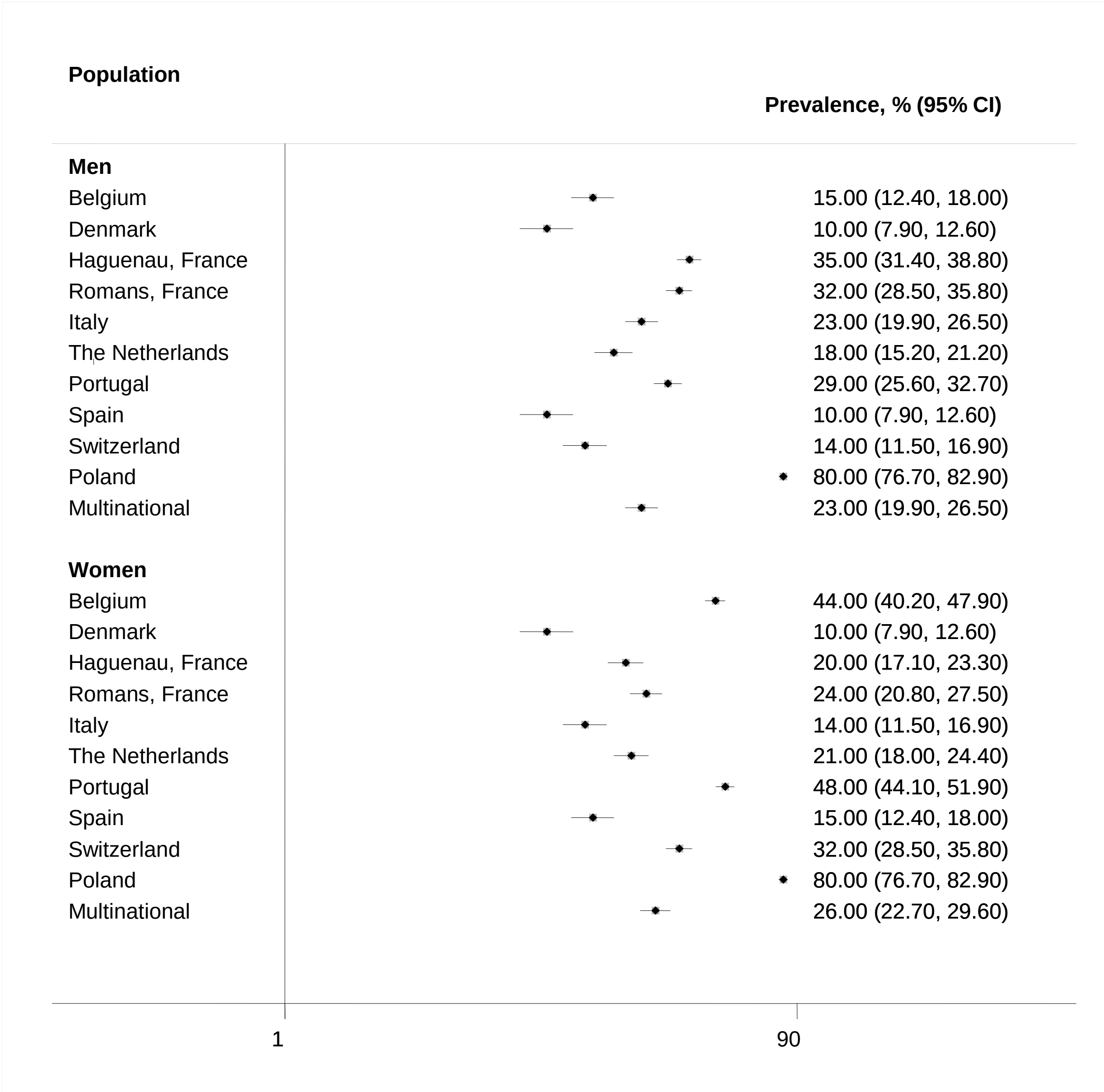
Reference	Sample	Definition of Frailty	Mean (95% CI)
		Frail according to Burden model (weighted (weighted for nonresponse percentages)	14.8 (13.2; 16.6)
		Frail according to Biologic Syndrome Model (weighted (weighted for nonresponse percentages)	13.3 (11.7; 15.0)
The MOBILIZE (Maintenance of Balance, Independent Living, Intellect, And Zest in the Elderly) Boston Study			
Kiely, 2009[26]	765	Frailty index based on; weight loss >10 pounds or greater than 5% of body weight, subjective exhaustion, impaired walking, Timed Up and Go Test >19 seconds, abnormal strength on physical examination	10.0 (8.1; 12.3)
		Cardiovascular Health Study Frailty Index	76.0 (72.8; 78.9)

Appendix E Table 21. Differences in Prevalence of Frailty in Older Persons By Race

Reference	Study	Race	Definition	Estimate	Prevalence (95% CI)
Accumulation deficit					
Bowles, 2000[123]	Frailty Study of African Americans in South Central Los Angeles	African American	Any of four: functional impairment, depression, urinary incontinence, falls	crude	66.9 (62.7; 70.9)
Cigolle, 2009[72]	Health and Retirement Study	African American	Frail according to Functional Domains Model	*	34.0 (31.7; 36.3)
		African American	Frail according to Burden Model	*	20.2 (18.3; 22.2)
		Caucasian	Frail according to Functional Domains Model	*	20.2 (18.3; 22.2)
		Caucasian	Frail according to Burden Model	*	14.4 (12.8; 16.2)
		Hispanic	Frail according to Functional Domains Model	*	22.3 (20.3; 24.3)
		Hispanic	Frail according to Burden Model	*	12.8 (11.3; 14.5)
Phenotype					
Fried, 2001[55]	Cardiovascular Health Study	African American	Three or more of criteria list	crude	12.9 (12.0; 13.8)
Fried, 2001[55]	Cardiovascular Health Study	Caucasian	Three or more of criteria list	crude	5.9 (5.3; 6.5)
Hardy, 2005[37]	New Haven Older Americans Independence Center Study	African American	Rapid gait test >10 seconds	crude	54.2 (50.6; 57.7)
Hardy, 2005[37]	New Haven Older Americans Independence Center Study	Caucasian	Rapid gait test >10 seconds	crude	41.5 (38.0; 45.1)
Ottenbacher, 2005[204]	Hispanic Established Populations Epidemiologic Studies of the Elderly	Hispanic	Modified Frailty Index: Scale of 0 -4 for weight loss, exhaustion, walking speed, and grip strength	crude	20.0 (17.0; 23.3)
Ottenbacher, 2009[203]	Hispanic Established Populations Epidemiologic Studies of the Elderly	Hispanic	Frailty index based on weight loss, exhaustion, walking speed, grip strength, and physical activity	crude	7.6 (6.5; 8.8)
Cigolle, 2009[72]	Health and Retirement Study	African American	Frail according to Biologic Syndrome Model	*	30.0 (27.8; 32.2)
Cigolle, 2009[72]	Health and Retirement Study	Caucasian	Frail according to Biologic Syndrome Model	*	11.8 (10.3; 13.4)
Cigolle, 2009[72]	Health and Retirement Study	Hispanic	Frail according to Biologic Syndrome Model	*	15.0 (13.4; 16.9)
Kiely, 2009[26]	MOBILIZE	Caucasian	Frailty index based on; weight loss >10 pounds or greater than 5% of body weight, subjective exhaustion, impaired walking, Timed Up and Go Test >19 seconds, abnormal strength on physical examination	crude	8.6 (6.8; 10.8)

*Weighted percentages were derived using Health and Retirement Study respondent population weights to adjust for differential probability of selection into the sample and differential nonresponse

Appendix E Figure 2. Differences in Prevalence of Nutritional Risk (Defined as a Mini-Nutritional Assessment Score of <24) in European Older Persons: SENECA Study[221]



Appendix E Table 22. Association Between Micronutrients and Chronic Inflammation in Older Disabled Women: Women's Health and Aging Study I[102]

Definition of Micronutrient	Odds Ratio* (95% CI)
Outcome - highest tertile of interleukin-6 level	
a-Carotene (lmol/liter) — one-standard-deviation increase in log-transformed micronutrient level	**0.65 (0.53; 0.8)**
b-Carotene (lmol/liter) — one-standard-deviation increase in log-transformed micronutrient level	**0.72 (0.59; 0.87)**
Lycopene (lmol/liter) —one-standard-deviation increase in log-transformed micronutrient level	**0.75 (0.63; 0.91)**
Lutein/zeaxanthin (lmol/liter) — one-standard-deviation increase in log-transformed micronutrient level	**0.72 (0.59; 0.89)**
b-Cryptoxanthin (lmol/liter) — one-standard-deviation increase in log-transformed micronutrient level	**0.77 (0.63; 0.94)**
Retinol (lmol/liter) — one-standard-deviation increase in log-transformed micronutrient level	0.87 (0.72; 1.05)
a-Tocopherol (lmol/liter) — one-standard-deviation increase in log-transformed micronutrient level	0.91 (0.74; 1.11)
a-Tocopherol:cholesterol ratio (mg/g) — one-standard-deviation increase in log-transformed micronutrient level	1.01 (0.82; 1.24)
Total carotenoids (lmol/liter) — one-standard-deviation increase in log-transformed micronutrient level	**0.65 (0.53; 0.79)**
Selenium (lg/liter) — one-standard-deviation increase in log-transformed micronutrient level	**0.65 (0.52; 0.8)**
Zinc (lg/liter) — one-standard-deviation increase in log-transformed micronutrient level	0.99 (0.82; 1.2)
Outcome - interleukin-6 level increase by >0.5 standard deviation (3.21 pg/ml)	
a-Carotene (lmol/liter) — <0.039 vs. >0.094	**7.99 (2.27; 28.21)**
b-Carotene (lmol/liter — <0.23 vs. >0.45	**4.09 (1.38; 12.11)**
Lutein/zeaxanthin (lmol/liter) — <0.27 vs. >0.41	**5.57 (1.74; 17.8)**
Total carotenoids (lmol/liter) — < 1.17 vs. >1.80	**3.98 (1.51; 10.49)**
a-Carotene (lmol/liter) — <0.040 vs. >0.094	1.06 (0.7; 1.59)
a-Carotene (lmol/liter) — >0.040-0.094 vs. >0.094	1.19 (0.81; 1.74)

*After controlling for age, race, years of education, smoking status, body mass index, chronic obstructive pulmonary disease, peripheral arterial disease, angina, diabetes, physical activity, and incident cardiovascular disease.

Bold=significant association at 95% confidence level.

Appendix E Table 23. Association Between Multimorbid Conditions and Patient Outcomes in Older Persons

Reference	Study	Sample	Adjustment	Definition of Exposure	Gender	Estimate	Mean (95% CI or P Value)
Frailty							
Xue, 2008[108]	Women's Health and Aging Study I	599	Adjusted for age, education, and race, number of chronic diseases, anxiety, personal mastery, depression, MMSE score, ADL, IADL, and mobility disability at baseline	Number of chronic diseases	Women	HR	1.06 (1; 1.19)
Szanton, 2009[103]	Women's Health and Aging Studies	728	Adjusted for age, race, and education	Disease count (>3)	Women	OR	**1.47 (1.3; 1.71)**
Chang, 2010[104]	Women's Health and Aging Studies I and II and complementary cohorts	620	Crude	Total inflammatory disease count (8)	Women	OR	**1.84 (1.5; 2.26**
Sarcopenia (aLM/ht2)							
Newman, 2003[75]	Health Aging and Body Composition (Health ABC) Study	3,075 (analytic sample: 2,984)	Adjusted for age, race, drinking, smoking, physical activity, and body mass index	≥3 conditions	Men	OR	**2.8 (1.7; 4.8)**
				≥3 conditions	Women	OR	0.8 (0.4; 1.5)
Sarcopenia (residual)							
Newman, 2003[75]	Health Aging and Body Composition (Health ABC) Study	3,075 (analytic sample: 2,984)	Adjusted for age, race, drinking, smoking, physical activity	≥3 conditions	Men	OR	1.5 (1; 2.3)
				≥3 conditions	Women	OR	1.1 (0.7; 1.6)
Mortality							
Xue, 2008[108]	Women's Health And Aging Study I	599	Adjusted for age, education, and race, number of chronic diseases, anxiety, personal mastery, depression, MMSE score, ADL, IADL, and mobility disability at baseline	Number of chronic diseases	Women	HR	1.18 (1; 1.41)
Seeman, 2004[21]	MacArthur Studies of Successful Aging	657	Adjusted for age, gender, ethnicity	Chronic conditions, comorbidity	Total	OR	**1.32 (1.1; 1.62)**
Kelman, 1994[47]	Norwood -Montefiore Aging Study (NMAS)	1,855	Adjusted for age, income, self-assessed health, receiving social support, sex, cognitive impairment, education, marital status, depression, problems in daily activities	Two or more cardiovascular conditions vs. not in persons with mild/ moderate impairment	Total	RR	**1.5 (1.1; 2.18)**
Schultz-Larsen, 2007[159]	Glostrup Aging Study	705	Adjusted by sex, income, education, individual diseases, weight, and the maximal power	Comorbidity 2-6 vs. 0-1 at 5-year followup	Total	OR	1.6 (1; 2.47)
				10-year followup	Total	OR	**2 (1.4; 2.82)**

Appendix E Table 23. Association Between Multimorbid Conditions and Patient Outcomes in Older Persons (continued)

Reference	Study	Sample	Adjustment	Definition of Exposure	Gender	Estimate	Mean (95% CI or P Value)
				15-year followup	Total	OR	**1.59 (1.1; 2.25)**
Dorr, 2006[115]	Community-dwelling elderly patients with at least one chronic disease	2,166	Adjusted for age, sex, PCS and MCS score (from SF-12)	3 diseases vs. ≤2	Total	OR	1.3 (p= 0.2)
				4-5 vs. ≤2	Total	OR	**1.85 (p = 0.001)**
				≥6 vs. ≤2	Total	OR	**2.12 (p <0.001)**
Malmgren, 1999[116]	A prospective cohort from a large health maintenance organization of (Group Health Cooperative (GHC) in Seattle, Washington)	1,129	Adjusted for age, education, widowhood, CDC intervention participation, co-morbid conditions, and self-reported health	Charlson Comorbidity Index 1 vs. 0	Female	OR	**1.89 (1.05; 3.4)**
				Charlson Comorbidity Index 2-4 vs. 0	Female	OR	**2.54 (1.08; 5.97)**
				Charlson Comorbidity Index 1 vs. 0	Male	OR	1.09 (0.63; 1.9)
				Charlson Comorbidity Index 2-4 vs. 0	Male	OR	**2.27 (1.27; 4.08)**
Long, 2005[118]	Medicaid program: applicants to the home- and community-based care (HCBC)	1,690	Adjusted for receiving HCBC services, age, race, gender, health status, did not have hospital stay or SNF, LTCH, rehab hospital stay in prior 6 months, 0 to 3 MSQ errors, needs supervision never/sometimes/unknown, does not need assistance with mobility, does not need help with medication or meal preparation, does not have a mental illness, Alzheimer's or dementia, does not have medications with potential side effects in elderly, lives with spouse/child/other/ unknown, primary caregiver is other relative/nonrelative/none/unknown, did not have Medicare home health use in prior 6 months, monthly income greater than $1,000.	Number of health conditions vs. no comorbidities	Total	OR	**1.193 (p <0.05)**
Mor, 1994[294]	Longitudinal Study on Aging	7,407	Adjusted for age, gender, self-rated health, number of medical conditions, baseline functional status, and interaction between age and gender	Number of illnesses	Total	OR	**1.3 (1.2; 1.3)**

Appendix E Table 23. Association Between Multimorbid Conditions and Patient Outcomes in Older Persons (continued)

Reference	Study	Sample	Adjustment	Definition of Exposure	Gender	Estimate	Mean (95% CI or P Value)
Tilvis, 2004[161]	Helsinki Aging Study	650	Adjusted for age and gender	Comorbidity present vs. not present	1 year	RR	5.71 (1.72; 18.9)
					5 year	RR	1.92 (1.29; 2.86)
					10 year	RR	2.2 (1.51; 3.26)
Association between mortality and polypharmacy							
Ganguli, 2002[85]	Population-based dementia registry	1,064	Crude	Number of prescription drugs taken (per drug)	Total	RR	**1.16 (p <0.05)**
Ahmad, 2005[209]	Nottingham Longitudinal Study of Activity and Ageing (NLSAA)	1,042	Crude	Total number of prescribed drugs including hypnotics	Total	HR	**1.13 (1.1; 1.20)**
Helmer, 1999[166]	PAQUID (Personnes Agees QUID) Research Program	3,660	Adjusted for age, sociodemographic factors, physical and mental health, and disability	≥5 medications versus None	Men	RR	0.96 (0.7; 1.42)
					Women	RR	1.15 (0.7; 2.04)

HR=hazard ratio; OR=odds ratio; bold=statistically significant.

Appendix E Table 24. Association Between Poor Perceived Health and Mortality in Older Persons

Reference	Study	Sample Size	Adjustment	Subgroups	Estimate	Mean (95% CI or P Value)
Poor vs. excellent/very good						
Grant, 1995[295]	Longitudinal Study of Aging	4,380	Adjusted for self-reported health, age, race, marital status, education, ADL difficulties, BMI, self-reported disease, prior hospitalization, social contacts, and interaction self-reported health with time	Female, 5 months	Hazard Ratio	**3.8 (2; 7.1)**
				Female, 14 months	Hazard Ratio	**2.7 (1.8; 4.1)**
				Female, 23 months	Hazard Ratio	**2 (1.3; 3)**
				Female, 32 months	Hazard Ratio	1.4 (0.7; 2.7)
				Male	Hazard Ratio	**1.7 (1.1; 2.6)**
Wolinsky, 1995[296]	Longitudinal Study of Aging	7,527	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, health services utilization, and change in functional status measures	Total	Odds Ratio	**1.32** (p = 0.0002)
Steinbach, 1992[297]	Longitudinal Study of Aging	5,151	Adjusted for age, sex, race, family income, self-perceived health status, ADLs, hypertension, stroke or CVA, cancer, heart disease, arthritis, DM, fall, social network, social activities, and living arrangement	Total	Odds Ratio	**2.48 (1.93; 3.19)**
Poor/fair health vs. good health						
Porell, 2001[134]	Medicare Current Beneficiary Survey	17,299	Adjusted for demographics, insurance coverage and access, health behaviors, and chronic conditions	Functional dependence	Odds Ratio	**2.24** (p <0.05)
		7,407		Functional limitations	Odds Ratio	1.39 (p >0.05)
		6,488		IADL disability	Odds Ratio	**1.99** (p <0.01)
		9,595		1+ ADL disability	Odds Ratio	**1.7** (p <0.05)
		3,976	Adjusted for demographics, insurance coverage and access, health behaviors, and chronic conditions	3+ ADL disability	Odds Ratio	**1.48** (p <0.05)
Gutman, 2001[143]	Canadian Study of Health and Aging	8,912	Adjusted for age, sex, trouble, health, and interactions	Total	Hazard Ratio	**1.8 (1.45; 2.23)**

Appendix E Table 25. Association Between Institutionalization and Comorbidity in Older Persons

Reference	Study	Sample	Adjustment	Estimate	Mean (95% CI or P Value)
Multiple comorbidities					
Long, 2005[118]	Medicaid program: applicants to the home- and community-based care (HCBC)	1,690	Adjusted age, race, sex, health status, hospital stay or SNF, LTCH, rehab hospital stay in prior 6 months, 0 to 3 MSQ errors, ADL and IADL, Alzheimer's or dementia, does not have medications with potential side effects in elderly, lives with spouse/child/other/unknown, primary caregiver is other relative/nonrelative, did not have Medicare home health use in prior 6 months, monthly income greater than $1000.	Odds Ratio	**0.86** (p <0.05)
Mor, 1994[294]	Longitudinal Study on Aging	7,407	Adjusted for age, sex, self-rated health, number of medical conditions, baseline functional status, and the interaction between age and sex	Odds Ratio	**1.2 (1.1; 1.3)**
Falconer, 1992[113]	2-year longitudinal study of independent residents of a continuing care retirement community	152	Adjusted for age, sex, GERI-AIMS, disease severity, and Williams test	Relative Risk	0.89 (p >0.05)
Previous hospitalization (SNF, LTCH, rehab hospital stay)					
Long, 2005[118]	Applicants to the home- and community-based care (HCBC) programs	1,690	Adjusted age, race, sex, health status, hospital stay or SNF, LTCH, rehab hospital stay in prior 6 months, 0 to 3 MSQ errors, ADL and IADL, Alzheimer's or dementia, does not have medications with potential side effects in elderly, lives with spouse/child/other/unknown, primary caregiver is other relative/nonrelative, did not have Medicare home health use in prior 6 months, monthly income greater than $1000.	Odds Ratio	**3.848** (p <0.01)
Hospital admission, 12 months					
Goodin, 2004[298]	Secondary analysis of data from the Medicare Current Beneficiary Survey	3,232	Adjusted for sociodemographic characteristics, health status, functional ability, previous use of health services, insurance, income, and family composition	Odds Ratio	**2.01** (p = 0.001)
Miller, 1999[299]	Longitudinal Study of Aging	12,007	Adjusted for sex, age, race, hospitalization, marital status, living, family income, home ownership, survey transition year	Odds Ratio	1.65 (0.13; 2.12)
Wolinsky, 1992[300]	Longitudinal Study of Aging	5,151	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, health services utilization, and change in functional status measures	Odds Ratio	**1.463** (p = 0.0184)
Coward, 1996[301]	Longitudinal Study of Aging	7,527	Adjusted for residence, sociodemographic characteristics, health status characteristic, and social support characteristics	Odds Ratio	**1.23** (p <0.01)

Appendix E Table 26. Association Between Institutionalization and Self-Perceived Health Status in Older Persons

Reference	Study	Sample Size of the Study	Adjustment	Estimate	Mean (95% CI or P Value)
Excellent vs. poor					
Coward, 1996[301]	Longitudinal Study of Aging	7,527	Adjusted for residence, socio-demographic characteristics, health status characteristic, and social support characteristics	Odds Ratio	**0.7 (0.5; 0.9)**
Very good vs. poor					
Coward, 1996[301]	Longitudinal Study of Aging	7,527	Adjusted for residence, socio-demographic characteristics, health status characteristic, and social support characteristics	Odds Ratio	1.0 (0.8; 1.3)
Good vs. excellent/very good					
Mor, 1994[294]	Longitudinal Study on Aging	7,407	Adjusted for age, gender, self-rated health, number of medical conditions, baseline functional status, and the interaction between age and gender	Odds Ratio	**1.8 (1.4; 2.3)**
Good vs. poor					
Coward, 1996[301]	Longitudinal Study of Aging	7,527	Adjusted for residence, socio-demographic characteristics, health status characteristic, and social support characteristics	Odds Ratio	1.0 (0.8; 1.2)
Good or very good vs. poor or very poor					
St. John, 2002[150]	Canadian Study of Health and Aging	8,073	Adjusted for age, gender, education, Time 1 MMSE, and self-rated health	Odds Ratio	1.2 (1.0; 1.5)
Fair vs. poor					
Coward, 1996[301]	Longitudinal Study of Aging	7,527	adjusted for residence, socio-demographic characteristics, health status characteristic, and social support characteristics	Odds Ratio	1.1 (0.9; 1.4)
Poor					
Gutman, 2001[143]	Canadian Study of Health and Aging	8,912	Adjusted for age, sex, trouble, health, and interactions	Hazard Ratio	**1.8 (1.3; 2.4)**
Kersting, 2001[302]	Longitudinal Study of Aging	7,527	Adjusted for social support, poverty, age, gender, race, ADL/IADL score, self-reported health status, and fall	Hazard Ratio	**1.1 (1.1; 1.2)**
Steinbach, 1992[297]	Longitudinal Study of Aging	4,547	Adjusted for age, sex, race, family income, self-perceived health status, ADLs, hypertension, stroke or CVA, cancer, heart disease, arthritis, DM, fall, social network, social activities, and living arrangement	Odds Ratio	**1.7 (1.1; 2.5)**
Poor (dose response 1-5)					
Speare, 1991[303]	Longitudinal Study of Aging	5,151	Adjusted for disability, incontinence, blindness, deafness, limitation in major activities, social support, age, sex, income	Odds ratio	1.2 (1.0; 1.4)
Poor, African American					
Kersting, 2001[304]	Longitudinal Study of Aging	555	Adjusted for social support, poverty, age, gender, race, ADL/IADL score, self-reported health status,	Hazard Ratio	1.2 (0.8; 1.7)

Appendix E Table 26. Association Between Institutionalization and Self-Perceived Health Status in Older Persons (continued)

Reference	Study	Sample Size of the Study	Adjustment	Estimate	Mean (95% CI or P Value)
			and fall		
Belgrave, 1994[305]	Longitudinal Study of Aging	560	Adjusted for ADL, IADL, self-health, activity limitations, confused, age, sex, living alone, education, income, and Medicaid	Odds Ratio	1.1 (0.8; 1.5)
Poor, Caucasians					
Kersting, 2001[304]	Longitudinal Study of Aging	6,986	Adjusted for social support, poverty, age, gender, race, ADL/IADL score, self-reported health status, and fall	Hazard Ratio	**1.2 (1.1; 1.2)**
Belgrave, 1994[305]	Longitudinal Study of Aging	6,880	Adjusted for ADL, IADL, self-health, activity limitations, confused, age, sex, living alone, education, income, and Medicaid	Odds Ratio	**1.1 (1.1; 1.2)**
Poor/fair					
Long, 2005[118]	Medicaid program-applicants to the home- and community-based care (HCBC)	1,690	Adjusted for age, race, gender, health status, did not have hospital stay or SNF, LTCH, rehab hospital stay in prior 6 months, 0 to 3 MSQ errors, ADL, IADL, Alzheimer's or dementia, does not have medications with potential side effects in elderly, lives with spouse/child, primary caregiver is other relative/non-relative/none/unknown, did not have Medicare home health use in prior 6 months, monthly income greater than $1000.	Odds Ratio	1.4 (p >0.05)
Mor, 1994[294]	Longitudinal Study on Aging	7,407	Adjusted for age, gender, self-rated health, number of medical conditions, baseline functional status, and the interaction between age and gender	Odds Ratio	**2.7 (2.1; 3.5)**

Bold=statistically significant.

Appendix E Table 27. Association Between Comorbidity and Hospitalization in Older Persons

Reference	Definition of Exposure	Definition of the Outcome	Study	Sample	Adjustment	Estimate	Mean (95% CI or P Value)
Multiple comorbidities							
Shelton, 2000[114]	2 or more comorbidities vs. none	A hospitalization or ED visit during the first year of the study	Generalist Physician Initiative	411	Adjusted for age, female sex, living arrangement, race, marital status, less than a high school education, taking 5 or more prescription medications daily, comorbid illness category, restricted-activity bed days category (confined to bed for at least 1 day during the past 12 months), 5 health status measures of the HSQ, and the baseline indicator of any hospitalization or ED encounter	Odds Ratio	**1.7 (1.1; 2.9)**
Comorbidity score							
Dorr, 2006[115]	3 vs. ≤2	Risk for hospitalization	7,076 community-dwelling elderly patients	1,899	Adjusted for age, sex, PCS, and MCS score (from SF-12), and comorbidity score	Odds Ratio	**1.37 (p = 0.01)**
	4-5 vs. ≤2					Odds Ratio	**1.46 (p = 0.004)**
	≥6 vs. ≤2					Odds Ratio	**1.94 (p <0.001)**
Numbers of medications							
Shelton, 2000[114]	5+ prescription medications vs. not	A hospitalization or ED visit during the first year of the study	Generalist Physician Initiative	411	Adjusted for age, female sex, living arrangement, race, marital status, less than a high school education, taking 5 or more prescription medications daily, comorbid illness category, restricted-activity bed days category (confined to bed for at least 1 day during the past 12 months), 5 health status measures of the HSQ, and the baseline indicator of any hospitalization or ED encounter	Odds Ratio	**2.9 (2.2; 4.1)**
Mazzaglia, 2007[187]	≥5 medications vs. not	Risk for hospitalization	ASSI, Florence, Italy	5,396	Not available	Odds Ratio	**2.24 (1.77; 2.84)**
Previous hospitalization							
Shelton, 2000[114]	Any hospitalization or ED visit in prior year vs.	A hospitalization or ED visit during the first year of the study	Generalist Physician Initiative	411	Adjusted for age, female sex, living arrangement, race, marital status, less than a high school education, taking 5 or more	Odds Ratio	**3.40 (2.70; 4.50)**

Appendix E Table 27. Association Between Comorbidity and Hospitalization in Older Persons (continued)

Reference	Definition of Exposure	Definition of the Outcome	Study	Sample	Adjustment	Estimate	Mean (95% CI or P Value)
	not				prescription medications daily, comorbid illness category, restricted-activity bed days category (confined to bed for at least 1 day during the past 12 months), 5 health status measures of the HSQ, and the baseline indicator of any hospitalization or ED encounter		
Mazzaglia, 2007[187]	Yes vs. no	Risk for hospitalization	ASSI in Florence, Italy	5,396	Not available	Odds Ratio	**3.60 (2.66; 4.87)**
Chodosh, 2004[20]	Yes vs. no in previous 2 years	Risk for hospitalization	MacArthur Research Network on Successful Aging Community Study	598	Adjusted for age, sex, race/ethnicity, and prior hospitalization	Odds Ratio	**2.40 (1.50; 4.00)**
Boult, 1993[306]	Hospital admission in last year	Repeated admission	Longitudinal Study on Aging	5,876	Adjusted for need variables, predisposing variables, and enabling variables	Odds Ratio	**1.70 (1.30; 2.30)**
Stearns, 1996[307]	Yes vs. no	Probability of nonterminal hospitalization	Longitudinal Study of Aging	870	Adjusted for cancer, heart disease, prior hospitalization, age, age square, insurance, and interaction between age and functional status	Odds Ratio	**1.70 (p <0.05)**
Stearns, 1996[307]	Yes vs. no	Number of nights of hospitalization	Longitudinal Study of Aging	870	Adjusted for cancer, heart disease, prior hospitalization, age, age square, insurance, and interaction between age and functional status	Odds Ratio	**1.33 (p <0.1)**
Laditka, 2003[308]	Number of previous admissions	Hospitalization for Ambulatory Care Sensitive Conditions	the Longitudinal Study of Aging	3562	Adjusted for age, education, insurance and marital status, health status, primary care access, self-rated health, comorbidities, physical impairments, and previous hospitalizations	Relative Risk	**12.11 (9.74; 14.48)**
Laditka, 2003[308]	Previous discharge within 90 days					Relative Risk	**94.15 (93.92; 94.39)**

Appendix E Table 27. Association Between Comorbidity and Hospitalization in Older Persons (continued)

Reference	Definition of Exposure	Definition of the Outcome	Study	Sample	Adjustment	Estimate	Mean (95% CI or P Value)
Wolinsky, 1995[309]	Hospital contact	Natural log of the mean annual number of hospital episodes (plus one)	Longitudinal Study of Aging	2,538	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, health services utilization, and change in functional status measures	Odds Ratio in survivor with at least one hospital episode	**1.08 (p <0.001)**
Wolinsky, 1995[309]	Hospital contact	Natural log of the maximum absolute deviation (plus one) from the mean annual number of hospital episodes	Longitudinal Study of Aging	2,538	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, health services utilization, and change in functional status measures	Odds Ratio in survivor with at least one hospital episode	**1.04 (p <0.01)**
Wolinsky, 1995[309]	Hospital contact	Natural log of the mean annual number of hospital episodes (plus one)	Longitudinal Study of Aging	1,783	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, health services utilization, and change in functional status measures	Odds Ratio in decedents with at least one hospital episode	**1.16 (p <0.001)**
Previous physician visits							
Boult, 1993[306]	>6 doctor visit in past year	Repeated admission	Longitudinal Study on Aging	5,876	Adjusted for need variables, predisposing variables, and enabling variables	Odds Ratio	**1.40 (1.10; 1.80)**
Laditka, 2003[308]	Physician visits ≥ 4 in previous 12 months	Hospitalization for Ambulatory Care Sensitive Conditions	Longitudinal Study of Aging	3,562	Adjusted for age, education, insurance and marital status, health status, primary care access, self-rated health, comorbidities, physical impairments, and previous hospitalizations	Relative Risk	1.12 (1.00; 1.24)
Wolinsky, 1995[309]	Physician visits	Natural log of the mean annual number of hospital episodes (plus one)	Longitudinal Study of Aging	2,538	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, health services utilization, and change in functional status measures	Odds Ratio in survivor with at least one hospital episode	**1.01 (p <0.001)**
Wolinsky, 1995[309]	Physician visits	Natural log of the maximum absolute deviation (plus one) from the	Longitudinal Study of Aging	2,538	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, health services utilization, and change in	Odds Ratio in survivor with at least one hospital episode	**1.005 (p <0.01)**

Appendix E Table 27. Association Between Comorbidity and Hospitalization in Older Persons (continued)

Reference	Definition of Exposure	Definition of the Outcome	Study	Sample	Adjustment	Estimate	Mean (95% CI or P Value)
		mean annual number of hospital episodes			functional status measures		
Wolinsky, 1995[309]	Physician visits	Natural log of the mean annual number of hospital episodes (plus one)	Longitudinal Study of Aging	1,783	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, health services utilization, and change in functional status measures	Odds Ratio in decedents with at least one hospital episode	**1.01 (p <0.001)**
Wolinsky, 1995[309]	Physician visits	Natural log of the maximum absolute deviation (plus one) from the mean annual number of hospital episodes	Longitudinal Study of Aging	1,783	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, health services utilization, and change in functional status measures	Odds Ratio in decedents with at least one hospital episode	1.00 (p>0.05)

Appendix E Table 28. Association Between Self-Perceived Health and Hospitalization in Older Persons

Reference	Study	Sample	Definition of the Outcome	Adjustment	Estimate	Mean (95% CI or P Value)
Health perception score						
Shelton, 2000[114]	Generalist Physician Initiative	411	A hospitalization or ED visit during the first year of the study	Adjusted for age, female sex, living arrangement, race, marital status, less than a high school education, taking 5 or more prescription medications daily, comorbid illness category, restricted-activity bed days category (confined to bed for at least 1 day during the past 12 months), 5 health status measures of the HSQ, and the baseline indicator of any hospitalization or ED encounter	Odds Ratio	1 (0.98; 1)
Physical health score						
Shelton, 2000[114]				Adjusted for age, female sex, living arrangement, race, marital status, less than a high school education, taking 5 or more prescription medications daily, comorbid illness category, restricted-activity bed days category (confined to bed for at least 1 day during the past 12 months), 5 health status measures of the HSQ, and the baseline indicator of any hospitalization or ED encounter	Odds Ratio	0.99 (0.98; 1.1)
Mental health score						
Shelton, 2000[114]		411	A hospitalization or ED visit during the first year of the study	Adjusted for age, female sex, living arrangement, race, marital status, less than a high school education, taking 5 or more prescription medications daily, comorbid illness category, restricted-activity bed days category (confined to bed for at least 1 day during the past 12 months), 5 health status measures of the HSQ, and the baseline indicator of any hospitalization or ED encounter	Odds Ratio	1 (0.98; 1.1)
Pain score						
Shelton, 2000[114]		411	A hospitalization or ED visit during the first year of the study	Adjusted for age, female sex, living arrangement, race, marital status, less than a high school education, taking 5 or more prescription medications daily, comorbid illness category, restricted-activity bed days category (confined to bed for at least 1 day during the past 12 months), 5 health status measures of the	Odds Ratio	1 (0.97; 1.1)

Appendix E Table 28. Association Between Self-Perceived Health and Hospitalization in Older Persons (continued)

Reference	Study	Sample	Definition of the Outcome	Adjustment	Estimate	Mean (95% CI or P Value)
				HSQ, and the baseline indicator of any hospitalization or ED encounter		
<14 bed days in past year						
Boult, 1993[306]	Longitudinal Study on Aging	5,876	Repeated admission	Adjusted for need variables, predisposing variables, and enabling variables	Odds Ratio	1 (0.7; 1.4)
Fair vs. excellent						
Aliyu, 2003[310]	Longitudinal Study of Aging	7,541	Hospital stay/admission	Adjusted for race, education, family relationship family income, health insurance coverage, social network involvement, perceived health status and activities of daily living (ADL)	Odds Ratio	**2.99 (2.15; 4.15)**
Laditka, 2003[308]		3,562	Hospitalization for Ambulatory Care Sensitive Conditions	Adjusted for age, education, insurance and marital status, health status, primary care access, self-rated health, comorbidities, physical impairments, and previous hospitalizations	Relative Risk	1.14 (0.38; 1.9)
Wolinsky, 1995[309]		2,538	Natural log of the mean annual number of hospital episodes (plus one)	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, health services utilization, and change in functional status measures	Odds Ratio in survivor with at least one hospital episode	**1.03 (p <0.01)**
Wolinsky, 1995[309]		1,783	Natural log of the mean annual number of hospital episodes (plus one)	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, health services utilization, and change in functional status measures	Odds Ratio in decedents with at least one hospital episode	**1.06 (p <0.01)**
Boult, 1993[306]		5,876	Repeated admission	Adjusted for need variables, predisposing variables, and enabling variables	Odds Ratio	**1.7 (1.2; 2.6)**
Good vs. excellent						
Aliyu, 2003[310]	Longitudinal Study of Aging	7,541	Hospital stay/admission	Adjusted for race, education, family relationship family income, health insurance coverage, social network involvement, perceived health status and activities of daily living (ADL)	Odds Ratio	**1.59 (1.15; 2.18)**
Boult, 1993[306]	Longitudinal Study on Aging	5,876	Repeated admission	Adjusted for need variables, predisposing variables, and enabling variables	Odds Ratio	1.4 (1; 2)
Poor vs. excellent						
Wolinsky, 1994[311]	Longitudinal Study of Aging	7,527	Any Medicare-reimbursed hospital	Adjusted for baseline predisposing characteristics, enabling characteristics,	Odds Ratio	**2.14** (p = 0.015)

Appendix E Table 28. Association Between Self-Perceived Health and Hospitalization in Older Persons (continued)

Reference	Study	Sample	Definition of the Outcome	Adjustment	Estimate	Mean (95% CI or P Value)
			episode occurring	need characteristics, health services utilization, and change in functional status measures		
Aliyu, 2003[310]	Longitudinal Study of Aging	7,541	Hospital stay/admission	Adjusted for race, education, family relationship family income, health insurance coverage, social network involvement, perceived health status and activities of daily living (ADL)	Odds Ratio	**2.79 (1.92; 4.05)**
Laditka, 2003[308]	Longitudinal Study of Aging	3,562	Hospitalization for Ambulatory Care Sensitive Conditions	Adjusted for age, education, insurance and marital status, health status, primary care access, self-rated health, comorbidities, physical impairments, and previous hospitalizations	Relative Risk	**1.47 (1.26; 1.68)**
Wolinsky, 1995[309]	Longitudinal Study of Aging	2,538	Natural log of the maximum absolute deviation (plus one) from the mean annual number of hospital episodes	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, health services utilization, and change in functional status measures	Odds Ratio in survivor with at least one hospital episode	**1.07** (p <0.01)
Wolinsky, 1995[309]	Longitudinal Study of Aging	2,538	Natural log of the mean annual number of hospital episodes (plus one)	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, health services utilization, and change in functional status measures	Odds Ratio in survivor with at least one hospital episode	**1.05** (p <0.01)
Wolinsky, 1995[309]	Longitudinal Study of Aging	1,783	Natural log of the mean annual number of hospital episodes (plus one)	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, health services utilization, and change in functional status measures	Odds Ratio in decedents with at least one hospital episode	1.72 (p>0.05)
Stearns, 1996[307]	Longitudinal Study of Aging	870	Number of nights of hospitalization	Adjusted for cancer, heart disease, prior hospitalization, prior health, age square, ADL, ADL square, insurance, and interaction between age and functional status	Odds Ratio	**1.76** (p <0.05)
Boult, 1993[306]	Longitudinal Study on Aging	5,876	Repeated admission	Adjusted for need variables, predisposing variables, and enabling variables	Odds Ratio	**2.2 (1.3; 3.6)**

Bold=statistically significant.

Appendix E Table 29. Association Between Cognitive Impairment and Mortality in Older Persons [312]

Reference	Study	Country	Sample Size	Age	Followup, Years	Measure	Cut Off	Risk (95% CI)	Type	Adjustment
Ostbye, 1999[313]	Canadian Study of Health and Aging	Canada	10,263	65+	2, 5	3MS	Women <50 vs. 78-100	**3.5 (2.1; 6)**	Odds Ratio	Age, marital status, education, ADL, vision, hearing
							50-77	**1.6 (1.3; 1.9)**		
							Men <50 vs. 78-100	**3.8 (1.8; 7.8)**		
							50-77	**1.7 (1.4; 2.1)**		
Saz, 1999[314]	Zaragoza study	Spain	1,080	65+	4.5	Automated Geriatric Examination for Computer Assisted Taxonomy organic syndrome level	4 and 5 vs. 0	**4.3 (1.7; 10.6)**	Odds Ratio	Age, sex, education
Saz, 1999[314]	Zaragoza study	Spain	1,080	65+	4.5	Organic syndrome level	Level 3 vs. 0	**2 (1; 3.8)**		
Saz, 1999[314]	Zaragoza study	Spain	1,080	65+	4.5	Automated Geriatric Examination for Computer Assisted Taxonomy organic syndrome level	level 1 and 2 vs. 0	1.3 (0.8; 2.1)		
Jagger, 1995[315]	Community based study, Melton Mowbray, Leicestershire	England	1,579	75+	5	CAPE information sub-scale	≤7 vs. 12	**4.18 (2.73; 6.41)**	Hazard Ratio	Age sex
Jagger, 1995[315]	Community based study, Melton Mowbray, Leicestershire	England	1,579	75+	5	CAPE information sub-scale	8-9 vs. 12	**2.36 (1.56; 3.58)**		
Jagger, 1995[315]	Community based study, Melton Mowbray, Leicestershire	England	1,579	75+	5	CAPE information sub-scale	10-11 vs. 12	**1.45 (1.15; 1.84)**		
Clarke,		England	1,042	65+	4, 8	CAPE	≤7 vs. 10-	**3.61 (2.31; 4.37)**	Odds	Age sex

Appendix E Table 29. Association Between Cognitive Impairment and Mortality in Older Persons [312] (continued)

Reference	Study	Country	Sample Size	Age	Followup, Years	Measure	Cut Off	Risk (95% CI)	Type	Adjustment
1996[286]						information sub-scale	12		Ratio	
Clarke, 1996[286]		England	1,042	65+	4, 8	CAPE information sub-scale	8-9 vs. 10-12	**2.28 (1.86; 4.37)**		
Liu, 1998[316]		Taiwan	2,915	65+	1, 2	Composite score	Lowest decile	**1.67 (1.18; 2.35)**	Hazard Ratio	Age sex education
Liu, 1998[316]		Taiwan	2,915	65+	1, 2	Composite score	26-75 percentile	1 (0.76; 1.32)		
Foley, 1999[317]	Honolulu Heart Program cohort study	United States	3,741	71+	3	Composite score	<74	**2.26 (1.64; 3.1)**	Odds Ratio	Age, BMI, marital status, sleep vars, health
Gale, 1996[318]		Great Britain	983	65+	20	Hodkinson	≤7 v 10	**2.2 (1.6;2.9)**	Hazard Ratio	Age, sex
Ho, 1991[319]		Hong Kong	1,054	70+	2	Mental score	<16 v 20	**2.2 (1.2; 4.1)**	Odds Ratio	Ag, sex
Ho, 1991[319]		Hong Kong	1,054	70+	2	Mental score	16-19 v 20+	1.4 (0.7; 2.5)		
Eagles, 1990[320]		Scotland	1778	65+	3	Mental Status Questionnaire	≤8	**3.5 (2.37; 5.17)**	Relativ e Risk	Age, sex
Shapiro, 1991[321]		Canada	722	65+	17	Mental Status Questionnaire	0-6	**1.95 (1.35; 2.83)**	Hazard Ratio	Age, sex
Shapiro, 1991[321]		Canada	722	65+	17	Mental Status Questionnaire	7.0-8.0	1.04 (0.78; 1.36)		
Salive, 1993[322]	EPESE	United States	10,269	65+	6	Mental Status Questionnaire	1 error vs. 0 men	**1.4 (1.1; 1.8)**	Hazard Ratio	Age, health, BMI, smoking, exercise, ADL
Liang, 1996[323]		Japan	1,506	65+	3	Mental Status Questionnaire	3 + errors	**3.48**(p<0.05)	Relativ e Risk	
Gussekoo, 1997[324]	Leiden 85-plus study	Netherlands	891	85+	4, 7	Mini Mental State Examination	0-18	**2.8 (2.3; 3.4)**	Hazard Ratio	Age, sex
Gussekloo, 1997[324]	Leiden 85-plus study	Netherlands	891	85+	4, 7	Mini Mental State Examination	19-23	**2.5 (2; 3.1)**		
Gussekloo, 1997[324]	Leiden 85-plus study	Netherlands	891	85+	4, 7	Mini Mental State Exam	24-27	**1.8 (1.1; 3)**		
Kelman, 1994[47]		United States	1,855	65+	1.5	Mini Mental State	<18	**2.2 (1.13; 2.69)**	Hazard Ratio	Age, sex, ADL, health,

Appendix E Table 29. Association Between Cognitive Impairment and Mortality in Older Persons [312] (continued)

Reference	Study	Country	Sample Size	Age	Followup, Years	Measure	Cut Off	Risk (95% CI)	Type	Adjustment
						Examination				soc support, education, marital status, depression
Arve, 1998[325]		Finland	1,032	70+	5	Mini Mental State Examination	<24	1.43 (0.78; 2.65)	Relativ e Risk	
Arve, 1998[325]		Finland	1,032	70+	5	Mini Mental State Examination	11-25 percentile	1.3 (0.95; 1.8)		
Korten, 1999[326]		Australia	897	70+	3.5	Mini Mental State Examination	<24 vs. 30	**1.88 (1.05; 3.12)**	Hazard Ratio	Age, sex, ADL, health, soc support, education, marstat, depression
Fredman, 1999[327]		United States	806	65+	6	Mini Mental State Examination	<24 vs. 24 +	**2 (1.33; 3)**	Hazard Ratio	Age ,health, ADL, depression
Nakanishi, 1998[328]		Japan	1,083	65+	3.5	Office of Population Censuses (OPCS) score	1.0-2.0	1.19 (0.81; 1.74)	Hazard Ratio	age, sex, health, anxiety, depression
Nakanishi, 1998[328]		Japan	1,083	65+	3.5	Office of Population Censuses (OPCS) score	3.5-4.5	1.12 (0.65; 1.9)		
Nakanishi, 1998[328]		Japan	1,083	65+	3.5	Office of Population Censuses (OPCS) score	6 +	**1.74 (1.05; 2.88)**		
Swan, 1995[329]	Western Collaborative Group Study	United States	1,118	60+	5	Wechsler Adult Intelligence Scale		**1.44 (1.12; 1.86)**	Hazard Ratio	Age, education

Appendix E Table 30. Association Between Cognitive Status and Mortality in Older Persons: Studies of Treatment Utilization (Health Care-Based Samples)

Reference	Study	Sample	Adjustment	Estimate	Mean (95% CI or P Value)
Alzheimer's disease					
Eaker, 2002[83]	Marshfield Epidemiologic Study Area (MESA) system	811	Adjusted for age	HR	**2.18 (1.57; 3.03)**
			Adjusted for age, insurance, and number of comorbidities	HR	**1.9 (1.36; 2.65)**
Long, 2005[118]	Medicaid program: applicants to home- and community-based care (HCBC)	1,690	Adjusted age, race, gender, health status, did not have hospital stay or SNF, LTCH, rehab hospital stay in prior 6 months, 0 to 3 MSQ errors, needs supervision never/sometimes/unknown, does not need assistance with mobility, does not need help with medication or meal preparation, does not have a mental illness, Alzheimer's or dementia, does not have medications with potential side effects in elderly, lives with spouse/child/other/unknown, primary caregiver is other relative/non-relative/none/unknown, did not have Medicare home health use in prior 6 months, monthly income greater than $1000.	OR	0.72 (p >0.05)
Wolinsky, 1995[296]	Longitudinal Study of Aging	7,527	*Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, health services utilization, and change in functional status measures*	OR	1.48 (p = 0.05)
Cognitive impairment					
Buuman, 2008[198]	Patients 65 years or older acutely admitted from November 1, 2002, through July 1, 2005, to a 1,024-bed tertiary university teaching hospital	463	Crude	OR	1.16 (0.73; 1.84)
Jones, 2004[153]	MGAT study	170	Adjusted for age, sex, marriage status, and status of intervention	HR	**1.75 (1.08; 2.84)**
Dementia					
Eaker, 2002[83]	Marshfield Epidemiologic Study Area (MESA) system	811	Adjusted for age	HR	**2.69 (1.94; 3.74)**
			Adjusted for age, insurance, and number of comorbidities	HR	**2.27 (1.62; 3.18)**
Inouye, 2003[122]	Prospective developmental cohort from Yale New Haven	525	Adjusted for age, Medicaid status, nursing home resident, lab, dementia, walking impairment, depression, and UI	HR	**1.5 (1.1; 2.2)**

Appendix E Table 30. Association Between Cognitive Status and Mortality in Older Persons: Studies of Treatment Utilization (Health Care-Based Samples) (continued)

Reference	Study	Sample	Adjustment	Estimate	Mean (95% CI or P Value)
	hospital				
Inouye, 2003[122]	Prospective developmental cohort from Yale New Haven hospital	525	Adjusted for high risk diagnoses, albumin, creatinine, dementia, and walking impairment	HR	**1.9 (1.3; 2.7)**
Inouye, 2003[122]	Prospective validation cohort from Yale New Haven hospital	1,246	Adjusted for high risk diagnoses, albumin, creatinine, dementia, and walking impairment	HR	**2.2 (1.7; 2.7)**
Mild cognitive impairment					
Stump, 2001[69]	General Medicine Practice of the Regenstrief Health Center	3,861	Adjusted for cognitive impairment, age, gender, race, education, and comorbid health conditions	HR	0.93 (0.74; 1.16)
Moderate to severe cognitive impairment					
Stump, 2001[69]	General Medicine Practice of the Regenstrief Health Center	3,861	Adjusted for cognitive impairment, age, gender, race, education, and comorbid health conditions	HR	**1.7 (1.32; 2.19)**

Bold=significant association at 95% confidence level.

Appendix E Table 31. Association Between Dementia and Mortality in Older Persons[312]

Reference	Study	Country	Sample Size	Age	Followup, Years	Diagnosis	Population	Risk (95% CI)	Risk Type	Adjustment
Jorm, 1991[331]		Australia	274	70+	5	DSMIII dementia		2.24	Risk Ratio	
Snowdon, 1995[337]	Longitudinal study of elderly people in Botany	Australia	211	65+	2, 4, 6, 8	DSMIII dementia		2.71	Risk Ratio	
Hill, 1997[338]	Canadian Study of Health and Aging	Canada	10,263	65+	2, 5	DSMIII	Men	**2.84** (p<0.05)	Odds Ratio	Age
							Women	**2.67** (p<0.05)		
Ostbye, 1999[313]	Canadian Study of Health and Aging	Canada	10,263	65+	2, 5	Men	Mild	0.9 (0.3; 3.5)	Odds Ratio	Age, marital status, education, ADL, vision, hearing
							Moderate	2.1 (0.8; 5.6)		
							Severe	2.9(0.7; 11.7)		
Ostbye, 1999[339]	Canadian Study of Health and Aging	Canada	10,263	65+	2, 5	Men	Mild	0.9 (0.3; 3.5)	Odds Ratio	Age, marital status, education, ADL, vision, hearing
Ostbye, 1999[313]	Canadian Study of Health and Aging	Canada	10,263	65+	2, 5	Women	Mild	1 (0.5; 2)		
Ostbye, 1999[339]	Canadian Study of Health and Aging	Canada	1,0263	65+	2, 5	Women	Mild	1 (0.5; 2)		
Ostbye, 1999[313]	Canadian Study of Health and Aging	Canada	10,263	65+	2, 5		Moderate	1.4 (0.8; 2.6)		
							Severe	1.9 (0.9; 4.1)		
Ostbye, 1999[339]	Canadian Study of Health and Aging	Canada	10,263	65+	2, 5		Moderate	2.1 (0.8; 5.6)		
Ostbye, 1999[339]	Canadian Study of Health and Aging	Canada	10,263	65+	2, 5		Severe	2.9 (0.7; 11.7)		
							Moderate	1.4 (0.8; 2.6)		
							Severe	1.9 (0.9; 4.1)		

Appendix E Table 31. Association Between Dementia and Mortality in Older Persons[312] (continued)

Reference	Study	Country	Sample Size	Age	Followup, Years	Diagnosis	Population	Risk (95% CI)	Risk Type	Adjustment
Li, 1991[330]		China	1,090	60+	3	Dementia (clinical)		2.95	SMR	
Katzman, 1994[340]		China	3,531	65+	2, 5	DSMIIIR dementia	AD	2.65	Risk Ratio	Age, sex
Jagger, 1995[315]		England	1,579	75+	5	Cambridge Mental Disorders in the Elderly Examination		**1.53 (1.08; 2.16)**	Risk Ratio	Age, sex
Juva, 1994[341]		Finland	656	75+	1	DSMIII-R dementia		**3.2 (1.8; 5.6)**	Risk Ratio	Age, sex
Meller, 1999[342]		Germany	358	85+	4.7	Clinical	Men	**2.47 (1.35; 4.5)**	Odds Ratio	Age
							Women	**1.98 (1.43; 2.75)**		
							Total	**2.08 (1.56; 2.77)**		
Bonaiuto, 1995[343]	Appignano study	Italy	778	60+	7	DSMIII dementia		3.78	Risk Ratio	
Baldereschi, 1999[344]	Italian Longitudinal Study on Aging	Italy	4,521	65+	2	DSMIIIR		**3.56 (2.52; 5.04)**	Hazard Ratio	Age, sex, health
Tsuji, 1995[345]	Sendai Longitudinal Study of Aging	Japan	3,549	65+	3	DSMIII-R dementia		**2.81 (2.02; 3.9)**	Hazard Ratio	Age, sex
Asada, 1996[346]		Japan	38	100+	0.5	DSMIII-R dementia		No death occurred in non demented, risk difference 0.27	Risk Ratio	
Heeren, 1992[334]	Leiden 85-plus study	Netherlands	891	85+	4, 7	DSMIII dementia		**1.9 (1.7; 2.2)**	Hazard Ratio	Age, sex
Engedal, 1996[347]	Oslo study	Norway	334	75+	3	DSMIII dementia		2.01	Risk Ratio	
Saz, 1999[314]	Zaragoza study	Spain	1,080	65+	4.5	Automated Geriatric Examination for Computer Assisted Taxonomy		**3.7 (2; 6.7)**	Odds Ratio	Age, sex, education
Aevarsson, 1998[336]	Longitudinal Gerontological and Geriatric Population	Sweden	494	85	3, 7	Alzheimer's Disease	Men	**2.6 (1.5; 4.7)**	Hazard Ratio	Health
							Women	**2.9 (1.9; 4.3)**		

Appendix E Table 31. Association Between Dementia and Mortality in Older Persons[312] (continued)

Reference	Study	Country	Sample Size	Age	Followup, Years	Diagnosis	Population	Risk (95% CI)	Risk Type	Adjustment
	Studies in Gothenburg, Sweden									
Aguero-Torres, 1998[348]	Kungsholmen Project	Sweden	989	75+	5	DSMIII-R		**2.7 (2.1; 3.4)**	Risk Ratio	Age and sex
Skoog, 1993[335]	Longitudinal Gerontological and Geriatric Population Studies in Gothenburg, Sweden	Sweden	494	85	3, 7	DSMIII-R dementia		2.39	Risk Ratio	
Johansson, 1995[349]	OCTO study	Sweden	324	84+	2, 4	DSMIII-R dementia		**2.86 (1.72; 4.75)**	Risk Ratio	Age, sex
Aguero-Torres, 1998[348]	Kungsholmen Project	Sweden	989	75+	5	Men	77-84	**3.6 (1.4; 9.1)**		
Aevarsson, 1998[336]	Longitudinal Gerontological and Geriatric Population Studies in Gothenburg, Sweden	Sweden	494	85	3, 7	Vascular	Men	**2.9 (1.4; 6.2)**		
							Women	**3.6 (2.3; 5.9)**		
Aguero-Torres, 1998[348]	Kungsholmen Project	Sweden	989	75+	5	Women	77-84	**4.5 (2.2; 8.9)**		
							85+	1.7 (0.8; 3.5)		
							85+	**2.4 (1.8; 3.2)**		
Liu, 1998[316]		Taiwan	2,915	65+	1, 2	Consortium to Establish a Registry of Alzheimer's Disease		**2.7 (2.1; 3.4)**	Risk Ratio	
Gurland, 1999[350]	North Manhattan Aging Project	United States	2,162	65+	1.5	African-American	65-74	2.94		
						Algorithmic	Latino 65-74	4.77	Odds Ratio	
Albert, 1999[351]	Washington Heights-Inwood Columbia Aging Project (WHICAP)	United States	2,334	65+	1.8	Alzheimer's		2.57	Risk Ratio	

Appendix E Table 31. Association Between Dementia and Mortality in Older Persons[312] (continued)

Reference	Study	Country	Sample Size	Age	Followup, Years	Diagnosis	Population	Risk (95% CI)	Risk Type	Adjustment
Aronson, 1991[332]	Bronx Aging Study	United States	488	75+	8	DSMIII dementia		**3 (2.1; 3.1)**	Risk Ratio	
Evans, 1991[333]		United States	3,623	65+	4.9	National Institute of Neurological and Communica-tive Disorders and Stroke and the – Alzheimer's Disease and Related Disorders Association	Alzheimer's	**1.4 (1.05; 1.96)**	Hazard Ratio	Age, sex
Gurland, 1999[350]	North Manhattan Aging Project	United States	2,162	65+	1.5	Non-Latino white	65-74	6.7		
							75-84	1.91		
							85+	0.77		
							75-84	1.23		
							85+	2.83		
							75-84	1.44		
							85+	11		

Appendix E Table 32. Institutionalization in Older Persons With Cognitive Impairment

Reference	Study	Country	Sample	Adjustment	Estimate	Mean (95% CI or P Value)
Alzheimer's disease						
Long, 2005[118]	Medicaid program: applicants to the home- and community-based care (HCBC)	USA	1,690	Adjusted for receiving HCBC services, age, race, gender, health status, did not have hospital stay or SNF, LTCH, rehab hospital stay in prior 6 months, 0 to 3 MSQ errors, ADL and IADL, lives with spouse/child/other/unknown, primary caregiver is other relative/non-relative/none/ unknown, did not have Medicare home health use in prior 6 months, monthly income greater than $1,000.	Odds Ratio	**1.72** (p <0.05)
Rockwood, 1996[147]	Canadian Study of Health and Aging	Canada	9,113	Adjusted for age, gender, race, married status, absence of a caregiver, non-spouse caregiver, IADL-dependence in finances, dependence in shopping, ADL-dependence in dressing, dependence in feeding, bladder incontinence, bowel incontinence, cardiovascular disease, hypertension, diabetes mellitus, stroke, Parkinson's disease, hearing impairment, visual impairment, age-associated memory impairment (AAMI), Alzheimer's disease, vascular dementia, and other dementia	Odds Ratio	**14.60 (12.10; 17.60)**
Eaker, 2002[83]	Marshfield Epidemiologic Study Area (MESA) system	USA	811	Adjusted for age	Hazard Ratio	**5.84 (3.96; 8.61)**
				Adjusted for age, insurance, and stroke	Hazard Ratio	**5.44 (3.68; 8.05)**
				Adjusted for age, insurance, stroke, and number of comorbidity	Hazard Ratio	**3.01 (2.35; 3.87)**
Dementia						
Goodlin, 2004[298]	Secondary analysis of data from the Medicare Current Beneficiary Survey	USA	3232	adjusted for socio-demographic characteristics, health status, functional ability, previous use of health services, insurance, income, and family composition	Odds Ratio	**34.87** (p <0.001)
Rockwood, 1996[147]	Canadian Study of Health and Aging	Canada	9,113	Adjusted for age, gender, race, married status, absence of a caregiver, non-spouse caregiver, IADL-dependence in finances, dependence in shopping, ADL-dependence in dressing, dependence in feeding, bladder incontinence, bowel incontinence, cardiovascular disease, hypertension, diabetes mellitus, stroke, Parkinson's disease, hearing impairment, visual impairment, age-associated memory impairment (AAMI), Alzheimer's disease, vascular dementia, and other dementia	Odds Ratio	**36.30 (27.10; 48.70)**
Eaker, 2002[83]	Marshfield Epidemiologic Study	USA	811	Adjusted for age	Hazard Ratio	**5.91 (3.97; 8.80)**
				Adjusted for age, insurance, and stroke	Hazard Ratio	**5.08 (3.38; 7.63)**

Appendix E Table 32. Institutionalization in Older Persons With Cognitive Impairment (continued)

Reference	Study	Country	Sample	Adjustment	Estimate	Mean (95% CI or P Value)
	Area (MESA) system			Adjusted for age, insurance, stroke, and number of comorbidity	Hazard Ratio	**3.10 (2.39; 4.03)**
Vascular dementia						
Rockwood, 1996[147]	Canadian Study of Health and Aging	Canada	9,113	Adjusted for age, gender, race, married status, absence of a caregiver, non-spouse caregiver, IADL-dependence in finances, dependence in shopping, ADL-dependence in dressing, dependence in feeding, bladder incontinence, bowel incontinence, cardiovascular disease, hypertension, diabetes mellitus, stroke, Parkinson's disease, hearing impairment, visual impairment, age-associated memory impairment (AAMI), Alzheimer's disease, vascular dementia, and other dementia	Odds Ratio	**13.80 (10.20; 18.70)**
Confusion, sometimes						
Speare, 1991[303]	Longitudinal Study of Aging	USA	5,151	Adjusted for disability, incontinence, blindness, deafness, limitation in major activities, social support, age, sex, income	Odds Ratio	1.08 (0.82; 1.43)
Confusion, frequently						
Speare, 1991[303]	Longitudinal Study of Aging	USA	5,151	Adjusted for disability, incontinence, blindness, deafness, limitation in major activities, social support, age, sex, income	Odds Ratio	**1.39 (1.03; 1.87)**
Confusion , African Americans						
Belgrave, 1994[305]	Longitudinal Study of Aging	USA	560	Adjusted for ADL, IADL, self-health, activity limitations, confused, age, sex, living alone, education, income, and Medicaid	Odds Ratio	1.45 (0.71; 2.93)
Confusion, Caucasians						
Belgrave, 1994[305]	Longitudinal Study of Aging	USA	6,880	Adjusted for ADL, IADL, self-health, activity limitations, confused, age, sex, living alone, education, income, and Medicaid	Odds Ratio	1.21 (0.99; 1.47)
Cognitive impairment, Short Portable Mental Status Questionnaire (MSQ)						
Long, 2005[118]	Applicants to the home- and community-based care (HCBC) programs	USA	1,690	Adjusted for receiving HCBC services, age, race, gender, health status, did not have hospital stay or SNF, LTCH, rehab hospital stay in prior 6 months, 0 to 3 MSQ errors, ADL and IADL, lives with spouse/child/other/unknown, primary caregiver is other relative/non-relative/none/ unknown, did not have Medicare home health use in prior 6 months, monthly income greater than $1,000.	Odds Ratio	1.32 (>0.05)
Cognitive impairment, MMSE						
Rockwood,	Canadian Study of	Canada	9,113	Adjusted for age, gender, race, married status,	Odds Ratio	**29.10 (25.10; 33.80)**

Appendix E Table 32. Institutionalization in Older Persons With Cognitive Impairment (continued)

Reference	Study	Country	Sample	Adjustment	Estimate	Mean (95% CI or P Value)
1996[147]	Health and Aging			absence of a caregiver, non-spouse caregiver, IADL-dependence in finances, dependence in shopping, ADL-dependence in dressing, dependence in feeding, bladder incontinence, bowel incontinence, cardiovascular disease, hypertension, diabetes mellitus, stroke, Parkinson's disease, hearing impairment, visual impairment, age-associated memory impairment (AAMI), Alzheimer's disease, vascular dementia, and other dementia		
Cognitive impairment, increase in MMSE						
St John, 2002[150]	Canadian Study of Health and Aging	Canada	8,073	Adjusted for age, gender, education, Time 1 MMSE, and self-rated health	Odds Ratio	**0.91 (0.90; 0.94)**
Cognitive impairment, normal MMSE vs. <23						
St John, 2002[150]	Canadian Study of Health and Aging	Canada	6,934	Adjusted for age, gender, education, Time 1 MMSE, and self-rated health	Odds Ratio	**0.88 (0.83; 0.93)**
Age-associated memory impairment						
Rockwood, 1996[147]	Canadian Study of Health and Aging	Canada	9,113	Adjusted for age, gender, race, married status, absence of a caregiver, non-spouse caregiver, IADL-dependence in finances, dependence in shopping, ADL-dependence in dressing, dependence in feeding, bladder incontinence, bowel incontinence, cardiovascular disease, hypertension, diabetes mellitus, stroke, Parkinson's disease, hearing impairment, visual impairment, age-associated memory impairment (AAMI), Alzheimer's disease, vascular dementia, and other dementia	Odds Ratio	**17.50 (14.00; 22.00)**
Mild/moderate cognitive impairment						
Banaszak-Holl, 2004[352]	Asset and Health Dynamics Among the Oldest Old (AHEAD) Study	USA	6,676	Adjusted for socio-demographic measures, potential caregiver network, geographic region, medical conditions, and ADL and IADL impairments	Hazard Ratio	**2.30 (1.80; 2.80)**
Severe cognitive impairment						
Banaszak-Holl, 2004[352]	Asset and Health Dynamics Among the Oldest Old (AHEAD) Study	USA	6,676	Adjusted for socio-demographic measures, potential caregiver network, geographic region, medical conditions, and ADL and IADL impairments	Hazard Ratio	**1.80 (1.50; 2.20)**

Bold=statistically significant.

Appendix E Table 33. Association Between Hospitalization and Cognitive Impairment in Older Persons

Reference	Study	Sample	Adjustment	Estimate	Mean (95% CI)
Alzheimer's disease					
Weiner, 1998[131]	Practices providing services to Medicare beneficiaries in the U.S.	1,221,615	Crude	Ratio of Per Capita Expenditures of Medicare Beneficiaries	2.2
Laditka, 2003[308]	Longitudinal Study of Aging	3,562	Adjusted for age, education, insurance and marital status, health status, primary care access, self-rated health, comorbidities, physical impairments, and previous hospitalizations	Relative Risk	1.19 (0.91; 1.46)
Cognitive impairment, frequent or increasing trouble remembering things or getting confused					
Boult, 1993[306]	Longitudinal Study on Aging	5,876	Adjusted for need variables, predisposing variables, and enabling variables	Odds Ratio	0.9 (0.8; 1.2)
Decline in SPMSQ in 1991 (>2 points) vs. no for age >75					
Chodosh, 2004[20]	MacArthur Research Network on Successful Aging Community Study	598	Adjusted for age, sex, race/ethnicity, and prior hospitalization	Odds Ratio	**7.8 (2; 30.8)**

Bold=statistically significant.

Appendix E Table 34. Prevalence of Frailty in Older Persons With Cognitive Impairment, Comorbidity, and Disability, According to Definition of Frailty

Reference	Study	Sample Size	Prevalence Subgroups	Mean (95% CI)
		Cognitive Impairment		
Accumulation deficit, functional domains model				
Cigolle, 2009[72]	The Health and Retirement Study	1,657	Cognitive impairment, mild	**82.8 (81.0; 84.6)**
Accumulation deficit, burden model				
Cigolle, 2009[72]	The Health and Retirement Study	1,657	Cognitive impairment, mild	**48.5 (46.1; 50.9)**
Phenotype model				
Fried, 2001[55]	Cardiovascular Health Study	5,317	Cognitive function: MMSE >23 84.9	**6.3 (5.7; 7.0)**
			Cognitive function: MMSE 18 - 23	**16.6 (15.6; 17.60)**
Cigolle, 2009[72]	The Health and Retirement Study	1,657	Cognitive impairment, mild	**30.2 (28.1; 32.5)**
		Comorbidity		
Accumulation deficit, functional domain model				
Cigolle, 2009[72]	The Health and Retirement Study	1,657	>3 chronic diseases	**33.9 (31.6; 36.20)**
Accumulation deficit, burden model				
Cigolle, 2009[72]	The Health and Retirement Study	1,657	>3 chronic diseases	**41.7 (39.3; 44.01)**
Phenotype model				
Fried, 2001[55]	Cardiovascular Health Study	5,317	Number of chronic diseases: 0	**2.7 (2.3; 3.2)**
			Number of chronic diseases: 1	**5.1 (4.6; 5.80)**
			Number of chronic diseases: 2	**7.3 (6.6; 8.0)**
			Two or more comorbidities	**9.7 (8.9; 10.5)**
			Number of chronic diseases: 3-4	**11.5 910.7; 12.4)**
			Number of chronic diseases: ≥ 5	**19.6 (18.5; 20.7)**
Cigolle, 2009[72]	The Health and Retirement Study	1,657	>3 chronic diseases	**24.3 (22.3; 26.4)**
Phenotype model, women				
Ensrud, 2008[50]	Study of osteoporotic fractures	6,701	No medical conditions	**10.7 (10.0; 11.5)**
			≥3 medical conditions	**39.0 (37.8; 40.2)**
			1-2 medical conditions	**17.8 (16.9; 18.7)**
		Disability		
Phenotype model, women				
Ensrud, 2008[50]	Study of osteoporotic fractures	6,701	≥1 new IADL impairment	**6.6 (6.0; 7.2)**
Phenotype model, men				
Cawthon, 2007[28]	Osteoporotic Fractures in Men (MrOS) Study	5,993	Unable to complete chair stands	**35.2 (34.0; 36.4)**
			Unable to complete narrow walk	**19.0 (18.0; 20.0)**
			At least one IADL limitation	**15.2 (14.3; 16.1)**
			At least one mobility limitation	**16.1 (15.2; 17.1)**
Accumulation deficit model, functional domains model, both genders				
Cigolle, 2009[72]	The Health and Retirement Study	1,657	>1 ADL dependency	**67.9 (65.6; 70.1)**
			>2 ADL dependencies	**60.2 (57.8; 62.5)**
			>3 ADL dependencies	**53.3 (50.9; 55.7)**
			>1 IADL dependency	**57.6 (55.2; 59.9)**
			>2 IADL dependencies	**77.5 (75.4; 79.4)**
			>3 IADL dependencies	**100.0 (99.5; 100.0)**

Appendix E Table 34. Prevalence of Frailty in Older Persons With Cognitive Impairment, Comorbidity, and Disability, According to Definition of Frailty (continued)

Reference	Study	Sample Size	Prevalence Subgroups	Mean (95% CI)
Accumulation deficit model, burden model, both genders				
. Cigolle, 2009[72]	The Health and Retirement Study	1,657	>1 ADL dependency	**78.9 (76.8; 80.8)**
			>2 ADL dependencies	**92.2 (90.8; 93.4)**
			>3 ADL dependencies	**91.2 (89.7; 92.5)**
			>1 IADL dependency	**62.7 (60.4; 65.0)**
			>2 IADL dependencies	**75.3 (73.1; 77.3)**
			>3 IADL dependencies	**82.8 (80.9; 84.5)**
Gutman, 2001[143]	Canadian Study of Health and Aging - 1	5,987	Trouble rating: not at all	**10.2 (9.5; 11.0)**
			Trouble rating: a little	**20.6 (19.6; 21.6)**
			Trouble rating: a great deal	**51.0 (49.7; 52.3)**
Phenotype model, both genders				
Fried, 2001[55]	Cardiovascular Health Study	5,317	≥ 1 mobility task	**17.3 (16.3; 18.3)**
			≥ 1 IADL task	**17.4 (16.4; 18.4)**
			≥ 1 ADL task	**27.9 (26.7; 29.1)**
			Any disability	**14.4 (13.5; 15.3)**
Cigolle, 2009[72]	The Health and Retirement Study	1,657	>1 ADL dependency	**56.7 (54.3; 59.1)**
			>2 ADL dependencies	**64.8 (62.5; 67.1)**
			>3 ADL dependencies	**55.3 (52.9; 57.7)**
			>1 IADL dependency	**43.4 (41.0; 45.8)**
			>2 IADL dependencies	**52.5 (50.1; 54.9)**
			>3 IADL dependencies	**92.9 (91.6; 94.1)**

Appendix E Table 35. Association Between Frailty and Mortality in Older Persons According to Definition of Frailty and Study Adjustment

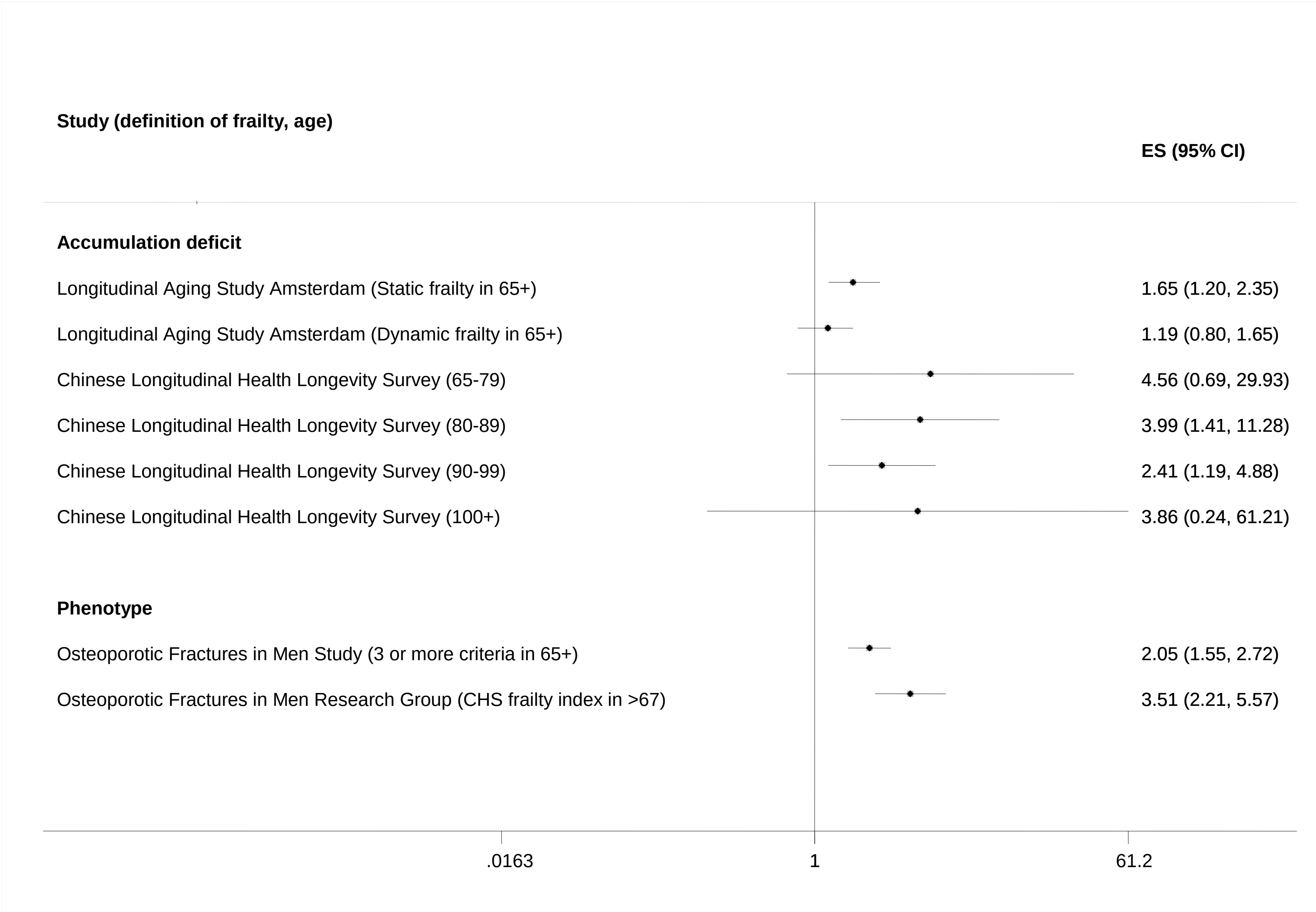
Reference	Study	Age	Sample	Adjustment	Estimate	Mean	Lower 95%CI	Upper 95%CI
	Frailty							
Passarino, 2007[183]	European Challenge for Healthy Aging	65-85	209	Crude	OR*	3.11		
Dukers, 2001[353]	Cardiovascular Health Study	>65	5,317	Adjusted for age, gender, race, income, smoking, blood pressure, glucose, albumin, creatinine, carotid stenosis, CHF, cognitive function, major EKG abnormality, use of diuretics, problems of IADL, self-reported health measure, CES-D modified depression measure	HR	**2.24**	**1.51**	**3.33**
Intermediate frailty								
Passarino, 2007[183]	European Challenge for Healthy Aging	65-85	209	Crude	OR*	1.5		
Dukers, 2001[353]	Cardiovascular Health Study	>65	5,317	Adjusted for age, gender, race, income, smoking, blood pressure, glucose, albumin, creatinine, carotid stenosis, CHF, cognitive function, major EKG abnormality, use of diuretics, problems of IADL, self-reported health measure, CES-D modified depression measure	HR	**1.49**	**1.11**	**1.99**
Very frail								
Passarino, 2007[183]	European Challenge for Healthy Aging	>90	117	Crude	OR*	1.9375	p value 0.128	
Prefrail without cognitive impairment								
Avila-Funes, 2009[169]	Three-City Study	>65	5,423	Adjusted for sex; education level; income; smoking status; drinker status; number of chronic diseases; self-reported health; Center for Epidemiologic Studies Depression Scale score	OR	1.27	0.95	1.7

Appendix E Table 35. Association Between Frailty and Mortality in Older Persons According to Definition of Frailty and Study Adjustment (continued)

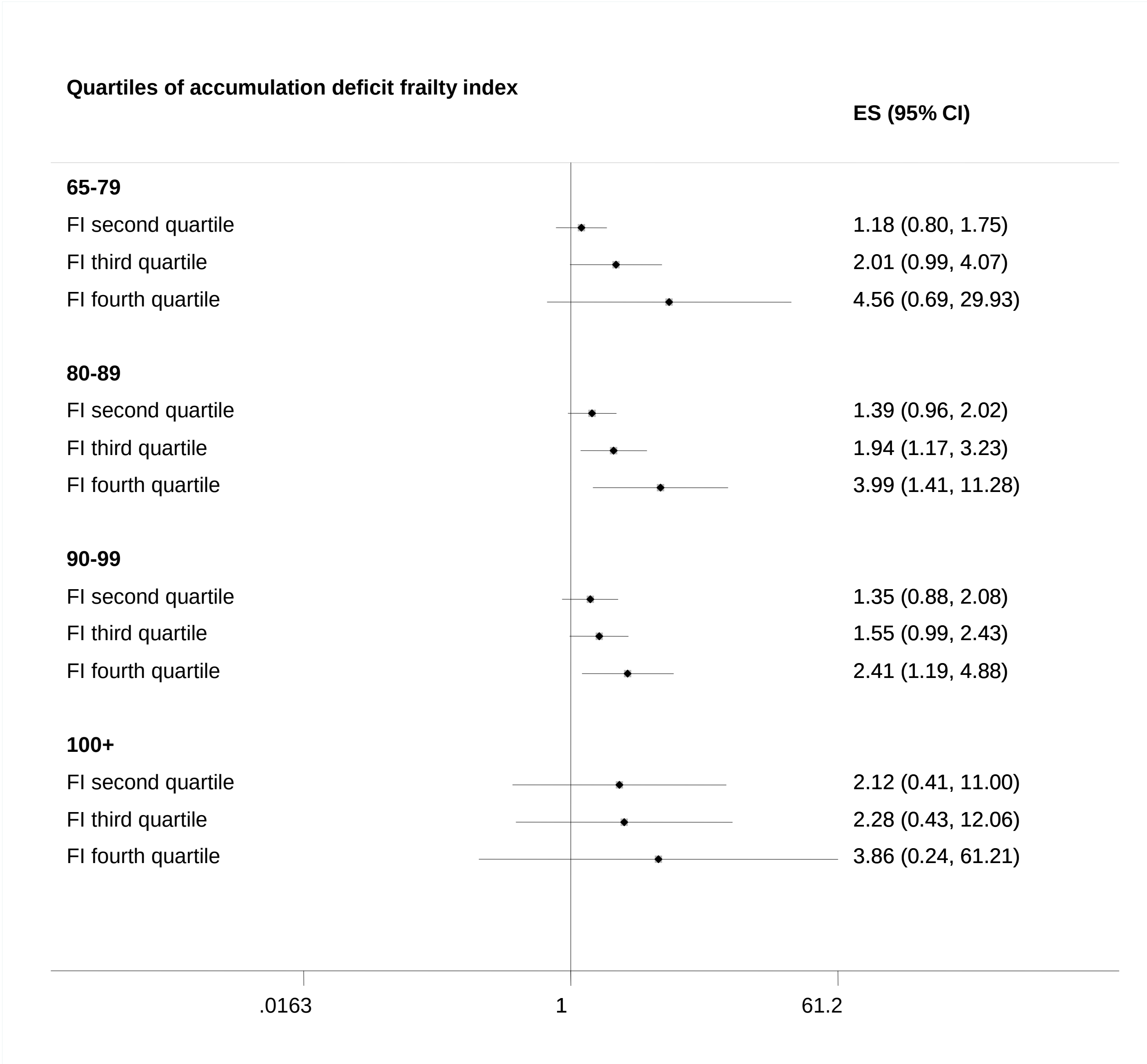
Reference	Study	Age	Sample	Adjustment	Estimate	Mean	Lower 95%CI	Upper 95%CI
				(excluding the two questions used for the frailty definition); and mobility, instrumental activity of daily living, and activity of daily living disability at baseline				
Prefrail with cognitive impairment								
		>65	5,423		OR	1.59	0.98	2.57
Frail without cognitive impairment								
		>65	5,423		OR	1.26	0.76	2.11
Frail with cognitive impairment								
		>65	5,423		OR	1.91	1	3.68
Outcome: mortality, utilization, and institutionalization								
FI-GGA								
15507074	The MGAT study	NA	169	Adjusted for age, sex, marriage status, and status of intervention	HR	**1.23**	**1.01**	**1.45**
Outcome: Repeat outpatient ED visit, hospital admission, nursing home admission, or death, within 30 days of the index ED visit								
Hastings, 2008[354]	Medicare Current Beneficiary Survey	≥65	1,581	Adjusted for age, sex, race, income, living alone, insurance status, previous emergency department (ED) visits, previous hospitalizations.	HR DAI 2 VS. 1	1.2	0.91	1.6
					HR DAI 3 vs. 1	**1.33**	**1.02**	**1.77**
					HR DAI 4 vs. 1	**1.44**	**1.06**	**1.96**
Outcome: Hospital admission, nursing home admission, or death, within 30 days of the index ED visit								
Hastings, 2008[354]	Medicare Current Beneficiary Survey	≥65	1,581	Adjusted for age, sex, race, income, living alone, insurance status, previous emergency department (ED) visits, previous hospitalizations.	HR DAI 2 vs. 1	1.45	0.98	2.16
					HR DAI 3 vs. 1	**1.55**	**1.04**	**2.33**
					HR DAI 4 VS. 1	**1.98**	**1.29**	**3.05**

*OR is calculated from 2x2 table.

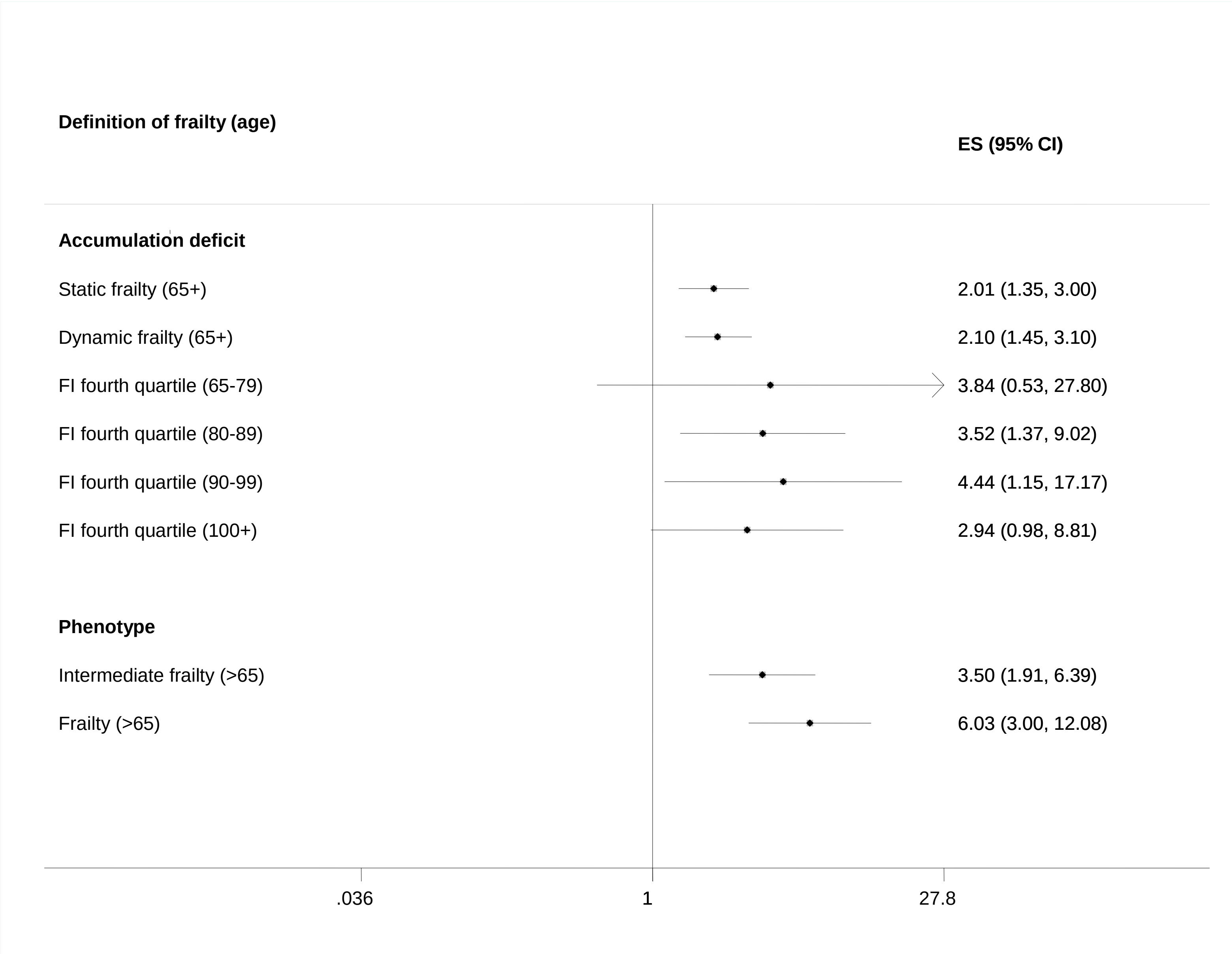
Appendix E Figure 3. Association Between Mortality and Frailty Definition in Older Men[28,51,156,194]



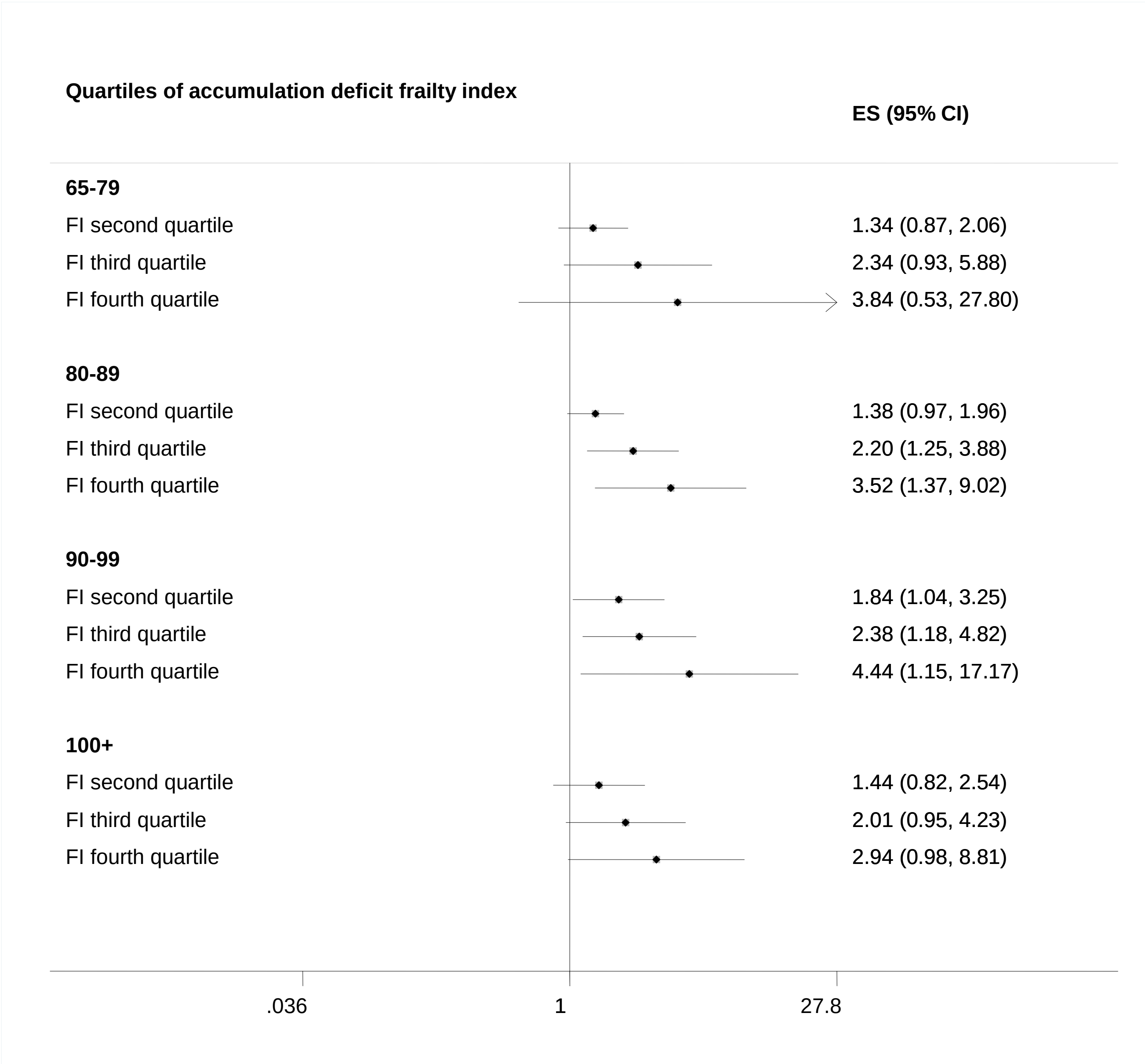
Appendix E Figure 4. Dose Response Association Between Accumulation Deficit Frailty Index and Mortality in Older Men: Chinese Longitudinal Health Longevity Survey[156]



Appendix E Figure 5. Association Between Mortality and Frailty Definition in Older Women[99,156,194]



Appendix E Figure 6. Dose Response Association Between Accumulation Deficit Frailty Index and Mortality in Older Women: Chinese Longitudinal Health Longevity Survey[156]



Appendix E Table 36. Association Between Frailty and Institutionalization in Older Persons

Reference	Study	Country	Sample	Adjustment	Estimate	Mean (95% CI)
Intermediate frailty vs. nonfrail						
Bandeen-Roche, 2006[99]	Women's Health and Aging Studies (WHAS)	USA	750	Adjusted for age, race, grades completed, smoking, history of congestive heart failure, Mini-Mental State Examination score, Geriatric Depression Scale score (≥14), number of adjudicated diseases, ankle-arm blood pressure, use of diuretics	Hazard Ratio	5.16 (0.81; 32.79)
Frailty						
Bandeen-Roche, 2006[99]	Women's Health and Aging Studies (WHAS)	USA	750	Adjusted for age, race, grades completed, smoking, history of congestive heart failure, Mini-Mental State Examination score, Geriatric Depression Scale score (≥14), number of adjudicated diseases, ankle-arm blood pressure, use of diuretics	Hazard Ratio	**23.98 (4.45; 129.2)**
Frailty- GGA						
Jones, 2005[144]	Canadian Study of Health and Aging	Canada	2,305	Adjusted for age, sex, and education	Hazard Ratio	**1.2 (1.1; 1.32)**
Components of frailty						
Slow gait speed						
Rothman, 2008[44]	Precipitating Events Project (PEP)	USA	754	Adjusted for age, sex, race, education, chronic conditions, and the presence of the other six frailty criteria	Hazard Ratio	**3.9 (2.2; 6.7)**
Low physical activity						
Rothman, 2008[44]	Precipitating Events Project (PEP)	USA	754	Adjusted for age, sex, race, education, chronic conditions, and the presence of the other six frailty criteria	Hazard Ratio	**2.1 (1.3; 3.3)**
Weight loss						
Rothman, 2008[44]	Precipitating Events Project (PEP)	USA	754	Adjusted for age, sex, race, education, chronic conditions, and the presence of the other six frailty criteria	Hazard Ratio	**1.7 (1.2; 2.4)**
Self-reported exhaustion						
Rothman, 2008[44]	Precipitating Events Project (PEP)	USA	754	Adjusted for age, sex, race, education, chronic conditions, and the presence of the other six frailty criteria	Hazard Ratio	1.1 (0.8; 1.7)
Weakness						

Appendix E Table 36. Association Between Frailty and Institutionalization in Older Persons (continued)

Reference	Study	Country	Sample	Adjustment	Estimate	Mean (95% CI)
Rothman, 2008Rothman, 2008 #2899}	Precipitating Events Project (PEP)	USA	754	Adjusted for age, sex, race, education, chronic conditions, and the presence of the other six frailty criteria	Hazard Ratio	1 (0.6; 1.6)
Cognitive impairment						
Rothman, 2008[44]	Precipitating Events Project (PEP)	USA	754	Adjusted for age, sex, race, education, chronic conditions, and the presence of the other six frailty criteria	Hazard Ratio	**2.6 (1.7; 4)**
Depressive symptoms						
Rothman, 2008[44]	Precipitating Events Project (PEP)	USA	754	Adjusted for age, sex, race, education, chronic conditions, and the presence of the other six frailty criteria	Hazard Ratio	1.4 (1; 2.1)

Bold=statistically significant.

Appendix E Table 37. Association Between Frailty and Hospitalization in Older Persons

Reference	Study	Sample	Adjustment	Estimate	Mean (95% CI)
Intermediate frailty					
Bandeen-Roche, 2006[99]	Women's Health and Aging Studies (WHAS)	715	Adjusted for baseline age, race, grades completed, smoking (pack-years), disease-related variables—history of congestive heart failure, Mini-Mental State Examination score, Geriatric Depression Scale score (≥14), number of adjudicated diseases, ankle-arm blood pressure, use of diuretics without history of hypertension or congestive heart failure	Hazard Ratio	0.99 (0.67; 1.47)
Avila-Funes, 2008[171]	Three-City Study	6,078	Adjusted by age, sex, education level, income, smoking status, alcohol use, number of chronic diseases, self-reported health, Center for Epidemiologic Studies-Depression scale score, Mini-Mental State Examination score, and baseline disability	Odds Ratio	1.14 (0.98; 1.31)
Avila-Funes, 2008[169]	Three-City Study	5,152	Adjusted for age; sex; education level; income; smoking status; drinker status; number of chronic diseases; self-reported health; Center for Epidemiologic Studies Depression Scale score (excluding the two questions used for the frailty definition); and mobility, instrumental activity of daily living, and activity of daily living disability at baseline	Odds Ratio	1.15 (0.99; 1.32)
Dukers, 2001[353]	Cardiovascular Health Study	5,317	Adjusted for age, gender, indicator for minority cohort, income, smoking, blood pressure, glucose, albumin, creatinine, carotid stenosis, history of CHF, cognitive function, major EKG abnormality, use of diuretics, problems of IADL, self-reported health measure, CES-D modified depression measure	Hazard Ratio	**1.13 (1.03; 1.25)**
				Hazard Ratio, original cohort	**1.11 (1.03; 1.19)**
Prefrail					
Kiely, 2009[26]	MOBILIZE Boston Study	765	Adjusted for age, gender, race, diabetes, stroke, hypertension, hyperlipidemia, education and income	Odds Ratio for accumulation deficit index	**2.64 (1.74; 4.01)**
				Odds Ratio for phenotype index	**1.97 (1.37; 2.84)**
Avila-Funes, 2009[169]	Three-City Study	5,152	Adjusted for age; sex; education level; income; smoking status; drinker status; number of chronic diseases; self-reported health; Center for Epidemiologic Studies Depression Scale score (excluding the two questions used for the frailty definition); and mobility, instrumental activity of daily living, and activity of daily living disability at	Odds Ratio	**1.19 (1.03; 1.39)**

Appendix E Table 37. Association Between Frailty and Hospitalization in Older Persons (continued)

Reference	Study	Sample	Adjustment	Estimate	Mean (95% CI)
			baseline		
Prefrail + cognitive impairment					
Avila-Funes, 2009[169]	Three-City Study	5,152	Adjusted for age; sex; education level; income; smoking status; drinker status; number of chronic diseases; self-reported health; Center for Epidemiologic Studies Depression Scale score (excluding the two questions used for the frailty definition); and mobility, instrumental activity of daily living, and activity of daily living disability at baseline	Odds Ratio	0.95 (0.68; 1.31)
Frailty					
Bandeen-Roche, 2006[99]	Women's Health and Aging Studies (WHAS)	715	Adjusted for baseline age, race, grades completed, smoking (pack-years), disease-related variables—history of congestive heart failure, Mini-Mental State Examination score, Geriatric Depression Scale score (≥14), number of adjudicated diseases, ankle-arm blood pressure, use of diuretics without history of hypertension or congestive heart failure	Hazard Ratio	0.67 (0.33; 1.35)
Avila-Funes, 2008[171]	Three-City Study	6,078	Adjusted by age, sex, education level, income, smoking status, alcohol use, number of chronic diseases, self-reported health, Center for Epidemiologic Studies-Depression scale score, Mini-Mental State Examination score, and baseline disability	Odds Ratio	**1.36 (1.01; 1.81)**
Avila-Funes, 2009[169]	Three-City Study	5,152	Adjusted for age; sex; education level; income; smoking status; drinker status; number of chronic diseases; self-reported health; Center for Epidemiologic Studies Depression Scale score (excluding the two questions used for the frailty definition); and mobility, instrumental activity of daily living, and activity of daily living disability at baseline	Odds Ratio	**1.41 (1.06; 1.87)**
Kiely, 2009[26]	MOBILIZE Boston Study	765	Adjusted for age, gender, race, diabetes, stroke, hypertension, hyperlipidemia, education and income	Odds Ratio for accumulation deficit index	**3.49 (1.53; 7.98)**
				Odds Ratio for phenotype	**4.45 (2.42; 8.18)**
Dukers, 2001[353]	Cardiovascular Health Study	5,317	Adjusted for age, gender, indicator for minority cohort, income, smoking, blood pressure, glucose, albumin, creatinine, carotid stenosis, history of CHF, cognitive function, major EKG abnormality, use of diuretics, problems of IADL,	Hazard Ratio	**1.29 (1.09; 11.54)**
				Hazard Ratio, original cohort	**1.27 (1.11; 1.46)**

Appendix E Table 37. Association Between Frailty and Hospitalization in Older Persons (continued)

Reference	Study	Sample	Adjustment	Estimate	Mean (95% CI)
			self-reported health measure, CES-D modified depression measure		
Avila-Funes, 2009[169]	Three-City Study	5,152	Adjusted for age; sex; education level; income; smoking status; drinker status; number of chronic diseases; self-reported health; Center for Epidemiologic Studies Depression Scale score (excluding the two questions used for the frailty definition); and mobility, instrumental activity of daily living, and activity of daily living disability at baseline	Odds Ratio	1.26 (0.91; 1.74)
Frailty +cognitive impairment					
Avila-Funes, 2009[169]	Three-City Study	5,152	Adjusted for age; sex; education level; income; smoking status; drinker status; number of chronic diseases; self-reported health; Center for Epidemiologic Studies Depression Scale score (excluding the two questions used for the frailty definition); and mobility, instrumental activity of daily living, and activity of daily living disability at baseline	Odds Ratio	**1.9 (1.09; 3.31)**

Appendix E Table 38. Association Between Health Care Utilization and Frailty in Older Persons

Reference	Study	Sample	Definition of the Outcome	Definition of Exposure	Adjustment	Estimate	Mean (95% CI)
Hastings, 2008[354]	Secondary analysis of data from the Medicare Current Beneficiary Survey	1,581	Repeat outpatient ED visit	DAI 2 vs. 1	Adjusted for age, sex, race, income, living alone, insurance status, previous emergency department (ED) visits, and previous hospitalizations.	Hazard Ratio	0.93 (0.62; 1.39)
			Repeat outpatient ED visit	DAI 3 vs. 1		Hazard Ratio	1.1 (0.74; 1.64)
			Repeat outpatient ED visit	DAI 4 vs. 1		Hazard Ratio	1.06 (0.73; 1.54)
Kiely, 2009[26]	MOBILIZE Boston Study	765	Emergency Room Visits	SOF Frailty Index prefrail vs. robust	Adjusted for age, gender, race, diabetes, stroke, hypertension, hyperlipidemia, education and income	Odds Ratio	**2.19 (1.43; 3.33)**
				SOF Frailty Index frail vs. robust		Odds Ratio	**3.54 (1.43; 8.79)**
				CHS Frailty Index prefrail vs. robust		Odds Ratio	1.34 (0.95; 1.89)
				CHS Frailty Index frail vs. robust		Odds Ratio	**3.1 (1.64; 5.86)**

Appendix E Table 39. Association Between Hospitalization and Disability in Older Persons

Reference	Study	Country	Sample Size	Adjustment	Estimate	Mean (95% CI or P Value)
ADL ≥1 vs. 0						
Aliyu, 2003[310]	The Longitudinal Study of Aging	USA	7,541	Adjusted for race, education, family relationship family income, health insurance coverage, social network involvement, perceived health status, and activities of daily living (ADL)	Odds Ratio	**1.78 (1.64; 1.96)**
Uses cane, walker, wheelchair vs. no						
Wieland, 2000[128]	Data from Program of All-Inclusive Care for the Elderly (PACE)	USA	5,478	Adjusted for age, Hispanic (vs. White) ethnicity, living at home with others, or other living arrangements (vs. home alone), widowed, and divorced/separated (vs. married), varying Medicare coverages, self-reported health, number of household and nonhousehold caregivers, informal meal preparation, housework, money management and transportation received, SPMSQ score, ADL/IADL status, use of dressing and feeding devices, visual, hearing, communication and behavioral impairments, bowel/bladder rehabilitation, ostomy care, parenteral medications, inhalation treatment, syphilis, tuberculosis, infectious disease other than TB or syphilis, neoplasms, hypo/hyperthyroidism, anemia, other blood disease, dementia, psychosis, depression/anxiety, other mental disorders, CVD, Parkinson's, diseases of eye and ear, other nervous system diseases, hypertension, PVD, arteriosclerosis, bronchitis, COPD, bronchiectasis, bronchitis, other respiratory diseases, diverticulosis, colitis, chronic constipation, biliary tract disease, inguinal hernia, esophageal reflux, hepatic disease, UTI, skin infections, dermatitis, psoriasis, other skin diseases, arthritis, osteomyelitis, osteoporosis, other musculoskeletal disease, fracture, decubitus ulcer, amputation, and "other (unclassified) diseases."	Hazard Ratio	**1.16 (**p=0.006)
Dentures yes vs. no						
Wieland, 2000[128]	Data from Program of All-Inclusive Care for the Elderly (PACE)	USA	5478	Adjusted for age, Hispanic (vs. White) ethnicity, living at home with others, or other living arrangements (vs. home alone), widowed, and divorced/separated (vs. married), varying Medicare coverages, self-reported health, number of household and nonhousehold caregivers, informal meal preparation, housework, money management and transportation received, SPMSQ score, ADL/IADL status, use of dressing and feeding devices, visual, hearing, communication and behavioral impairments, bowel/bladder rehabilitation, ostomy care, parenteral medications, inhalation treatment, syphilis, tuberculosis, infectious disease other than TB or syphilis, neoplasms, hypo/hyperthyroidism, anemia, other blood disease, dementia, psychosis, depression/anxiety, other mental disorders, CVD, Parkinson's, diseases of eye and ear, other	Hazard Ratio	**1.1 (**p=0.02)

Appendix E Table 39. Association Between Hospitalization and Disability in Older Persons (continued)

Reference	Study	Country	Sample Size	Adjustment	Estimate	Mean (95% CI or P Value)
				nervous system diseases, hypertension, PVD, arteriosclerosis, bronchitis, COPD, bronchiectasis, bronchitis, other respiratory diseases, diverticulosis, colitis, chronic constipation, biliary tract disease, inguinal hernia, esophageal reflux, hepatic disease, UTI, skin infections, dermatitis, psoriasis, other skin diseases, arthritis, osteomyelitis, osteoporosis, other musculoskeletal disease, fracture, decubitus ulcer, amputation, and "other (unclassified) diseases."		
Number of ADLs (continuous variable 0-7) and hospitalization (defined as hospitalization for Ambulatory Care Sensitive Conditions)						
Laditka, 2003[308]	Longitudinal Study of Aging	USA	3,562	Adjusted for age, education, insurance and marital status, health status, primary care access, self-rated health, comorbidities, physical impairments, and previous hospitalizations	Relative Risk	1.31 (-2.59; 5.21)
Number of restricted-activity bed days as continuous variables and hospitalization (defined as a hospitalization or ED visit during the first year)						
Shelton, 2000[114]	411 patients who participated as control patients in the Generalist Physician Initiative at the Carle Clinic site, Urbana, Illinois	USA	411	Adjusted for age, female sex, living arrangement, race, marital status, less than a high school education, taking 5 or more prescription medications daily, comorbid illness category, restricted-activity bed days category (confined to bed for at least 1 day during the past 12 months), 5 health status measures of the HSQ, and the baseline indicator of any hospitalization or ED encounter	Odds Ratio	1.7 (0.86; 2.9)
Male: disability in 3+ ADLs and disability in 1-2 ADLs in the 2 years prior to severe disability onset vs. disability in 1-2 ADLs in the 2 years prior to severe disability onset but final ADLs <3						
Ferrucci, 1997[10]	Established Populations for Epidemiologic Studies of the Elderly	USA	6,070	Adjusted for age and disability	Odds Ratio	**2.8 (1.6; 5.2)**
Female: disability in 3+ ADLs and disability in 1-2 ADLs in the 2 years prior to severe disability onset vs. disability in 1-2 ADLs in the 2 years prior to severe disability onset but final ADLs <3						
Ferrucci, 1997[10]	Established Populations for Epidemiologic Studies of the Elderly	USA	6,070	Adjusted for age and disability	Odds Ratio	**3.8 (2.2; 4.9)**
Unable to do one or more of five ADLs and four IADLs without other assistance and special device and hospitalization (defined as larger than 0.5 admission per year)						
Boult, 1993[306]	Longitudinal Study on Aging	USA	5,876	Adjusted for need variables, predisposing variables, and enabling variables	Odds Ratio	1.2 (0.8; 1.8)
Male: ≥3 ADLs (used 6)--new onset after having no disabilities vs. additional ADL disability developed after having 1-2 ADL disabilities						
Ferrucci,	EPESE Boston,	USA	6,070	Adjusted for socio-demographic characteristics, health status,	Odds	**15.9 (9.1; 27.5)**

Appendix E Table 39. Association Between Hospitalization and Disability in Older Persons (continued)

Reference	Study	Country	Sample Size	Adjustment	Estimate	Mean (95% CI or P Value)
1997[10]	New Haven, Iowa sites Established Populations for Epidemiologic Studies of the Elderly			functional ability, previous use of health services, insurance, income, and family composition	Ratio	
Female: ≥3 ADL (used 6)--new onset after having no disabilities vs. additional ADL disability developed after having 1-2 ADL disabilities						
Ferrucci, 1997[10]	EPESE Boston, New Haven, Iowa sites Established Populations for Epidemiologic Studies of the Elderly	USA	6,070	Adjusted for socio-demographic characteristics, health status, functional ability, previous use of health services, insurance, income, and family composition	Odds Ratio	**16 (11.1; 23)**
Male: ≥3 ADL (used 6)--additional ADL disability developed after having 1-2 ADL disabilities vs. additional ADL disability developed after having 1-2 ADL disabilities						
Ferrucci, 1997[10]	EPESE Boston, New Haven, Iowa sites Established Populations for Epidemiologic Studies of the Elderly	USA	6,070	Adjusted for socio-demographic characteristics, health status, functional ability, previous use of health services, insurance, income, and family composition	Odds Ratio	**2.8 (1.6; 5.2)**
Female: ≥3 ADL (used 6)--additional ADL disability developed after having 1-2 ADL disabilities vs. additional ADL disability developed after having 1-2 ADL disabilities						
Ferrucci, 1997[10]	EPESE Boston, New Haven, Iowa sites Established Populations for Epidemiologic Studies of the Elderly	USA	6,070	Adjusted for socio-demographic characteristics, health status, functional ability, previous use of health services, insurance, income, and family composition	Odds Ratio	**3.8 (2.2; 4.9)**
≥1 ADL (used 7) assistance vs. no ADL or IADL difficulty, and physically able; and hospitalization (defined as two or more hospitalization in prior year)						
Harris, 1989[355]	Longitudinal Study on Aging	USA	1,791	Adjusted for age and sex	Odds Ratio	**3.3 (1.9; 5.5)**
≥1 ADL (used 7) difficulty, no assistance vs. no ADL or IADL difficulty, and physically able; and hospitalization (defined as two or more hospitalization in prior year)						

Appendix E Table 39. Association Between Hospitalization and Disability in Older Persons (continued)

Reference	Study	Country	Sample Size	Adjustment	Estimate	Mean (95% CI or P Value)
Harris, 1989[355]	Longitudinal Study on Aging	USA	1,791	Adjusted for age and sex	Odds Ratio	**2 (1.1; 3.4)**
≥1 IADL difficulty, no ADL difficulty vs. no ADL or IADL difficulty, and physically able; and hospitalization (defined as two or more hospitalization in prior year)						
Harris, 1989[355]	Longitudinal Study on Aging	USA	1,791	Adjusted for age and sex	Odds Ratio	**2.5 (1.4; 4.5)**
No ADL or IADL difficulty, and not physically able vs. no ADL or IADL difficulty, and physically able; and hospitalization (defined as two or more hospitalization in prior year)						
Harris, 1989[355]	Longitudinal Study on Aging	USA	1,791	Adjusted for age and sex	Odds Ratio	**2.1 (1.2; 3.5)**

Bold=statistically significant.
Physically able=having no difficulty in walking 1/4 of a mile, stooping, crouching or kneeling, lifting 10 pounds, or walking up 10 steps without resting.

Appendix E Table 40. Association Between Institutionalization and Disability in Older Persons

Reference	Study	Country	Sample Size	Adjustment	Estimate	Mean (95% CI or P Value)
ADLs >1 vs. 0						
Miller, 1999Miller, 1999 #3016}	Longitudinal Study of Aging	USA	12,007	Adjusted for gender, age, race, hospitalization, marital status, living arrangements (alone/others), family income, home ownership, survey transition year, two- and three way interaction terms if they met either of two criterion: (1) if the overall test of the effect of the interaction across all outcome categories was significant at p <.05, or (2) if the overall test was not significant, but the component of the interaction term related to moves versus no transition was significant at p <.05, the assistance and functional status variables	Odds Ratio	**2.16 (1.41; 3.31)**
ADL >1 vs. 0, male						
Nuotio, 2003[163]	The second wave of the Tampere Longitudinal Study on Ageing (TamELSA)	Finland	775	Adjusted for age, urge incontinence, living alone, neurological diseases, cardiovascular diseases, musculoskeletal diseases, other chronic diseases, ADL disability, depressive symptoms	Relative Risk	1.39 (0.59; 3.28)
ADL >1 vs. 0, female						
Nuotio, 2003[163]	The second wave of the Tampere Longitudinal Study on Ageing (TamELSA)	Finland	775	Adjusted for age, urge incontinence, living alone, neurological diseases, cardiovascular diseases, musculoskeletal diseases, other chronic diseases, ADL disability, depressive symptoms	Relative Risk	1.09 (0.63; 1.88)
ADL 1 vs. 0						
Miller, 1999[299]	Longitudinal Study of Aging	USA	12,007	Adjusted for gender, age, race, hospitalization, marital status, living arrangements (alone/others), family income, home ownership, survey transition year, two- and three way interaction terms if they met either of two criterion: (1) if the overall test of the effect of the interaction across all outcome categories was significant at p <.05, or (2) if the overall test was not significant, but the component of the interaction term related to moves versus no transition was significant at p <.05, the assistance and functional status variables	Odds Ratio	**1.61 (1.08; 2.39)**
ADL 1-2 vs. 0						
Mor, 1994[294]	Longitudinal Study on Aging	USA	7,407	Adjusted for age, gender, self-rated health, number of medical conditions, baseline functional status, and the interaction between age and gender	Odds Ratio	**9.8 (6.8; 14)**
Steinbach, 1992[297]	Longitudinal Study of Aging	USA	4,547	Adjusted for age, sex, race, family income, self-perceived health status, ADLs, hypertension, stroke or CVA, cancer, heart disease, arthritis, DM, fall, social network, social activities, and living arrangement	Odds Ratio	**2.8 (1.78; 4.4)**
ADL 1-3 vs. 0						
Banaszak-	Asset and Health	USA	6,676	Adjusted for other variables: Model 1 included socio-demographic	Hazard	**2.1 (1.8; 2.5)**

Appendix E Table 40. Association Between Institutionalization and Disability in Older Persons (continued)

Reference	Study	Country	Sample Size	Adjustment	Estimate	Mean (95% CI or P Value)
Holl, 2004Banaszak-Holl, 2004 #2488}	Dynamics Among the Oldest Old (AHEAD) Study			measures, potential caregiver network, geographic region, medical conditions, and ADL and IADL impairments	Ratio	
ADL ≥3 vs. 0						
Mor, 1994[294]	Longitudinal Study on Aging	USA	7,407	Adjusted for age, gender, self-rated health, number of medical conditions, baseline functional status, and the interaction between age and gender	Odds Ratio	**17 (9.1; 32)**
Steinbach, 1992[297]	Longitudinal Study of Aging	USA	4,547	Adjusted for age, sex, race, family income, self-perceived health status, ADLs, hypertension, stroke or CVA, cancer, heart disease, arthritis, DM, fall, social network, social activities, and living arrangement	Odds Ratio	**4.53 (2.97; 6.9)**
ADL 4-5 vs. 0						
Banaszak-Holl, 2004[352]	Asset and Health Dynamics Among the Oldest Old (AHEAD) Study	USA	6,676	Adjusted for other variables: Model 1 included socio-demographic measures, potential caregiver network, geographic region, medical conditions, and ADL and IADL impairments	Hazard Ratio	**2.1 (1.7; 2.6)**
Number of ADLs (continuous variable 0-7)						
Belgrave, 1994[305]	Longitudinal Study of Aging	USA	560	Adjusted for ADL, IADL, self-health, activity limitations, confused, age, sex, living alone, education, income, and Medicaid in African American	Odds Ratio	1.05 (p >0.1)
	Longitudinal Study of Aging	USA	6880	Adjusted for ADL, IADL, self-health, activity limitations, confused, age, sex, living alone, education, income, and Medicaid in Whites	Odds Ratio	1.04 (p >0.1)
	Longitudinal Study of Aging	USA	180	Adjusted for ADL, IADL, self-health, activity limitations, confused, age, sex, living alone, education, income, and Medicaid in African American and with limitation of IADL	Odds Ratio	1.29 (p >0.1)
Belgrave, 1994[305]	Longitudinal Study of Aging	USA	1,720	Adjusted for ADL, IADL, self-health, activity limitations, confused, age, sex, living alone, education, income, and Medicaid	Odds Ratio	**1.17 (**p <0.05)
Coward, 1996[301]	Longitudinal Study of Aging	USA	7,527	Adjusted for residence, socio-demographic characteristics, health status characteristic, and social support characteristics	Odds Ratio	**1.15 (**p <0.01)
St John, 2002[150]	Canadian Study of Health and Aging	Canada	8,073	Adjusted for age, gender, education, Time 1 MMSE, and self-rated health	Odds Ratio	1.07 (0.97; 1.67)
			6,934	Adjusted for age, gender, education, Time 1 MMSE, and self-rated health	Odds Ratio	**1.14 (1.01; 1.29)**
Dependence in ADLs						
Miller, 1999[299]	Longitudinal Study of Aging	USA	12,007	Adjusted for gender, age, race, hospitalization, marital status, living arrangements (alone/others), family income, home ownership, survey transition year, two- and three way interaction terms if they met either of two criterion: (1) if the overall test of the effect of the interaction across all outcome categories was	Odds Ratio	1.3 (0.92; 1.84)

Appendix E Table 40. Association Between Institutionalization and Disability in Older Persons (continued)

Reference	Study	Country	Sample Size	Adjustment	Estimate	Mean (95% CI or P Value)
				significant at p <.05, or (2) if the overall test was not significant, but the component of the interaction term related to moves vs. no transition was significant at p <.05, the assistance and functional status variables		
Wolinsky, 1991[356]	Longitudinal Study of Aging	USA	5,151	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics	Odds Ratio	1 (p >0.05)
Wolinsky, 1993Wolinsky, 1993 #3083}	Longitudinal Study of Aging	USA	3,646	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, change in functional status measures	Odds Ratio	**1.29** (p = 0.02)
Dependence in walking						
Long, 2005[118]	Applicants to the home- and community-based care (HCBC) programs	USA	1,690	Adjusted for receiving HCBC services, age, race, gender, health status, did not have hospital stay or SNF, LTCH, rehab hospital stay in prior 6 months, 0 to 3 MSQ errors, needs supervision never/sometimes/unknown, does not need assistance with mobility, does not need help with medication or meal preparation, does not have a mental illness, Alzheimer's or dementia, does not have medications with potential side effects in elderly, lives with spouse/child/other/unknown, primary caregiver is other relative/non-relative/none/unknown, did not have Medicare home health use in prior 6 months, monthly income greater than $1000.	Odds Ratio	0.85 (p >0.05)
Goodlin, 2004[298]	Secondary analysis of data from the Medicare Current Beneficiary Survey	USA	3,232	Adjusted for socio-demographic characteristics, health status, functional ability, previous use of health services, insurance, income, and family composition	Odds Ratio	**1.84 (**p = 0.006)
Dependence in dressing						
Rockwood, 1996[147]	Canadian Study of Health and Aging	Canada	9,113	Adjusted for age, gender, race, married status, absence of a caregiver, non-spouse caregiver, IADL-dependence in finances, dependence in shopping, ADL-dependence in dressing, dependence in feeding, bladder incontinence, bowel incontinence, cardiovascular disease, hypertension, diabetes mellitus, stroke, Parkinson's disease, hearing impairment, visual impairment, age-associated memory impairment (AAMI), Alzheimer's disease, vascular dementia, and other dementia	Odds Ratio	**4.41 (3.6; 5.4)**
Dependence in feeding						
Rockwood, 1996[147]	Canadian Study of Health and Aging	Canada	9,113	Adjusted for age, gender, race, married status, absence of a caregiver, non-spouse caregiver, IADL-dependence in finances, dependence in shopping, ADL-dependence in dressing, dependence in feeding, bladder incontinence, bowel incontinence, cardiovascular disease, hypertension, diabetes mellitus, stroke, Parkinson's disease, hearing impairment, visual	Odds Ratio	**2.76 (2.16; 3.52)**

Appendix E Table 40. Association Between Institutionalization and Disability in Older Persons (continued)

Reference	Study	Country	Sample Size	Adjustment	Estimate	Mean (95% CI or P Value)
				impairment, age-associated memory impairment (AAMI), Alzheimer's disease, vascular dementia, and other dementia		
Using equipment for bathing						
Goodlin, 2004[298]	Secondary analysis of data from the Medicare Current Beneficiary Survey	USA	3,232	Adjusted for socio-demographic characteristics, health status, functional ability, previous use of health services, insurance, income, and family composition	Odds Ratio	**1.92 (**p = 0.019)
IADL ≥1 vs. 0						
Mor, 1994[294]	Longitudinal Study on Aging	USA	7,407	Adjusted for age, gender, self-rated health, number of medical conditions, baseline functional status, and the interaction between age and gender	Odds Ratio	**6.7 (4.6; 9.6)**
IADL >1 vs. 0						
Miller, 1999[299]	Longitudinal Study of Aging	USA	12,007	Adjusted for gender, age, race, hospitalization, marital status, living arrangements (alone/others), family income, home ownership, survey transition year, two- and three way interaction terms if they met either of two criterion: (1) if the overall test of the effect of the interaction across all outcome categories was significant at p <.05, or (2) if the overall test was not significant, but the component of the interaction term related to moves versus no transition was significant at p <.05, the assistance and functional status variables	Odds Ratio	1.36 (0.69; 2.68)
IADL 1 vs. 0						
Miller, 1999[299]	Longitudinal Study of Aging	USA	12,007	Adjusted for gender, age, race, hospitalization, marital status, living arrangements (alone/others), family income, home ownership, survey transition year, two- and three way interaction terms if they met either of two criterion: (1) if the overall test of the effect of the interaction across all outcome categories was significant at p <.05, or (2) if the overall test was not significant, but the component of the interaction term related to moves versus no transition was significant at p <.05, the assistance and functional status variables	Odds Ratio	1.04 (0.6; 1.8)
IADL 1-3 vs. 0						
Banaszak-Holl, 2004[352]	Asset and Health Dynamics Among the Oldest Old (AHEAD) Study	USA	6,676	Adjusted for other variables: Model 1 included socio-demographic measures, potential caregiver network, geographic region, medical conditions, and ADL and IADL impairments	Hazard Ratio	**2 (1.7; 2.3)**
IADL 4-5 vs. 0						
Banaszak-Holl, 2004[352]	Asset and Health Dynamics Among the Oldest Old (AHEAD) Study	USA	6,676	Adjusted for other variables: Model 1 included socio-demographic measures, potential caregiver network, geographic region, medical conditions, and ADL and IADL impairments	Hazard Ratio	**2.5 (2; 3.3)**

Appendix E Table 40. Association Between Institutionalization and Disability in Older Persons (continued)

Reference	Study	Country	Sample Size	Adjustment	Estimate	Mean (95% CI or P Value)
Number of IADLs (continuous variable 0-4)						
Wolinsky, 1992[300]	Longitudinal Study of Aging	USA	5,151	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, health services utilization, and change in functional status measures	Odds Ratio	**1.14 (**p = 0.03)
Number of IADLs (continuous variable 0-6)						
Belgrave, 1994[305]	Longitudinal Study of Aging	USA	560	Adjusted for ADL, IADL, self-health, activity limitations, confused, age, sex, living alone, education, income, and Medicaid in African American	Odds Ratio	1.21 (p >0.1)
	Longitudinal Study of Aging	USA	6,880	Adjusted for ADL, IADL, self-health, activity limitations, confused, age, sex, living alone, education, income, and Medicaid in Whites	Odds Ratio	1.1 (p >0.1)
	Longitudinal Study of Aging	USA	180	Adjusted for ADL, IADL, self-health, activity limitations, confused, age, sex, living alone, education, income, and Medicaid in African American with IADL limitations	Odds Ratio	1.1 (p >0.1)
Belgrave, 1994[305]	Longitudinal Study of Aging	USA	1,720	Adjusted for ADL, IADL, self-health, activity limitations, confused, age, sex, living alone, education, income, and Medicaid	Odds Ratio	1.03 (p >0.1)
Coward, 1996[301]	Longitudinal Study of Aging	USA	,7527	Adjusted for residence, socio-demographic characteristics, health status characteristic, and social support characteristics	Odds Ratio	**1.16 (**p <0.05)
Number of IADLs (continuous variable 0-7)						
St John, 2002[150]	Canadian Study of Health and Aging	Canada	8,073	Adjusted for age, gender, education, Time 1 MMSE, and self-rated health	Odds Ratio	**1.21 (1.15; 1.28)**
Number of IADLs (continuous variable 0-7) in population with normal MMSE score						
St John, 2002[150]	Canadian Study of Health and Aging	Canada	6,934	Adjusted for age, gender, education, Time 1 MMSE, and self-rated health	Odds Ratio	**1.27 (1.19; 1.36)**
Dependence in finances						
Rockwood, 1996[147]	Canadian Study of Health and Aging	Canada	9,113	Adjusted for Age, gender, race, married status, absence of a caregiver, non-spouse caregiver, IADL-dependence in finances, dependence in shopping, ADL-dependence in dressing, dependence in feeding, bladder incontinence, bowel incontinence, cardiovascular disease, hypertension, diabetes mellitus, stroke, Parkinson's disease, hearing impairment, visual impairment, age-associated memory impairment (AAMI), Alzheimer's disease, vascular dementia, and other dementia	Odds Ratio	**1.67 (1.41; 2)**
Dependence in shopping						
Goodlin, 2004[298]	Secondary analysis of data from the Medicare Current Beneficiary Survey	USA	3,232	Adjusted for socio-demographic characteristics, health status, functional ability, previous use of health services, insurance, income, and family composition	Odds Ratio	**2.88 (**p <0.001)
Rockwood, 1996[147]	Canadian Study of Health and Aging	Canada	9,113	Adjusted for Age, gender, race, married status, absence of a caregiver, non-spouse caregiver, IADL-dependence in finances, dependence in shopping, ADL-dependence in dressing, dependence in feeding, bladder incontinence, bowel	Odds Ratio	0.88 (0.74; 1.03)

Appendix E Table 40. Association Between Institutionalization and Disability in Older Persons (continued)

Reference	Study	Country	Sample Size	Adjustment	Estimate	Mean (95% CI or P Value)
				incontinence, cardiovascular disease, hypertension, diabetes mellitus, stroke, Parkinson's disease, hearing impairment, visual impairment, age-associated memory impairment (AAMI), Alzheimer's disease, vascular dementia, and other dementia		
Needs help with medications vs. no						
Long, 2005[118]	Applicants to the home- and community-based care (HCBC) programs	USA	1690	Adjusted for receiving HCBC services, age, race, gender, health status, did not have hospital stay or SNF, LTCH, rehab hospital stay in prior 6 months, 0 to 3 MSQ errors, needs supervision never/sometimes/unknown, does not need assistance with mobility, does not need help with medication or meal preparation, does not have a mental illness, Alzheimer's or dementia, does not have medications with potential side effects in elderly, lives with spouse/child/other/unknown, primary caregiver is other relative/non-relative/none/unknown, did not have Medicare home health use in prior 6 months, monthly income greater than $1000.	Odds Ratio	1.34 (p >0.05)
Needs help with meal preparation vs. no						
Long, 2005[118]	Applicants to the home- and community-based care (HCBC) programs	USA	1,690	Adjusted for receiving HCBC services, age, race, gender, health status, did not have hospital stay or SNF, LTCH, rehab hospital stay in prior 6 months, 0 to 3 MSQ errors, needs supervision never/sometimes/unknown, does not need assistance with mobility, does not need help with medication or meal preparation, does not have a mental illness, Alzheimer's or dementia, does not have medications with potential side effects in elderly, lives with spouse/child/other/unknown, primary caregiver is other relative/non-relative/none/unknown, did not have Medicare home health use in prior 6 months, monthly income greater than $1000.	Odds Ratio	2.61 (p >0.05)
Number of ADLs and IADL (0-13)						
Speare, 1991[303]	Longitudinal Study of Aging	USA	5,151	Adjusted for disability, incontinence, blindness, deafness, limitation in major activities, social support, age, sex, income	Odds Ratio	**1.19 (**p <0.01)
Kersting, 2001[302]	Longitudinal Study of Aging	USA	7,527	Adjusted for social support, poverty, age, gender, race, ADL/IADL score, self-reported health status, and fall	Hazard Ratio	**1.17 (1.13; 1.2)**
	Longitudinal Study of Aging	USA	555	Adjusted for social support, poverty, age, gender, race, ADL/IADL score, self-reported health status, and fall in African Americans	Hazard Ratio	**1.24 (1.13; 1.36)**
[304]	Longitudinal Study of Aging	USA	6,986	Adjusted for social support, poverty, age, and ADL/IADL score	Hazard Ratio	**1.19 (1.16; 1.21)**
GERI-AIMS scale						
Falconer, 1992[113]	2-year longitudinal study of independent residents of a continuing care retirement	USA	152	Adjusted for age, sex, GERI-AIMS, disease severity, and Williams test	Relative Risk	**1.14 (**p ≤0.01)

Appendix E Table 40. Association Between Institutionalization and Disability in Older Persons (continued)

Reference	Study	Country	Sample Size	Adjustment	Estimate	Mean (95% CI or P Value)
	community					
Williams test for hand function						
Falconer, 1992[113]	2-year longitudinal study of independent residents of a continuing care retirement community	USA	152	Adjusted for age, sex, GERI-AIMS, disease severity, and Williams test	Relative Risk	2.42 (p >0.05)
LBL						
Miller, 1999[299]	Longitudinal Study of Aging	USA	12,007	Adjusted for gender, age, race, hospitalization, marital status, living arrangements (alone/others), family income, home ownership, survey transition year, two- and three way interaction terms if they met either of two criterion: (1) if the overall test of the effect of the interaction across all outcome categories was significant at p <.05, or (2) if the overall test was not significant, but the component of the interaction term related to moves versus no transition was significant at p <.05, the assistance and functional status variables	Odds Ratio	1.09 (0.99; 1.2)
Wolinsky, 1992[300]	Longitudinal Study of Aging	USA	5,151	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, health services utilization, and change in functional status measures	Odds Ratio	**1.08 (**p = 0.0417)
Change in lower body function						
Wolinsky, 1993[357]	Longitudinal Study of Aging	USA	3,646	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, change in functional status measures	Odds Ratio	**1.179 (**p = 0.01)
Change in advanced ADLs						
Wolinsky, 1993[357]	Longitudinal Study of Aging	USA	3,646	Adjusted for baseline predisposing characteristics, enabling characteristics, need characteristics, change in functional status measures	Odds Ratio	**1.48 (**p = 0.001)
≥ 3ADL (used 6)--new onset after having no disabilities vs. additional ADL disability developed after having 1-2 ADL disabilities						
Ferrucci, 1997[10]	EPESE Boston, New Haven, Iowa sites Established Populations for Epidemiologic Studies of the Elderly	USA	6,070	Adjusted for socio-demographic characteristics, health status, functional ability, previous use of health services, insurance, income, and family composition	Odds Ratio	**2.8 (1.7; 4.5)**
Female: ≥3 ADL (used 6)--new onset after having no disabilities vs. additional ADL disability developed after having 1-2 ADL disabilities						
Ferrucci, 1997[10]	EPESE Established Populations for	USA	6,640	Adjusted for socio-demographic characteristics, health status, functional ability, previous use of health services, insurance, income, and family composition	Odds Ratio	**2.3 (1.6; 3.2)**

Appendix E Table 40. Association Between Institutionalization and Disability in Older Persons (continued)

Reference	Study	Country	Sample Size	Adjustment	Estimate	Mean (95% CI or P Value)
	Epidemiologic Studies of the Elderly - East Boston & New Haven Communities					
Male: ≥3 ADL (used 6)--new onset after having no disabilities vs. additional ADL disability developed after having 1-2 ADL disabilities						
Ferrucci, 1997[10]	EPESE Established Populations for Epidemiologic Studies of the Elderly - East Boston & New Haven Communities	USA	6,640	Adjusted for socio-demographic characteristics, health status, functional ability, previous use of health services, insurance, income, and family composition	Odds Ratio	1.3 (0.8; 2.1)
1-2 ADLs (used 7) vs. 0, 4 year prior						
Anderson, 1998[358]	Longitudinal Study on Aging	USA	5,079	Adjusted odds ratio predicting being institutionalized relative to being independent (defined as no IADL or ADL limitations)	Odds Ratio	**2.63 (1.49; 4.66)**
≥3 ADLs (used 7) vs. 0, 4 year prior						
Anderson, 1998[358]	Longitudinal Study on Aging	USA	5,079	Adjusted odds ratio predicting being institutionalized relative to being independent (defined as no IADL or ADL limitations)	Odds Ratio	**3.43 (1.48; 7.95)**
≥1 IADL (used 6) AND no ADL (used 7) vs. 0, 4 year prior						
Anderson, 1998[358]	Longitudinal Study on Aging	USA	5,079	Adjusted odds ratio predicting being institutionalized relative to being independent (defined as no IADL or ADL limitations)	Odds Ratio	**2.38 (1.61; 3.51)**
1-2 ADLs (used 7) vs. 0, 2 year prior						
Anderson, 1998[358]	Longitudinal Study on Aging	USA	5,079	Adjusted odds ratio predicting being institutionalized relative to being independent (defined as no IADL or ADL limitations)	Odds Ratio	**15.57 (9.12; 26.58)**
≥3 ADLs (used 7) vs. 0, 2 year prior						
Anderson, 1998[358]	Longitudinal Study on Aging	USA	5,079	Adjusted odds ratio predicting being institutionalized relative to being independent (defined as no IADL or ADL limitations)	Odds Ratio	**83.22 (33.28; 208.1)**
≥1 IADL (used 6) AND no ADL (used 7) vs. 0, 2 year prior						
Anderson, 1998[358]	Longitudinal Study on Aging	USA	5,079	Adjusted odds ratio predicting being institutionalized relative to being independent (defined as no IADL or ADL limitations)	Odds Ratio	**3.53 (2.27; 5.49)**
≥1 ADL (used 7) assistance vs. no ADL or IADL difficulty, and physically able						
Harris, 1989[355]	Longitudinal Study on Aging	USA	1,791	Adjusted for age and sex	Odds Ratio	**6.7 (3.8; 12.8)**
≥1 ADL (used 7) difficulty, no assistance vs. no ADL or IADL difficulty, and physically able						
Harris, 1989[355]	Longitudinal Study on Aging	USA	1,791	Adjusted for age and sex	Odds Ratio	**3.7 (2; 7.4)**
≥1 IADL difficulty, no ADL difficulty vs. no ADL or IADL difficulty, and physically able						

Appendix E Table 40. Association Between Institutionalization and Disability in Older Persons (continued)

Reference	Study	Country	Sample Size	Adjustment	Estimate	Mean (95% CI or P Value)
Harris, 1989[355]	Longitudinal Study on Aging	USA	1,791	Adjusted for age and sex	Odds Ratio	**2.8 (1.4; 5.6)**
No ADL or IADL difficulty, and not physically able vs. no ADL or IADL difficulty, and physically able						
Harris, 1989[355]	Longitudinal Study on Aging	USA	1,791	Adjusted for age and sex	Odds Ratio	**2.2 (1.1; 4.1)**
Restricted activity						
Gill, 2004[36]	Precipitating Events Project	USA	754	Adjusted for age, sex, race/ethnicity, living alone, years of education, chronic conditions, cognitive impairment, depressive symptoms, and prior intervening events	Hazard Ratio	**3.51 (1.72; 7.19)**
Restricted activity in population with physically frail at baseline						
Gill, 2004[36]	Precipitating Events Project	USA	754	Adjusted for age, sex, race/ethnicity, living alone, years of education, chronic conditions, cognitive impairment, depressive symptoms, and prior intervening events	Hazard Ratio	**4.52 (1.95; 10.5)**
Restricted activity in population without physically frail at baseline						
Gill, 2004[36]	Precipitating Events Project	USA	754	Adjusted for age, sex, race/ethnicity, living alone, years of education, chronic conditions, cognitive impairment, depressive symptoms, and prior intervening events	Hazard Ratio	1.71 (0.35; 8.29)

Bold=statistically significant.
Lower Body Limitations (LBL)=any difficulty with walking 1/4 of a mile, walking up 10 steps without rest, standing or being on the feet for 2 hours, stooping, crouching or kneeling, or lifting or carrying 25 pounds; Restricted activity=cut down on usual activities or stayed in bed for at least half a day due to an illness; Physically able=having no difficulty in walking 1/4 of a mile, stooping, crouching or kneeling, lifting 10 pounds, or walking up 10 steps without resting.

Appendix E Table 41. Association Between Disability and Mortality in Older Persons

Disability Definition	Reference	Study	Sample Size	Followup	Adjustment	Estimate (95% CI)
ADL continuous- per increase in 1 score						
Number of ADL limits (used 7)	Naeim, 2007[359]	Second Longitudinal Study on Aging (LSOAII)	8,838	Mortality at 4-yr followup	*	**OR 1.1 (1.04; 1.16)**
Increase by 1 score in Barthel index (range 0 to 20 [higher score is better], includes 10 ADLs)	Buurman, 2008[198]	Tertiary university teaching hospital	463	90-day survival after hospital admission	*	**OR 0.9 (0.87; 0.94)**
Number of "other" ADLs (used 5--bathe, dress, transfer, toilet, eat)	Long, 2005[118]	Medicaid applicants to the home- and community-based care (HCBC) programs	1,690	Mortality 6-months following application for services	*	**OR 1.44** p < 0.01
ADL/IADL per increase in 1 score						
Number of Functional Limits (unclear in this write-up, but assumed to include 13 total: 7 ADLs and 6 IADLs)	Grabowski, 2001[360]	Longitudinal Study of Aging	7,459	Cox regression to calculate proportional hazards ratios for mortality over 96 months	*	**HR 1.10 (1.08; 1.12)**
IADL continuous						
Number of IADL limits (used 8)	Naeim, 2007[359]	Second Longitudinal Study on Aging (LSOAII)	,8838	Mortality at 4-eayr followup	*	**OR 1.12 (1.08; 1.17)**
Number of "other" IADLs (used 6--housework, laundry, telephone, finances, travel, shopping)	Long, 2005[118]	Medicaid applicants to the home- and community-based care (HCBC) programs	1,690	Mortality 6-months following application for services	*	OR 0.88 NS
IADL						
≥1 IADL (used 3) AND no ADL	Mor, 1994[294]	Longitudinal Study on Aging	7,407	Mortality at 6-year followup	*	**OR 6.6 (5.1; 8.6)**
≥1 IADL (used 6) AND no ADL (used 7)	Anderson, 1998[358]	Longitudinal Study on Aging	5,079	4-years prior IADL		**OR 1.86 (1.4; 2.46)**
≥1 IADL (used 6) AND no ADL (used 7)				2-years prior IADL		**OR 4.14 (3.2; 5.36)**
≥1 IADL difficulty, no ADL difficulty	Harris, 1989[355]	Longitudinal Study on Aging	1,791	Mortality at 2-year followup		**OR 2.2 (1.4; 3.3)**
1-3 IADLs (used OARS--number of items not given)	Ganguli, 2002[85]	Monongahela Valley Independent Elders Survey	1,064	3 year mortality	*	RR 1.54 (p=0.05)
1-3 IADLs (used OARS--number of items not given)	Ganguli, 2002[85]	Monongahela Valley Independent Elders Survey	1,064	5 year mortality	*	**RR 1.72 (p=0.001)**
1-3 IADLs (used OARS--number of items not given)	Ganguli, 2002[85]	Monongahela Valley Independent Elders Survey	1,064	10 year mortality	*	**RR 1.62 (p<0.001)**
2 IADL (used 6)	Fried, 1998[54]	Cardiovascular Health Study	5,201	5 year mortality	*	**RR 1.46 (1.2; 1.78)**
≥ 3 IADL (used 6)	Fried, 1998[54]	Cardiovascular Health Study	5,201	5 year mortality	*	**RR 1.64 (1.26; 2.14)**

Appendix E Table 41. Association Between Disability and Mortality in Older Persons (continued)

Disability Definition	Reference	Study	Sample Size	Followup	Adjustment	Estimate (95% CI)
≥4 IADLs (used OARS--number of items not given)	Ganguli, 2002[85]	Monongahela Valley Independent Elders Survey	1,064	3 year mortality	*	**RR 2.49 (p=0.02)**
≥4 IADLs (used OARS--number of items not given)				5 year mortality	*	**RR 2.09 (p=0.03)**
≥4 IADLs (used OARS--number of items not given)				10 year mortality	*	**RR 2.20 (p=0.001**
IADL individual						
meal preparation	Long, 2005[118]	Applicants to home- and community-based care (HCBC) programs	1,690	Mortality 6-months following application for services	*	OR 2.421 NS
Medication management				Mortality 6-months following application for services	*	OR 1.149 NS
Manage finances	Lee, 2006[71]	Health and Retirement Study	11,701	4 year mortality	*	**OR 1.9 (1.6; 2.3)**
IADL/ADL						
No issues, IADL issues only, ADL issues only (does not specify number of IADLs and ADLs used.	Jones, 2004[153]	The MGAT study	171	Death or institutionalization	*	**HR 1.84 (1.04; 3.24)**
ADL						
≥1 ADL (used 7) difficulty, no assistance	Harris, 1989[355]	Longitudinal Study on Aging	1,791	Mortality at 2-year followup		**OR 1.9 (1.3; 2.7)**
1-2 ADLs (used 5)	Walter, 2001[125]	Individuals enrolled in 2 randomized trials of an intervention to improve functional outcomes of hospitalized older adults	1,495	1 year after hospital discharge	*	**OR 2.1 (1.6; 2.8)**
5 ADLs (used 5)				1 year after hospital discharge	*	**OR 5.7 (4.2; 7.7)**
Used 7 ADLs	Espino, 2006[200]	H-EPESE Hispanic Established Populations for Epidemiologic Studies of the Elderly	3,050	8 year mortality	*	**HR 1.13 (1.07; 1.19)**
ADL individual						
"Mobility" disability [definition of ADL/IADLs used is not very clear; is this referring to the "walking across the room" ADL?]	Long, 2005[118]	Applicants to the home- and community-based care (HCBC) programs	1,690	Mortality 6-months following application for services	*	OR 1.75 ($p < 0.05$)
Bathe	Lee, 2006[71]	Health and Retirement Study	11,701	4 year mortality	*	**OR 2 (1.6; 2.4)**
Dress: fully dependent	Carey, 2008[129]	PACE Program of All-Inclusive	3,899	1-year or 3-year		**HR 1.6**

Appendix E Table 41. Association Between Disability and Mortality in Older Persons (continued)

Disability Definition	Reference	Study	Sample Size	Followup	Adjustment	Estimate (95% CI)
		Care for the Elderly		mortality		**(1.3; 2.1)**
Dress: partially dependent	Carey, 2008[129]	PACE Program of All-Inclusive Care for the Elderly	3,899			**HR 1.2 (1; 1.4)**
Toilet: fully dependent	Carey, 2008[129]	PACE Program of All-Inclusive Care for the Elderly	3,899			**HR 1.3 (1.1; 1.5)**
ADL moderate						
1-2 ADLs (used 7)	Anderson, 1998[358]	Longitudinal Study on Aging	5,079	4-years prior mod ADL		**OR 2 (1.22; 3.27)**
1-2 ADLs (used 7)	Anderson, 1998[358]	Longitudinal Study on Aging	5,079	2-years prior mod ADL		**OR 14.06 (9.15; 21.61)**
1-2 ADLs (used 6)	Mor, 1994[294]	Longitudinal Study on Aging	7,407	Mortality at 6-year follow-up	*	**OR 8.6 (6.6; 11)**
ADL severe						
≥3 ADLs (used 7)	Anderson, 1998[358]	Longitudinal Study on Aging	5,079	2-years prior severe ADL		**OR 3.43 (1.57; 7.51)**
≥ 3 ADLs (used 7)	Anderson, 1998[358]	Longitudinal Study on Aging	5,079	2-years prior severe ADL		**OR 86.75 (39.44; 190.8)**
≥3 ADLs (used 6)	Mor, 1994[294]	Longitudinal Study on Aging	7,407	Mortality at 6-year followup	*	**OR 30 (18; 51)**
Rosow-Breslau individual						
Walk 1/2 mile	Melzer, 2003[14]	EPESE East Boston & New Haven Site Established Populations for Epidemiologic Studies of the Elderly	3,040	4 year mortality	*	**HR 2.95 (2.48; 3.5)**
Walk several blocks	Lee, 2006[71]	Health and Retirement Study	11,701	4 year mortality	*	**OR 2.1 (1.8; 2.4)**
SPPB						
0-6 score on SPPB (0 to 12)	Rolland, 2006[165]	EPIDOS Epidemiologie de l'osteoporose study	7,250	NR	*	**HR 1.34 (1.04; 1.73)**
7-9 score on SPPB (0 to 12)	Rolland, 2006[165]	EPIDOS Epidemiologie de l'osteoporose study	7250		*	**HR 1.24 (1.01; 1.53)**
Mobility						
Assessed using CGA, rated at highest level of independence, with aid where used.	Jones, 2004[153]	MGAT study	170	Death or institutionalization	*	HR 1.21 (0.73; 2)

Appendix E Table 41. Association Between Disability and Mortality in Older Persons (continued)

Disability Definition	Reference	Study	Sample Size	Followup	Adjustment	Estimate (95% CI)
MOBLI score						
< 0.2021	Melzer, 2003[14]	EPESE East Boston & New Haven Site Established Populations for Epidemiologic Studies of the Elderly	3,040	4 year mortality	*	**HR 2.71 (2.28; 3.21)**
Nagi individual						
Push/pull heavy objects	Lee, 2006[71]	Health and Retirement Study	11,701	4 year mortality	*	**OR 1.5 (1.3; 1.8)**

*Multivariate adjusted estimates.
Bold= significant at 95% confidence limits.

Appendix E Table 42. Association Between Sarcopenia and Clinical Outcomes in Older Persons

Reference	Study	Adjustment	Definition of Exposure	Measure of the Association	Mean (95% CI)
EPESE score of less than 10(Impaired lower extremity function was defined as a total score less than 10)					
Newman, 2003[75]	Health Aging and Body Composition (Health ABC) Study	Adjusted for age, race, drinking, smoking, physical activity and comorbidity	Men who are sarcopenic (aLM/ht2)	OR	**1.5 (1.1; 2.1)**
			Women who are sarcopenic (aLM/ht2)	OR	0.9 (0.7; 1.2)
			Men who are sarcopenic (residual)	OR	**1.8 (1.3; 2.5)**
			Women who are sarcopenic (residual)	OR	**1.9 (1.4; 2.5)**
Mortality					
Cesari, 2009[180]	Invecchiare in Chianti Study	Adjusted for age, gender, site, education, Mini-Mental State Examination score, Center for Epidemiological Studies-Depression scale score, physical activity, congestive heart failure, coronary artery disease, hypertension, peripheral artery disease, respiratory disease, osteoarthritis, stroke, interleukin-6 (log value), C-reactive protein, and tumor necrosis factor-α (log value)	Sarcopenia in BMI <25	HR	1.25 (0.69; 2.25)
			Sarcopenia in BMI 25-29.9	HR	1.24 (0.65; 2.37)
			Sarcopenia in BMI ≥30	HR	1.18 (0.46; 3.02)
Cesari, 2009[180]	Invecchiare in Chianti Study	Unadjusted	Muscle density (in mg/cm3)	HR	**0.78 (0.69; 0.88)**
			Muscle area (in cm2)	HR	**0.75 (0.66; 0.86)**

Bold=statistically significant.

Appendix E Table 43. Association Between Frailty, Mortality, and Malnutrition Definition in Older Persons

Reference	Study	Age	Sample	Definition of Exposure	Adjustment	Relative Measure of Association with 95% CI
Frailty						
Abnormalities: Anemia; Inflammation; Endocrine; Micronutrient; Body composition; Fine motor speed						
Fried, 2009[98]	Women ' s Health and Aging Studies I and II	>70	1,438	Multiple vs. isolated abnormalities	Adjusted for age, race, education, and number of chronic diseases	**OR 2.59 (1.22; 5.52)**
				Abnormal levels in 3-4 physiological measures		**OR 11 (2.5; 47.9)**
				Abnormal levels in >5 physiological measures		**OR 26 (3.7; 183.3)**
				Anemia		OR 1.5 (0.7; 3.4)
				Dehydroepiandrosterone sulfate DHEA-S <0.215 mcg/mL		OR 1.4 (0.7; 2.8)
				≥2 nutritional deficits		**OR 2.6 (1.3; 5)**
				Skinfold thickness <17 mm		**OR 2.6 (1.3; 5.2)**
Bartali, 2008[177]	Invecchiare in Chianti (InCHIANTI)	>65	698	Vitamin E, 1.1 µg/mL, lowest vs. the highest quartile	Adjusted for age, sex, educational achievement, marital status, household composition, smoking, physical activity , number of diseases, BMI, Depression Scale, and Mini-Mental State Examination	**OR 1.62 (1.11; 2.36)**
				Vitamin B12, 275 pg/mL, lowest vs. the highest quartile		OR 1.03 (0.71; 1.5)
				Vitamin B6, 4.35 ng/mL, lowest vs. the highest quartile		OR 1.04 (0.71; 1.53)
				Folic acid, 1.9 ng/mL, lowest vs. the highest quartile		OR 0.72 (0.49; 1.03)
				Vitamin D, 305 ng/mL, lowest vs. the highest quartile		OR 0.92 (0.63; 1.36)
				Iron, 55 µg/dL, lowest vs. the highest quartile		OR 1.1 (0.77; 1.59)
Mortality						
Albumin levels (g/L)						
Raynaud-Simon, 2002[167]	PAQUID research program	>65	245	<44.8 vs. 44.8-48.0	Adjusted for Transthyretin, CRP, Orosomucoid, and BMI	RR 5.3 (0.2; 5.7), 2 years
				<44.8 vs. 44.8-48.0	Adjusted for Transthyretin, CRP, Orosomucoid, and BMI	**RR 2.1 (1.1; 3.9), 6 years**

Appendix E Table 43. Association Between Frailty, Mortality, and Malnutrition Definition in Older Persons (continued)

Reference	Study	Age	Sample	Definition of Exposure	Adjustment	Relative Measure of Association with 95% CI
Anemia						
Semba, 2007[107]	Women's Health and Aging Study I	>65	688	Anemia with nutritional deficiencies	Adjusted for age	HR 0.79 (0.29; 2.14)
Zakai, 2005[61]	Cardiovascular Health Study	>65	5888	Anemia	Adjusted for age, sex, and race, baseline cardiovascular disease, congestive heart failure, diabetes mellitus, pre-baseline cancer, ankle-arm index, self-reported health status (fair or poor), history of cigarette use, and forced vital capacity	**RR 1.33 (1.15; 1.54)**
BMI						
Volpato, 2001[100]	Women's Health and Aging Study	≥65	620	<21.45 vs. 21.45–31.58	Adjustment for age, smoking history, BMI, inflammatory markers and albumin	**RR 2.03 (1.09; 3.77)**
Raynaud-Simon, 2002[167]	PAQUID research program	>65	245	<22.8 vs. 22.8-27.3	Adjusted for Transthyretin, CRP, Orosomucoid, and BMI	RR 0.7 (0.1; 3) 2 years **RR 2.3 (1.3; 4.4) 6 years**
Rakowski, 1992[361]	Longitudinal Study of Aging	>70	1391	lowest vs. highest quintile	Crude	**OR 2.17 (1.03; 4.55)**
Not intentional weight loss						
Newman, 2001[64]	Cardiovascular Study Research Group	>65	4718	Weight loss of 5%	Adjusted for age in years, gender, race, digital symbol score, number of medications, gastrointestinal disease, log of pack years of smoking, waist circumference, and mobility-impairment	**HR 1.67 (1.29; 2.15)**
Composite nutritional score						
Beck, 1999[157]	Danish part of 'Survey in	>73	202	MNA nutritional score (<23.5 vs. >24)	Adjusted for age and smoking status	**RR 2.86 (1.52; 5.56)**

Appendix E Table 43. Association Between Frailty, Mortality, and Malnutrition Definition in Older Persons (continued)

Reference	Study	Age	Sample	Definition of Exposure	Adjustment	Relative Measure of Association with 95% CI
	Europe of Nutrition in the Elderly, a Concerted Action' (SENECA)					
Visvanathan, 2003[141]	Domiciliary care services for elderly people with moderate or severe functional limitations	>67	250	MNA <24	Adjusted for age and living status	RR 1.02 (0.44; 2.38) 1 year
Beck, 1999[157]	Danish part of 'Survey in Europe of Nutrition in the Elderly, a Concerted Action' (SENECA)	>73	202	High nutritional risk by NSI Checklist score	Adjusted for age and smoking status	RR 1.45 (0.78; 2.71)
Transthyretin, mg/L						
Raynaud-Simon, 2002[167]	PAQUID research program	>65	245	<258 vs. 258-316	Adjusted for Transthyretin, CRP, Orosomucoid, and BMI	RR 2.8 (0.7; 10.7) 2 years
				>316 vs. 258 -316	Adjusted for Transthyretin, CRP, Orosomucoid, and BMI	**RR 6.6 (1.7; 25.9) 2 years**
				<258 vs. 258 -316	Adjusted for Transthyretin, CRP, Orosomucoid, and BMI	RR 1.4 (0.7; 2.6) 6 years
				>316 vs. 258 -316	Adjusted for Transthyretin,CRP, Orosomucoid, and BMI	**RR 2.6 (1.4; 5) 6 years**
Orosomucoid, g/L						
Raynaud-Simon, 2002[167]	The PAQUID research	>65	245	<0.68 vs. 0.68- 0.88	Adjusted for Transthyretin,CRP,	RR 0.6 (0.1; 3.9) 2 years; RR 0.5 (0.2; 1.1) 6 years

Appendix E Table 43. Association Between Frailty, Mortality, and Malnutrition Definition in Older Persons (continued)

Reference	Study	Age	Sample	Definition of Exposure	Adjustment	Relative Measure of Association with 95% CI
	program			>0.88 vs. 0.68- 0.88	Orosomucoid, and BMI	**RR 7.4 (2.2; 24.6) 2 years; RR 2.9 (1; 3.4) 6 years**
					Adjusted for Transthyretin, CRP, Orosomucoid, and BMI, functional status (ADL and IADL), cognitive function (MMSE), and depression (CES-D)	**RR 6.1 (1.7; 22.2) 2 years**
						RR 1.7 (0.9; 3.2) 6 years
				>1 g/L	Adjusted for Transthyretin, CRP, Orosomucoid, and BMI, functional status (ADL and IADL), cognitive function (MMSE), and depression (CES-D)	**RR 12.3 (4.3; 35) 2 years**
						RR 4.4 (2.3; 8.5) 6 years
Vitamin D						
Semba, 2009[105]	Women's Health and Aging Studies (WHAS) I and II, 2	>70	714	25 (OH)D <15.3 vs. >27	Age, race, education, season, BMI, smoking, supplement use, physical activity, total cholesterol, HDL cholesterol, and chronic diseases	**HR 2.45 (1.12; 5.36)**
Visser, 2006[196]	Longitudinal Aging Study Amsterdam (1995–1996)	>65	1260	25 (OH)D: <25 nmol/L vs. >75 nmol/L	Adjusted for sex, age, and education; model, for chronic diseases, serum creatinine concentration, cognitive status, and depressive symptoms, BMI, smoking status, alcohol consumption, and physical activity, mobility performance, low serum albumin concentration, and low serum total	HR 1.28 (0.85; 1.92)
				25 (OH)D: 25–49.9 nmol/L vs. >75 nmol/L		HR 1 (0.72; 1.4)

Appendix E Table 43. Association Between Frailty, Mortality, and Malnutrition Definition in Older Persons (continued)

Reference	Study	Age	Sample	Definition of Exposure	Adjustment	Relative Measure of Association with 95% CI
					cholesterol concentration	
Red cell distribution width						
Patel, 2010[46]	InCHIANTI Study, NHANES III, and WHAS I;the Health ABC Study; the East Boston, Iowa, and New Haven sites of the EPESE	>65	11,827	Red cell distribution width,1% increment	Adjusted for age, sex, race, education level, smoking history, and body mass index, age-associated medical conditions (cancer, diabetes, heart attack, hypertension, and stroke	**HR 1.14 (1.11; 1.17)**
		No major age-associated diseases				**HR 1.32 (1.21; 1.44)**
		Iron, folate, and/or vitamin B12 deficiencies				**HR 1.16 (1.09; 1.24)**
				RDW of 14.0%–14.9%		**HR 1.77 (1.53; 2.04)**
				RDW >14.9%		**HR 2.51 (2.16; 2.91)**
		65-74		Red cell distribution width, 1% increment		**HR 1.25 (1.22; 1.3)**
		75-84				**HR 1.16 (1.13; 1.19)**
		>85				**HR 1.16 (1.112; 1.21)**
		male				**HR 1.21 (1.175; 1.24)**
		female				**HR 1.16 (1.13; 1.19)**
		African American				**HR 1.13 (1.1; 1.18)**
		Caucasian				**HR 1.19 (1.16; 1.212)**
		BMI <18.5				HR 1.15 (1.035; 1.23)
Treatment utilization among those with high risk of undernutrition and malnutrition MNA <26						
Visvanathan, 2003[141]	Domiciliary care services for elderly people with moderate or severe functional limitations	>67, 250 elderly		Needing any form of admission	Adjusted for Age and Living Status	**RR 1.51 (1.07; 2.14)**
				Needing emergency admission		**RR 1.94 (1.24; 3.03)**
				Requiring >2 admissions		**RR 2.17 (1.05; 4.44)**
				Requiring >2 emergency admissions		**RR 2.96 (1.15; 7.59)**
				Spending >4 weeks in the hospital		**RR 3.22 (1.29; 8.07)**

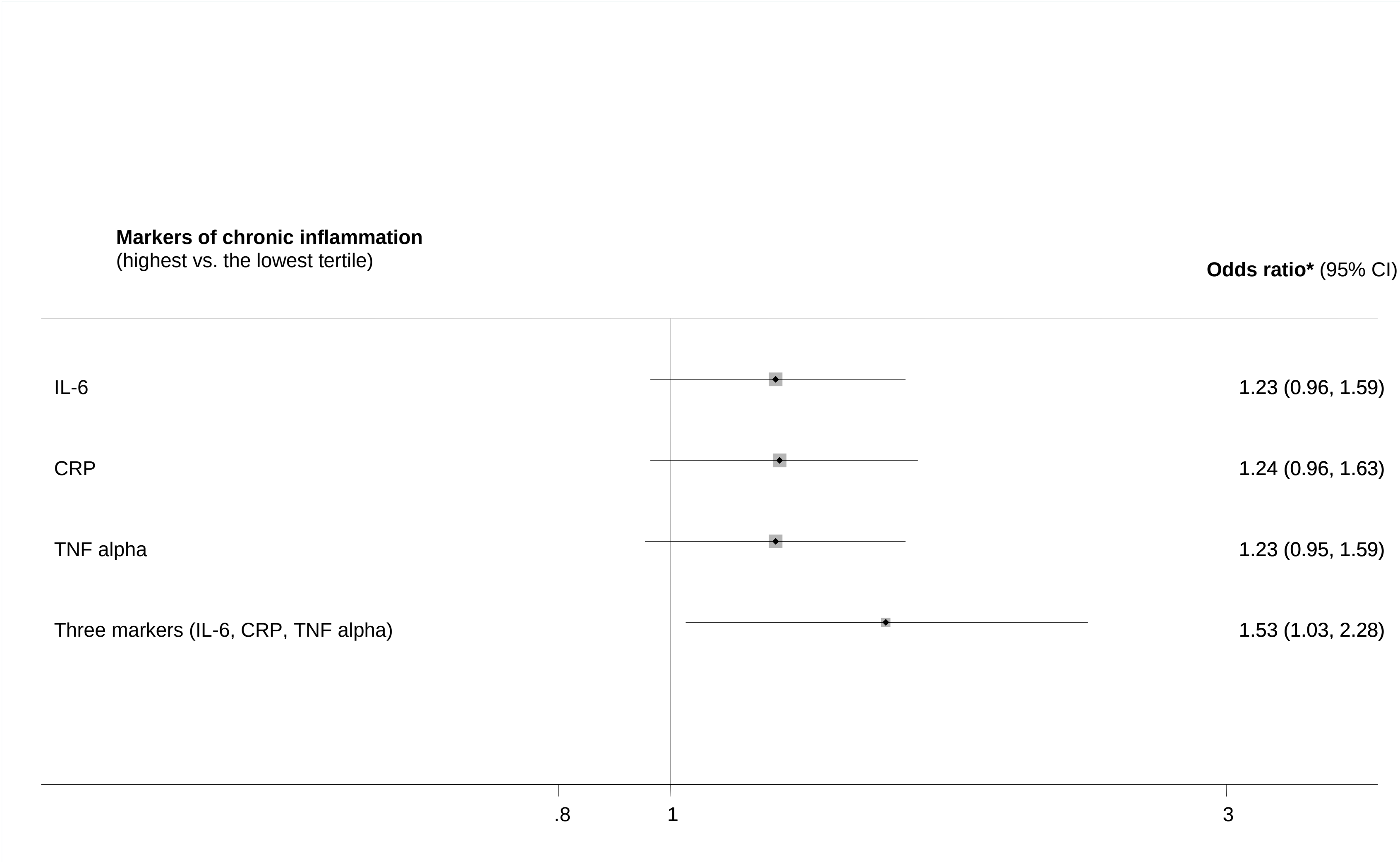
Bold=significant association at 95% confidence limit.

Appendix E Table 44. Association Between Sex-Specific Early and Late Mortality and Malnutrition and Inflammation Biomarkers in Older Persons: Pathologies Oculaires Liées à l'Age Cohort[168]

Reference	Study	Age, Sample, Adjustment	Gender	Mortality	Exposure Definition	Hazard Ratio (95% CI)
Albumin, g/L						
Carriere, 2008[168]	Pathologies Oculaires Lie´es a` l'Age Study	>60, 1,441 Adjusted for age, educational level, perceived health, and smoking	Males	Early Death (5 years after baseline)	<39.44 vs. 39.44–44.77	2.72 (1.44; 5.14)
			Females		<39.44 vs. 39.44–44.77	1.37 (0.7; 2.7)
			Males	Late Death (Between 5 and 9 years after baseline)	<39.44 vs. 39.44–44.77	1.13 (0.61; 2.11)
			Females		<39.44 vs. 39.44–44.77	0.84 (0.48; 1.48)
			Alpha 1-acid glycoprotein, g/L			
			Males	Early Death	highest quartile and Transthyretin, lowest quartile	**6.86 (3.2; 14.71)**
			Females			**4.64 (1.79; 12.05)**
			Males	Early Death	<0.64 vs. 0.64–0.89	1.03 (0.47; 2.28)
			Females		<0.64 vs. 0.64–0.89	1.99 (0.95; 4.16)
			Males	Late Death	<0.64 vs. 0.64–0.89	0.38 (0.16; 0.92)
			Females		<0.64 vs. 0.64–0.89	0.68 (0.36; 1.29)
			Males	Early Death	>0.90 vs. 0.64–0.90	**2.26 (1.19; 4.31)**
			Females	Early Death	>0.90 vs. 0.64–0.90	**2.61 (1.27; 5.35)**
			Males	Late Death	>0.90 vs. 0.64–0.90	1.44 (0.82; 2.53)
			Females	Late Death	>0.90 vs. 0.64–0.90	1.1 (0.6; 2.02)
			Transthyretin, g/L			
			Males	Early Death	<0.24 vs. 0.24–0.29	**2.23 (1.21; 4.13)**
			Females	Early Death	<0.24 vs. 0.24–0.29	**2.39 (1.24; 4.58)**
			Males	Late Death	<0.24 vs. 0.24–0.29	1.17 (0.64; 2.17)
			Females	Late Death	<0.24 vs. 0.24–0.29	1.36 (0.77; 2.38)
			Males	Early Death	>0.30 vs. 0.24–0.30	0.39 (0.13; 1.16)
			Females	Early Death	>0.30 vs. 0.24–0.30	0.97 (0.41; 2.33)
			Males	Late Death	>0.30 vs. 0.24–0.30	0.89 (0.47; 1.68)
			Females	Late Death	>0.30 vs. 0.24–0.30	1.04 (0.52; 2.1)
			Prognostic inflammatory and nutritional index			
			Males	Early Death	<0.052 vs. 0.052–0.265	0.66 (0.27; 1.58)
			Females	Early Death	<0.052 vs. 0.052–0.265	1.28 (0.61; 2.68)
			Males	Late Death	<0.052 vs. 0.052–0.265	0.53 (0.23; 1.23)
			Females	Late Death	<0.052 vs. 0.052–0.265	0.78 (0.39; 1.56)
			Males	Early Death	>0.266 vs. 0.052–0.266	**2.13 (1.15; 3.95)**
			Females	Early Death	>0.266 vs. 0.052–0.266	1.33 (0.66; 2.68)
			Males	Late Death	>0.266 vs. 0.052–0.266	**2.5 (1.44; 4.36)**
			Females	Late Death	>0.266 vs. 0.052–0.266	**1.25 (0.72; 2.18)**

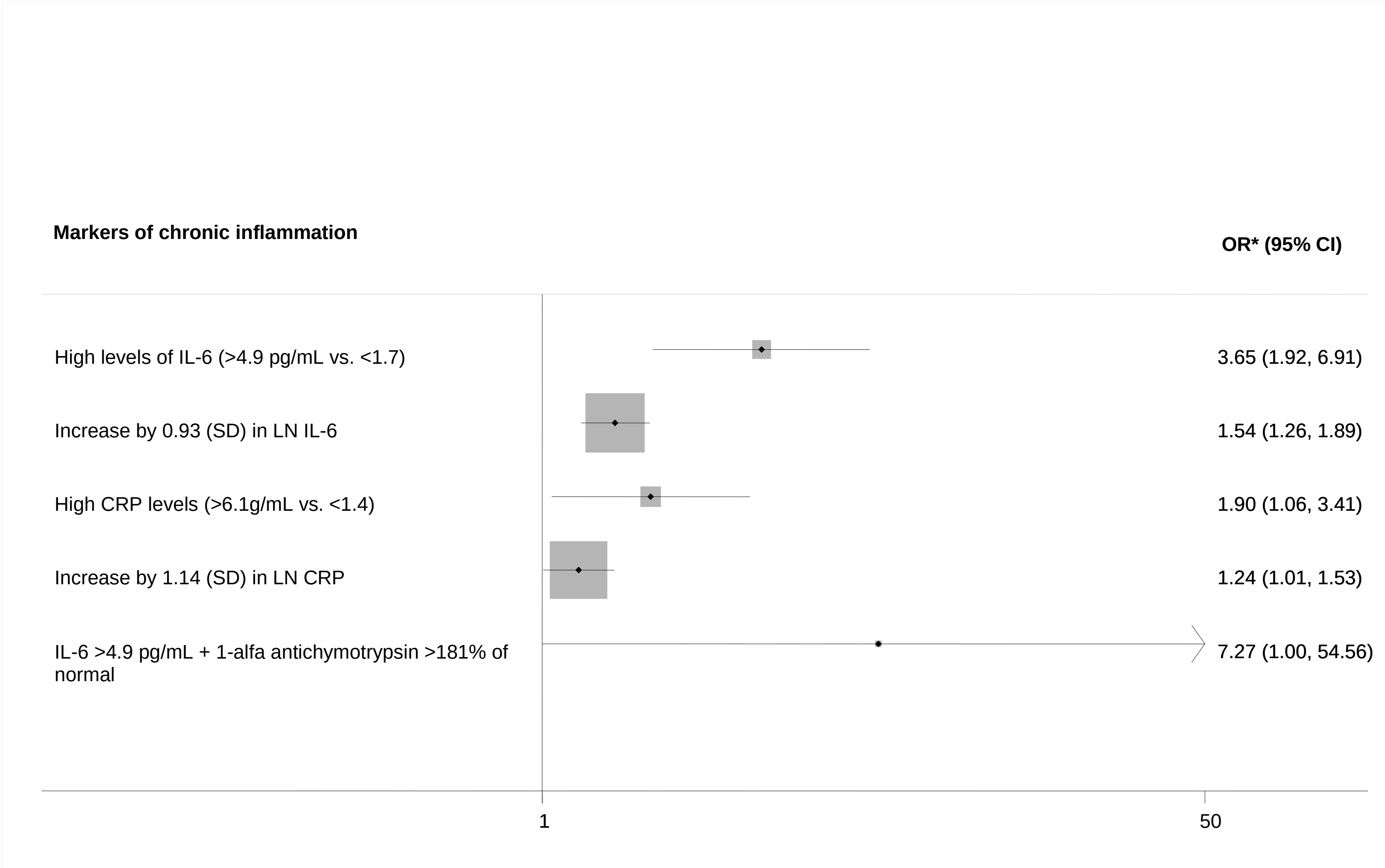
Bold=significant association at 95% confidence limit.

Appendix E Figure 7. Association Between Chronic Inflammation Biomarkers and Cognitive Decline in Older Persons: Health, Aging, and Body Composition Study[77]



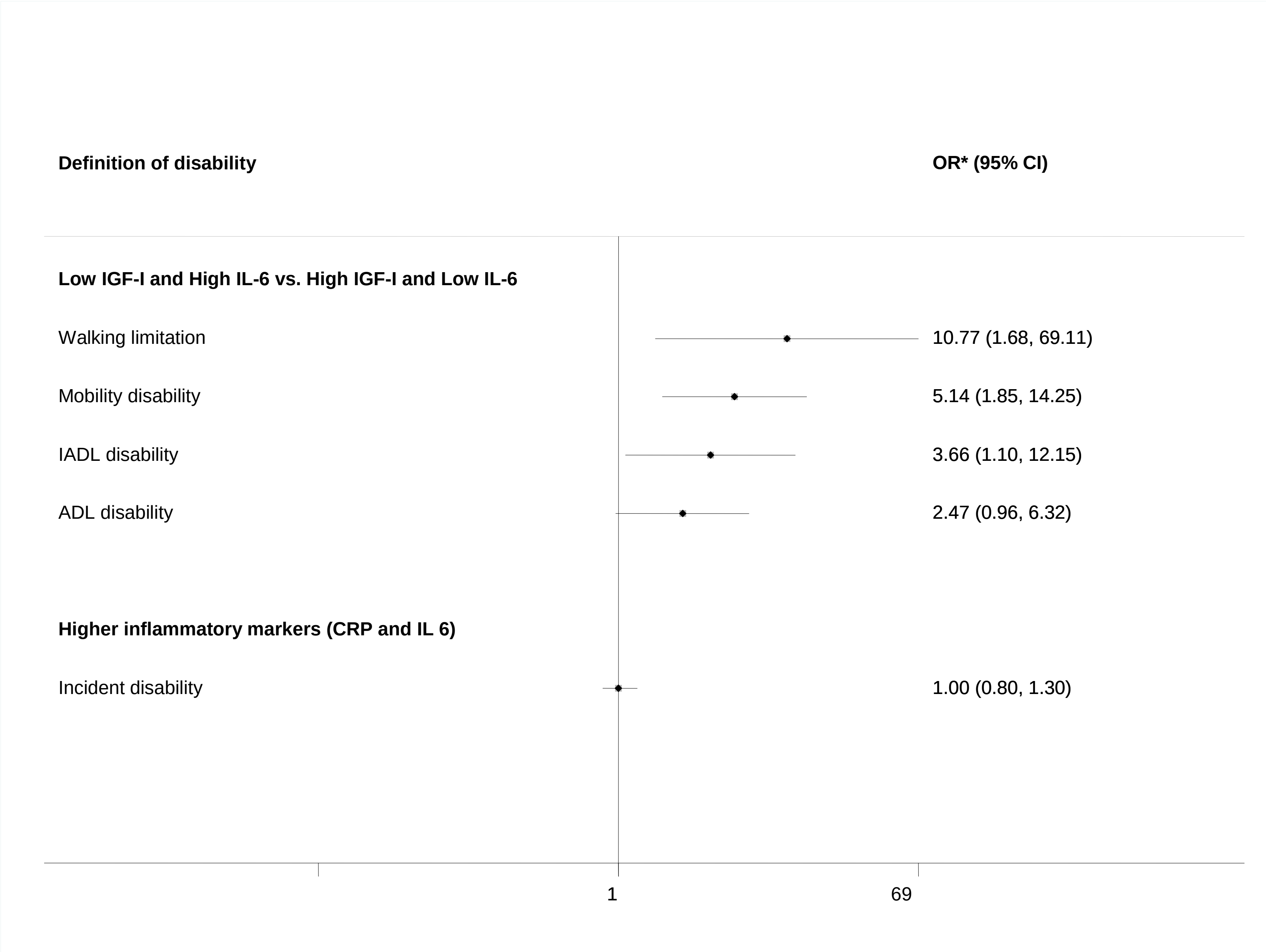
*After adjustment for age, education, race, sex, smoking, alcohol use, body mass index, self-reported health, CES-D score (depression), comorbidities (myocardial infarction, diabetes mellitus, hypertension, and stroke), use of NSAIDs, use of estrogen for women, and baseline cognitive test score.

Appendix E Figure 8. Association Between Chronic Inflammation and Sarcopenia (Muscle Strength Loss) in in Older Persons: Longitudinal Aging Study Amsterdam[195]



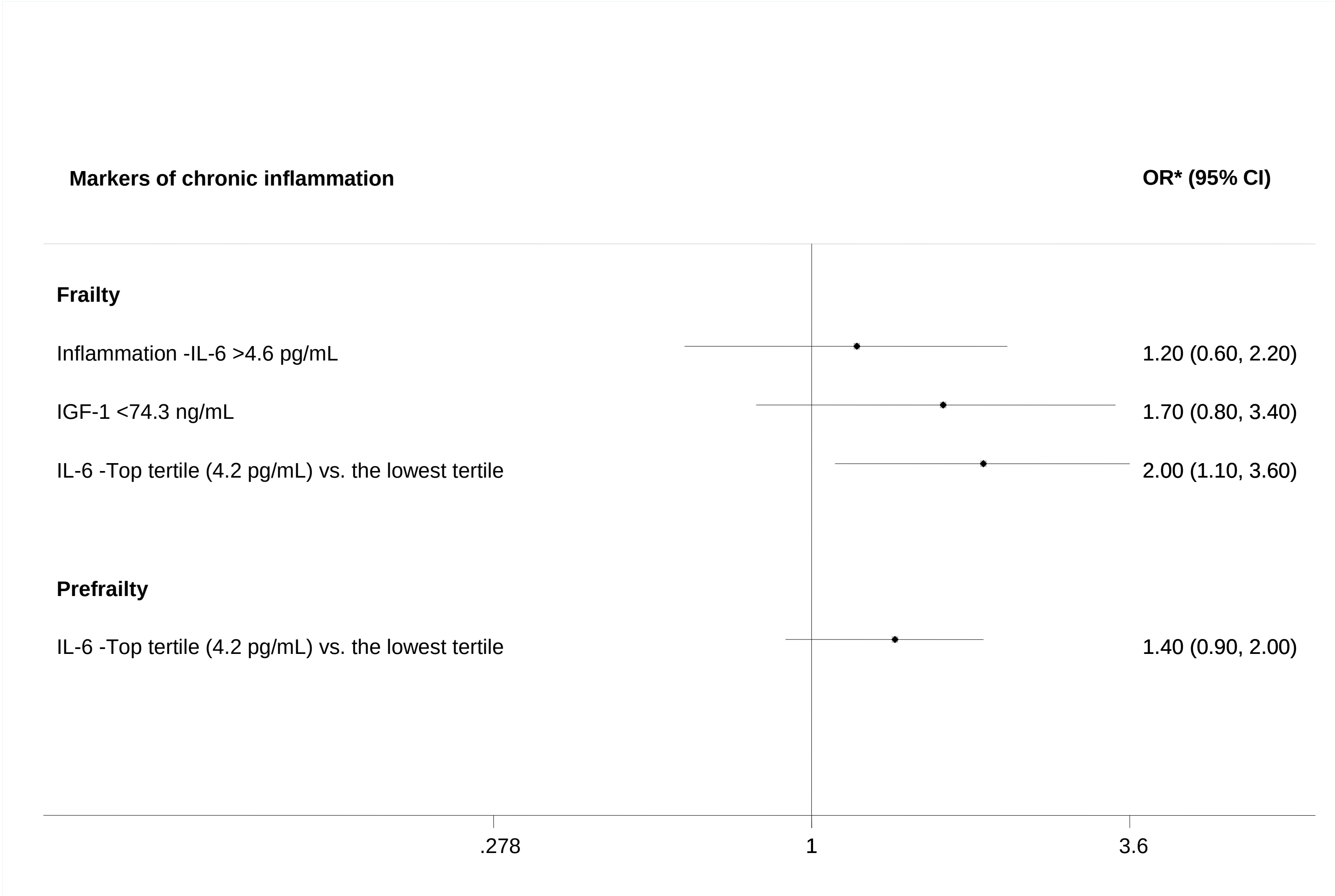
*After controlling for age, sex, education level, smoking status, number of chronic diseases, alcohol use, physical activity, anti-inflammatory drug use, body mass index (or total body fat when available), cognitive impairment, and depressive symptoms.

Appendix E Figure 9. Association Between Chronic Inflammation and Disability in Older Women: Women's Health and Aging Study I[101]



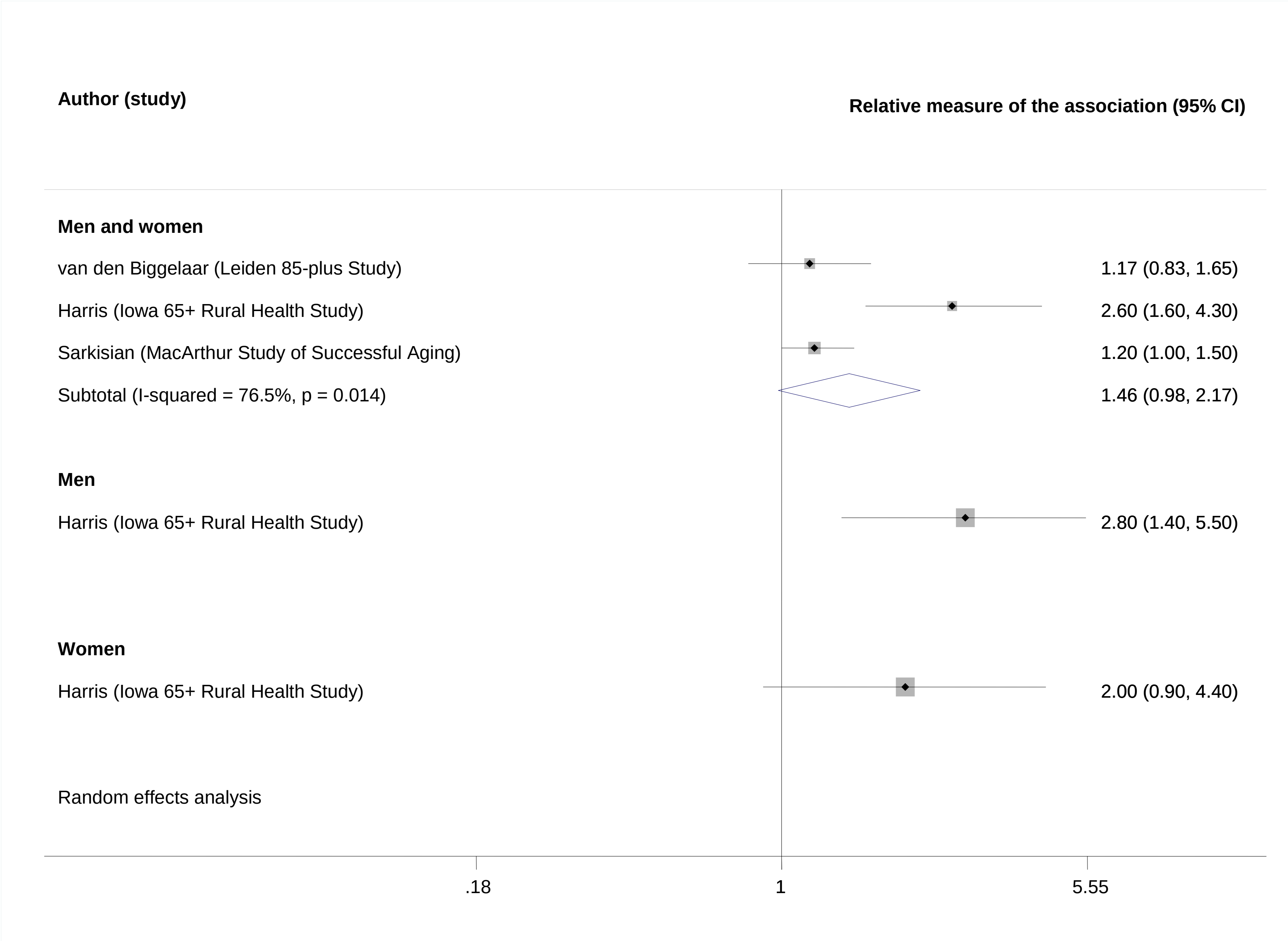
*After controlling for age, education, race, smoking status, BMI, estrogen use, corticosteroid use, and chronic conditions.

Appendix E Figure 10. Association Between Chronic Inflammation and Frailty in Older Women: Women's Health and Aging Studies I and II[98,109]

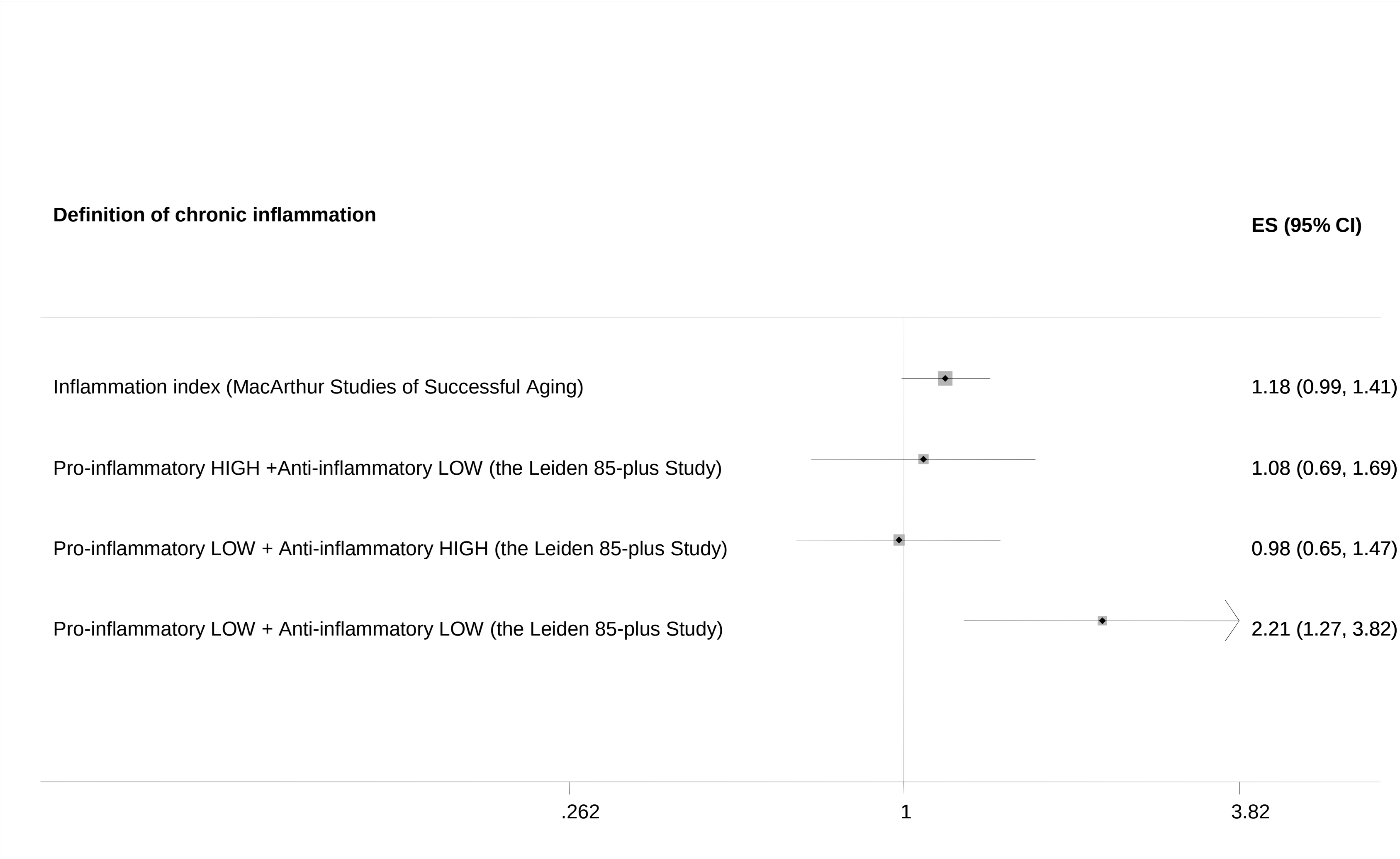


*After controlling for age, history of smoking, BMI >25 kg/m^2, number of chronic diseases, and markers for socioeconomic status.

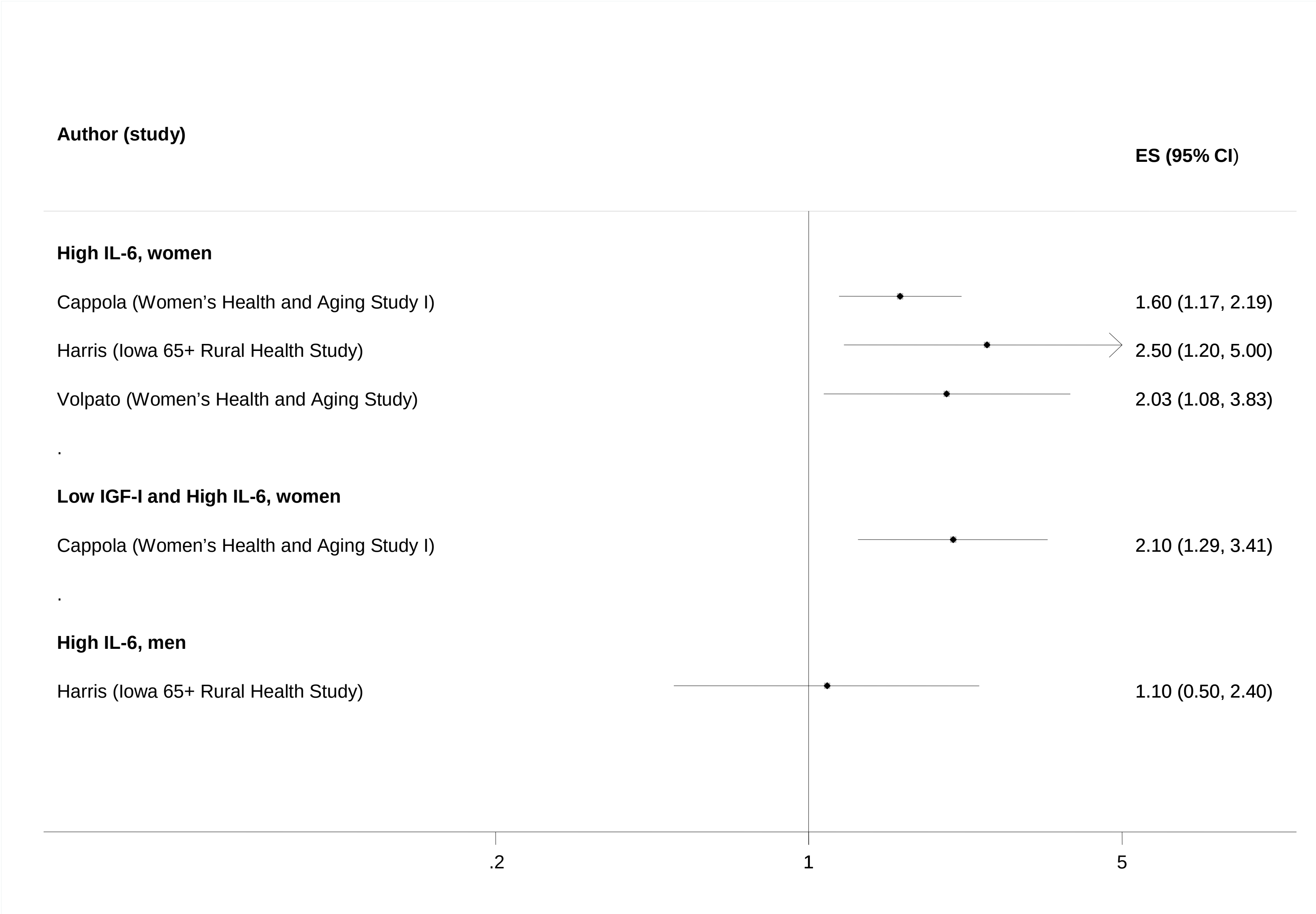
Appendix E Figure 11. Association Between Elevated Inflammatory Biomarkers (CRP and IL6) and Mortality in Older Persons[21,24,82,193]



Appendix E Figure 12. Association Between Inflammatory Indexes and Mortality in Older Persons[21,193]



Appendix E Figure 13. Association Between Elevated Interleukin-6 and Mortality in Older Persons[82,100,101]



Appendix E Table 45. Association Between C-Reactive Protein and Mortality in Older Persons

Reference	Study	Adjustment	Age	Definition of exposure	Estimate	Mean (95% CI)
Women						
Harris, 1999[82]	Iowa 65+ Rural Health Study	Adjusted for age, sex, prevalent cardiovascular disease, diabetes, BMI	>65	High C-reactive protein levels only (C-reactive protein >2.78 mg/L and interleukin-6<3.19 pg/mL)	Relative Risk	0.3 (0.1; 1.2)
Volpato, 2001[100]	Women's Health and Aging Study	Adjusted for age, smoking history, BMI, inflammatory markers and albumin	≥65	CRP, mg/L 2.1–7.4 vs. <2	Relative Risk	1.16 (0.64; 2.1)
				CRP, mg/L >7.5 vs. <2	Relative Risk	1.65 (0.93; 2.9)
Carriere, 2008[168]	Pathologies Oculaires Lie´es a` l'Age Study	Adjusted for age, educational level, perceived health, and smoking	>60	C-reactive protein, mg/L < 0.86 vs. 0.86–3.30	Hazard Ratio	1.45 (0.7; 3.04)
				C-reactive protein, mg/L >3.31 vs. 0.86–3.30	Hazard Ratio	1.32 (0.65; 2.69)
				C-reactive protein, mg/L 0.86 vs. 0.86–3.30	Hazard Ratio	0.82 (0.42; 1.59)
				C-reactive protein, mg/L 3.31 vs. 0.86–3.30	Hazard Ratio	1.05 (0.6; 1.85)
Men						
Harris, 1999[82]	Iowa 65+ Rural Health Study	Adjusted for age, sex, prevalent cardiovascular disease, diabetes, body mass index	>65	High C-reactive protein levels (C-reactive protein >2.78 mg/L)	Relative Risk	1.5 (0.7; 3.2)
Carriere, 2008[168]	Pathologies Oculaires Lie´es a` l'Age Study	Adjusted for age, educational level, perceived health, and smoking	>60	C-reactive protein, mg/L <0.86 vs. 0.86–3.30	Hazard Ratio	0.7 (0.31; 1.63)
				C-reactive protein, mg/L >3.31 vs. 0.86–3.30	Hazard Ratio	2.15 (1.14; 4.02)
				C-reactive protein, mg/L <0.86 vs. 0.86–3.30	Hazard Ratio	0.6 (0.27; 1.33)
				C-reactive protein, mg/L >3.31 vs. 0.86–3.30	Hazard Ratio	2.37 (1.36; 4.15)
All elderly						
Raynaud-Simon, 2002[167]	PAQUID research program	Adjusted for Transthyretin, CRP, Orosomucoid, and BMI	>65	CRP (mg/L) >15 vs. <15	Relative Risk	0.2 (0.1; 9.2)
Bruunsgaard, 2003[158]	Danish Centenarian Study	Crude	>100	C-reactive protein increase by SD in log scale	Hazard Ratio	1.26 (1.03; 1.53)
Cao, 2007[58]	Cardiovascular Health Study	Adjusted for age, sex, race, systolic and diastolic blood pressure, use of antihypertensive medications, BMI, smoking (never, former, current), and amount smoked (in pack-years), high-density lipoprotein and low-density lipoprotein cholesterol, diabetes (none, impaired	>95	CRP >3 mg/L	Hazard Ratio	1.38 (1.25; 1.53)

Appendix E Table 45. Association Between C-Reactive Protein and Mortality in Older Persons (continued)

Reference	Study	Adjustment	Age	Definition of exposure	Estimate	Mean (95% CI)
		fasting glucose, diabetes), plaque risk group, and carotid wall thickness				
Seeman, 2004[21]	MacArthur Studies of Successful Aging	Adjusted for age, gender, ethnicity	>70	High C-reactive protein	Odds Ratio	1.67 (1.1; 2.55)
Harris, 1999[82]	Iowa 65+ Rural Health Study	Adjustment for age, sex, BMI, and history of smoking, diabetes, and cardiovascular disease, as well as known indicators of inflammation including fibrinogen and albumin levels and white blood cell count	>65	C-reactive protein-the highest quartile ≥2.78 mg/L) vs. the lowest quartile	Relative Risk	1.6 (1; 2.6)
Alley, 2007[178]	Invecchiare in Chianti Study	Adjusted for inflammatory markers, age, sex, education, and health behaviors (alcohol intake, smoking in pack-years, low physical activity) at baseline, and covariates at follow-up: high waist circumference, high blood pressure, low high-density lipoprotein cholesterol, high low-density lipoprotein cholesterol, high triglycerides, hospital stay in previous year, liver disease, coronary heart disease, diabetes mellitus, depression, cancer	>65	baseline CRP >3.0 mg/L	Odds Ratio	1.98 (0.8; 4.86)
				Followup CRP >3.0 mg/L	Odds Ratio	2.06 (0.81; 5.23)
				CRP increase	Odds Ratio	3.1 (1.25; 7.68)
Pizzarelli, 2009[179]	Invecchiare in Chianti Study	Adjusted for age, gender, cholesterol, physical activity, stroke, congestive heart failure, and renal function	>65	CRP increase	Hazard Ratio	1.01 (1; 1.02)

Appendix E Table 46. Association Between Inflammatory Biomarkers and Mortality in Older Persons

Reference	Study	Adjustment	Age	Outcome	Exposure	Estimate	Mean (95% CI)
Seeman, 2004[21]	MacArthur Studies of Successful Aging	Adjusted for age, gender, ethnicity	>70	7.5-year mortality	High fibrinogen	Odds Ratio	1.28 (0.83; 1.99)
Wikby, 2005[192]	NONA Immune Study	Crude	>85	Mortality	CD4/CD8 ratio > vs. <1	Odds Ratio	
Cohen, 2003[9]	Duke Established Populations for Epidemiologic Studies of the Elderly	Adjusted for age; sex; race; current and past smoking; BMI; baseline cancer, stroke, diabetes, or myocardial infarction; and baseline functional status	>65	5-year Mortality	High D-dimer levels only	Relative Risk	**1.53 (1.18; 1.97)**
				5-year Mortality	Log D-dimer	Relative Risk	**1.74 (1.31; 2.31)**
Bruunsgaard, 2003[158]	Danish Centenarian Study	Adjusted for dementia, cardiovascular diseases, and an interaction between soluble TNF receptor-II and dementia	>100	Mortality	Soluble TNF receptor-II ng/mL per SD	Hazard Ratio	**1.36 (1.1; 1.67)**
					Soluble TNF receptor-II	Hazard Ratio	**1.41 (1.06; 1.88)**
					TNF-alpha pg/mL (per SD)	Hazard Ratio	**1.54 (1.04; 2.27)**
					TNF-alpha increase by SD in log scale	Hazard Ratio	**1.34 (1.12; 1.6)**
Cohen, 2003[9]	Duke Established Populations for Epidemiologic Studies of the Elderly	Adjusted for age; sex; race; current and past smoking; BMI; baseline cancer, stroke, diabetes, or myocardial infarction; and baseline functional status	>65	5-year Mortality	High interleukin-6 and D-dimer levels	Relative Risk	**2 (1.53; 2.62)**
Carriere, 2008[168]	Pathologies Oculaires Lie´es a` l'Age Study	Adjusted for age, educational level, perceived health, and smoking	>60	Early Death (5 years after baseline)	CRP, the highest quartile and albumin, the lowest quartile	Hazard Ratio	**4.98 (2.25; 11.01)**
Jenny, 2007[63]	Cardiovascular Health Study	Adjusted for age, cholesterol, BMI, systolic blood pressure, smoking, diabetes, race, and clinical and subclinical	≥65	Early death	Highest quartile of fibrinogen and CRP in men (4th quartile for CRP: ≥3.42μg/ml and for fibrinogen ≥362mg/dl) compared to those in lowest quartile	Hazard Ratio	**9.56 (4.34; 21.1)**
					Highest quartile of fibrinogen and CRP in men aged 65-73 years at baseline(4th quartile for CRP:		**4.82 (1.6; 14.5)**

Appendix E Table 46. Association Between Inflammatory Biomarkers and Mortality in Older Persons (continued)

Reference	Study	Adjustment	Age	Outcome	Exposure	Estimate	Mean (95% CI)
		cardiovascular disease			≥3.42µg/ml and for fibrinogen ≥362mg/dl) compared to those in lowest quartile		
					Highest quartile of fibrinogen and CRP in men aged ≥74 years at baseline (4th quartile for CRP: ≥3.42µg/ml and for fibrinogen ≥362mg/dl) compared to those in lowest quartile		**14.33 (4.42; 46.52)**
					Highest quartile of fibrinogen and CRP in women (4th quartile for CRP: ≥3.42µg/ml and for fibrinogen ≥362mg/dl) compared to those in lowest quartile		1.5 (0.73; 3.1)
					Highest quartile of fibrinogen and CRP in women aged ≤73 years at baseline (4th quartile for CRP: ≥3.42µg/ml and for fibrinogen ≥362mg/dl) compared to those in lowest quartile		1.31 (0.4; 4.34)
					Highest quartile of fibrinogen and CRP in women aged ≥74 years at baseline (4th quartile for CRP: ≥3.42µg/ml and for fibrinogen ≥362mg/dl) compared to those in lowest quartile		1.25 (0.52; 3.02)
					Fibrinogen in men: 1st Quartile (1st Quartile: ≤281mg/dl)		1
					Fibrinogen in men: 2nd Quartile (2nd Quartile: 282-311 mg/dl)		**2.05 (1.27; 3.3)**
					Fibrinogen in men: 3rd Quartile (3rd quartile: 312-361 mg/dl)		**2.76 (1.75; 4.35)**
					Fibrinogen in men: 4th Quartile (4th quartile:≥362mg/dl)		**4.11 (2.66; 6.35)**
					Fibrinogen in women: 1st Quartile (1st Quartile: ≤281mg/dl)		1
					Fibrinogen in women: 2nd Quartile (2nd Quartile: 282-311 mg/dl)		0.95 (0.56; 1.61)
					Fibrinogen in women: 3rd Quartile (3rd quartile: 312-361 mg/dl)		1.19 (0.73; 1.94)
					Fibrinogen in women: 4th Quartile (4th quartile:≥362mg/dl)		1.31 (0.79; 2.15)
				Late death	Fibrinogen in men: 1st Quartile (1st Quartile: ≤281mg/dl)		1
					Fibrinogen in men: 2nd Quartile (2nd Quartile: 282-311 mg/dl)		1.01 (0.78; 1.3)

Appendix E Table 46. Association Between Inflammatory Biomarkers and Mortality in Older Persons (continued)

Reference	Study	Adjustment	Age	Outcome	Exposure	Estimate	Mean (95% CI)
					Fibrinogen in men: 3rd Quartile (3rd quartile: 312-361 mg/dl)		1.02 (0.79; 1.31)
					Fibrinogen in men: 4th Quartile (4th quartile:≥362mg/dl)		1.39 (1.09; 1.77)
					Fibrinogen in women: 1st Quartile (1st Quartile: ≤281mg/dl)		1
					Fibrinogen in women: 2nd Quartile (2nd Quartile: 282-311 mg/dl)		1.07 (0.81; 1.41)
					Fibrinogen in women: 3rd Quartile (3rd quartile: 312-361 mg/dl)		0.86 (0.65; 1.15)
					Fibrinogen in women: 4th Quartile (4th quartile:≥362mg/dl)		1.14 (0.86; 1.51)
Jylha, 2007[164]	Vitality 90+ Study	Adjusted for sex, CVD, diabetes, cancer, infections, HDL Cholesterol, MMSE Score, smoking, status, exercise, and education.	≥90 years	4-year mortality	IL-1ra tertiles(pg/mL): <312	Hazard Ratio	1
				4-year mortality	IL-1ra tertiles (pg/mL): 312-454	Hazard Ratio	1.58 (0.95; 2.63)
				4-year mortality	IL-1ra tertiles (pg/mL): >454	Hazard Ratio	**2.12 (1.24; 3.62)**
				4-year mortality	IL-6 tertiles (pg/mL): <1.97	Hazard Ratio	1
				4-year mortality	IL-6 tertiles (pg/mL): 1.97-3.8	Hazard Ratio	1.13 (0.7; 1.18)
				4-year mortality	IL-6 tertiles (pg/mL): >3.8	Hazard Ratio	1.2 (0.74; 1.19)

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
Drame, 2008{Drame, 2008 #2310 1) for baseline descriptive analysis of all the patients in both derivation and validation cohorts; 2) enter into bivariable model to study the association between each predictor and mortality in the derivation cohort; 3) enter into multivariable model if they are significant (p<0.2) to identify components of the mortality risk index	Drame, 2008{Drame, 2008 #2310 Age	75-84; 85 and over	
	Gender	Female; Male	
	Living location	Private home; Institution	
	Education level	Primary; Secondary; University	
	Dependence on the ADL	No; Yes	Katz's index
	Delirium	No; Yes	DSM-IV criteria: Disturbance of consciousness (defined by Folstein's Mini-Mental State Examination score of 24 or less); change in cognition; development over a short period of time.
	Malnutrition risk	No ; Yes	Mini Nutritional Assessment short form score of less than 12.
	Pressure sore risk	No ; Yes	Norton's scale score of 14 or less
	Walking difficulties	No ; Yes	Timed Get-up and Go Test
	Mood disorders or depression risk	No ; Yes	Schwab and Gilleard's scale of score greater than 14
	Gait and balance difficulties	No ; Yes	One-Leg Standing Balance Test
	Comorbidity level	Low (0 or 1)	Charlson comorbidity index
		Medium (2 to 4)	
		High 5 or more)	
	Recent hospitalization (within 3 months)	No ; Yes	
	Day of admission	Weekday; Weekend	
Ensrud, 2008[50] 1) to compare characteristics of participants at the 4th examination by category of frailty according to the Study of Osteoporotic Fractures (SOF) index; 2) to identify components of the Study of Osteoporotic Fractures index	Age	By year	
	Health status	Excellent or good;	Self reported
		Fair	
		Poor or very poor	
	Smoking status	Current; former; never	
	Current estrogen use		
	Fracture since age 50		
	Falls in previous year		
	Intent to lose weight		
	Educational achievement		
	Selected medical conditions	None	Stroke; cancer(except skin cancer); dementia; hypertension; parkinsonism; Diabetes mellitus; coronary heart disease; chronic obstructive lung disease
		1-2	
		>=3	
	Physical activity	Weighted score of kilocalories	Modified version of Harvard Alumni Questionnaire
		Expended per week	
	Depressive symptoms		15-item Geriatric Depression Scale score 0-15
	Cognitive function		Modified Mini-Mental State Examination score 0-26

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
	Functional disability		Any of 5 instrumental activities of daily living
	Physical function	Grip strength	Handheld dynamometer
		Walking speed	Time in seconds to walk 6 m at usual pace
		One's ability to rise from a chair 5	
		Times without using her arms	
	Body weight		Recorded by a balanced beam scale
	Height		By a standard held-expiration technique with a wall-mounted stadiometer
	Bone mineral density of the femoral neck		By dual-energy x-ray absorptiometry
Ravaglia, 2008[362] Develop a frailty score including only self-reported information and easy-to-perform standardized measurements recommended in routine geriatric practice	Age	<80	
		≥80	
	Gender	Women	
		Men	
	Education	>3 years	
		≤3 years	
	Living alone	No	
		Yes	
	Current or former smoking	No	
		Yes	
	Physical inactivity	No	Defined as lack of adherence to the current exercise recommendation for older People (<4 hour/week of moderate intensity activity)
		Yes	
	≥2 medical conditions	No	Hypertension; cardiovascular disease (history of myocardial infarct and congestive
		Yes	Heart failure); cerebrovascular disease (history of stroke or transient ischemic attack); Diabetes; chronic pulmonary disease; cancer and dementia
	Daily use of ≥3 drugs	No	
		Yes	
	Sensory deficits	No	Blindness or deafness
		Yes	
	Calf circumference	<31cm;	
		≥31cm	
	Body mass index	≥25	
		<25	
	Activity of daily living	No difficulty	Any difficulty with bathing, dressing, toileting, transferring, continence and feeding
		Any difficulty	

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
	Instrumental activity of daily living	No difficulty	Any difficulty with using telephone, taking medicine, travelling and managing money
		Any difficulty	
	Gait and balance	>24	Tinetti gait and balance test score ≤24
		≤24	
	Abnormal cognition	<24	Mini Mental State Examination score<24
		≥24	
	Depressive symptom	≥10	Geriatric depression scale score >=10
		<10	
	Pessimism about one's health	No;	Subjects were asked if they felt 'their health was worse than others'
		Yes	
Carey, 2008[129] Develop and validate a prognostic index for mortality in community-living, frail elderly people.	Age	<75;	
		75-79;	
		80-84;	
		≥85	
	Female		
	Ethnicity	White;	
		Black;	
		Hispanic;	
		Asian;	
		Other	
	Education	<12 years;	
		≥12 years	
	Married		
	Medical eligible		
	Received caregiving assistance at home	Formal	
		informal	
	Activities of daily living (ADL)	Independent	ADL includes: bathing; toileting; transferring; eating; dressing; walking across a room;
		Partially independent	Defined as independent if entire activity is performed without supervision all of the
		Fully dependent	Time; defined as partially independent if patients required assistance from another. Person only some of the time or with only part of the task; defined as fully dependent if they required assistance for the entire activity all of the time.
	Instrumental activity of daily living (IADL)	Independent;	IADL includes: meal preparation; shopping; housework; laundry; heavy chores; managing money; taking medications; using transportation.
		Dependent	Defined as dependence if requiring another person to complete

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
			every component of the task for the patient
	Impaired vision		
	Impaired hearing		
	Receptive or expressive		
	Communication impairment		
	Cognitive impairment	Moderate or severe	10-points short portable mental status questionnaire (SPMSQ) of 6 or more errors is defined as moderate or severe cognitive impairment
		Other	
	Hospital admission		Admission defined as within 6 months before enrollment
	Comorbidity		Comorbidity includes: anemia; recurrent pneumonia; renal insufficiency or failure; pressure ulcer; malignant neoplasm; diabetes mellitus; dementia; depression; cerebrovascular disease; coronary artery disease; congestive heart failure; chronic obstructive pulmonary disease; bowel or bladder incontinence; defined as comorbidities if they were active medical problems; if they were problems that were currently controlled using diet or medications; if they affected the management of the participant's care
Pilotto, 2008[363] 1) to develop a multidimensional prognostic index (MPI); 2) to validate the MPI by comparing derivation cohort and validation cohort	Functional status	0-2;3-4;5-6	Activities of daily living (ADL) index
		0-3;4-5;6-8	Instrumental activities of daily living (IADL) scale
	Cognitive status	0-3;4-7;8-10	Short Portable Mental Status Questionnaire (SPMSQ)
	Comorbidity	0;1-2;>3	Comorbidity index (CIRS-CI) derived from Cumulative Illness Rating Scale (CIRS)
	Nutritional status	<17;17-23.5;>=24	Mini Nutritional Assessment (MNA)
	Pressure development	5-9;10-15;16-20	5-item Exton Smith Scale (ESS)
	Medication use	0-3;4-6;>7	Number of medications
	Social aspects	Living with family	Social support network includes household composition, home services
		Institutionalized	
		Living alone	
Walter, 2001[125] 1) for baseline descriptive analysis of all the patients in both derivation and validation cohorts; 2) enter into bivariable model to study the association between each predictor and mortality in	Age	70-74;75-79;80-84; 85-89;>=90	5-year interval
	Sex	Women; Men	
	Race	White; Black	
	Marital status	Married; not married	
	Activities of daily living(ADL) dependency at discharge	Independent in all ADLs;	
		Dependent in 1-4 ADLs;	
		Dependent in all ADLs	
	Comorbid conditions	Absent;	Conditions include: history of myocardial infarction; congestive

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
the derivation cohort; 3) enter into multivariable model if they are significant (p<0.2) to identify components of the prognostic index.		Present	heart failure; cerebrovascular disease; dementia; chronic obstructive pulmonary disease; diabetes mellitus
	Cancer	Absent	
		Solitary	
		Metastatic solid	
	Length of hospital stay	1-7 days; >7days	
	Discharge destination	Other	
		Nursing home or skilled nursing facility	
	Creatinine level on admission	<1.5;1.5-3;>3	
	Albumin level on admission	≥4; 3.5-3.9; 3-3.4;<3	
Lee, 2006[71] 1) for baseline descriptive analysis of all the patients in both development and validation cohorts; 2) enter into bivariable model to study the association between each predictor and mortality in the derivation cohort; 3) enter into multivariable model to identify components of the prognostic index.	Age	50-59;60-64; 65-69; 70-74; 75-79; 80-84; >=85	5-year interval
	Sex	Women; Men	
	Comorbidities and behaviors	Absent; present	Includes: diabetes mellitus; cancer; lung disease; heart failure; coronary artery
		Independent in all ADLs;	disease; dementia
	Body mass index	≥25; ≤24.9	
	Tobacco	Never and former; other	
	Activities of daily living(ADL)-bathing	No difficulty; difficulty or need help	
	Instrumental ADL	No difficulty	Instrumental ADL includes: preparing meals; using the telephone; managing finances
		Difficulty, can't, or don't	
	Other functional status measures	No difficulty	Measures include: walking several blocks; pushing heavy objects; climbing stairs
		Difficulty, can't, or don't	
	Vigorous physical activity	Yes; no	
Song, 2004[364] 1) derive the relationships between the variables and mortality; 2) to compare with a frailty index classification to evaluate the the predictive validity of the artificial neural networks classification	Dichotomized variables	Absent; present	Include: Living alone; coughing; feeling tired; sneezing; high blood pressure; heart/circulation problems; stroke; arthritis; Parkinson's disease; eye trouble; ear trouble; dental, chest, stomach or kidney problems; bladder or bowel incontinence; diabetes mellitus;
	3-level variables	Low risk; intermediate risk; high risk	Includes: need for assistance with eating, dressing, grooming, walking, transferring, bathing/showering, toileting, telephoning, getting to places out of walking distance, preparing meals, doing housework, taking medicine, handling money, having troubles that prevent normal activities.
	5-level variables	Lowest risk; low risk; intermediate risk; high risk; highest risk	Eyesight, hearing, self-rating of health
	age	Not reported	

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
	sex	Not reported	
Fried, 1998[54] 1) for the descriptive analysis of the entire study population at Baseline; 2) determine the disease, functional and personal characteristics that jointly predict mortality in community-dwelling men and women aged 65 years or older.	Age	65-69; 70-74;75-79;80-84; ≥85	By year
	Sex	Female; Male	
	Education	<high school	
		High school or college; postgraduate	
	Annual income	<50,000	By dollar
		≥50,000	
	Widowhood	No; yes	
	Men weight	≤63.9	By kg (lb)
		>63.9-70.2	
		>70.2-77.4	
		>77.4-85.5	
		>85.5	
	Women weight	≤51.8;	By kg (lb)
		>51.8-59;	
		>59-65.2;	
		>65.2-75.6;	
		>75.6	
	Physical activity	≤282;	kJ(kcal)/wk in moderate or vigorous exercise
		>282-1789;	
		>1789-4100;	
		>4100-7908;	
		>7908	
	Pack-years smoking	Never; 1-25;26-50;>50	
	Alcohol assumption	None; <=1;>1-3;>3	Drinks/day
	Brachial systolic blood pressure	≤128; >128-140;>140-152	mm Hg; measured by Hawksley random-zero sphygmomanometer
		>152-168;>169	
	Posterior tibial artery blood pressure	≤127;>127-146;>146-158	mm Hg; measured by Hawksley random-zero sphygmomanometer
		>158-168;>168	
	Diuretic use	No; yes	
	Low density lipoprotein cholesterol	<2.48(96);	mmol/L (mg/dL)
		>2.48-3.02(96-117)	
		>3.02-3.46(117-134)	
		>3.46-3.96(134-153)	
		>3.96(153)	
	Fasting blood glucose	≤5.2(94);	mmol/L (mg/Dl)
		>5.2-5.6(94-100);	
		>5.6-6(100-108);	

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
		>6-7.2(108-130);	
		>7.2(130)	
	Albumin	≤37;	g/L
		>37-39;	
		>39-40;	
		>40-42;	
		>42	
	Creatinine	≤80(0.9);	μmol/L(mg/dL)
		>80-97(0.9-1.1);	
		>97-106(1.1-1.2);	
		>106-133(1.2-1.5);	
		>133(1.5)	
	Fibrinogen	≤2.9;	g/L
		>2.9-3.1;	
		>3.1-3.5;	
		3.5-4;	
		>4	
	Congestive heart failure	No; yes	
	Coronary heart disease	No; yes	
	Forced vital capacity	<=2.06	mL (spirometry)
		>2.06-2.54;	
		>2.54-3;	
		>3-3.6;	
		>3.6	
	Ejection fraction abnormal	No; yes	echocardiogram
	Aortic stenosis	None; mild ; moderate; severe	echocardiogram
	Major ECG abnormality	No; yes	
	Maximum stenosis of the internal carotid artery	0;1-24;25-49;50-74;75-99;100	%; by carotid ultrasound
	Difficulty with instrumental activities of daily living	≤1; 2;≥3	Number; by self-reported
	Depressive symptoms	≤18; >18-26;>26-33;>33-40;>40	Digit symbol substitution subset of the Wechsler Adult Intelligence Scale-Revised
	Self-assessed health	Excellent ;very good; good; fair; poor	
Inouye, 2003[122] 1) identify key variables from sociodemographic, diagnosis, Laboratory, and functional axes	Age ≥85	Present; absent	
	Male gender	Present; absent	
	Nonwhite race	Present; absent	
	Unmarried	Present; absent:	

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
that predict 1-year mortality in an older hospitalized cohort; 2) develop a predictive model for mortality based on selected variables and to validate its performance in an independent sample; 3) evaluate the effects of adding data from different sources of Information on index performance in the two cohorts.	Medicaid status	Present; absent	
	Nursing home resident	Present; absent	
	Emergent admission	Present; absent	
	High risk diagnosis group A;	Present; absent	Diagnoses include: lymphoma/leukemia(6 pts);acute renal failure (5 pts);metastatic cancer (3 pts); localized cancer (3 pts); stroke (2 pts); congestive heart failure(2 pts);chronic lung disease (2 pts);chronic renal failure (2 pts); diabetes with end-organ damage (1 pts); pneumonia(1 pts). A (score of 0);B(1-2); C(3-5); D(≥6)
	B		
	C		
	D		
	Albumin<=3.5	Present; absent	mg/dL
	Creatinine>15l	Present; absent	mg/dL
	Hematocrit ,30	Present; absent:	ml/dL
	Dementia	Present; absent	Defined as any evidence from the medical record of dementia, Alzheimer disease, Organic brain syndrome or chronic cognitive impairment before admission.
	Walking impairment	Present; absent	Defined as chart documentation of needing help of another person for walking or Being unable to walk.
	Depression	Present; absent	Defined as any evidence of depression before admission, such as a diagnosis of depression, suicide attempts or antidepressant therapy.
	Urinary incontinence	Present; absent	Defined as any evidence that the patient was incontinent or used a urinary catheter before admission.
Melzer, 2003*[14] To show the distribution of study sample by socio-demographic, mortality and test measures.	Age	70-74;75-79; 80-84; 85 and over	
	Sex	Female; Male	
	Site	East Boston; New Heaven	
	Cumulative death	1 year;2 year;3 year; 4year	
	Self-reported walking 1/2 mile	Able; unable	
	Gait speed	<0.57;0.57-0.71;0.72-0.81;	m/second
		0.82-0.94;>0.94;unable to do	
	Time to do five chair stands	<10.4;10.4-12;12.1-13.6;	
		13.7-16.3;>16.3; unable to do	second
	Peak flow	<3902;3902-5021;5022-6068;	ml/second
		6069-7472;>7472	
Ensrud, 2009[51] to identify components of the Study of Osteoporotic Fractures index	Physical activity		Physical activity scale for the elderly
	Depressive symptoms		15-item Geriatric Depression Scale score 0-15
	Cognitive function		Teng Modified Mini-Mental State Examination score 0-26
	Functional disability		Any of 5 instrumental activities of daily living
	Physical function	Grip strength	Handheld Jamar dynamometer
		Walking speed	Time in seconds to walk 6 m at usual pace
		One's ability to rise from a chair 5	

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
		Times without using her arms	
	Body Mass Index		Weight and height
	Bone mineral density of the hip		By dual-energy x-ray absorptiometry
Albertsson, 2007[365] 1 to describe characteristics of participants by risk factors 2 to identify components of Fracture and Mortality (FRAMO) index	Age	By year	(continuous risk factors)
	Weight		By kg
	Height		cm
	Dairy calcium intake		Mg/d
	age	70-74; 75-79; 80-84; 85-89; 90-100	(predefined risk factors)
	Weight	<60kg; >=60kg	
	Fragility fracture after age 40	Yes; no	
	Fells during last 12 months	Yes; no	
	Uses arms when rising 5 times from chair	Yes; no	
	Any type of fracture after age 40		(other possible risk factors)
	Use of cortisone medication for >3 month		
	Has never given birth		
	Lives in residential care	(vs. community)	
	Height>167cm		
	Dairy calcium intake<500 mg/d		
	Impaired vision, self-reported	(vs. good vision)	
	History of maternal hip fracture		
	Subjective health poor	(vs. excellent or fair)	
	Current smoking		
	Daily coffee intake >=2 cups	(vs. 0-1 cup)	
	Menopausal age <45 years		
	No daily medication		
	Any parent of non-Nordic origin	(vs. Nordic)	
Schonberg, 2009[366] 1) to describe the demographic and health status characteristics of the development cohort; 2) to identify components of the index to predict 5-year mortality Among community-dwelling older adults	Age	65-69;70-74; 75-79; 80-84; 85+	
	Men		
	Smoking status	Current; former; never (<100 Cigarettes in lifetime)	
	Body mass index >25 kg/(m*m)		
	Physical inactivity	Less than 10 minutes per week of activity that causes slight to moderate increase in breathing or heart rate	
	Perceived health	Excellent/very good; good; fair/poor	

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
	Dependent in at least 1 activity of daily living (ADL)		ADL includes: bathing; dressing; eating; getting in or out of bed or chairs; using the toilet
	Dependent in at least 1 instrumental activity of daily living (IADL)		IADL includes: handling household chores; doing necessary business; shopping or Getting around for other purposes
	Reported functional difficulty		Difficulty includes: walking 1/4 mile or 3 blocks; walking up ten steps; standing or sitting for 2Hours; stooping; reaching above the head; grasping small objects; lifting/carrying 10 Pounds; pushing/pulling large objects; going out to do things like shopping
	Emotional health	So sad that nothing could cheer you up; nervous; restless; hopeless that everything was a worthless effort	Measured by "during the past 30 days, how much of the time did you feel about each question?"
	Comorbid conditions		Comorbid conditions include: hypertension; coronary heart disease; angina; heart attack; any other heart condition or heart disease; stroke; chronic obstructive pulmonary disease; asthma; stomach, duodenal or peptic ulcer; cancer (excluding nonmelanomatous skin cancer); diabetes (including borderline diabetes); weak or failing kidneys; liver condition; joint pain or stiffness in the past 30 days
	Overnight hospitalization in the past year	None; one; two or more	
	Emergency room visits	None; one; two or more	
	Clinic visits	0-1; 2-5; 6+	
Garcia-Gonzalez, 2009[367] 1) to develop a frailty index to predict the mortality risk in Mexican adults	Health problems before age 10	Yes; No	Health problems include: tuberculosis; rheumatic fever; poliomyelitis; typhoid fever;
	Poor self-assessed health	Poor; fair; good; very good, excellent	
	Medically diagnosed conditions	Yes; No Legally blind; poor; fair; good; very good; excellent Legally deaf; poor; fair; good; very good; excellent	Conditions include: high blood pressure; diabetes mellitus; cancer; chronic obstructive pulmonary disease; heart attack; stroke; arthritis/rheumatism; falls in the past two years; fractures after age-50; vision problems; hearing problems
	Medical symptoms during past 2 years	Yes; No Frequent and severe; frequent and moderate; frequent and mild; not frequent	Symptoms include: sever fatigue; panting, cough or phlegm; involuntary urine loss; leg pain on walking; stomach pain, indigestion or diarrhea; bodily pain;
		Yes; No	For depressive symptoms: indicate present if the participant felt depressed; unhappy; lonely; tire; sad; didn't enjoy life; had no energy; restless sleep or thought that everything did was an effort
	Difficulty with activities of daily living	Yes; No	Having difficulty with mobility includes having difficulty picking up a 1-peso coin from the table; dressing including putting on shoes

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
			and socks; walking several blocks; walking across a room
		Yes; No	Activities of daily living include: taking a shower; eating; getting in and out of bed; going to the toilet
	Difficulty with instrumental activities of daily living	Yes; No	Instrumental activities of daily living includes: meal preparation; shopping; taking medication; handling own finances
Carey, 2004[368] Develop and validate a functional morbidity index to predict mortality in community-living elders	Age	<75;	By year
		76-80;	
		81-85;	
		>85	
	Gender	Female; male	
	Activities of daily living (ADL)	Independent; dependent	ADL includes: bathing; toileting; transferring; eating; dressing; walking;
	Instrumental activity of daily living (IADL)	Independent; dependent	IADL includes: preparing meals; shopping; using the telephone; managing medications; managing finances.
	Physical functioning measures	No difficulty; difficulty	Measures include: walking several blocks; climbing stairs; push/pull heavy object; lifting 10-lb object; picking up a dime
Levine, 2007[369]	Age	70-74;75-79;80-84; 85-89;≥90	5-year interval
	Sex	Women; Men	
	Discharge to nursing home or skilled nursing facility	Yes; No	
	Length of stay ≥5 days	Yes; no	
	Comorbid conditions	Absent; present	Conditions include: myocardial infarction; congestive heart failure; peripheral vascular - disease; cerebrovascular disease; dementia; chronic obstructive pulmonary disease; rheumatologic disease; peptic ulcer disease; diabetes; renal disease; liver disease; hematologic and solid malignancy; metastatic cancer; acquired immune deficiency syndrome
Pijpers, 2009[370] 1) for baseline descriptive analysis of all the patients 2) enter into bivariable model to study the association between each predictor and mortality in the cohort 3) enter into multivariable model if they are significant to identify components of the mortality risk index.	Age		By per 10 years
	Male sex	Male; female	
	Living alone	Yes; No	
	Medical conditions	Present; absent	Conditions include: cardiovascular disease; chronic obstructive pulmonary disease; Cancer; diabetes; autoimmune disease; renal function estimated by glomerular filtration rate; number of medications; Charlson score is also calculated; visual problems; hearing problems; incontinence
	Body mass index	<18.5; ≥18.5	Kg/(m*m)
	Weight loss		
	Albumin	<34; ≥34	g/l
	Mobility	<20; ≥20	Measured by Elderly Mobility Scale (EMS)

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
	Disability in activities of daily living (ADL)	Motor deficit in ADL; process deficit In ADL	Measured by the Assessment of Motor and Process Skills (AMPS)
	Cognitive function	<24; ≥24	Measured by the Mini Mental State Examination (MMSE)
Mazzaglia, 2007[187] 1 for baseline descriptive analysis of all the patients 2 enter into multivariable model if they are significant to identify components of the mortality risk index.	Age	65-74; 75-84; ≥85	
	Female	Male; female	
	Living alone	Yes; No	
	Hospitalization in the previous 6 months	Yes; No	
	Taking ≥5 prescriptions	Yes; No	
	Positive responses to the screening instrument	0-1; 2-3; 4-6	Screening questions include: need help performing basic activities of daily living - eating; toileting; bathing; dressing; transferring and walking across the room); need help performing instrumental activities of daily living (grocery shopping; preparing meals; washing clothes; managing medications; showering); poor vision(Inability to read newspapers heading); poor hearing (inability to hold a conversation); absence of home care services (personal assistance; rehabilitation; nursing services); self-perceived inadequacy of income; weight loss of >3kg in previous year.
Jones, 2004[144] 1) simplify the clinical assessment of frailty while maintaining the precision of the original frailty index by constructing it from a standardized comprehensive geriatric assessment	1) Impairment index includes cognition		
		No cognitive impairment;	
		Cognitive impairment, no dementia	
		dementia	
	Emotion	<5; 5-10;>10	Measured by geriatric depression scale
	Communication	No deficits in speech, hearing, vision	
		1 deficit in either speech, hearing, or	
		Vision; ≥2 deficits in either speech,	
		Hearing or vision	
	Mobility	>19 or without help; 10-19 or with	Measured by Timed up and go
		Help; <10 or unable	
	Balance	>33 or no falls;21-33 or less than yearly falls ;<21 or more than yearly falls	Measured by Functional Reach
	Bladder	Continent; bladder deficits; Incontinent or catheterized	
	Bowel	Continent; bowel deficits; incontinent	
	Nutrition	Stable weight; 5% weight change	
		>5% weight change	
	Activities of daily living	Independent; complex or low level Intermediate dependence; simple or high level intermediate dependence	

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
	Social	Institutionalized; uses formal home Supports; living alone	
	2) Comorbidity index	0;1;2;3;4	Measured by the cumulative illness Rating scale (CIRS); 14 possible co-existing diseased body system were coded as 0,1, or 2 and the range of the index was standardized into 0-4
Fried, 2001[55] 1 develop and operationalize a phenotype of frailty in older adults And assess concurrent and predictive validity	Weight loss	Yes; No	Frail for weight loss if answer is "yes" to "in the last year, have you lost more than 10 Pounds unintentionally (not due to dieting or exercise)?
	Exhaustion	0;1;2;3	Measured by the Center for Epidemiologic Studies Depression Scale (CES-D), the two statements were read: a) I felt that everything I did was an effort; b) I could not get going. The question is asked "How often in the last week did you feel this way?" 0=rarely or none of the time (<1 day);1=some or a little of the time (1-2 days); 2=a moderate amount of the time (3-4days); or 3=most of the time. Subjects answering 2 or 3 are categorized as frail by exhaustion.
	Low physical activity	For men: <383 Kcal/week; ≥383Kcal/week For women: <270 Kcal/week; ≥270 Kcal/week	Based upon the short version of the Minnesota Leisure Time Activity questionnaire, asking about walking, chores (moderately strenuous), mowing the lawn, raking, gardening, hiking, biking, exercise cycling, dancing aerobics, bowling, golf, singles, tennis, doubles tennis, racquetball, calisthenics, swimming.
	Walk time(slowness)	For men: ≥7 seconds for height ≤173cm ≥6 seconds for height >173cm For women: ≥7 seconds for height ≤159cm ≥6 seconds for height >159cm	Time to walk 15 feet is stratified by gender and height; frail for the slowest 20%
	Grip strength (weakness)	For men: ≥29 kg for BMI ≤24; ≥30 kg for BMI 24.1-26 ≥30 kg for BMI 26.1-28 ≥32 kg for BMI >28; For women: ≥17 kg for BMI ≤23; ≥17.3 kg for BMI 23.1-26 ≥18 kg for BMI26.1-29 ≥21 kg for BMI >29	Stratified by gender and body mass index (BMI); frail for the lowest 20%.
Markides, 2001[371] Examine the impact of performance-based and self-	Age	65-74; 75+	By years
	Gender	Men; women	
	Performance Score	0 (unable);1;2;3;4	1) three separate tasks were assessed and a combined score was

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
reported lower body measures on 2-year mortality in Mexican American elderly persons.			created to represent lower body function. The tasks include: a timed 8-ft walk; timed repeated chair stands and stand balancing. The two timed tasks were divided into quartiles each and scored 1 (slowest) to 4 (fasted). Subjects unable to complete each task were assigned a value of 0. The standing balance tests included tandem, semi-tandem and side-by- side stands. Subjects were scored 1 to 3, with 3 indicating the highest performance; those unable to perform any of the balance tests were assigned a value of 0. 2) the three scores were combined to form a total lower body function score ranging from 0 to 11. The scale was further categorized from 0 to 4 to approximate the timed walk categorization.
	Short walk	0 (unable);1;2;3;4	This task was divided into quartiles each and Scored 1 (slowest) to 4 (fasted). Subjects unable to complete each task were assigned a value of 0.
	Any activities of daily living	Yes; No	
	Medical conditions	Present; not present	Medical conditions include: hypertension; heart attack; cancer; diabetes; hip fracture; Stroke.
Gill, 2006[372] Determine the transition rates between frailty states and evaluate the effect of the preceding frailty state on subsequent frailty transitions.	Weight loss		Frail for weight loss if answer is “yes” to “in the past year, have you lost more than 10 pounds?
	Exhaustion		Measured by the Center for Epidemiologic Studies Depression Scale (CES-D), the two statements were read: a I felt that everything I did was an effort; b I could not get going. The question is asked ”How often in the last week did you feel this way?” Subjects answering “much or most of the time” were defined as frail
	Low Physical activity	For men <64; ≥64 For women <52; ≥52	Measured by the Physical Activity Scale for the Elderly;
	Grip strength (muscle weakness)		When grip strength measured as the average of 3 readings by a handheld dynamometer;
	Slow walking speed	>10 seconds; ≤10 seconds	Defined as frail for walking speed if participant scored more than 10 seconds on the rapid gait test.
Graham, 2009[202] 1) examine the relationship between frailty and 10-year mortality In older community-dwelling Mexican Americans.	Weight loss	0;1	Is evaluated as the change in body weight over the preceding year. Subjects with unintentional weight loss of 4.5 or more kilograms received a score of 1
	Exhaustion	0;1	Measured by the Center for Epidemiologic Studies Depression Scale (CES-D), the two statements were read: a I felt that everything I did was an effort; b I could not get going. The question is asked ”How often in the last week did you feel this way?”

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
			Participants reporting yes for a moderate amount or most of the time over the previous week on either question received a score of 1
	Low Physical activity	Slowest 20% for men: ≤30	Based upon the Physical Activity Scale for the Elderly
		Slowest 20% for women: ≤27.5	
	Walking speed	Slowest 20% for men: ≥11.2 seconds for height ≤168cm ≥9.7 seconds for height >168cm Slowest 20% for women: ≥12 seconds for height<=154cm ≥11.2 seconds for height >154cm	Was recorded during a 4.9-meter timed walk test. Participants were instructed to walk as fast as they felt safe. Those unable to complete the walk or who scored the lowest quintile based on gender-and height specific thresholds received a Score of 1
	Grip strength (weakness)	Weakest 20% for men:	Was quantified with a hand dynamometer. Those unable to perform the test or those
		≤21 kg for BMI ≤24.2;	Scoring in the lowest quintile based on gender and BMI specific criteria received a Score of 1
		≤24.5 kg for BMI 24.3-26.8	
		≤25.4 kg for BMI 26.9-29.5;	
		≤25.5 kg for BMI >29.5;	
		Weakest 20% for women:	
		≤13.5 kg for BMI ≤24.7;	
		≤14.2 kg for BMI 24.8-28.3;	
		≤15 kg for BMI28.4.1-32.1;	
		≤15 kg for BMI >32.1	
Purser, 2006[373] 1 determine whether single-item performance measures are good indicators of multidimensional frailty and to estimate the association between frailty and 6-month mortality.	**Measure set A**		
	Weight loss	Yes; No	Frail for weight loss if answer is “yes” to “in the last year, have you lost more than 10 pounds unintentionally (not due to dieting or exercise)?
	Exhaustion		Measured by the Center for Epidemiologic Studies Depression Scale (CES-D), the two statements were read: a I felt that everything I did was an effort; b I could not get going. The question is asked ”How often in the last week did you feel this way?” 0=rarely or none of the time(<1 day);1=some or a little of the time (1-2days);2=a Moderate amount of the time (3-4days); or 3=most of the time. Subjects answering 2 or 3 are categorized as frail by the exhaustion;
	Low Physical activity		Based on the 36-item Medical Outcomes Study Short Form survey physical function subscale scores in the lowest quartile for sex;
	Mobility		Time to walk 15 feet is stratified by gender and height; frail for the slowest 20%
	Grip strength		Stratified by gender; frail for the lowest 20%.
	Measure set B	0;1;2;3	Rates the number of self-reported limitations in mobility, activities

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
			of daily living, incontinence and cognitive impairment. Defined as frail if one receives a score -of 1 or more.
	Single-item performance measures		
	Gait speed		By 15-foot walk time; usual assistance is allowed when walking
	Grip strength		Stratified by gender; frail for the lowest 20%.
	Chair stands		30-seconds chair-stand test is used to determine the number of times a patient could rise from a chair without the use of arms in 30-second interval.
Avila-Funes, 2009[169] To determine whether adding cognitive impairment to frailty Improves its predictive validity for adverse health outcomes.	Weight loss		Defined as self-report of recent and unintentional weight loss of 3 kg or more or a Body mass index lower than 21 kg/(m*m);
	Exhaustion		Measured by the Center for Epidemiologic Studies Depression Scale (CES-D), the two statements were read: a I felt that everything I did was an effort; b I could not get going. The question is asked "How often in the last week did you feel this way?" 0=rarely or none of the time(<1 day);1=some or a little of the time (1-2days);2=a Moderate amount of the time (3-4days); or 3=most of the time. Subjects answering 2 Or 3 are categorized as frail by the exhaustion;
	Low physical activity		Established in participants who denied doing daily leisure activities such as walking or gardening or participating in athletic activity at least once a week;
	Slowness		Defined as the lowest quintile on a timed 6-m walking test, at usual pace, adjusted for sex and height;
	Weakness		Participants answering "yes" to the question "do you have difficulty rising from a chair?" were categorized as frail for weakness.
	Global cognitive performance		Measured by:1) Mini-Mental State Examination (scores ranging from 0 to 30, higher Indicates better cognitive status); 2) Issacs Set Test, which assess the verbal fluency abilities and speed of verbal production (subjects give a list of words belonging to a specific semantic category in 30 seconds; cities; fruits animals and colors were used; total number of items named is the score, the higher the better cognitive status. divided into 4 levels according to quartiles of score distribution; subjects in the lowest quartile in both tests were considered cognitively impaired.
Mitnitski, 2002[374] 1 estimate the frailty and fitness based on the proportion of 20 Deficits observed in a structured clinical examination.	Vision loss	Present; not present	
	Hearing loss	Present; not present	
	Impaired mobility	Present; not present	
	Vascular problem	Present; not present	
	Gait abnormality	Present; not present	

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
	Impaired vibration sense	Present; not present	
	Difficulty bathing	Present; not present	
	Difficulty going out	Present; not present	
	Difficulty cooking	Present; not present	
	Difficulty toileting	Present; not present	
	Difficulty grooming	Present; not present	
	Skin problem	Present; not present	
	Resting tremor	Present; not present	
	Changes in sleep	Present; not present	
	Difficulty dressing	Present; not present	
	Urinary complaints	Present; not present	
	Gastro-intestinal problem	Present; not present	
	Diabetes	Present; not present	
	Hypertension	Present; not present	
	Limb tone abnormality	Present; not present	
Kiely, 2009[26] 1) validate and compare CHS and SOF indexes using an independent diverse sample of men and women, in their ability to predict recurrent falls, overnight hospitalizations, emergency department visits, and instrumental activities of daily living disability.	1) Fried frailty index Cardiovascular Health Study (CHS)	1) unintentional weight loss	Defined using questions "in the last year, have you lost more than 10 pounds unintentionally that is, not due to dieting or exercise?"
		2) weakness	Defined according to the sit-stand test time, which is part of the Short Physical Performance Battery (SPPB);Time required to perform five repetitions of sit to stand was measured and used as a proxy for leg strength. The cohort was stratified by gender and body mass index; The highest 20% of sit-to-stand times (including those unable to perform the task) was defined as frail for weakness
		3) low energy level (poor	Determined according to the Center for Epidemiologic Studies Depression Scale, Hopkins
		Endurance or exhaustion)	Version(CESD-R) question, "over the past week or so, did you feel like you could not get going?" Those reporting symptoms occurring on 3 days or more in the previous week were considered as demonstrating low energy level;
		4) slow gait	Defined from the timed 4-m walk. Two trials were performed and the fastest time was used. The time scores were stratified by sex and height. Those in the slowest quintile in each stratum were considered to have slow gait;
		5) low physical activity	Determined using the Physical Activity Scale for the Elderly (PASE). The PASE score was stratified according to sex and those scoring in the bottom quintile considered to exhibit low daily activity.
	2) Ensrud frailty index Study of Osteoporotic Fracture (SOF)	1) unintentional weight loss	Defined using questions "in the last year, have you lost more than 10 pounds unintentionally that is, not due to dieting or exercise?"
		2) inability to rise from a chair five	

Appendix E Table 47. Statistical Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Reference Purpose	Predictor Name	Category	Index/ Measurement Used
		times without the use of arms	
		3) low energy level	Determined according to the Center for Epidemiologic Studies Depression Scale, Hopkins Version (CESD-R) question, “over the past week or so, did you feel like you could not get Going?” Those reporting symptoms occurring on 3 days or more in the previous week were considered as demonstrating low energy level

Appendix E Table 48. Index Development of Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions

Prediction Outcome	Index Component	Weight	Weight Method	Risk Group	Score	Accuracy/Validation		
Drame, 2008[375] 2-year mortality	1 age: 85 years or older	1	Equals to hazard ratio in the multivariable model that rounded up to the nearest integer	Low-risk	<=2	No. of death/ No. at risk, 95% CI for each risk group, and overall group were calculated and compared		
	2 dependent for the ADL: yes	1		Medium risk	3-5			
	3 delirium: yes	2		High-risk	>=6		**Derivation Cohort**	**Validation Cohort**
	4 malnutrition risk: yes	2				**Receiver Operating**	0.72 (0.68-0.75)	0.71 (0.66-0.76)
	5 comorbidity level: medium	2						
	6 comorbidity level: high	3						
Ensrud, 2008[50] Disability; Hip fracture; death	1) weight loss of 5% or more between the 3rd and 4th examination		Frailty is defined by the presence of 2 or more of the 3 components	robust	0	Number and percentage of participants with recurrent falls, disability, hip fracture and death, 95% CI, odds ratio, hazard ratio for each risk group according to Study of Osteoporotic Fractures and Cardiovascular Health Study index		
	2) subject's inability to rise from a chair 5 times without using her arms			immediate	1	**Receiver Operating**	**SOF**	**CHS**
	3) reduced energy level			frailty	>=2	**Characteristic curve area**		
						Recurrent falls	0.61 (0.59-0.64)	0.61 (0.59-0.63)
						Hip fracture	0.63 (0.60-0.65)	0.63 (0.60-0.65)
						Death	0.72 (0.71-0.73)	0.72 (0.71-0.74)
						Disability	0.64 (0.62-0.65)	0.64 (0.63-0.66)
Ravaglia, 2008[362] 4-year mortality; fractures; hospital admission; worsening disability; Incident disability	1 age >=80	1	Each present predictor is assigned one point and all the points assigned to each participant is summed to be the total score	4-year mortality	0-2	Not reported		
	2 male gender	1			3			
	3 physical inactivity	1			4			
	4 use of >=3 drug	1			**5**			
	5 sensory deficits	1			6			
	6 calf circumference <31cm	1			≥7			
	7 instrumental activity of daily	1		4-year risk of fracture				
	Living disability	1			0-2			
	8 gait and	1		Hospital	3			

Appendix E Table 48. Index Development of Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Prediction Outcome	Index Component	Weight	Weight Method	Risk Group	Score	Accuracy/Validation		
	balance test <=24			admission				
	9 pessimism about one's health	1		Worsening disability	>=4			
				Incident disability				
Carey, 2008[129] 1-year mortality; 2-year mortality; 3-year mortality;	1) male	2	The coefficient for each risk factor was divided by the lowest coefficient (for the partial dependence in the ADL dressing) and rounded to the nearest integer; all the points for each present risk factor were summed up and would be the risk score for each patient.	low	0-3	No. at risk, mortality rate for each risk group was calculated and compared between development and validation cohorts.		
	2) age			medium	4-5			
	75-79	2		high	>5			
	80-84	2					**Derivation cohort**	**Validation cohort**
	>=85	3				**Receiver operating**	0.66	0.69
	3) dependence in toileting	1						
	4) dressing							
	Partially dependent	1						
	Fully dependent	3						
	5) malignant neoplasm	2						
	6) congestive heart failure	3						
	7) chronic obstructive Pulmonary disease	1						
	8) renal failure or insufficiency	3						
Pilotto, 2008[363] 1-year mortality	1) Activities of daily living index	0;0.5;1	Each domain can be assigned one of three weights (0;0.5;1) depending on the specific scores for each domain. The sum of the calculated scores from the eight domains was divided by 8 to obtain a final multidimensional index score from 0 to 1.	Low risk	≤0.33	Calibration of the model was assessed by comparing the predicted mortality with the actual mortality in the development and validation cohorts; discrimination of the model was assessed by calculating the receiver operating characteristic curves for the development and validation cohorts.		
	2) instrumental activities of daily living scale	0;0.5;1		Moderate risk	0.34-0.66			
	3) Short Portable Mental Status questionnaire	0;0.5;1		Severe risk	>0.66			
	4) comorbidity index	0;0.5;1						
	5) Mini Nutritional Assessment	0;0.5;1					**Development cohort**	**Validation cohort**
	6) Exton Smith Scale	0;0.5;1				**Receiver operating**	0.751 (0.71-0.81)	Not reported

Appendix E Table 48. Index Development of Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Prediction Outcome	Index Component	Weight	Weight Method	Risk Group	Score	Accuracy/Validation		
	7) number of medications	0;0.5;1						
	8) social support network	0;0.5;1						
Walter, 2001[125] 1-year mortality	1) male sex	1	A risk score was calculated for each patient by adding the points of each present risk factor	Low-risk	0-1	No. of death/ No. at risk, 95% CI for each risk group were calculated and compared between derivation and validation cohorts.		
	2) dependent in 1-4 ADLs	2		Medium risk	2-3			
				High-risk	4-6	**Receiver Operating**	**Derivation Cohort**	**Validation Cohort**
	3) dependent in all ADLs	5		Very high-risk	>6	**Characteristic curve area**		
	4) congestive heart failure	2				By risk group	0.75	0.79
	5) solitary cancer	3				By quartile of risk	0.75	0.8
	6) metastatic cancer	8						
	7) creatinine level on admission >3mg/dl	2						
	8) albumin level on admission							
	3-3.4 g/dl	1						
	<3 g/dl	2						
Lee, 2006[71] 4-year mortality	1) male sex	2	Points were assigned to each risk factor by dividing each beta coefficient by the lowest beta coefficient (ability to push or pull heavy objects) and rounding to the nearest integer. A risk score was assigned to each participant by summing the points for each present risk factor.	lowest	0-5	No. of death/ No. at risk for each risk group were calculated and compared		
	2) age 60-64	1		Medium	6-9	between development and validation cohorts.		
	3) age 65-69	2		High	10-13	**Receiver Operating**	**Development Cohort**	**Validation Cohort**
	4) age 70-74	3		Very high	>=14	**Characteristic curve area**		
	5) age 75-79	4				By risk group	0.84	0.817
	6) age 80-84	5				By quartile of risk	0.842	0.819
	7) age >=85	7						
	8) diabetes mellitus	1						
	9) cancer	2						
	10) lung cancer	2						
	11) heart failure	2						
	12) body mass index<25	1						
	13) current smoker	2						

Appendix E Table 48. Index Development of Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Prediction Outcome	Index Component	Weight	Weight Method	Risk Group	Score	Accuracy/Validation
	14) bathing	2				
	15) managing finances	2				
	16) walking several blocks	2				
	17) pushing/pulling heavy objects	1				
Song, 2004[364] 6-year mortality	1 dichotomized variables 2 3-level variables 3 5-level variables		The artificial neural network (ANN) has 3 layers: input layer (40 neurons); intermediate hidden layer of 20 neurons; and the output neuron. All input neurons fed into each of the hidden layer neurons and every neuron in the hidden layer was connected to the single output neuron. The output of a neuron was determined by the summary input of all the neurons to it. The artificial neural network survival classification output is a function of the input variables, the network architecture and the weights.	survivors died	<0.5 >=0.5	The area under the receiver operating characteristic curve was calculated for the artificial neural network and unweighted frailty index **ANN** / **Frailty index** **Receiver Operating Characteristic curve area**: 0.86 / 0.62
Fried, 1998[54] 5-year mortality	Same as above predictors	Not reported	A risk score was computed by multiplying, for each individual, the regression coefficient from each variable in the Cox model by the value of the corresponding variable for the individual. These products were summed to give a prognosis score for each individual.	1 2 3 5	Based on quintile	The 5-year overall mortality rate and mortality per person-year for each risk group were calculated and compared between cardiovascular health study (CHS) original cohort and the African American cohort. **Original cohort** / **African American cohort** **Chi-square trend**: 659.73 / 55.97 **P-value**: <.001 / <.001
Inouye, 2003[122] 1-year mortality	1) high risk diagnoses;	0-3	A burden of illness score was calculated for each	I	0-1	No. of death/ No. at risk, hazard ratio, 95% CI for each risk group were calculated and compared

Appendix E Table 48. Index Development of Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Prediction Outcome	Index Component	Weight	Weight Method	Risk Group	Score	Accuracy/Validation		
	2) albumin ≤3.5 mg/dL	0/1	person by summing all the points for each present risk factor.	II	2	between development and validation cohort.		
	3 Creatinine >15 mg/dL	0/1		III	3		**Derivation Cohort**	**Validation Cohort**
	4) dementia;	0/1		IV	≥4	**Receiver Operating**	0.83 (0.78-0.87)	0.77 (0.74-0.8)
	5 walking impairment	0/1				**Characteristic curve area**		
						Chi-square trend	179.33	274.01
						P-value	0.001	0.001
Melzer, 2003*[14] 4-year mortality	1) gait speed	N/A	1) In the logistic regression models all physiological measures were coded into ranks or categories; 2) the ß values for different coding of three measures used in the difficulty and inability equations were calculated; 3) difficulty and inability models for calculating MOBLI scores were developed; 4) coefficients (beta values) of different coding in three measures used in the logistic regression models and equations to produce the MOBLI score were calculated and entered Into difficulty and inability models; 5) MOBLI score represents the probability of risk to mobility limitations or impairments, the higher the score the higher the probability of mobility limitation and impairment.	1st quintile	<0.0416	Crude and age/sex-adjusted death rates, hazard ratio for self-reported and predicted inability to walk 1/2 mile based on mobility-related limitation index scores (MOBLI).		
	2) time to 5 chair stands			2nd quintile	0.0416-0.0954			
	3) peak expiratory flow			3rd quintile	0.0955-0.1984			
				4th quintile	0.1985-0.4395	**Unable to walk1/2 mile**	**MOBLI**	**Self-reported**
				5th quintile	>0.4395	**By death rate**	31.7	32.4
						By hazard ratio	2.71(2.28-3.21)	2.95(2.48-3.5)
Ensrud, 2009[51]	1) weight loss of		Frailty is defined by the	robust	0	Number and percentage of participants with recurrent		

Appendix E Table 48. Index Development of Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Prediction Outcome	Index Component	Weight	Weight Method	Risk Group	Score	Accuracy/Validation		
Recurrent falls; disability; non-spine fracture; death	5% or more between the baseline and 2nd examination		presence of 2 or more of the 3 components	immediate	1	falls, disability, hip fracture and death, 95% CI, odds ratio, hazard ratio for each risk group according to Study of Osteoporotic Fractures and Cardiovascular Health Study index		
				frailty	≥2			
	2) inability to rise from a chair 5 times without using the arms					**Receiver Operating Characteristic curve area**	**SOF**	**CHS**
	3) poor energy					Recurrent falls	0.63 (0.6-0.66)	0.63 (0.6-0.66)
						Non-spine fracture	0.63 (0.58-0.67)	0.63 (0.58-0.67)
						Death	0.71 (0.67-0.75)	0.72 (0.69-0.76)
						Disability	0.68 (0.65-0.71)	0.68 (0.65-0.71)
Albertsson, 2007[365] 2-year Hip fractures; 2-year Fragility fractures 2-year mortality	1) age 80 years or older	unweighted		Low risk	0-1	Number and percentage of participants with hip fracture, fragility fracture and mortality, 95% CI, odds ratio, for each risk group		
	2) weight less than 60 kg			High risk	2-4			
	3) previous fragility fracture							
	4) need to use arms to rise from a chair 5 times without using her arms					**Receiver Operating Characteristic curve area**	**Development cohort**	
						Hip fractures	0.72 (0.64-0.81)	
						Fragility fractures		
						Mortality	0.75 (0.71-0.79)	
Schonberg, 2009[366] 5-year mortality	1) age		Derived from the beta coefficients of each factor in the final model		0-1	Number and percentage of mortality,95% CI according to quintile of risk and		
	65-69	0			2-3	Point score were calculated.		
	70-74	1			4-5			
	75-79	3			6-7			
	80-84	5			8-9			
	85+	7			10-11	**Receiver Operating Characteristic curve area**	0.75 (other info isn't reported)	
	2) Male sex	3			12-13			
	3) Smoking status				14-15			
	never	0			16-17			

Appendix E Table 48. Index Development of Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Prediction Outcome	Index Component	Weight	Weight Method	Risk Group	Score	Accuracy/Validation
	Former	1			18+	
	Current	3		Also by quintile of risk		
	4) body mass index<25 kg/(m*m)	2				
	5) comorbid conditions					
	COPD	2				
	Diabetes mellitus	2				
	Cancer	2				
	6) overnight hospitalization in					
	Past year					
	None	0				
	One	1				
	Two or more	3				
	7) perceived health					
	Excellent/very good	0				
	Good	1				
	Fair/good	2				
	8) functional measures					
	Dependent in at least 1 IADL	2				
	Difficulty walking several blocks	3				
Garcia-Gonzalez, 2009[367] 2-year mortality	Same as above predictors		1) For variables with yes/no categories, yes=1; No=0	Level 1	.00-.07	Number and hazard ratios of mortality, 95% CI according to different levels of the frailty index were calculated. No ROC reported
				Level 2	.07-.14	
			2) for poor self-assessed health: poor=1; fair=0.75; good=0.5; very good=0.25; excellent=0	Level 3	.14-.21	
				Level 4	.21-.35	
				Level 5	.35-.65	
			3) For vision problems: legally blind=1; poor=0.8; fair=0.6; good=0.4; very good=0.2; excellent=0			
			4) For hearing problems: legally deaf=1; poor=0.8; fair=0.6; good=0.4; very good=0.2; excellent=0			
			5) for bodily pain:			

Appendix E Table 48. Index Development of Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Prediction Outcome	Index Component	Weight	Weight Method	Risk Group	Score	Accuracy/Validation		
			frequent and severe=1; Frequent and moderate=2/3; frequent and Mild=1/3; not frequent=0					
			6) for depression symptoms: 1/9 for each positive answer if the participants felt: depressed; unhappy; lonely; tired; sad; did not enjoy life; had no energy; restless sleep or thought that everything was an effort; 0= none of the above Frailty index is defined as a proportion of the total number of deficits an individual has with respect to the 34 deficits included.					
Carey, 2004[368] 2-year mortality;	1) male gender	2	The beta-coefficient for each risk factor was divided by the lowest beta-coefficient (for bathing) and rounded to the nearest integer; all the points for each present risk factor were summed up and is the risk score for each patient.	low	0-2	No. at risk, mortality rate for each risk group was calculated and compared between development and validation cohorts.		
	2) age			medium	3-6			
	76-80	1		high	7-10			
	81-85;	2					**Derivation cohort**	**Validation cohort**
	>85	2				**Receiver operating**	0.76	0.74
	)3 dependence in bathing	1						
	4) dependence in shopping	2						
	5) difficulty walking several blocks	2						
	6) difficulty pulling/pushing heavy objects	1						
Levine, 2007[369] 1-year mortality	1) age		The beta-coefficient for each risk factor was divided by the lowest beta-coefficient (for congestive heart failure) and rounded to the	Low-risk	0-1	No. of death/ No. at risk, 95% CI for each risk group were calculated and		
	70-74	1		Medium risk	2	Compared between derivation and validation cohorts.		
	75-79	2		High-risk	3	**Receiver Operating**	**Derivation Cohort**	**Validation Cohort**
	80-84	2		Very high-	>=4	**Characteristic**		

Appendix E Table 48. Index Development of Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Prediction Outcome	Index Component	Weight	Weight Method	Risk Group	Score	Accuracy/Validation		
			nearest integer; all the points for each present risk factor were added up and is the risk score for each patient.	risk		**curve area**		
	85-89	2				By risk group	0.67	0.65
	≥90	2				By quartile of risk	0.70	0.68
	2) Discharge to nursing home or skilled nursing facility	1						
	3) length of stay ≥5 days	1						
	4) congestive heart failure	1						
	5) peripheral vascular disease	1						
	6) dementia	1						
	7) renal disease	1						
	8) hematologic and solid Malignancy	1						
	9) metastatic cancer	2						
Pijpers, 2009[370] 3-year mortality	1) age: per 10 years	4	1) Weight was obtained by multiplying the Regression coefficient by 10 rounded up to the nearest integer; 2) the weight will be multiplied by the patient's characteristics value and the sum of these values is the risk score for each patient.	Very good	<45	ROC curves were computed; mean predicted 3-year mortality risk and observed 3-year mortality were calculated and compared in each quintile of risk score		
	2) male sex	10		Good	45-51			
	3) living alone	5		Moderate	52-57			
	4) cardiovascular disease	4		Poor	58-63	**Receiver Operating**	0.78 (0.71-0.84) (other info not reported)c	
	5) diabetes	4		Very poor	>63			
	6) medication number ≥2	5						
	7) Body mass index<18.5	12						
	8) Elderly Mobility Scale score <20	5						
	9) motor deficit in ADL	4						
	10) process deficit in ADL	7						
Mazzaglia, 2007[187] 15-month mortality 15-month	1) age:		Each risk factor was assigned a score based on the ratio between the regression b-coefficient for that variable and the		0	Number of death/who at risk, percentage, 95%CI, sensitivity and specificity were calculated and compared for both cohorts according to risk scores		
	65-74	0			1			
	75-84	1			2	**Receiver Operating**	**Development cohort**	**Validation cohort**

Appendix E Table 48. Index Development of Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Prediction Outcome	Index Component	Weight	Weight Method	Risk Group	Score	Accuracy/Validation		
hospitalization	>=85	1	lowest significant b-coefficient in the corresponding logistic regression (which is being 75-84 years old). The ratio is rounded up to the nearest integer. A summary point score was calculated for each participant by adding the points for each risk factor present		≥3	**Characteristic curve area**		
	2) sex					Mortality	0.75 (0.72-0.78)	0.75(0.73-0.78)
	female	0				Hospitalization	0.68(0.66-0.71)	0.67(0.65-0.7)
	Male	1						
	3) positive responses to the							
	Screening test							
	0-1	0						
	2-3	2						
	4-6	1						
	4) having hospitalization in the previous 6 months	4						
	5) having ≥5 prescriptions	3						
Jones, 2004[144] 5-year mortality 5-year institutionalization	1) impairment index		1) Each of 10 domains in impairment index was scored such that 0=no problem; 0.5=minor problem; 1=major problem 2) the CIRS codes the severity of 14 co-existing diseased body system as 0,1, or 2 and standardized into a range of 0-4 (CIRS/6) 3) the current index is calculated as # of total deficits/total # deficits (impairment Index + comorbidity index)/14	Level 1	≤0.23	Mean and standard deviation for sociodemographic , clinical variables and uses of clinical services were calculated and compared by index levels.		
	2) comorbidity index			Level 2	0.24-0.31			
				Level 3	0.32-0.4	**Receiver Operating**	**FI-GCA**	**FI**
				Level 4	0.41-0.48	**Characteristic curve area**		
				Level 5	0.49-0.6	Mortality	0.67	0.7
				Level 6	0.61-0.74	hospitalization	0.66	0.75
				Level 7	≥0.75			
Fried, 2001[55] 3-year mortality 7-year mortality 3-year incident falls 7-year incident falls 3-year disability 7-year disability 3-year mobility	1) weight loss (shrinking);		Defined as frail if ≥3 components present; Intermediate frail if 1 or 2 components present; Not frail if none present	Not frail		Cox proportional hazards models were used to assess the independent Predictive validity of frailty phenotype.		
	2) grip strength (weakness)			Intermediate frail				
	3) exhaustion (poor endurance)			Frail		**3-year outcomes/HR(CI)**	**Intermediate**	**Ffrail**
						Incident fall	1.16(1-1.34)	1.29(1-1.68)
	4) walking time (slowness)					Mobility	1.58(1.41-1.76)*	1.5(1.23-1.82)
	5) low physical					Disability	1.67(1.41-	1.98(1.54-

Appendix E Table 48. Index Development of Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Prediction Outcome	Index Component	Weight	Weight Method	Risk Group	Score	Accuracy/Validation		
7-year mobility	activity						1.99)	2.55)
						First hospitalization	1.13(1.03-1.25)	1.29(1.09-1.54)
						Mortality	1.49(1.11-1.99)	2.24(1.51-3.33)
						7-year outcomes/HR(CI)	**Intermediate**	**Ffrail**
						Incident fall	1.12(1-1.26)	1.23(0.99-1.54)
						Mobility	1.41(1.29-1.54)	1.36(1.15-1.62)
						Disability	1.55(1.38-1.75)	1.79(1.47-2.17)
						First hospitalization	1.11(1.03-1.19)	1.27(1.11-1.46)
						Mortality	1.32(1.13-1.55)	1.63(1.27-2.08)
						* highlighted area indicated significance ≤0.05		
Markides, 2001[371] 2-year mortality	**Set one includes:**	N/A	N/A	N/A		Logistic regression models were used to assess the predictivity of summary		
	1) age (75+vs.65-74)					Performance score and short walk measures on 2-year mortality.		
	2) gender (male)					**Outcome measures/OR(CI)**	**Set one**	**Set two**
	3) summary performance					Age (75 vs.65-74)	1.42(1.02-1.97)	1.46(1.06-2.03)
	Score (vs. 9-11)					Gender (male)	1.84(1.34-2.52)	1.76(1.29-2.42)
	7-8					Summary performance		
	4-6					Score (vs. 9-11)		
	1-3					7-8	2.02(1.12-3.64)*	
	0					4-6	3.25(1.86-5.67)	
	4) lower body ADL disability					1-3	2.87(1.37-6.05)	
	5) chronic conditions					0	7.39(3.86-14.13)	
	Hypertension					Short walk (vs.4)		
	Heart disease					3		2.16(1.12-4.14)
	Cancer					2		2.57(1.33-4.94)
	Diabetes					1		3.64(1.93-

Appendix E Table 48. Index Development of Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Prediction Outcome	Index Component	Weight	Weight Method	Risk Group	Score	Accuracy/Validation		
								6.85)
	Hip fracture					0		7.47(3.83-14.55)
	stroke					Lower body ADL Disability	1.46(0.9-2.36)	1..48(0.93-2.36)
	Set two includes:					Chronic conditions		
	1) age (75+vs.65-74)					hypertension	1.09(0.79-1.51)	1.11(0.8-1.53)
	2) gender (male)					Heart disease	1.59(1.07-2.38)	1.6(1.08-2.39)
	3) summary performance					Cancer	3.18(2.02-5.01)	3.37(2.14-5.3)
	Score (vs.4)					Diabetes	1.78(1.29-2.51)	1.8(1.29-2.52)
	3					Hip fracture	1.35(0.73-2.5)	1.35(0.73-2.48)
	2					Stroke	0.81(0.48-1.36)	0.82(0.49-1.38)
	2					* highlighted area indicated significance ≤0.05		
	0							
	4) lower body ADL disability							
	5) chronic conditions							
	Hypertension							
	Heart disease							
	Cancer							
	Diabetes							
	Hip fracture							
	Stroke							
Gill, 2006[372] 6-year mortality	1) weight loss		Defined as frail if ≥3 components present;	Nonfrail		Cox proportional hazards models were used to calculate the unadjusted hazard ratios and assess the predictive validity for each component.		
	2) muscle weakness		Prefrail if 1 or 2 components present;	Prefrail				
	3) exhaustion		Nonfrail if none present	Frail		**Outcome measures/HR**	**6-year mortality**	
	4) slow walking speed					Weight loss	2.03*	
	5) low physical activity					Exhaustion	1.97	
						Low physical activity	2.83	
						Muscle weakness	1.93	
						Slow walking	2.28	

Appendix E Table 48. Index Development of Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Prediction Outcome	Index Component	Weight	Weight Method	Risk Group	Score	Accuracy/Validation
						speed
						* highlighted area indicated significance <=0.05 and unadjusted HR
Graham, 2009[202] 10-year mortality	1) weight loss	0 or 1	Each item was scored dichotomously (0 vs. 1); The total score was recorded as the sum of all five items (range: 0-5)	Non-frail	0	Cox proportional hazards models were used to assess the independent
	2) grip strength	0 or 1		Pre-frail	1-2	Predictive validity of frailty index
	3) exhaustion	0 or 1		Frail	3-5	**10-year outcomes/HR(CI)** **Pre-frail** **frail**
	4) slow walking	0 or 1				Mortality 1.25(1.07-1.46) 1.81(1.41-2.31)
	5) low physical activity	0 or 1				* highlighted area indicated significance ≤0.05
Purser, 2006[373] 6-month mortality	**Set A**		Defined as frail if ≥3 components present			Logistic regressions were used to assess the independent predictive validity for
	1) mobility					Each composite or single item measures.
	2) grip strength					**Frailty index/OR(CI)** **6-month mortality**
	3) low endurance					Measure set A 1.9(0.6-6)
	4) physical activity limitation					Measure set B 1.4(0.3-5.6)
	5) nutrition					Gait speed 4(1.1-13.8)
	Set B		People with impairments in any domain, Resulting in scores of 1 or more, were considered frail			Grip strength 2.7(0.7-10)
	1) mobility					Chair-stand 1.5(0.4-5)
	2) activities of daily living					
	3) incontinence					
	4) cognitive impairment					
	Gait speed		Walked <0.65m/s is considered frail			
	Grip strength		<25 kg is considered as frail			
	Chair stands		<7/ 30 seconds is considered frail			
Avila-Funes, 2009[169] 4-year mobility disability 4-year IADL disability 4-year ADL disability 4-year	1) weight loss					Logistic regressions and multivariate logistic regressions were used to assess
	2) exhaustion					the unadjusted and independent effect of frailty on each outcome
	3) low physical activity					**Outcome measures/OR(CI)** **Pre-frail** **frail with cognitive**
	4) slowness					**impairment**
	5) weakness					Mortality 1.96(1.38-2.8)* 3.46(2.05-5.84)

Appendix E Table 48. Index Development of Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Prediction Outcome	Index Component	Weight	Weight Method	Risk Group	Score	Accuracy/Validation		
hospitalization 4-year mortality 4-year dementia	6) with or without cognitive impairment					hospitalization	1.19(1.03-1.39)**	1.9(1.09-3.31)
						Dementia	5.21(2.95-9.23)##	4.98(2.17-11.41)
						Mobility disability	1.34(1.13-1.59)**	3.88(0.78-19.41)
						IADL disability	2.83(1.91-4.19)##	3.17(1.47-6.83)
						ADL disability	3.28(1.61-6.67)*	5.6(2.13-14.7)
						*crude OR;#frail;**pre-frail without cognitive Impairment; ##pre-frail with cognitive impairment;		
Mitnitski, 2002[374] mortality	Same as aforementioned predictors		1) The proportion of the deficits in the individual as a state variable, measuring an individual degree of impairment and frailty; then analyzed the proportion q(t) averaged across all subjects at age t, for those with no cognitive impairment; 2) an individual's health status f(i) may be defined as a ratio of that person's impairment Index to the mean index value, averaged across individuals without cognitive impairment, but of the same age f(i)=qi/m; f>1 if the individual Is frail; and the individual is fit if f<1.			Construct validity was examined through its relationship to chronological age; criterion validity was examined in its ability to predict mortality.		
							Biological age	**Chronological age**
						Beta coefficient	0.0081	0.0081
						Standard deviation	0.0014	0.0038
						t-value	5.7	2.15
						p-value	<0.000001	0.0313
Kiely, 2009[26] 1) recurrent falls 2) overnight hospitalization 3) emergency department visit 4) instrumental activities of Daily living disability (IADL)	1) For Fried's CHS frailty index, frailty status is defined as robust if 0 component; prefrail if 1-2 components; and frail if 3-5 components			Robust Prefrail Frail Robust	0 1-2 3-5 0	The mean value for selected variables, including outcomes were calculated by risk group and compared. Odds ratio, hazard ratio for each risk group were calculated for both CHS and SOF frailty indexes.		
				Prefrail	1	**HR/OR***	**SOF**	**CHS**
				Frail	≥2	Recurrent falls		
						prefrail	1.62(1.14-2.32)	1.1(0.8-1.5)
						frail	2.19(1.19-4.03)	1.9(1.17-3.1)

Appendix E Table 48. Index Development of Models That Predict Mortality in Older Persons Based on Geriatric Syndromes or Nonsyndromic Conditions (continued)

Prediction Outcome	Index Component	Weight	Weight Method	Risk Group	Score	Accuracy/Validation		
	2) for Ensrud's SOF frailty index, frailty status was defined as robust if 0 component; prefrail if 1 component; frail if ≥2 components					Overnight hospitalization		
						Prefrail	2.64(1.74-4.01)	1.97(1.37-2.84)
						Frail	.49(1.53-7.98)	4.45(2.42-8.18)
						Emergency department visit		
						Prefrail	2.19(1.43-3.33)	1.34(0.95-1.89)
						Frail	3.54(1.43-8.79)	3.1(1.64-5.86)
						IADL disability		
						Prefrail	2.88(1.81-4.58)	2.73(1.69-4.4)
						Frail	5.38(2.34-12.35)	7.68(4.01-14.74)
						*adjusted; highlighted area indicating significance ≤0.05		

Appendix E Table 49. Simple Models That Predict Mortality in Older Persons

Reference, Outcome	Independent Variables	Results
Albertsson, 2007[365] 2-year mortality	1 age 80 years or older; 2 weight less than 60 kg; 3 previous fragility fracture; 4 need to use arms to rise from a chair 5 times without using her arms;	1 63% of women with 0 to 1 risk factor had a 2-year mortality risk of 3.2%; 2 women with 2 to 4 risk factors had a 2-year mortality risk of 23.7% (odds ratio = 9.5; 95% CI 6.0-14.9)
Carey, 2004[368] 2-year mortality	1 male gender; 2 age; 76-80 81-85; >85 3 dependence in bathing 4 dependence in shopping 5 difficulty walking several blocks 6 difficulty pulling/pushing heavy objects	1 in the development cohort, 2-year mortality was 3% in the lowest risk group (0 to 2 points), 11% in the middle risk group (3 to 6 points), and 34% in the highest risk group (>7 points). 2 in the validation cohort, 2-year mortality was 5% in the lowest risk group, 12% in the middle risk group, and 36% in the highest risk group.
Levine, 2007[369] 1-year mortality	1 age 70-74 75-79 80-84 85-89 >=90 2 Discharge to nursing home or skilled nursing facility 3 length of stay >=5 days 4 congestive heart failure 5 peripheral vascular disease 6 dementia 7 renal disease 8 hematologic and solid malignancy 9 metastatic cancer	1 In the derivation cohort, 1-year mortality was 11% in the lowest-risk group (0 or 1 point) and 48% in the highest-risk group (4 or greater points). 2 in the validation cohort, 1-year mortality was 11% in the lowest risk group and 45% in the highest-risk group.
Walter, 2001[125] 1-year mortality	1 male sex 2 dependent in 1-4 ADLs 3 dependent in all ADLs 4 congestive heart failure 5 solitary cancer 6 metastatic cancer 7 creatinine level on admission > 3mg/dl 8 albumin level on admission is 3-3.4 g/dL albumin level on admission is <3 g/dL	1 In the derivation cohort, 1-year mortality was 13% in the lowest-risk group (0-1 point), 20% in the group with 2 or 3 points, 37% in the group with 4 to 6 points, and 68% in the highest-risk group (>6 points). 2 In the validation cohort, 1-year mortality was 4% in the lowest-risk group, 19% in the group with 2 or 3 points, 34% in the group with 4 to 6 points, and 64% in the highest-risk group.
Lee, 2006[71] 4-year mortality	1 male sex 2 age 60-64 3 age 65-69 4 age 70-74	In validation cohort, 0 to 5 points predicting a less than 4% mortality risk, 6 to 9 points predicting a 15% risk, 10 to 13 points predicting a 42% risk, and 14 or more points predicting a 64% risk.

Appendix E Table 49. Simple Models That Predict Mortality in Older Persons (continued)

Reference, Outcome	Independent Variables	Results
	5 age 75-79 6 age 80-84 7 age >=85 8 diabetes mellitus 9 cancer 10 lung cancer 11 heart failure 12 body mass index<25 13 current smoker 14 bathing 15 managing finances 16 walking several blocks 17 pushing/pulling heavy objects	
Inouye, 2003[122] 1-year mortality	1 high risk diagnoses; 2 albumin <=3.5 mg/dL; 3 Creatinine >15 mg/dL; 4 dementia; 5 walking impairment	1 In the development cohort, where overall mortality was 154/525 (29%), 1-year mortality rates increased significantly across each risk group, from 8% to 24%, 51%, and 74%, in groups I to IV respectively 2 Corresponding rates in the validation cohort, where overall mortality was 488/1246 (39%), were 5%, 17%, 33%, and 61% in groups I to IV, respectively
Schonberg, 2009[366] 5-year mortality	1 age 65-69 70-74 75-79 80-84 85+ 2Male sex 3 Smoking status: never, Former, Current 4 body mass index<25 kg/m² 5 comorbid conditions COPD Diabetes mellitus Cancer 6 overnight hospitalization in past year None One Two or more 7 perceived health Excellent/very good Good Fair/good 8 functional measures Dependent in at least 1 IADL Difficulty walking several blocks	1 In the development cohort,5-year mortality rates increased significantly across each quintile of risk from 6% to 10%, 14%, 27%, and 52% in quintile 1 through 5 2 In the validation cohort,5-year mortality rates increased significantly across each quintile of risk from 5% to 10%, 17%, 31%, and 50% in quintile 1 through 5

Appendix E Table 50. Complex Models That Predict Mortality in Older Persons

Reference, Outcome	Independent Variables	Model Description
Drame, 2008[375] 2-year mortality	1 age: 85 years or older 2 dependent for the ADL: yes 3 delirium: yes 4 malnutrition risk: yes 5 comorbidity level: medium	A point value was assigned to each characteristic according to the hazard ratio in the final model. Point values for all mortality-related characteristics present for each patient were rounded to the nearest integer and summed. Three groups were determined: low-risk (<=2), medium risk (3-5) and high-risk (>=6)
Ravaglia, 2008[362] 4-year mortality; 4-year Fractures; 4-year Hospital admission; 4-year Worsening disability; 4-year Incident disability	1 age >=80; 2 male gender; 3 physical inactivity 4 use of >=3 drugs; 5 sensory deficits; 6 calf circumference <31cm; 7 instrumental activity of daily Living disability; 8 gait and balance test <=24; 9 pessimism about one's health	A risk scoring system was developed, assigning one point to each present predictor and summing the points assigned to each participant. Cox regression was used to assess the association between the score and mortality
Carey, 2008[129] 1-year mortality; 2-year mortality; 3-year mortality;	1 male; 2 age; 75-79 80-84; >=85 3 dependence in toileting 4 dressing Partially dependent; Fully dependent 5 malignant neoplasm 6 congestive heart failure 7 chronic obstructive Pulmonary disease 8 renal failure or insufficiency	A point scoring system was constructed in which points were assigned to each risk factor using the coefficients (parameter estimates) from the final Cox regression model The coefficient for each risk factor was divided by the lowest coefficient (partial dependence in the ADL dressing) and rounded to the nearest integer. A risk score was then calculated for each patient by adding the points for each risk factor present.
Pilotto, 2008[363] 1-year mortality	1 Activities of daily living index 2 instrumental activities of daily living scale 3 Short Portable Mental Status questionnaire 4 comorbidity index 5 Mini Nutritional Assessment 6 Exton Smith Scale 7 number of medications 8 social support network	Each domain can be assigned one of three weights (0;0.5;1) depending on the specific scores for each domain. The sum of the calculated scores from the eight domains was divided by 8 to obtain a final multidimensional index score from 0 to 1.
Fried, 1998[54] 5-year mortality	1 age 2 male sex 3 income less than $50 000 per year, 4 low weight 5 lack of moderate or vigorous exercise 6 smoke > 50 pack-years	A risk score was computed by multiplying, for each individual, the regression coefficient from each variable in the Cox model by the value of the corresponding variable for the individual. These products were summed to give a prognosis score for each individual. The risk group is based on quintile of risk

Appendix E Table 50. Complex Models That Predict Mortality in Older Persons (continued)

Reference, Outcome	Independent Variables	Model Description
	7 high brachial systolic blood pressure (> 169mm Hg) 8 low tibial systolic blood pressure (<127mm Hg) 9 diuretic use by those without hypertension or congestive heart failure 10 elevated fasting glucose level >7.2 mmol/L [130 mg/dL] 11 low albumin level (<=37 g/L) 12 elevated creatinine level (>=106 µmol/L [1.2 mg/dL]) 13 low forced vital capacity (<=2.06 mL) 14 aortic stenosis (moderate or severe) and abnormal left ventricular ejection fraction (by echocardiography) 15 major electrocardiographic abnormality 16 stenosis of internal carotid artery (by ultrasound), 17 congestive heart failure 18 difficulty in any instrumental activity of daily living, 19 low cognitive function by Digit Symbol Substitution test score.	
Melzer, 2003[14] 4-year mortality	1 gait speed; 2 time to 5 chair stands; 3 peak expiratory flow	1 In the logistic regression models all physiological measures were coded into ranks or categories 2 The ß values for different coding of three measures used in the difficulty and inability equations were calculated 3 Difficulty and inability models for calculating MOBLI scores were developed 4 Coefficients (beta values) of different coding in three measures used in the logistic regression models and equations to produce the MOBLI score were calculated and entered into difficulty and inability models; 5 MOBLI score represents the probability of risk to mobility limitations or impairments, the higher the score the higher the probability of mobility limitation and impairment.
Garcia-Gonzalez, 2009[367] 2-year mortality	Health problems before age 10 Poor self-assessed health Medically diagnosed conditions Medical symptoms during past 2 years Difficulty with activities of daily living Difficulty with instrumental activities of Daily living	Frailty index was defined as a proportion of the total number of deficits an individual has with respect to the 34 deficits included.

Appendix E Table 50. Complex Models That Predict Mortality in Older Persons (continued)

Reference, Outcome	Independent Variables	Model Description
Pijpers, 2009[370] 3-year mortality	1 age: per 10 years 2 male sex 3 living alone 4 cardiovascular disease 5 diabetes 6 medication number>=2 7 Body mass index<18.5 8 Elderly Mobility Scale score <20 9 motor deficit in ADL 10 process deficit in ADL	1 Weight was obtained by multiplying the regression coefficient by 10 rounded up to the nearest integer; 2 The weight will be multiplied by the patient's characteristics value and the assume of these values is the risk score for each patient
Mazzaglia, 2007[187] 15-month mortality 15-month hospitalization	1 age: 65-74 75-84 >=85 2 sex female Male 3 positive responses to the Screening test 0-1 2-3 4-6 4 having hospitalization in the Previous 6 months 5 having >=5 prescriptions	Each risk factor was assigned a score based on the ratio between the regression b-coefficient for that variable and the lowest significant b-coefficient in the corresponding logistic regression (which is being 750=-84 years old); The ratio is rounded up to the nearest integer; a summary point score was calculated for each participant by adding the points for each risk factor present.
Jones, 2005[144] 5-year mortality 5-year institutionalization	**1** Impairment index includes cognition Emotion Communication mobility Balance Bladder Bowel Nutrition Activities of daily living Social **2** Comorbidity index	1 Each of 10 domains in impairment index was scored such that 0=no problem; 0.5=minor problem; 1=major problem; 2 The CIRS codes the severity of 14 co-existing diseased body system as 0,1, or 2 and standardized into a range of 0-4 (CIRS/6); 3 The current index is calculated as # of total deficits/total # deficits (impairment index + comorbidity index)/14
Mitnitski, 2002[374] mortality	Vision loss; Hearing loss; Impaired mobility; Vascular problem;	1 The proportion of the deficits in the i-th Individual as a state variable, measuring an individual degree of impairment and frailty; then analyzed the proportion q(t) averaged across all subjects at age t, for those with no cognitive impairment;

Appendix E Table 50. Complex Models That Predict Mortality in Older Persons (continued)

Reference, Outcome	Independent Variables	Model Description
	Gait abnormality; Impaired vibration sense; Difficulty bathing; Difficulty going out; Difficulty cooking; Difficulty toileting; Difficulty grooming Skin problem; Resting tremor; Changes in sleep; Difficulty dressing; Urinary complaints; Gastro-intestinal problem; Diabetes; Hypertension; Limb tone abnormality	2 An individual's health status f(i) may be defined as a ratio of that person's impairment Index to the mean index value, averaged across Individuals without cognitive impairment, but of the same age f(i)=qi/m; f>1 if the individual Is frail; and the individual is fit if f<1.

Appendix E Table 51. Predictive Models Based on Frailty Phenotype Definition

Reference	Outcome	Independent Variables	Accuracy and Validation		
Ensrud, 2008[50]	mortality	1 weight loss of 5% or more between the 3rd and 4th Examination;	mortality rate, 95% CI, odds ratio, hazard ratio for each risk group and area under the curve were calculated and compared between cohorts from study of osteoporotic fractures (SOF) and cardiovascular health study (CHS)		
		2 subject's inability to rise from a chair 5 times without using her arms;		**SOF**	**CHS**
		3 reduced energy level	**Receiver Operating Characteristic curve area (ROC)**	0.72 (0.71-0.73)	0.72 (0.71-0.74)
Ensrud, 2009[51]	mortality	1 weight loss of 5% or more between baseline and 2nd examination;	mortality rate, 95% CI, odds ratio, hazard ratio for each risk group and area under the curve were calculated and compared between cohorts from study of osteoporotic fractures (SOF) and cardiovascular health study (CHS)		
		2 subject's inability to rise from a chair 5 times without using her arms;		**SOF**	**CHS**
		3 poor energy	**Receiver Operating Characteristic curve area (ROC)**	0.71 (0.67-0.75)	0.72 (0.69-0.76)
Fried, 2001[55]	3-year mortality 7-year mortality	1 weight loss (shrinking); 2 grip strength (weakness);	Cox proportional hazards models were used to assess the independent predictive validity of frailty phenotype.		
		3 exhaustion (poor endurance);	**3-year outcomes/HR(CI)**	**Intermediate**	**frail**
			Mortality	1.49(1.11-1.99)	2.24(1.51-3.33)
		4 walking time (slowness);	**7-year outcomes/HR(CI)**	**Intermediate**	**frail**
		5 low physical activity	Mortality	1.32(1.13-1.55)	1.63(1.27-2.08)
Gill, 2006[372]	6-year mortality	1 weight loss 2 muscle weakness	Cox proportional hazards models were used to calculate the unadjusted hazard ratios and assess the predictive validity for each component		
		3 exhaustion	**Outcome measures/HR**	**6-year mortality**	
		4 slow walking speed;	Weight loss	2.03	
		5 low physical activity	Exhaustion	1.97	
			Low physical activity	2.83	
			Muscle weakness	1.93	
			Slow walking speed	2.28	
Graham, 2009[202]	10-year mortality	1 weight loss 2 grip strength	Cox proportional hazards models were used to assess the independent predictive validity of frailty index		
		3 exhaustion	**10-year outcomes/HR(CI)**	**Pre-frail**	**frail**
		4 slow walking 5 low physical activity	Mortality	1.25(1.07-1.46)	1.81(1.41-2.31)
Purser, 2006[373]	6-month mortality	**measure set A** 1 mobility	Logistic regressions were used to assess the independent predictive validity for each composite or single item measures.		
		2 grip strength	**Frailty index/OR(CI)**	**6-month mortality**	
		3 low endurance	Measure set A	1.9(0.6-6)	
		4 physical activity limitation	Measure set B	1.4(0.3-5.6)	
		5 nutrition	Gait speed	4(1.1-13.8)	

Appendix E Table 51. Predictive Models Based on Frailty Phenotype Definition (continued)

Reference	Outcome	Independent Variables	Accuracy and Validation		
		measure set B	Grip strength	2.7(0.7-10)	
		1 mobility	Chair-stand	1.5(0.4-5)	
		2 activities of daily living			
		3 incontinence			
		4 cognitive impairment			
		single item performance measure			
		1 Gait speed			
		2 Grip strength			
		3 Chair stands			
Avila-Funes, 2009[169]	4-year mortality	1 weight loss 2 exhaustion	Logistic regressions and multivariate logistic regressions were used to assess the unadjusted and independent effect of frailty on each outcome		
		3 low physical activity	**Outcome measures/OR(CI)**	**Pre-frail**	**frail with cognitive impairment**
		4 slowness	Mortality	1.96(1.38-2.8)	3.46(2.05-5.84)
		5 weakness			
		6 with or without cognitive impairment			

Appendix E Table 52. Predictive Models Based on Frailty Accumulation of Deficits Definition

Reference	Outcome	Independent Variables	Accuracy/Validation
Drame, 2008[375]	2-year mortality	1 age: 85 years or older 2 dependent for the ADL: yes 3 delirium: yes 4 malnutrition risk: yes 5 comorbidity level: medium	death rate, 95% CI for each risk group and area under the curve were calculated and compared **Derivation Cohort** / **Validation Cohort** **Receiver operating characteristics curve area**: 0.72 (0.68-0.75) / 0.71 (0.66-0.76)
Ravaglia, 2008[362]	4-year mortality; 4-year Hospital admission; 4-year Worsening disability; 4-year Incident disability	1 age >=80; 2 male gender; 3 physical inactivity 4 use of >=3 drugs; 5 sensory deficits; 6 calf circumference <31cm; 7 instrumental activity of daily Living disability; 8 gait and balance test <=24; 9 pessimism about one's health	not reported
Carey, 2008[129]	1-year mortality; 2-year mortality; 3-year mortality	1 male; 2 age; 75-79 80-84; >=85 3 dependence in toileting 4 dressing Partially dependent; Fully dependent 5 malignant neoplasm 6 congestive heart failure 7 chronic obstructive Pulmonary disease 8 renal failure or insufficiency	No. at risk, mortality rate for each risk group and area under the curve were calculated compared between development and validation cohorts. **Derivation cohort** / **Validation cohort** **Receiver operating characteristic curve (ROC)**: 0.66 / 0.69
Pilotto, 2008[363]	1-year mortality	1 Activities of daily living index 2 instrumental activities of daily living scale 3 Short Portable Mental Status questionnaire 4 comorbidity index 5 Mini Nutritional Assessment	Calibration of the model was assessed by comparing the predicted mortality with the actual mortality in the development and validation cohorts; discrimination of the model was assessed by calculating the receiver operating characteristic curves for the development and validation cohorts. **Development** / **Validation**

Appendix E Table 52. Predictive Models Based on Frailty Accumulation of Deficits Definition (continued)

Reference	Outcome	Independent Variables	Accuracy/Validation		
				cohort	**cohort**
		6 Exton Smith Scale	**Receiver operating characteristic curve area (ROC)**	0.751 (0.71-0.81)	Not reported
		7 number of medications 8 social support network			
Fried, 1998[54]	5-year mortality	1 age 2 male sex 3 income less than $50 000 per year, 4 low weight	The 5-year overall mortality rate and mortality per person-year for each risk group were calculated and compared between cardiovascular health study (CHS) original cohort and the African American cohort.		
				Original cohort	**African American cohort**
		5 lack of moderate or vigorous exercise	**Chi-square trend**	659.73	55.97
		6 smoke > 50 pack-years 7 high brachial systolic blood pressure (> 169mm Hg) 8 low tibial systolic blood pressure (<127mm Hg) 9 diuretic use by those without hypertension or congestive heart failure 10 elevated fasting glucose level >7.2 mmol/L [130 mg/dL] 11 low albumin level (<=37 g/L) 12 elevated creatinine level (>=106 µmol/L [1.2 mg/dL]) 13 low forced vital capacity (<=2.06 mL) 14 aortic stenosis (moderate or severe) and abnormal left ventricular ejection fraction (by echocardiography) 15 major electrocardiographic abnormality 16 stenosis of internal carotid artery (by ultrasound), 17 congestive heart failure 18 difficulty in any instrumental activity of daily living, 19 low cognitive function by Digit Symbol Substitution test score.	**P-value**	<.001	<.001
Melzer, 2003[14]	4-year mortality	1 gait speed;	Crude and age/sex-adjusted death rates, hazard ratio for self-reported and predicted inability to walk 1/2 mile based on mobility-related limitation index scores (MOBLI).		
		2 time to 5 chair stands;	**Unable to walk1/2 mile**	**MOBLI**	**Self-reported**
		3 peak expiratory flow	**By death rate**	31.7	32.4
			By hazard ratio	2.71(2.28-3.21)	2.95(2.48-3.5)

Appendix E Table 52. Predictive Models Based on Frailty Accumulation of Deficits Definition (continued)

Reference	Outcome	Independent Variables	Accuracy/Validation
Garcia-Gonzalez, 2009[367]	2-year mortality	Health problems before age 10 Poor self-assessed health Medically diagnosed conditions Medical symptoms during past 2 years Difficulty with activities of daily living Difficulty with instrumental activities of Daily living	Number and hazard ratios of mortality,95% CI according to different levels of the frailty index were calculated. No ROC reported
Pijpers, 2009[370]	3-year mortality	1 age: per 10 years 2 male sex 3 living alone 4 cardiovascular disease 5 diabetes 6 medication number>=2 7 Body mass index<18.5 8 Elderly Mobility Scale score <20 9 motor deficit in ADL 10 process deficit in ADL	ROC curves were computed; mean predicted 3-year mortality risk and observed 3-year mortality were calculated and compared in each quintile of risk score **index model** **Receiver Operating Characteristics curve area** 0.78 (0.71-0.84)
Mazzaglia, 2007[187]	15-month mortality 15-month hospitalization	1 age: 65-74 75-84 >=85 2 sex female Male 3 positive responses to the Screening test 0-1 2-3 4-6 4 having hospitalization in the Previous 6 months 5 having >=5 prescriptions	Number of death/who at risk, percentage, 95%CI, sensitivity and specificity, area under the curve were calculated and compared for both cohorts according to risk scores **Receiver operating characteristic curve area** — **Development cohort** / **Validation cohort** Mortality — 0.75 (0.72-0.78) / 0.75(0.73-0.78)
Jones, 2005[144]	5-year mortality 5-year institutionalization	**1 Impairment index includes** cognition Emotion Communication mobility Balance	Mean and standard deviation for socio-demographic , clinical variables and uses of clinical services were calculated and compared by index levels. **Receiver Operating Characteristic curve area** — **FI-GCA** / **FI** Mortality — 0.67 / 0.7

Appendix E Table 52. Predictive Models Based on Frailty Accumulation of Deficits Definition (continued)

Reference	Outcome	Independent Variables	Accuracy/Validation		
		Bladder Bowel Nutrition Activities of daily living Social **2 Comorbidity index**			
Mitnitski, 2002[374]	mortality	Vision loss;	Construct validity was examined through its relationship to chronological age; criterion validity was examined in its ability to predict mortality.		
		Hearing loss;		**Biological age**	**Chronological age**
		Impaired mobility;	Beta coefficient	0.0081	0.0081
		Vascular problem;	Standard deviation	0.0014	0.0038
		Gait abnormality;	t-value	5.7	2.15
		Impaired vibration sense;	p-value	<0.000001	0.0313
		Difficulty bathing; Difficulty going out; Difficulty cooking; Difficulty toileting; Difficulty grooming Skin problem; Resting tremor; Changes in sleep; Difficulty dressing; Urinary complaints; Gastro-intestinal problem; Diabetes; Hypertension; Limb tone abnormality			
Walter, 2001[125]	1-year mortality	1 male sex 2 dependent in 1-4 ADLs	No. of death/ No. at risk, 95% CI for each risk group and area under the curve were calculated and compared between derivation and validation cohorts		
		3 dependent in all ADLs	**Receiver Operating characteristic curve area**	**Derivation Cohort**	**Validation Cohort**
		4 congestive heart failure	By risk group	0.75	0.79
		5 solitary cancer	By quartile of risk	0.75	0.8
		6 metastatic cancer 7 creatinine level on admission >3mg/dl 8 albumin level on admission is 3-3.4 g/dL albumin level on admission is <3 g/dL			
Lee, 2006[71]	4-year mortality	1 male sex 2 age 60-64	No. of death/ No. at risk for each risk group and area under the curve were calculated and compared between development and validation cohorts.		
		3 age 65-69	**Receiver Operating Characteristic curve area**	**Development Cohort**	**Validation Cohort**

Appendix E Table 52. Predictive Models Based on Frailty Accumulation of Deficits Definition (continued)

Reference	Outcome	Independent Variables	Accuracy/Validation		
		4 age 70-74			
		5 age 75-79	By risk group	0.84	0.817
		6 age 80-84	By quartile of risk	0.842	0.819
		7 age >=85			
		8 diabetes mellitus			
		9 cancer			
		10 lung cancer			
		11 heart failure			
		12 body mass index<25			
		13 current smoker			
		14 bathing			
		15 managing finances			
		16 walking several blocks			
		17 pushing/pulling heavy objects			
Inouye, 2003[122]	1-year mortality	1 high risk diagnoses;	No. of death/ No. at risk, hazard ratio, 95% CI for each risk group and area under the curve were calculated and compared between development and validation cohort.		
		2 albumin <=3.5 mg/dL;			
		3 Creatinine >15 mg/dL;		**Derivation Cohort**	**Validation Cohort**
			Receiver Operating characteristic curve	0.83 (0.78-0.87)	0.77 (0.74-0.8)
		4 dementia;	**Chi-square trend**	179.33	274.01
		5 walking impairment	**P-value**	0.001	0.001
Schonberg, 2009[366]	5-year mortality	1 age	mortality rate, person-year rate were calculated and compared between development and validation cohorts according to quintile of risk and point score.		
		65-69		**index model**	
		70-74	**Receiver operating characteristic curve area (ROC)**	0.75	
		75-79			
		80-84			
		85+			
		2 Male sex			
		3 Smoking status			
		never			
		Former			
		Current			
		4 body mass index<25 kg/m²			
		5 comorbid conditions			
		COPD			
		Diabetes mellitus			
		Cancer			
		6 overnight hospitalization in past year			
		None			
		One			

Appendix E Table 52. Predictive Models Based on Frailty Accumulation of Deficits Definition (continued)

Reference	Outcome	Independent Variables	Accuracy/Validation		
		Two or more			
		7 perceived health			
		Excellent/very good			
		Good			
		Fair/good			
		8 functional measures			
		Dependent in at least 1 IADL			
		Difficulty walking several blocks			
Carey, 2004[368]	2-year mortality;	1 male gender;	No. at risk, mortality rate for each risk group and area under the curve were calculated and compared between development and validation cohorts.		
		2 age;			
		76-80			
		81-85;		**Derivation cohort**	**Validation cohort**
		>85	**Receiver Operating Characteristics curve area**	0.76	0.74
		3 dependence in bathing			
		4 dependence in shopping			
		5 difficulty walking several blocks			
		6 difficulty pulling/pushing heavy objects			
Levine, 2007[369]	1-year mortality	1 age	No. of death/ No. at risk, 95% CI for each risk group and area under the curve were calculated and compared between derivation and validation cohorts		
		70-74			
		75-79	**Receiver operating characteristic curve area (ROC)**	**Derivation Cohort**	**Validation Cohort**
		80-84	By risk group	0.67	0.65
		85-89	By quartile of risk	0.7	0.68
		>=90			
		2 Discharge to nursing home or			
		Skilled nursing facility			
		3 length of stay >=5 days			
		4 congestive heart failure			
		5 peripheral vascular disease			
		6 dementia			
		7 renal disease			
		8 hematologic and solid malignancy			
		9 metastatic cancer			

Appendix E Table 53. Short-Term Prediction of Death in Older Persons

<table>
<tr><th>Reference</th><th>Outcome</th><th>Independent Variables</th><th colspan="3">Accuracy and validation</th></tr>
<tr><td rowspan="6">Purser, 2006[373]</td><td rowspan="6">6-month mortality</td><td rowspan="6">measure set A
1 mobility
2 grip strength
3 low endurance
4 physical activity limitation
5 nutrition
measure set B
1 mobility
2 activities of daily living
3 incontinence
4 cognitive impairment
single item performance measure
1 Gait speed
2 Grip strength
3 Chair stands</td><td colspan="3">Logistic regressions were used to assess the independent predictive validity for each composite or single item measures.
Frailty index/OR(CI) | 6-month mortality</td></tr>
<tr><td colspan="2">Measure set A</td><td>1.9(0.6-6)</td></tr>
<tr><td colspan="2">Measure set B</td><td>1.4(0.3-5.6)</td></tr>
<tr><td colspan="2">Gait speed</td><td>4(1.1-13.8)</td></tr>
<tr><td colspan="2">Grip strength</td><td>2.7(0.7-10)</td></tr>
<tr><td colspan="2">Chair-stand</td><td>1.5(0.4-5)</td></tr>
<tr><td rowspan="3">Carey, 2008[129]</td><td rowspan="3">1-year mortality;</td><td rowspan="3">1 male;
2 age;
75-79
80-84;
>=85
3 dependence in toileting
4 dressing
Partially dependent;
Fully dependent
5 malignant neoplasm
6 congestive heart failure
7 chronic obstructive
Pulmonary disease
8 renal failure or insufficiency</td><td colspan="3">Mortality rate for each risk group and area under the curve were calculated and compared between derivation and validation cohorts.</td></tr>
<tr><td></td><td>Derivation cohort</td><td>Validation cohort</td></tr>
<tr><td>Receiver operating characteristic curve area (ROC)</td><td>0.66</td><td>0.69</td></tr>
<tr><td rowspan="3">Pilotto, 2008[363]</td><td rowspan="3">1-year mortality</td><td rowspan="3">1 Activities of daily living index
2 instrumental activities of daily living scale
3 Short Portable Mental Status questionnaire
4 comorbidity index
5 Mini Nutritional Assessment
6 Exton Smith Scale
7 number of medications</td><td colspan="3">Calibration of the model was assessed by comparing the predicted mortality with the actual mortality in the development and validation cohorts; discrimination of the model was assessed by calculating the receiver operating characteristic curves for the development and validation cohorts.</td></tr>
<tr><td></td><td>Development cohort</td><td>Validation cohort</td></tr>
<tr><td>Receiver operating characteristic curve area (ROC)</td><td>0.751 (0.71-0.81)</td><td>Not reported</td></tr>
</table>

Appendix E Table 53. Short-Term Prediction of Death in Older Persons (continued)

Reference	Outcome	Independent Variables	Accuracy and validation		
		8 social support network			
Walter, 2001[125]	1-year mortality	1 male sex 2 dependent in 1-4 ADLs	No. of death/ No. at risk, 95% CI for each risk group and area under the curve were calculated and compared between derivation and validation cohort		
		3 dependent in all ADLs	**Receiver operating characteristic curve area (ROC)**	**Derivation Cohort**	**Validation Cohort**
		4 congestive heart failure	By risk group	0.75	0.79
		5 solitary cancer	By quartile of risk	0.75	0.8
		6 metastatic cancer 7 creatinine level on admission > 3mg/dl 8 albumin level on admission is 3-3.4 g/dL albumin level on admission is <3 g/dL			
Inouye, 2003[122]	1-year mortality	1 high risk diagnoses; 2 albumin <=3.5 mg/dL;	No. of death/ No. at risk, hazard ratio, 95% CI for each risk group and area under the curve were calculated and compared between derivation and validation cohort.		
		3 Creatinine >15 mg/dL;		**Derivation Cohort**	**Validation Cohort**
		4 dementia;	**Receiver operating characteristic curve area (ROC)**	0.83 (0.78-0.87)	0.77 (0.74-0.8)
		5 walking impairment	**Chi-square trend**	179.33	274.01
			P-value	0.001	0.001
Levine, 2007[369]	1-year mortality	1 age 70-74	No. of death/ No. at risk, 95% CI for each risk group and area under the curve were calculated and compared between derivation and validation cohorts		
		75-79	**Receiver operating characteristic curve area (ROC)**	**Derivation Cohort**	**Validation Cohort**
		80-84	By risk group	0.67	0.65
		85-89	By quartile of risk	0.7	0.68
		>=90 2 Discharge to nursing home or Skilled nursing facility 3 length of stay >=5 days 4 congestive heart failure 5 peripheral vascular disease 6 dementia 7 renal disease 8 hematologic and solid Malignancy 9 metastatic cancer			

Appendix E Table 54. Long-Term Prediction of Death in Older Persons

Reference	Outcome	Independent Variables	Accuracy and Validation
Fried, 1998[54]	5-year mortality	1 age 2 male sex 3 income less than $50 000 per year, 4 low weight 5 lack of moderate or vigorous exercise 6 smoke > 50 pack-years 7 high brachial systolic blood pressure (> 169mm Hg) 8 low tibial systolic blood pressure (<127mm Hg) 9 diuretic use by those without hypertension or congestive heart failure 10 elevated fasting glucose level >7.2 mmol/L [130 mg/dL] 11 low albumin level (<=37 g/L) 12 elevated creatinine level (>=106 µmol/L [1.2 mg/dL]) 13 low forced vital capacity (<=2.06 mL) 14 aortic stenosis (moderate or severe) and abnormal left ventricular ejection fraction (by echocardiography) 15 major electrocardiographic abnormality 16 stenosis of internal carotid artery (by ultrasound), 17 congestive heart failure 18 difficulty in any instrumental activity of daily living, 19 low cognitive function by Digit Symbol Substitution test score.	The 5-year overall mortality rate and mortality per person-year for each risk group were calculated and compared between cardiovascular health study (CHS) original cohort and the African American cohort. **Original cohort** / **African American cohort** **Chi-square trend**: 659.73 / 55.97 **P-value**: <.001 / <.001
Schonberg, 2009[366]	5-year mortality	1 age 65-69 70-74 75-79 80-84 85+ 2Male sex 3 Smoking status never	Mortality rate, person-year rate were calculated and compared between development and validation cohorts according to quintile of risk and point score. **index model** **Receiver operating characteristic curve area (ROC)**: 0.75

Appendix E Table 54. Long-Term Prediction of Death in Older Persons (continued)

Reference	Outcome	Independent Variables	Accuracy and Validation		
		Former Current 4 body mass index<25 kg/m² 5 comorbid conditions COPD Diabetes mellitus Cancer 6 overnight hospitalization in past year None One Two or more 7 perceived health Excellent/very good Good Fair/good 8 functional measures Dependent in at least 1 IADL Difficulty walking several blocks			
Jones, 2005[144]	5-year mortality	**1 Impairment index includes** cognition Emotion Communication mobility Balance Bladder Bowel Nutrition Activities of daily living Social **2 Comorbidity index**	Mean and standard deviation for socio-demographic , clinical variables and uses of clinical services were calculated and compared by index levels.		
			Receiver operating characteristic curve area (ROC)	**FI-GCA**	**FI**
			Mortality	0.67	0.7

Appendix E Table 55. Decisionmaking Models of Cost-Effectiveness of Screening

Reference	Aim	Perspective	Study Design	Subjects	Setting	Model Validity	Quality of Data
Frazier et al, 2000[376]	1) Evaluate the use of rehydration for fecal occult blood testing 2) Evaluate the impact of a followup colonoscopy after the detection of a small tubular adenoma by sigmoidoscopy 3) Consider the impact of imperfect compliance with screening in average-risk individuals	Societal	Cost effectiveness analysis	Hypothetical subjects, representative of the 50-year-old U.S. population, at average risk for colorectal cancer	Simulated clinical practice in U.S.	State-transition Markov model	1) Age and sex specific prevalence of adenomatous polyps using a weighted logistic regression analysis of results from 6 autopsy studies 2) Probability of transformation from low-risk to high-risk polyps was estimated from studies of small polyps left in situ and reexamined annually 3) Prevalence of colorectal cancer and stage distribution at 50-year-old was obtained from SEER data 4) Costs of colorectal cancer treatment by stage and time period were obtained from a cost study from a large HMO 5) Compliance rates were obtained in the optimized setting of clinical trials of colorectal cancer screening
Vijan et al, 2001[377]	Determine how compliance affects cost effectiveness, the optimal timing and frequency of colonoscopy, and the effects of pricing on the relative cost effectiveness of different screening procedures.	Third-party payer perspective	Cost effectiveness analysis			Is tested by altering the compliance rate, sensitivity and specificity of fecal occult blood testing to fit the Minnesota fecal occult blood testing screening trial and was validated	
Ness et al, 2000[378]	Investigate the age-dependent cost-utilityof one-time colonoscopy screening	Societal perspective	Cost utility analysis			1) Content validity was validated by literature search 2) Construct validity was validated through the ability to match colorectal cancer	

Appendix E Table 55. Decisionmaking Models of Cost-Effectiveness of Screening (continued)

Reference	Aim	Perspective	Study Design	Subjects	Setting	Model Validity	Quality of Data
						incidence and adenoma prevalence data simultaneously 3) Criterion validity was validated by modeling the National Polyp Study and correctly predicting their colorectal cancer outcomes by simulation	
Loeve et al, 2000[379]	Possible costs and savings of endoscopic colorectal cancer screening are explored to investigate whether the induced savings may compensate for the costs of screening		Cost saving analysis	Simulated dynamic U.S. population of 1993		Validity of the 'expert' model is based on observational data and has not been tested on a large longitudinal dataset; sensitivity analysis was performed for important uncertain parameters	
Song et al, 2004[380]	Compare the potential clinical and economic consequences of fecal DNA testing with those of established screening strategies and determine the target attributes that would make fecal DNA testing comparable with screening colonoscopy		Cost Effectiveness Analysis				

Appendix E Table 56. **Evaluation of Decisionmaking Models of Cost-Effectiveness of Screening**

Reference	Alternative Strategies	Measure of Cost/ Consequence	Differential Timing Adjustment	Incremental Analysis Performed	Uncertainty Allowance	Results
Frazier et al, 2000[376]	1) No screen 2) Sigmoidoscopy-1 at age 55 years 3) Sigmoidoscopy-2 at age 55 years 4) Double-contrast barium enema; at age 55 years 5) Sigmoidoscopy-1 every 10 years 6) Sigmoidoscopy-2 every 10 years 7) Colonoscopy at age 55 years 8) Sigmoidoscopy-1 every 5 years 9) Double-contrast barium enema; every 10 years 10) Sigmoidoscopy-2 every 5 years 11) Unrehydrated fecal occult blood testing 12) Unrehydrated fecal occult blood testing+sigmoidoscopy-1 every 10 years 13) Unrehydrated fecal occult blood testing+sigmoidoscopy-2 every 10 years 14) Double-contrast barium enema; every 5 years 15) Rehydrated fecal occult blood testing 16) Unrehydrated fecal occult blood testing+sigmoidoscopy-1 every 5 years 17) Colonoscopy every 10 years 18) Unrehydrated fecal occult blood testing+sigmoidoscopy-2 every 5 years 19) Rehydrated fecal occult blood testing+sigmoidoscopy-1 every 10 years 20) Rehydrated fecal occult blood testing+sigmoidoscopy-2 every 10 years 21) Rehydrated fecal occult blood testing+sigmoidoscopy-1 every 5 years 22) Rehydrated fecal occult blood testing+sigmoidoscopy-2 every 5 years	1) Lifetime cost per person screened, measured by dollar 2) Life expectancy, measured by year 3) Reduction in colorectal cancer incidence and mortality		Yes	Yes	1) In 1 base-case analysis, compliance was assumed to be 60% with the initial screen and 80% with followup or surveillance colonoscopy; annual rehydrated fecal occult blood testing plus sigmoidoscopy every 5 years had an incremental CE ratio of $489,900 per life-year gained compared with the same strategy every 10 years 2) The most effective strategy for white men was annual rehydrated fecal occult blood testing plus sigmoidoscopy (followed by colonoscopy if either a low- or high-risk polyp was found) every 5 years from age 50 to 85 years, which resulted in a 60% reduction in cancer incidence and an 80% reduction in colorectal cancer mortality compared with no screening, and an incremental CE ratio of $92,900 per year of life gained compared with annual unrehydrated fecal occult blood testing plus sigmoidoscopy every 5 years 3) In a base-case analysis in which compliance with screening and followup is assumed to be 100%, screening more often than every 10 years was prohibitively expensive 4) Other strategies recommended by the expert panel were either less effective

Appendix E Table 56. **Evaluation of Decisionmaking Models of Cost-Effectiveness of Screening (continued)**

Reference	Alternative Strategies	Measure of Cost/ Consequence	Differential Timing Adjustment	Incremental Analysis Performed	Uncertainty Allowance	Results
						or cost more per year of life gained than the alternatives 5) Colonoscopy every 10 years was less effective than the combination of annual fecal occult blood testing plus sigmoidoscopy every 5 years. However, a single colonoscopy at age 55 years achieves nearly half of the reduction in colorectal cancer mortality obtainable with colonoscopy every 10 years 6) Because of increased life expectancy among white women and increased cancer mortality among blacks, colorectal cancer screening was even more cost effective in these groups than in white men.
Vijan et al, 2001[377]	1) No screening 2) Sigmoidoscopy 3) Colonoscopy at age 60 years 4) Colonoscopy at age 55 years 5) Fecal occult blood testing 6) Colonoscopy at ages 55 years and 65 years 7) Colonoscopy at ages 50 years and 60 years 8) Sigmoidoscopy and fecal occult blood testing	1) Average gain in life expectancy, measured by days 2) Average cost, measured by dollar 3) Relative reduction in colorectal cancer	Costs and life expectancy discounted at 3% per annum	Yes	Yes	1) All strategies are cost effective versus no screening, at less than $20,000 per life-year saved 2) Direct comparison suggests that the most effective strategies are twice-lifetime colonoscopy and flexible sigmoidoscopy combined with fecal occult blood testing 3) Assuming perfect compliance, flexible sigmoidoscopy combined with fecal occult blood testing is slightly more effective than twice-lifetime colonoscopy (at ages 50 and 60 years) but is substantially more expensive, with an incremental cost

Appendix E Table 56. Evaluation of Decisionmaking Models of Cost-Effectiveness of Screening (continued)

Reference	Alternative Strategies	Measure of Cost/ Consequence	Differential Timing Adjustment	Incremental Analysis Performed	Uncertainty Allowance	Results
						effectiveness of $390,000 per additional life-year saved 4) Colonoscopy at ages 50 and 60 years is the preferred test regardless of compliance with the primary screening test 5) If followup colonoscopy for polyps is less than 75%, then even once-lifetime colonoscopy is preferred over most combinations of flexible sigmoidoscopy and fecal occult blood testing.
Ness et al, 2000[378]	1) Never screening 2) Colonoscopy screening at age 60-64 years 3) Colonoscopy screening at age 55-59 years 4) Colonoscopy screening at age 50-54 years 5) Colonoscopy screening at age 45-49 years	1) Cost is measured by dollars 2) Effectiveness (utility) is measured by QALYs	1) All costs and QALYs are discounted at a 3% annual rate 2) In sensitivity analysis discount rate varied from 0% to 5%	Yes	Yes	1) For both sexes, one-time colonoscopic screening between 50 and 54 years of age is associated with a marginal cost-utility of less than $10,000 per additional quality-adjusted life-year compared to screening between 55 and 60 years of age 2) Onetime colonoscopic screening between 45 and 49 years of age is either dominated (women) or associated with a marginal cost-utility of $69,000/per quality-adjusted life-year (men) compared to screening between 50 and 54 years of age 3) The marginal cost-utility of one-time colonoscopic screening is relatively insensitive to plausible changes in the cost of colonoscopy, the cost of colorectal cancer treatment,

Appendix E Table 56. Evaluation of Decisionmaking Models of Cost-Effectiveness of Screening (continued)

Reference	Alternative Strategies	Measure of Cost/ Consequence	Differential Timing Adjustment	Incremental Analysis Performed	Uncertainty Allowance	Results
						the sensitivity of colonoscopy for colorectal neoplasia, the utility values representing the morbidity associated with the colorectal cancer-related health states, and the discount rate.
Loeve et al, 2000[379]	1) Sigmoidoscopy at age 50 years 2) Sigmoidoscopy at age 55 years 3) Sigmoidoscopy at age 60 years 4) Sigmoidoscopy at age 65 years 5) Sigmoidoscopy at age 70 years 6) Sigmoidoscopy at age 75 years	All costs and savings are measured by dollars	3% discount rate is applied to costs and health effects	N/A	Yes	1) Given the expert opinion-based assumptions, a program based on every 5-year sigmoidoscopy screenings could result in a net savings of direct health care costs due to prevention of cancer treatment costs that compensate for the costs of screening, diagnostic followup, and surveillance 2) This result persists when costs and health effects are discounted at 3% 3) The “break-even” point, the time required before savings exceed costs, is 35 years for a screening program that terminates after 30 years and 44 years for a screening program that continues on indefinitely
Song et al, 2004[380]	1) Natural history (no screening) 2) Fecal DNA testing 3) Flexible sigmoidoscopy 4) Fecal occult blood testing 5) Colonoscopy	1) Costs are measured by dollars 2) Effectiveness is measured by life-years gained	Life years and costs were discounted at 3% annually	Yes	Yes	1) Compared with no screening, fecal-DNA at a screening interval of 5 years decreased colorectal cancer incidence by 35% and colorectal cancer mortality by 54% and gained 4,560 life-years per 100,000 persons at $47,700/life-year gained in the base case 2) The average number of colonoscopies per person was

Appendix E Table 56. Evaluation of Decisionmaking Models of Cost-Effectiveness of Screening (continued)

Reference	Alternative Strategies	Measure of Cost/ Consequence	Differential Timing Adjustment	Incremental Analysis Performed	Uncertainty Allowance	Results
						3.8 with colonoscopy and 0.8 with fecal-DNA 3) in most 1-way sensitivity analyses and Monte Carlo simulation iterations, fecal-DNA remained reasonably cost-effective compared with no screening, but colonoscopy and fecal occult blood testing dominated fecal-DNA 4) Assuming fecal DNA testing sensitivities of 65% for colorectal cancer and 40% for large polyp, and 95% specificity, a screening interval of 2 years and a test cost of $195 would be required to make fecal-DNA comparable with colonoscopy

References for Appendix E

1. Plassman BL, Langa KM, Fisher GG, et al. Prevalence of cognitive impairment without dementia in the United States.[summary for patients in Ann Intern Med. 2008 Mar 18;148(6):I-53; PMID: 18347348]. *Annals of internal medicine* 2008 Mar 18; 148(6):427-34.
2. Tabbarah M, Mihelic A, Crimmins E. Disability: the demographics of physical functioning and home environments of older Americans. *Journal of Architectural and Planning Research* 2001; 18(3):183-93.
3. Fuller-Thomson E, Nuru-Jeter A, Minkler M, et al. Black-White disparities in disability among older Americans: further untangling the role of race and socioeconomic status. *J Aging Health* 2009 Aug; 21(5):677-98.
4. Fuller-Thomson E, Yu B, Nuru-Jeter A, et al. Basic ADL disability and functional limitation rates among older AMERICANS from 2000-2005: the end of the decline? *J Gerontol A Biol Sci Med Sci* 2009 Dec; 64(12):1333-6.
5. Gallo JJ, Schoen R, Jones R. Cognitive impairment and syndromal depression in estimates of active life expectancy: the 13-year follow-up of the Baltimore Epidemiologic Catchment Area sample. *Acta Psychiatrica Scandinavica* 2000 Apr; 101(4):265-73.
6. Klein BE, Klein R, Knudtson MD, et al. Frailty, morbidity and survival. *Arch Gerontol Geriatr* 2005 Sep-Oct; 41(2):141-9.
7. Goins RT, Moss M, Buchwald D, et al. Disability among older American Indians and Alaska Natives: an analysis of the 2000 Census Public Use Microdata Sample. *Gerontologist* 2007 Oct; 47(5):690-6.
8. Stookey JD, Purser JL, Pieper CF, et al. Plasma hypertonicity: another marker of frailty? *J Am Geriatr Soc* 2004 Aug; 52(8):1313-20.
9. Cohen HJ, Harris T, Pieper CF. Coagulation and activation of inflammatory pathways in the development of functional decline and mortality in the elderly. *Am J Med* 2003 Feb 15; 114(3):180-7.
10. Ferrucci L, Guralnik JM, Pahor M, et al. Hospital diagnoses, Medicare charges, and nursing home admissions in the year when older persons become severely disabled.[see comment]. *JAMA* 1997 Mar 5; 277(9):728-34.
11. Hanlon JT, Fillenbaum GG, Kuchibhatla M, et al. Impact of inappropriate drug use on mortality and functional status in representative community dwelling elders. *Med Care* 2002 Feb; 40(2):166-76.
12. Corti MC, Guralnik JM, Salive ME, et al. Serum albumin level and physical disability as predictors of mortality in older persons. *JAMA* 1994 Oct 5; 272(13):1036-42.
13. Hays JC, Keller HH, Ostbye T. The effects of nutrition-related factors on four-year mortality among a biracial sample of community-dwelling elders in the North Carolina piedmont. *J Nutr Elder* 2005; 25(2):41-67.
14. Melzer D, Lan TY, Guralnik JM. The predictive validity for mortality of the index of mobility-related limitation--results from the EPESE study. *Age Ageing* 2003 Nov; 32(6):619-25.
15. Pahor M, Guralnik JM, Chrischilles EA, et al. Use of laxative medication in older persons and associations with low serum albumin. *J Am Geriatr Soc* 1994 Jan; 42(1):50-6.
16. Ferrucci L, Guralnik JM, Salive ME, et al. Cognitive impairment and risk of stroke in the older population. *J Am Geriatr Soc* 1996 Mar; 44(3):237-41.
17. Bassuk SS, Berkman LF, Wypij D. Depressive symptomatology and incident cognitive decline in an elderly community sample. *Arch Gen Psychiatry* 1998 Dec; 55(12):1073-81.
18. Royall DR, Chiodo LK, Mouton C, et al. Cognitive predictors of mortality in elderly retirees: results from the Freedom House study. *Am J Geriatr Psychiatry* 2007 Mar; 15(3):243-51.
19. Brody KK, Johnson RE, Douglas Ried L. Evaluation of a self-report screening instrument to predict frailty outcomes in aging populations. *Gerontologist* 1997 Apr; 37(2):182-91.
20. Chodosh J, Seeman TE, Keeler E, et al. Cognitive decline in high-functioning older persons is associated with an increased risk of hospitalization. *J Am Geriatr Soc* 2004 Sep; 52(9):1456-62.
21. Seeman TE, Crimmins E, Huang MH, et al. Cumulative biological risk and socio-economic differences in mortality: MacArthur studies of successful aging. *Social science & medicine* 2004 May; 58(10):1985-97.
22. Karlamangla AS, Singer BH, Seeman TE. Reduction in allostatic load in older adults is associated with lower all-cause mortality risk: MacArthur studies of successful aging. *Psychosom Med* 2006 May-Jun; 68(3):500-7.
23. Bruce ML, Seeman TE, Merrill SS, et al. The impact of depressive symptomatology on physical disability: MacArthur Studies of Successful Aging. *Am J Public Health* 1994 Nov; 84(11):1796-9.
24. Sarkisian CA, Gruenewald TL, John Boscardin W, et al. Preliminary evidence for subdimensions of geriatric frailty: the MacArthur study of successful aging. *J Am Geriatr Soc* 2008 Dec; 56(12):2292-7.
25. Seeman TE, McEwen BS, Rowe JW, et al. Allostatic load as a marker of cumulative biological risk: MacArthur studies of successful aging. *Proc Natl Acad Sci U S A* 2001 Apr 10; 98(8):4770-5.
26. Kiely DK, Cupples LA, Lipsitz LA. Validation and comparison of two frailty indexes: The MOBILIZE Boston Study. *J Am Geriatr Soc* 2009 Sep; 57(9):1532-9.

References for Appendix E

27. Kang HG, Costa MD, Priplata AA, et al. Frailty and the degradation of complex balance dynamics during a dual-task protocol. *J Gerontol A Biol Sci Med Sci* 2009 Dec; 64(12):1304-11.
28. Cawthon PM, Marshall LM, Michael Y, et al. Frailty in older men: prevalence, progression, and relationship with mortality. *J Am Geriatr Soc* 2007 Aug; 55(8):1216-23.
29. Shannon J, Shikany JM, Barrett-Connor E, et al. Demographic factors associated with the diet quality of older US men: baseline data from the Osteoporotic Fractures in Men (MrOS) study. *Public Health Nutr* 2007 Aug; 10(8):810-8.
30. Wiener JM, Hanley RJ, Clark R, et al. Measuring the activities of daily living: comparisons across national surveys. *J Gerontol* 1990 Nov; 45(6):S229-37.
31. Johnson TM, 2nd, Bernard SL, Kincade JE, et al. Urinary incontinence and risk of death among community-living elderly people: results from the National Survey on Self-Care and Aging. *J Aging Health* 2000 Feb; 12(1):25-46.
32. Gill TM, Kurland B. The burden and patterns of disability in activities of daily living among community-living older persons. *J Gerontol A Biol Sci Med Sci* 2003 Jan; 58(1):70-5.
33. Gill TM, Kurland BF. Prognostic effect of prior disability episodes among nondisabled community-living older persons. *Am J Epidemiol* 2003 Dec 1; 158(11):1090-6.
34. Hardy SE, Gill TM. Recovery from disability among community-dwelling older persons. *JAMA* 2004 Apr 7; 291(13):1596-602.
35. Gill TM, Allore H, Holford TR, et al. The development of insidious disability in activities of daily living among community-living older persons. *Am J Med* 2004 Oct 1; 117(7):484-91.
36. Gill TM, Allore HG, Holford TR, et al. Hospitalization, restricted activity, and the development of disability among older persons. *JAMA* 2004 Nov 3; 292(17):2115-24.
37. Hardy SE, Dubin JA, Holford TR, et al. Transitions between states of disability and independence among older persons. *Am J Epidemiol* 2005 Mar 15; 161(6):575-84.
38. Gill TM, Allore H, Hardy SE, et al. Estimates of active and disabled life expectancy based on different assessment intervals. *J Gerontol A Biol Sci Med Sci* 2005 Aug; 60(8):1013-6.
39. Gill TM, Guo Z, Allore HG. The epidemiology of bathing disability in older persons. *J Am Geriatr Soc* 2006 Oct; 54(10):1524-30.
40. Gill TM, Han L, Allore HG. Predisposing factors and precipitants for bathing disability in older persons. *J Am Geriatr Soc* 2007 Apr; 55(4):534-40.
41. Gill TM, Guo Z, Allore HG. Subtypes of disability in older persons over the course of nearly 8 years. *J Am Geriatr Soc* 2008 Mar; 56(3):436-43.
42. Gill TM, Murphy TE, Barry LC, et al. Risk factors for disability subtypes in older persons. *J Am Geriatr Soc* 2009 Oct; 57(10):1850-5.
43. Gill TM, Gahbauer EA. Evaluating disability over discrete periods of time. *J Gerontol A Biol Sci Med Sci* 2008 Jun; 63(6):588-94.
44. Rothman MD, Leo-Summers L, Gill TM. Prognostic significance of potential frailty criteria. *J Am Geriatr Soc* 2008 Dec; 56(12):2211-116.
45. Takahashi PY, Dyrbye LN, Thomas KG, et al. The association of transient ischemic attack symptoms with memory impairment among elderly participants of the Third US National Health and Nutrition Examination Survey. *J Geriatr Psychiatry Neurol* 2009 Mar; 22(1):46-51.
46. Patel KV, Semba RD, Ferrucci L, et al. Red cell distribution width and mortality in older adults: a meta-analysis. *J Gerontol A Biol Sci Med Sci* 2010 Mar; 65(3):258-65.
47. Kelman HR, Thomas C, Kennedy GJ, et al. Cognitive impairment and mortality in older community residents. *American Journal of Public Health* 1994 Aug; 84(8):1255-60.
48. Albert SM, Alam M, Nizamuddin M, et al. Comparative study of functional limitation and disability in old age: Delhi and New York city. *Journal of Cross-Cultural Gerontology* 2005 Sep; 20(3):231-41.
49. Ensrud KE, Ewing SK, Taylor BC, et al. Frailty and risk of falls, fracture, and mortality in older women: the study of osteoporotic fractures. *J Gerontol A Biol Sci Med Sci* 2007 Jul; 62(7):744-51.
50. Ensrud KE, Ewing SK, Taylor BC, et al. Comparison of 2 frailty indexes for prediction of falls, disability, fractures, and death in older women. *Arch Intern Med* 2008 Feb 25; 168(4):382-9.
51. Ensrud KE, Ewing SK, Cawthon PM, et al. A comparison of frailty indexes for the prediction of falls, disability, fractures, and mortality in older men. *J Am Geriatr Soc* 2009 Mar; 57(3):492-8.
52. Kravitz BA, Corrada MM, Kawas CH. High levels of serum C-reactive protein are associated with greater risk of all-cause mortality, but not dementia, in the oldest-old: results from The 90+ Study. *J Am Geriatr Soc* 2009 Apr; 57(4):641-6.
53. Hall CB, Verghese J, Sliwinski M, et al. Dementia incidence may increase more slowly after age 90: results from the Bronx Aging Study. *Neurology* 2005 Sep 27; 65(6):882-6.
54. Fried LP, Kronmal RA, Newman AB, et al. Risk factors for 5-year mortality in older adults: the Cardiovascular Health Study. *JAMA* 1998 Feb 25; 279(8):585-92.
55. Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: evidence for a phenotype. *J*

Gerontol A Biol Sci Med Sci 2001 Mar; 56(3):M146-56.
56. Walston J, McBurnie MA, Newman A, et al. Frailty and activation of the inflammation and coagulation systems with and without clinical comorbidities: results from the Cardiovascular Health Study. *Arch Intern Med* 2002 Nov 11; 162(20):2333-41.
57. Fitzpatrick AL, Kuller LH, Ives DG, et al. Incidence and prevalence of dementia in the Cardiovascular Health Study. *J Am Geriatr Soc* 2004 Feb; 52(2):195-204.
58. Cao JJ, Arnold AM, Manolio TA, et al. Association of carotid artery intima-media thickness, plaques, and C-reactive protein with future cardiovascular disease and all-cause mortality: the Cardiovascular Health Study. *Circulation* 2007 Jul 3; 116(1):32-8.
59. Lopez OL, Jagust WJ, DeKosky ST, et al. Prevalence and classification of mild cognitive impairment in the Cardiovascular Health Study Cognition Study: part 1. *Archives of Neurology* 2003 Oct; 60(10):1385-9.
60. Newman AB, Arnold AM, Sachs MC, et al. Long-term function in an older cohort--the cardiovascular health study all stars study. *J Am Geriatr Soc* 2009 Mar; 57(3):432-40.
61. Zakai NA, Katz R, Hirsch C, et al. A prospective study of anemia status, hemoglobin concentration, and mortality in an elderly cohort: the Cardiovascular Health Study. *Arch Intern Med* 2005 Oct 24; 165(19):2214-20.
62. Kulminski AM, Ukraintseva SV, Kulminskaya IV, et al. Cumulative deficits better characterize susceptibility to death in elderly people than phenotypic frailty: lessons from the Cardiovascular Health Study. *J Am Geriatr Soc* 2008 May; 56(5):898-903.
63. Jenny NS, Yanez ND, Psaty BM, et al. Inflammation biomarkers and near-term death in older men. *Am J Epidemiol* 2007 Mar 15; 165(6):684-95.
64. Newman AB, Yanez D, Harris T, et al. Weight change in old age and its association with mortality. *J Am Geriatr Soc* 2001 Oct; 49(10):1309-18.
65. Tschanz JT, Corcoran C, Skoog I, et al. Dementia: the leading predictor of death in a defined elderly population: the Cache County Study. *Neurology* 2004 Apr 13; 62(7):1156-62.
66. Wilson RS, Bennett DA, Bienias JL, et al. Cognitive activity and cognitive decline in a biracial community population. *Neurology* 2003 Sep 23; 61(6):812-6.
67. Jefferson AL, Massaro JM, Wolf PA, et al. Inflammatory biomarkers are associated with total brain volume: the Framingham Heart Study. *Neurology* 2007 Mar 27; 68(13):1032-8.
68. Ledikwe JH, Smiciklas-Wright H, Mitchell DC, et al. Dietary patterns of rural older adults are associated with weight and nutritional status. *J Am Geriatr Soc* 2004 Apr; 52(4):589-95.
69. Stump TE, Callahan CM, Hendrie HC. Cognitive impairment and mortality in older primary care patients. *J Am Geriatr Soc* 2001 Jul; 49(7):934-40.
70. Keller BK, Potter JF. Predictors of mortality in outpatient geriatric evaluation and management clinic patients. *J Gerontol* 1994 Nov; 49(6):M246-51.
71. Lee SJ, Lindquist K, Segal MR, et al. Development and validation of a prognostic index for 4-year mortality in older adults. *Jama* 2006 Feb 15; 295(7):801-8.
72. Cigolle CT, Ofstedal MB, Tian Z, et al. Comparing models of frailty: the Health and Retirement Study. *J Am Geriatr Soc* 2009 May; 57(5):830-9.
73. Koster A, Penninx BW, Bosma H, et al. Is there a biomedical explanation for socioeconomic differences in incident mobility limitation? *J Gerontol A Biol Sci Med Sci* 2005 Aug; 60(8):1022-7.
74. Peterson MJ, Giuliani C, Morey MC, et al. Physical activity as a preventative factor for frailty: the health, aging, and body composition study. *J Gerontol A Biol Sci Med Sci* 2009 Jan; 64(1):61-8.
75. Newman AB, Kupelian V, Visser M, et al. Sarcopenia: alternative definitions and associations with lower extremity function. *Journal of the American Geriatrics Society* 2003 Nov; 51(11):1602-9.
76. Visser M, Pahor M, Taaffe DR, et al. Relationship of interleukin-6 and tumor necrosis factor-alpha with muscle mass and muscle strength in elderly men and women: the Health ABC Study. *J Gerontol A Biol Sci Med Sci* 2002 May; 57(5):M326-32.
77. Yaffe K, Lindquist K, Penninx BW, et al. Inflammatory markers and cognition in well-functioning African-American and white elders. *Neurology* 2003 Jul 8; 61(1):76-80.
78. Schaap LA, Pluijm SM, Deeg DJ, et al. Higher inflammatory marker levels in older persons: associations with 5-year change in muscle mass and muscle strength. *J Gerontol A Biol Sci Med Sci* 2009 Nov; 64(11):1183-9.
79. Hsu FC, Kritchevsky SB, Liu Y, et al. Association between inflammatory components and physical function in the health, aging, and body composition study: a principal component analysis approach. *J Gerontol A Biol Sci Med Sci* 2009 May; 64(5):581-9.
80. Stewart R, Masaki K, Xue QL, et al. A 32-year prospective study of change in body weight and incident dementia: the Honolulu-Asia Aging Study. *Arch Neurol* 2005 Jan; 62(1):55-60.
81. Schmidt R, Schmidt H, Curb JD, et al. Early inflammation and dementia: a 25-year follow-up of the Honolulu-Asia Aging Study. *Annals of Neurology* 2002 Aug; 52(2):168-74.
82. Harris TB, Ferrucci L, Tracy RP, et al. Associations of elevated interleukin-6 and C-

reactive protein levels with mortality in the elderly. *Am J Med* 1999 May; 106(5):506-12.
83. Eaker ED, Vierkant RA, Mickel SF. Predictors of nursing home admission and/or death in incident Alzheimer's disease and other dementia cases compared to controls: a population-based study. *J Clin Epidemiol* 2002 May; 55(5):462-8.
84. Stewart ST, Woodward RM, Rosen AB, et al. The impact of symptoms and impairments on overall health in US national health data. *Med Care* 2008 Sep; 46(9):954-62.
85. Ganguli M, Dodge HH, Mulsant BH. Rates and predictors of mortality in an aging, rural, community-based cohort: the role of depression. *Arch Gen Psychiatry* 2002 Nov; 59(11):1046-52.
86. Crimmins EM, Saito Y, Reynolds SL. Further evidence on recent trends in the prevalence and incidence of disability among older Americans from two sources: the LSOA and the NHIS. *J Gerontol B Psychol Sci Soc Sci* 1997 Mar; 52(2):S59-71.
87. Pressley JC, Patrick CH. Frailty bias in comorbidity risk adjustments of community-dwelling elderly populations. *J Clin Epidemiol* 1999 Aug; 52(8):753-60.
88. Mathieson KM, Kronenfeld JJ, Keith VM. Maintaining functional independence in elderly adults: the roles of health status and financial resources in predicting home modifications and use of mobility equipment. *Gerontologist* 2002 Feb; 42(1):24-31.
89. Silver MH, Jilinskaia E, Perls TT. Cognitive functional status of age-confirmed centenarians in a population-based study. *J Gerontol B Psychol Sci Soc Sci* 2001 May; 56(3):P134-40.
90. Baumgartner RN, Koehler KM, Gallagher D, et al. Epidemiology of sarcopenia among the elderly in New Mexico. *Am J Epidemiol* 1998 Apr 15; 147(8):755-63.
91. Cheng H, Gurland BJ, Maurer MS. Self-reported lack of energy (anergia) among elders in a multiethnic community. *Journals of Gerontology Series A-Biological Sciences & Medical Sciences* 2008 Jul; 63(7):707-14.
92. Weatherspoon LJ, Worthen HD, Handu D. Nutrition risk and associated factors in congregate meal participants in northern Florida: role of Elder Care Services (ECS). *J Nutr Elder* 2004; 24(2):37-54.
93. Johnson MA, Fischer JG, Park S. Vitamin D deficiency and insufficiency in the Georgia Older Americans Nutrition Program. *J Nutr Elder* 2008; 27(1-2):29-46.
94. Aggarwal NT, Wilson RS, Beck TL, et al. Motor dysfunction in mild cognitive impairment and the risk of incident Alzheimer disease. *Archives of Neurology* 2006 Dec; 63(12):1763-9.
95. Buchman AS, Wilson RS, Bienias JL, et al. Change in frailty and risk of death in older persons. *Exp Aging Res* 2009 Jan-Mar; 35(1):61-82.
96. Espinoza SE, Hazuda HP. Frailty in older Mexican-American and European-American adults: is there an ethnic disparity? *J Am Geriatr Soc* 2008 Sep; 56(9):1744-9.
97. Santos-Eggimann B, Cuenoud P, Spagnoli J, et al. Prevalence of frailty in middle-aged and older community-dwelling Europeans living in 10 countries. *Journals of Gerontology Series A-Biological Sciences & Medical Sciences* 2009 Jun; 64(6):675-81.
98. Fried LP, Xue QL, Cappola AR, et al. Nonlinear multisystem physiological dysregulation associated with frailty in older women: implications for etiology and treatment. *J Gerontol A Biol Sci Med Sci* 2009 Oct; 64(10):1049-57.
99. Bandeen-Roche K, Xue QL, Ferrucci L, et al. Phenotype of frailty: characterization in the women's health and aging studies. *J Gerontol A Biol Sci Med Sci* 2006 Mar; 61(3):262-6.
100. Volpato S, Guralnik JM, Ferrucci L, et al. Cardiovascular disease, interleukin-6, and risk of mortality in older women: the women's health and aging study. *Circulation* 2001 Feb 20; 103(7):947-53.
101. Cappola AR, Xue QL, Ferrucci L, et al. Insulin-like growth factor I and interleukin-6 contribute synergistically to disability and mortality in older women. *Journal of Clinical Endocrinology & Metabolism* 2003 May; 88(5):2019-25.
102. Walston J, Xue Q, Semba RD, et al. Serum antioxidants, inflammation, and total mortality in older women. *Am J Epidemiol* 2006 Jan 1; 163(1):18-26.
103. Szanton SL, Allen JK, Seplaki CL, et al. Allostatic load and frailty in the women's health and aging studies. *Biol Res Nurs* 2009 Jan; 10(3):248-56.
104. Chang SS, Weiss CO, Xue QL, et al. Patterns of comorbid inflammatory diseases in frail older women: the Women's Health and Aging Studies I and II. *J Gerontol A Biol Sci Med Sci* 2010 Apr; 65(4):407-13.
105. Semba RD, Houston DK, Ferrucci L, et al. Low serum 25-hydroxyvitamin D concentrations are associated with greater all-cause mortality in older community-dwelling women. *Nutr Res* 2009 Aug; 29(8):525-30.
106. Fried LP, Bandeen-Roche K, Kasper JD, et al. Association of comorbidity with disability in older women: the Women's Health and Aging Study. *J Clin Epidemiol* 1999 Jan; 52(1):27-37.
107. Semba RD, Ricks MO, Ferrucci L, et al. Types of anemia and mortality among older disabled women living in the community: the Women's Health and Aging Study I. *Aging Clin Exp Res* 2007 Aug; 19(4):259-64.
108. Xue QL, Fried LP, Glass TA, et al. Life-space constriction, development of frailty, and the competing risk of mortality: the Women's Health And Aging Study I. *American Journal of Epidemiology* 2008 Jan 15; 167(2):240-8.

References for Appendix E

109. Schmaltz HN, Fried LP, Xue QL, et al. Chronic cytomegalovirus infection and inflammation are associated with prevalent frailty in community-dwelling older women. *J Am Geriatr Soc* 2005 May; 53(5):747-54.
110. Boyd CM, Xue QL, Simpson CF, et al. Frailty, hospitalization, and progression of disability in a cohort of disabled older women. *American Journal of Medicine* 2005 Nov; 118(11):1225-31.
111. Blaum CS, Xue QL, Tian J, et al. Is hyperglycemia associated with frailty status in older women? *Journal of the American Geriatrics Society* 2009 May; 57(5):840-7.
112. Kenny AM, Waynik IY, Smith J, et al. Association between level of frailty and bone mineral density in community-dwelling men. *Journal of Clinical Densitometry* 2006 Jul-Sep; 9(3):309-14.
113. Falconer J, Naughton BJ, Hughes SL, et al. Self-reported functional status predicts change in level of care in independent living residents of a continuing care retirement community. *J Am Geriatr Soc* 1992 Mar; 40(3):255-8.
114. Shelton P, Sager MA, Schraeder C. The community assessment risk screen (CARS): identifying elderly persons at risk for hospitalization or emergency department visit. *Am J Manag Care* 2000 Aug; 6(8):925-33.
115. Dorr DA, Jones SS, Burns L, et al. Use of health-related, quality-of-life metrics to predict mortality and hospitalizations in community-dwelling seniors. *J Am Geriatr Soc* 2006 Apr; 54(4):667-73.
116. Malmgren JA, Koepsell TD, Martin DP, et al. Mortality, health services use, and health behavior in a cohort of well older adults. *J Am Geriatr Soc* 1999 Jan; 47(1):51-9.
117. Perkins AJ, Kroenke K, Unutzer J, et al. Common comorbidity scales were similar in their ability to predict health care costs and mortality. *J Clin Epidemiol* 2004 Oct; 57(10):1040-8.
118. Long SK, Liu K, Black K, et al. Getting by in the community: lessons from frail elders. *J Aging Soc Policy* 2005; 17(1):19-44.
119. Laird RD, Studenski S, Perera S, et al. Fall history is an independent predictor of adverse health outcomes and utilization in the elderly. *Am J Manag Care* 2001 Dec; 7(12):1133-8.
120. Tennstedt S, Cafferata GL, Sullivan L. Depression among caregivers of impaired elders. *J Aging Health* 1992 Feb; 4(1):58-76.
121. Dayhoff NE, Suhrheinrich J, Wigglesworth J, et al. Balance and muscle strength as predictors of frailty among older adults. *J Gerontol Nurs* 1998 Jul; 24(7):18-27; quiz 54-5.
122. Inouye SK, Bogardus ST, Jr., Vitagliano G, et al. Burden of illness score for elderly persons: risk adjustment incorporating the cumulative impact of diseases, physiologic abnormalities, and functional impairments. *Med Care* 2003 Jan; 41(1):70-83.
123. Bowles J, Brooks T, Hayes-Reams P, et al. Frailty, family, and church support among urban African American elderly. *J Health Care Poor Underserved* 2000 Feb; 11(1):87-99.
124. Zarowitz BJ, Stebelsky LA, Muma BK, et al. Reduction of high-risk polypharmacy drug combinations in patients in a managed care setting. *Pharmacotherapy* 2005 Nov; 25(11):1636-45.
125. Walter LC, Brand RJ, Counsell SR, et al. Development and validation of a prognostic index for 1-year mortality in older adults after hospitalization. *Jama* 2001 Jun 20; 285(23):2987-94.
126. Jette AM, Branch LG, Berlin J. Musculoskeletal impairments and physical disablement among the aged. *J Gerontol* 1990 Nov; 45(6):M203-8.
127. Cho CY, Alessi CA, Cho M, et al. The association between chronic illness and functional change among participants in a comprehensive geriatric assessment program. *J Am Geriatr Soc* 1998 Jun; 46(6):677-82.
128. Wieland D, Lamb VL, Sutton SR, et al. Hospitalization in the Program of All-Inclusive Care for the Elderly (PACE): rates, concomitants, and predictors. *J Am Geriatr Soc* 2000 Nov; 48(11):1373-80.
129. Carey EC, Covinsky KE, Lui LY, et al. Prediction of mortality in community-living frail elderly people with long-term care needs. *Journal of the American Geriatrics Society* 2008 Jan; 56(1):68-75.
130. Friedman DS, Wolfs RC, O'Colmain BJ, et al. Prevalence of open-angle glaucoma among adults in the United States. *Arch Ophthalmol* 2004 Apr; 122(4):532-8.
131. Weiner M, Powe NR, Weller WE, et al. Alzheimer's disease under managed care: implications from Medicare utilization and expenditure patterns. *J Am Geriatr Soc* 1998 Jun; 46(6):762-70.
132. Marshall JA, Lopez TK, Shetterly SM, et al. Indicators of nutritional risk in a rural elderly Hispanic and non-Hispanic white population: San Luis Valley Health and Aging Study. *J Am Diet Assoc* 1999 Mar; 99(3):315-22.
133. Freburger JK, Holmes GM. Physical therapy use by community-based older people. *Phys Ther* 2005 Jan; 85(1):19-33.
134. Porell FW, Miltiades HB. Disability outcomes of older Medicare HMO enrollees and fee-for-service Medicare beneficiaries. *J Am Geriatr Soc* 2001 May; 49(5):615-31.
135. Tyas SL, Salazar JC, Snowdon DA, et al. Transitions to mild cognitive impairments, dementia, and death: findings from the Nun Study.[see comment]. *American Journal of Epidemiology* 2007 Jun 1; 165(11):1231-8.
136. Thom DH, Haan MN, Van Den Eeden SK. Medically recognized urinary incontinence and risks of hospitalization, nursing home admission

and mortality. *Age & Ageing* 1997 Sep; 26(5):367-74.
137. Evans DA, Funkenstein HH, Albert MS, et al. Prevalence of Alzheimer's disease in a community population of older persons. Higher than previously reported. *JAMA* 1989 Nov 10; 262(18):2551-6.
138. Martin CT, Kayser-Jones J, Stotts NA, et al. Risk for low weight in community-dwelling, older adults. *Clin Nurse Spec* 2007 Jul-Aug; 21(4):203-11; quiz 12-3.
139. Bannerman E, Miller MD, Daniels LA, et al. Anthropometric indices predict physical function and mobility in older Australians: the Australian Longitudinal Study of Ageing. *Public Health Nutr* 2002 Oct; 5(5):655-62.
140. Anpalahan M, Gibson SJ. Geriatric syndromes as predictors of adverse outcomes of hospitalization. *Internal Medicine Journal* 2008 Jan; 38(1):16-23.
141. Visvanathan R, Macintosh C, Callary M, et al. The nutritional status of 250 older Australian recipients of domiciliary care services and its association with outcomes at 12 months. *J Am Geriatr Soc* 2003 Jul; 51(7):1007-11.
142. Song X, Mitnitski A, Rockwood K. Prevalence and 10-year outcomes of frailty in older adults in relation to deficit accumulation. *J Am Geriatr Soc* 2010 Apr; 58(4):681-7.
143. Gutman GM, Stark A, Donald A, et al. Contribution of self-reported health ratings to predicting frailty, institutionalization, and death over a 5-year period. *Int Psychogeriatr* 2001; 13 Supp 1:223-31.
144. Jones D, Song X, Mitnitski A, et al. Evaluation of a frailty index based on a comprehensive geriatric assessment in a population based study of elderly Canadians. *Aging Clin Exp Res* 2005 Dec; 17(6):465-71.
145. Rockwood K, Andrew M, Mitnitski A. A comparison of two approaches to measuring frailty in elderly people. *J Gerontol A Biol Sci Med Sci* 2007 Jul; 62(7):738-43.
146. Canadian study of health and aging: study methods and prevalence of dementia. *CMAJ* 1994 Mar 15; 150(6):899-913.
147. Rockwood K, Stolee P, McDowell I. Factors associated with institutionalization of older people in Canada: testing a multifactorial definition of frailty. *J Am Geriatr Soc* 1996 May; 44(5):578-82.
148. Graham JE, Rockwood K, Beattie BL, et al. Prevalence and severity of cognitive impairment with and without dementia in an elderly population. *Lancet* 1997 Jun 21; 349(9068):1793-6.
149. Wolfson C, Wolfson DB, Asgharian M, et al. A reevaluation of the duration of survival after the onset of dementia. *N Engl J Med* 2001 Apr 12; 344(15):1111-6.
150. St John PD, Montgomery PR, Kristjansson B, et al. Cognitive scores, even within the normal range, predict death and institutionalization. *Age Ageing* 2002 Sep; 31(5):373-8.
151. Fisk JD, Merry HR, Rockwood K. Variations in case definition affect prevalence but not outcomes of mild cognitive impairment. *Neurology* 2003 Nov 11; 61(9):1179-84.
152. Disability and frailty among elderly Canadians: a comparison of six surveys. *Int Psychogeriatr* 2001; 13 Supp 1:159-67.
153. Jones DM, Song X, Rockwood K. Operationalizing a frailty index from a standardized comprehensive geriatric assessment. *J Am Geriatr Soc* 2004 Nov; 52(11):1929-33.
154. Wong RY, Miller WC. Adverse outcomes following hospitalization in acutely ill older patients. *BMC Geriatr* 2008; 8:10.
155. Dasgupta M, Rolfson DB, Stolee P, et al. Frailty is associated with postoperative complications in older adults with medical problems. *Arch Gerontol Geriatr* 2009 Jan-Feb; 48(1):78-83.
156. Gu D, Dupre ME, Sautter J, et al. Frailty and mortality among Chinese at advanced ages. *J Gerontol B Psychol Sci Soc Sci* 2009 Mar; 64(2):279-89.
157. Beck AM, Ovesen L, Osler M. The 'Mini Nutritional Assessment' (MNA) and the 'Determine Your Nutritional Health' Checklist (NSI Checklist) as predictors of morbidity and mortality in an elderly Danish population. *Br J Nutr* 1999 Jan; 81(1):31-6.
158. Bruunsgaard H, Andersen-Ranberg K, Hjelmborg JB, et al. Elevated levels of tumor necrosis factor alpha and mortality in centenarians. *Am J Med* 2003 Sep; 115(4):278-83.
159. Schultz-Larsen K, Avlund K. Tiredness in daily activities: a subjective measure for the identification of frailty among non-disabled community-living older adults. *Arch Gerontol Geriatr* 2007 Jan-Feb; 44(1):83-93.
160. Gardener EA, Huppert FA, Guralnik JM, et al. Middle-aged and mobility-limited: prevalence of disability and symptom attributions in a national survey. *J Gen Intern Med* 2006 Oct; 21(10):1091-6.
161. Tilvis RS, Kahonen-Vare MH, Jolkkonen J, et al. Predictors of cognitive decline and mortality of aged people over a 10-year period. *J Gerontol A Biol Sci Med Sci* 2004 Mar; 59(3):268-74.
162. Strandberg TE, Tilvis RS. C-reactive protein, cardiovascular risk factors, and mortality in a prospective study in the elderly. *Arteriosclerosis, Thrombosis & Vascular Biology* 2000 Apr; 20(4):1057-60.
163. Nuotio M, Tammela TL, Luukkaala T, et al. Predictors of institutionalization in an older population during a 13-year period: the effect of urge incontinence. *J Gerontol A Biol Sci Med Sci* 2003 Aug; 58(8):756-62.
164. Jylha M, Paavilainen P, Lehtimaki T, et al. Interleukin-1 receptor antagonist, interleukin-6,

and C-reactive protein as predictors of mortality in nonagenarians: the vitality 90+ study. *J Gerontol A Biol Sci Med Sci* 2007 Sep; 62(9):1016-21.
165. Rolland Y, Lauwers-Cances V, Cesari M, et al. Physical performance measures as predictors of mortality in a cohort of community-dwelling older French women. *Eur J Epidemiol* 2006; 21(2):113-22.
166. Helmer C, Barberger-Gateau P, Letenneur L, et al. Subjective health and mortality in French elderly women and men. *J Gerontol B Psychol Sci Soc Sci* 1999 Mar; 54(2):S84-92.
167. Raynaud-Simon A, Lafont S, Berr C, et al. Orosomucoid: a mortality risk factor in elderly people living in the community? *Clin Nutr* 2002 Feb; 21(1):45-50.
168. Carriere I, Dupuy AM, Lacroux A, et al. Biomarkers of inflammation and malnutrition associated with early death in healthy elderly people. *J Am Geriatr Soc* 2008 May; 56(5):840-6.
169. Avila-Funes JA, Amieva H, Barberger-Gateau P, et al. Cognitive impairment improves the predictive validity of the phenotype of frailty for adverse health outcomes: the three-city study. *J Am Geriatr Soc* 2009 Mar; 57(3):453-61.
170. Artero S, Ancelin ML, Portet F, et al. Risk profiles for mild cognitive impairment and progression to dementia are gender specific. *J Neurol Neurosurg Psychiatry* 2008 Sep; 79(9):979-84.
171. Avila-Funes JA, Helmer C, Amieva H, et al. Frailty among community-dwelling elderly people in France: the three-city study. *J Gerontol A Biol Sci Med Sci* 2008 Oct; 63(10):1089-96.
172. Jessen F, Wiese B, Bachmann C, et al. Prediction of dementia by subjective memory impairment: effects of severity and temporal association with cognitive impairment. *Arch Gen Psychiatry* 2010 Apr; 67(4):414-22.
173. Guehne U, Luck T, Busse A, et al. Mortality in individuals with mild cognitive impairment. Results of the Leipzig Longitudinal Study of the Aged (LEILA75+). *Neuroepidemiology* 2007; 29(3-4):226-34.
174. Heun R, Kolsch H, Jessen F. Risk factors and early signs of Alzheimer's disease in a family study sample. Risk of AD. *Eur Arch Psychiatry Clin Neurosci* 2006 Feb; 256(1):28-36.
175. Cesari M, Onder G, Russo A, et al. Comorbidity and physical function: results from the aging and longevity study in the Sirente geographic area (ilSIRENTE study). *Gerontology* 2006; 52(1):24-32.
176. Cesari M, Penninx BW, Pahor M, et al. Inflammatory markers and physical performance in older persons: the InCHIANTI study. *J Gerontol A Biol Sci Med Sci* 2004 Mar; 59(3):242-8.
177. Bartali B, Frongillo EA, Guralnik JM, et al. Serum micronutrient concentrations and decline in physical function among older persons. *JAMA* 2008 Jan 23; 299(3):308-15.
178. Alley DE, Crimmins E, Bandeen-Roche K, et al. Three-year change in inflammatory markers in elderly people and mortality: the Invecchiare in Chianti study. *J Am Geriatr Soc* 2007 Nov; 55(11):1801-7.
179. Pizzarelli F, Lauretani F, Bandinelli S, et al. Predictivity of survival according to different equations for estimating renal function in community-dwelling elderly subjects. *Nephrology Dialysis Transplantation* 2009 Apr; 24(4):1197-205.
180. Cesari M, Pahor M, Lauretani F, et al. Skeletal muscle and mortality results from the InCHIANTI Study. *J Gerontol A Biol Sci Med Sci* 2009 Mar; 64(3):377-84.
181. Maggio M, Ceda GP, Lauretani F, et al. Relationship between higher estradiol levels and 9-year mortality in older women: the Invecchiare in Chianti study. *J Am Geriatr Soc* 2009 Oct; 57(10):1810-5.
182. Ravaglia G, Forti P, Maioli F, et al. Blood inflammatory markers and risk of dementia: The Conselice Study of Brain Aging. *Neurobiol Aging* 2007 Dec; 28(12):1810-20.
183. Passarino G, Montesanto A, De Rango F, et al. A cluster analysis to define human aging phenotypes. *Biogerontology* 2007 Jun; 8(3):283-90.
184. Onder G, Landi F, Volpato S, et al. Serum cholesterol levels and in-hospital mortality in the elderly. *Am J Med* 2003 Sep; 115(4):265-71.
185. Solfrizzi V, Scafato E, Capurso C, et al. Metabolic syndrome, mild cognitive impairment, and progression to dementia. The Italian Longitudinal Study on Aging. *Neurobiol Aging* 2009 Dec 30.
186. Zoppini G, Verlato G, Targher G, et al. Variability of body weight, pulse pressure and glycaemia strongly predict total mortality in elderly type 2 diabetic patients. The Verona Diabetes Study. *Diabetes Metab Res Rev* 2008 Nov-Dec; 24(8):624-8.
187. Mazzaglia G, Roti L, Corsini G, et al. Screening of older community-dwelling people at risk for death and hospitalization: the Assistenza Socio-Sanitaria in Italia project. *J Am Geriatr Soc* 2007 Dec; 55(12):1955-60.
188. Zanetti M, Ballabio C, Abbate C, et al. Mild cognitive impairment subtypes and vascular dementia in community-dwelling elderly people: a 3-year follow-up study. *J Am Geriatr Soc* 2006 Apr; 54(4):580-6.
189. de Groot LC, Verheijden MW, de Henauw S, et al. Lifestyle, nutritional status, health, and mortality in elderly people across Europe: a review of the longitudinal results of the SENECA study. *J Gerontol A Biol Sci Med Sci* 2004 Dec; 59(12):1277-84.

References for Appendix E

190. Mitnitski A, Song X, Skoog I, et al. Relative fitness and frailty of elderly men and women in developed countries and their relationship with mortality. *J Am Geriatr Soc* 2005 Dec; 53(12):2184-9.
191. Yap KB, Niti M, Ng TP. Nutrition screening among community-dwelling older adults in Singapore. *Singapore Med J* 2007 Oct; 48(10):911-6.
192. Wikby A, Ferguson F, Forsey R, et al. An immune risk phenotype, cognitive impairment, and survival in very late life: impact of allostatic load in Swedish octogenarian and nonagenarian humans. *J Gerontol A Biol Sci Med Sci* 2005 May; 60(5):556-65.
193. van den Biggelaar AH, Huizinga TW, de Craen AJ, et al. Impaired innate immunity predicts frailty in old age. The Leiden 85-plus study. *Exp Gerontol* 2004 Sep; 39(9):1407-14.
194. Puts MT, Lips P, Deeg DJ. Sex differences in the risk of frailty for mortality independent of disability and chronic diseases. *J Am Geriatr Soc* 2005 Jan; 53(1):40-7.
195. Schaap LA, Pluijm SM, Deeg DJ, et al. Inflammatory markers and loss of muscle mass (sarcopenia) and strength. *Am J Med* 2006 Jun; 119(6):526 e9-17.
196. Visser M, Deeg DJ, Puts MT, et al. Low serum concentrations of 25-hydroxyvitamin D in older persons and the risk of nursing home admission. *Am J Clin Nutr* 2006 Sep; 84(3):616-22; quiz 71-2.
197. Dik MG, Jonker C, Hack CE, et al. Serum inflammatory proteins and cognitive decline in older persons. *Neurology* 2005 Apr 26; 64(8):1371-7.
198. Buurman BM, van Munster BC, Korevaar JC, et al. Prognostication in acutely admitted older patients by nurses and physicians. *J Gen Intern Med* 2008 Nov; 23(11):1883-9.
199. Raji MA, Al Snih S, Ray LA, et al. Cognitive status and incident disability in older Mexican Americans: findings from the Hispanic established population for the epidemiological study of the elderly. *Ethn Dis* 2004 Winter; 14(1):26-31.
200. Espino DV, Bazaldua OV, Palmer RF, et al. Suboptimal medication use and mortality in an older adult community-based cohort: results from the Hispanic EPESE Study. *J Gerontol A Biol Sci Med Sci* 2006 Feb; 61(2):170-5.
201. Raji MA, Kuo YF, Snih SA, et al. Cognitive status, muscle strength, and subsequent disability in older Mexican Americans. *J Am Geriatr Soc* 2005 Sep; 53(9):1462-8.
202. Graham JE, Snih SA, Berges IM, et al. Frailty and 10-year mortality in community-living Mexican American older adults. *Gerontology* 2009; 55(6):644-51.
203. Ottenbacher KJ, Graham JE, Al Snih S, et al. Mexican Americans and frailty: findings from the Hispanic established populations epidemiologic studies of the elderly. *Am J Public Health* 2009 Apr; 99(4):673-9.
204. Ottenbacher KJ, Ostir GV, Peek MK, et al. Frailty in older Mexican Americans. *J Am Geriatr Soc* 2005 Sep; 53(9):1524-31.
205. Al Snih S, Raji MA, Markides KS, et al. Weight change and lower body disability in older Mexican Americans. *J Am Geriatr Soc* 2005 Oct; 53(10):1730-7.
206. Syddall H, Roberts HC, Evandrou M, et al. Prevalence and correlates of frailty among community-dwelling older men and women: findings from the Hertfordshire Cohort Study. *Age Ageing* 2010 Mar; 39(2):197-203.
207. Stephan BC, Matthews FE, McKeith IG, et al. Early cognitive change in the general population: how do different definitions work? *J Am Geriatr Soc* 2007 Oct; 55(10):1534-40.
208. Rait G, Fletcher A, Smeeth L, et al. Prevalence of cognitive impairment: results from the MRC trial of assessment and management of older people in the community. *Age Ageing* 2005 May; 34(3):242-8.
209. Ahmad R, Bath PA. Identification of risk factors for 15-year mortality among community-dwelling older people using Cox regression and a genetic algorithm. *J Gerontol A Biol Sci Med Sci* 2005 Aug; 60(8):1052-8.
210. Rocca WA, Hofman A, Brayne C, et al. The prevalence of vascular dementia in Europe: facts and fragments from 1980-1990 studies. EURODEM-Prevalence Research Group. *Annals of Neurology* 1991 Dec; 30(6):817-24.
211. Ritchie K, Kildea D. Is senile dementia "age-related" or "ageing-related"?--evidence from meta-analysis of dementia prevalence in the oldest old. *Lancet* 1995 Oct 7; 346(8980):931-4.
212. Veehof L, Stewart R, Haaijer-Ruskamp F, et al. The development of polypharmacy. A longitudinal study. *Fam Pract* 2000 Jun; 17(3):261-7.
213. Chen PC, Wilmoth JM. The effects of residential mobility on ADL and IADL limitations among the very old living in the community. *J Gerontol B Psychol Sci Soc Sci* 2004 May; 59(3):S164-72.
214. Rakowski W, Fleischman JA, Mor V, et al. Self-Assessments of Health and Mortality Among Older Persons: Do Questions Other then Global Self-Rated Health Predict Mortality? *Research on Aging* 1993; 15(1):92-116.
215. Murtagh KN, Hubert HB. Gender differences in physical disability among an elderly cohort. *Am J Public Health* 2004 Aug; 94(8):1406-11.
216. Lesourd B, Decarli B, Dirren H. Longitudinal changes in iron and protein status of elderly Europeans. SENECA Investigators. *Eur J Clin Nutr* 1996 Jul; 50 Suppl 2:S16-24.
217. Dallman PR, Yip R, Johnson C. Prevalence and causes of anemia in the United States, 1976 to 1980. *Am J Clin Nutr* 1984 Mar; 39(3):437-45.
218. de Groot LC, Beck AM, Schroll M, et al. Evaluating the DETERMINE Your Nutritional

Health Checklist and the Mini Nutritional Assessment as tools to identify nutritional problems in elderly Europeans. *Eur J Clin Nutr* 1998 Dec; 52(12):877-83.
219. Nelson KM, Reiber G, Kohler T, et al. Peripheral arterial disease in a multiethnic national sample: the role of conventional risk factors and allostatic load. *Ethn Dis* 2007 Autumn; 17(4):669-75.
220. Pratt LA, Weeks JD, Goulding MR. Measures of cognitive functioning in the 1994-2000 Second Longitudinal Study of Aging. *Natl Health Stat Report* 2008 Jul 7; (2):1-15.
221. Pearson JM, Schlettwein-Gsell D, Brzozowska A, et al. Life style characteristics associated with nutritional risk in elderly subjects aged 80-85 years. *J Nutr Health Aging* 2001; 5(4):278-83.
222. Tuokko HA, Frerichs RJ, Kristjansson B. Cognitive impairment, no dementia: concepts and issues. *Int Psychogeriatr* 2001; 13 Supp 1:183-202.
223. Lee Y, Back JH, Kim J, et al. Systematic review of health behavioral risks and cognitive health in older adults. *Int Psychogeriatr* Mar; 22(2):174-87.
224. Masur DM, Sliwinski M, Lipton RB, et al. Neuropsychological prediction of dementia and the absence of dementia in healthy elderly persons. *Neurology* 1994 Aug; 44(8):1427-32.
225. Jacobs DM, Sano M, Dooneief G, et al. Neuropsychological detection and characterization of preclinical Alzheimer's disease. *Neurology* 1995 May; 45(5):957-62.
226. Linn RT, Wolf PA, Bachman DL, et al. The 'preclinical phase' of probable Alzheimer's disease. A 13-year prospective study of the Framingham cohort. *Arch Neurol* 1995 May; 52(5):485-90.
227. Braekhus A, Laake K, Engedal K. A low, 'normal' score on the Mini-Mental State Examination predicts development of dementia after three years. *J Am Geriatr Soc* 1995 Jun; 43(6):656-61.
228. Schmand B, Jonker C, Hooijer C, et al. Subjective memory complaints may announce dementia. *Neurology* 1996 Jan; 46(1):121-5.
229. Crystal HA, Dickson D, Sliwinski M, et al. Associations of status and change measures of neuropsychological function with pathologic changes in elderly, originally nondemented subjects. *Arch Neurol* 1996 Jan; 53(1):82-7.
230. O'Rourke N, Tuokko H, Hayden S, et al. Early identification of dementia: predictive validity of the clock test. *Arch Clin Neuropsychol* 1997; 12(3):257-67.
231. Small BJ, Viitanen M, Winblad B, et al. Cognitive changes in very old persons with dementia: the influence of demographic, psychometric, and biological variables. *J Clin Exp Neuropsychol* 1997 Apr; 19(2):245-60.
232. Fox NC, Warrington EK, Seiffer AL, et al. Presymptomatic cognitive deficits in individuals at risk of familial Alzheimer's disease. A longitudinal prospective study. *Brain* 1998 Sep; 121 (Pt 9):1631-9.
233. Katzman R, Aronson M, Fuld P, et al. Development of dementing illnesses in an 80-year-old volunteer cohort. *Ann Neurol* 1989 Apr; 25(4):317-24.
234. Fuld PA, Masur DM, Blau AD, et al. Object-memory evaluation for prospective detection of dementia in normal functioning elderly: predictive and normative data. *J Clin Exp Neuropsychol* 1990 Aug; 12(4):520-8.
235. Masur DM, Fuld PA, Blau AD, et al. Predicting development of dementia in the elderly with the Selective Reminding Test. *J Clin Exp Neuropsychol* 1990 Aug; 12(4):529-38.
236. Tuokko H, Vernon-Wilkinson R, Weir J, et al. Cued recall and early identification of dementia. *J Clin Exp Neuropsychol* 1991 Nov; 13(6):871-9.
237. Flicker C, Ferris SH, Reisberg B. Mild cognitive impairment in the elderly: predictors of dementia. *Neurology* 1991 Jul; 41(7):1006-9.
238. Flicker C, Ferris SH, Reisberg B. A longitudinal study of cognitive function in elderly persons with subjective memory complaints. *J Am Geriatr Soc* 1993 Oct; 41(10):1029-32.
239. Kivipelto M, Rovio S, Ngandu T, et al. Apolipoprotein E epsilon4 magnifies lifestyle risks for dementia: a population-based study. *J Cell Mol Med* 2008 Dec; 12(6B):2762-71.
240. Taaffe DR, Irie F, Masaki KH, et al. Physical activity, physical function, and incident dementia in elderly men: the Honolulu-Asia Aging Study. *J Gerontol A Biol Sci Med Sci* 2008 May; 63(5):529-35.
241. Rovio S, Kareholt I, Viitanen M, et al. Work-related physical activity and the risk of dementia and Alzheimer's disease. *Int J Geriatr Psychiatry* 2007 Sep; 22(9):874-82.
242. Larson EB, Wang L, Bowen JD, et al. Exercise is associated with reduced risk for incident dementia among persons 65 years of age and older. *Ann Intern Med* 2006 Jan 17; 144(2):73-81.
243. Simons LA, Simons J, McCallum J, et al. Lifestyle factors and risk of dementia: Dubbo Study of the elderly. *Med J Aust* 2006 Jan 16; 184(2):68-70.
244. Podewils LJ, Guallar E, Kuller LH, et al. Physical activity, APOE genotype, and dementia risk: findings from the Cardiovascular Health Cognition Study. *Am J Epidemiol* 2005 Apr 1; 161(7):639-51.
245. Singh-Manoux A, Hillsdon M, Brunner E, et al. Effects of physical activity on cognitive functioning in middle age: evidence from the Whitehall II prospective cohort study. *Am J Public Health* 2005 Dec; 95(12):2252-8.
246. Abbott RD, White LR, Ross GW, et al. Walking and dementia in physically capable elderly men. *Jama* 2004 Sep 22; 292(12):1447-53.

References for Appendix E

247. Weuve J, Kang JH, Manson JE, et al. Physical activity, including walking, and cognitive function in older women. *Jama* 2004 Sep 22; 292(12):1454-61.
248. Reitz C, den Heijer T, van Duijn C, et al. Relation between smoking and risk of dementia and Alzheimer disease: the Rotterdam Study. *Neurology* 2007 Sep 4; 69(10):998-1005.
249. Tyas SL, White LR, Petrovitch H, et al. Mid-life smoking and late-life dementia: the Honolulu-Asia Aging Study. *Neurobiol Aging* 2003 Jul-Aug; 24(4):589-96.
250. Ott A, Slooter AJ, Hofman A, et al. Smoking and risk of dementia and Alzheimer's disease in a population-based cohort study: the Rotterdam Study. *Lancet* 1998 Jun 20; 351(9119):1840-3.
251. Ngandu T, Helkala EL, Soininen H, et al. Alcohol drinking and cognitive functions: findings from the Cardiovascular Risk Factors Aging and Dementia (CAIDE) Study. *Dement Geriatr Cogn Disord* 2007; 23(3):140-9.
252. Dai Q, Borenstein AR, Wu Y, et al. Fruit and vegetable juices and Alzheimer's disease: the Kame Project. *Am J Med* 2006 Sep; 119(9):751-9.
253. Ganguli M, Vander Bilt J, Saxton JA, et al. Alcohol consumption and cognitive function in late life: a longitudinal community study. *Neurology* 2005 Oct 25; 65(8):1210-7.
254. Anttila T, Helkala EL, Viitanen M, et al. Alcohol drinking in middle age and subsequent risk of mild cognitive impairment and dementia in old age: a prospective population based study. *Bmj* 2004 Sep 4; 329(7465):539.
255. Luchsinger JA, Tang MX, Siddiqui M, et al. Alcohol intake and risk of dementia. *J Am Geriatr Soc* 2004 Apr; 52(4):540-6.
256. Elias PK, Elias MF, D'Agostino RB, et al. Alcohol consumption and cognitive performance in the Framingham Heart Study. *Am J Epidemiol* 1999 Sep 15; 150(6):580-9.
257. Whitmer RA, Gunderson EP, Quesenberry CP, Jr., et al. Body mass index in midlife and risk of Alzheimer disease and vascular dementia. *Curr Alzheimer Res* 2007 Apr; 4(2):103-9.
258. Elias MF, Elias PK, Sullivan LM, et al. Obesity, diabetes and cognitive deficit: The Framingham Heart Study. *Neurobiol Aging* 2005 Dec; 26 Suppl 1:11-6.
259. Kivipelto M, Ngandu T, Fratiglioni L, et al. Obesity and vascular risk factors at midlife and the risk of dementia and Alzheimer disease. *Arch Neurol* 2005 Oct; 62(10):1556-60.
260. Rosengren A, Skoog I, Gustafson D, et al. Body mass index, other cardiovascular risk factors, and hospitalization for dementia. *Arch Intern Med* 2005 Feb 14; 165(3):321-6.
261. Gustafson D, Rothenberg E, Blennow K, et al. An 18-year follow-up of overweight and risk of Alzheimer disease. *Arch Intern Med* 2003 Jul 14; 163(13):1524-8.
262. Yamada M, Kasagi F, Sasaki H, et al. Association between dementia and midlife risk factors: the Radiation Effects Research Foundation Adult Health Study. *J Am Geriatr Soc* 2003 Mar; 51(3):410-4.
263. Eskelinen MH, Ngandu T, Helkala EL, et al. Fat intake at midlife and cognitive impairment later in life: a population-based CAIDE study. *Int J Geriatr Psychiatry* 2008 Jul; 23(7):741-7.
264. Ravaglia G, Forti P, Lucicesare A, et al. Plasma tocopherols and risk of cognitive impairment in an elderly Italian cohort. *Am J Clin Nutr* 2008 May; 87(5):1306-13.
265. Laitinen MH, Ngandu T, Rovio S, et al. Fat intake at midlife and risk of dementia and Alzheimer's disease: a population-based study. *Dement Geriatr Cogn Disord* 2006; 22(1):99-107.
266. Morris MC, Evans DA, Tangney CC, et al. Associations of vegetable and fruit consumption with age-related cognitive change. *Neurology* 2006 Oct 24; 67(8):1370-6.
267. Huang TL, Zandi PP, Tucker KL, et al. Benefits of fatty fish on dementia risk are stronger for those without APOE epsilon4. *Neurology* 2005 Nov 8; 65(9):1409-14.
268. Morris MC, Evans DA, Tangney CC, et al. Fish consumption and cognitive decline with age in a large community study. *Archives of Neurology* 2005 Dec; 62(12):1849-53.
269. Ravaglia G, Forti P, Maioli F, et al. Homocysteine and folate as risk factors for dementia and Alzheimer disease. *Am J Clin Nutr* 2005 Sep; 82(3):636-43.
270. Laurin D, Masaki KH, Foley DJ, et al. Midlife dietary intake of antioxidants and risk of late-life incident dementia: the Honolulu-Asia Aging Study.[see comment]. *American Journal of Epidemiology* 2004 May 15; 159(10):959-67.
271. Morris MC, Evans DA, Bienias JL, et al. Dietary niacin and the risk of incident Alzheimer's disease and of cognitive decline. *J Neurol Neurosurg Psychiatry* 2004 Aug; 75(8):1093-9.
272. Grodstein F, Chen J, Willett WC. High-dose antioxidant supplements and cognitive function in community-dwelling elderly women. *Am J Clin Nutr* 2003 Apr; 77(4):975-84.
273. Luchsinger JA, Tang MX, Shea S, et al. Antioxidant vitamin intake and risk of Alzheimer disease. *Arch Neurol* 2003 Feb; 60(2):203-8.
274. Engelhart MJ, Geerlings MI, Ruitenberg A, et al. Dietary intake of antioxidants and risk of Alzheimer disease. *Jama* 2002 Jun 26; 287(24):3223-9.
275. Maxwell CJ, Hogan DB, Ebly EM. Serum folate levels and subsequent adverse cerebrovascular outcomes in elderly persons. *Dement Geriatr Cogn Disord* 2002; 13(4):225-34.
276. Tuokko H, Frerichs RJ. Cognitive impairment with no dementia (CIND): longitudinal studies, the findings, and the issues. *Clin Neuropsychol* 2000 Nov; 14(4):504-25.

References for Appendix E

277. O'Connor DW, Pollitt PA, Hyde JB, et al. A follow-up study of dementia diagnosed in the community using the Cambridge Mental Disorders of the Elderly Examination. *Acta Psychiatr Scand* 1990 Jan; 81(1):78-82.
278. Petersen RC, Smith GE, Ivnik RJ, et al. Apolipoprotein E status as a predictor of the development of Alzheimer's disease in memory-impaired individuals. *Jama* 1995 Apr 26; 273(16):1274-8.
279. Tierney MC, Szalai JP, Snow WG, et al. Prediction of probable Alzheimer's disease in memory-impaired patients: A prospective longitudinal study. *Neurology* 1996 Mar; 46(3):661-5.
280. Johansson B, Zarit SH. Early cognitive markers of the incidence of dementia and mortality: a longitudinal population-based study of the oldest old. *Int J Geriatr Psychiatry* 1997 Jan; 12(1):53-9.
281. Johnson KA, Jones K, Holman BL, et al. Preclinical prediction of Alzheimer's disease using SPECT. *Neurology* 1998 Jun; 50(6):1563-71.
282. Devanand DP, Folz M, Gorlyn M, et al. Questionable dementia: clinical course and predictors of outcome. *J Am Geriatr Soc* 1997 Mar; 45(3):321-8.
283. Jack CR, Jr., Petersen RC, Xu YC, et al. Prediction of AD with MRI-based hippocampal volume in mild cognitive impairment. *Neurology* 1999 Apr 22; 52(7):1397-403.
284. Herlitz A, Small BJ, Fratiglioni L, et al. Detection of mild dementia in community surveys. Is it possible to increase the accuracy of our diagnostic instruments? *Arch Neurol* 1997 Mar; 54(3):319-24.
285. Christensen H, Henderson AS, Korten AE, et al. ICD-10 mild cognitive disorder: its outcome three years later. *Int J Geriatr Psychiatry* 1997 May; 12(5):581-6.
286. Clarke D, Morgan K, Lilley J, et al. Dementia and 'borderline dementia' in Britain: 8-year incidence and post-screening outcomes. *Psychol Med* 1996 Jul; 26(4):829-35.
287. Bowen J, Teri L, Kukull W, et al. Progression to dementia in patients with isolated memory loss. *Lancet* 1997 Mar 15; 349(9054):763-5.
288. Rubin EH, Morris JC, Grant EA, et al. Very mild senile dementia of the Alzheimer type. I. Clinical assessment. *Arch Neurol* 1989 Apr; 46(4):379-82.
289. Aggarwal NT, Wilson RS, Beck TL, et al. Mild cognitive impairment in different functional domains and incident Alzheimer's disease. *J Neurol Neurosurg Psychiatry* 2005 Nov; 76(11):1479-84.
290. Petersen RC, Smith GE, Tangalos EG, et al. Longitudinal outcome of patients with a mild cognitive impairment. *Annals of Neurology* 1993; 34:294-5.
291. Hanninen T, Hallikainen M, Koivisto K, et al. A follow-up study of age-associated memory impairment: neuropsychological predictors of dementia. *J Am Geriatr Soc* 1995 Sep; 43(9):1007-15.
292. Tierney MC, Szalai JP, Snow WG, et al. The prediction of Alzheimer disease. The role of patient and informant perceptions of cognitive deficits. *Arch Neurol* 1996 May; 53(5):423-7.
293. Tierney MC, Szalai JP, Snow WG, et al. A prospective study of the clinical utility of ApoE genotype in the prediction of outcome in patients with memory impairment. *Neurology* 1996 Jan; 46(1):149-54.
294. Mor V, Wilcox V, Rakowski W, et al. Functional transitions among the elderly: patterns, predictors, and related hospital use. *Am J Public Health* 1994 Aug; 84(8):1274-80.
295. Grant MD, Piotrowski ZH, Chappell R. Self-reported health and survival in the Longitudinal Study of Aging, 1984-1986. *Journal of Clinical Epidemiology* 1995 Mar; 48(3):375-87.
296. Wolinsky FD, Johnson RL, Stump TE. The risk of mortality among older adults over an eight-year period. *Gerontologist* 1995 Apr; 35(2):150-61.
297. Steinbach U. Social networks, institutionalization, and mortality among elderly people in the United States. *J Gerontol* 1992 Jul; 47(4):S183-90.
298. Goodlin S, Boult C, Bubolz T, et al. Who will need long-term care? Creation and validation of an instrument that identifies older people at risk. *Dis Manag* 2004 Winter; 7(4):267-74.
299. Miller ME, Longino CF, Jr., Anderson RT, et al. Functional status, assistance, and the risk of a community-based move. *Gerontologist* 1999 Apr; 39(2):187-200.
300. Wolinsky FD, Callahan CM, Fitzgerald JF, et al. The risk of nursing home placement and subsequent death among older adults. *J Gerontol* 1992 Jul; 47(4):S173-82.
301. Coward RT, Netzer JK, Mullens RA. Residential differences in the incidence of nursing home admissions across a six-year period. *J Gerontol B Psychol Sci Soc Sci* 1996 Sep; 51(5):S258-67.
302. Kersting RC. Impact of social support, diversity, and poverty on nursing home utilization in a nationally representative sample of older Americans. *Soc Work Health Care* 2001; 33(2):67-87.
303. Speare A, Jr., Avery R, Lawton L. Disability, residential mobility, and changes in living arrangements. *J Gerontol* 1991 May; 46(3):S133-42.
304. Kersting RC. Predictors of nursing home admission for older black Americans *Journal of Gerontological Social Work* 2001; 35(3):33-50.
305. Belgrave LL, Bradsher JE. Health as a factor in institutionalization. *Research on Aging* 1994; 16(2):115-41.

References for Appendix E

306. Boult C, Dowd B, McCaffrey D, et al. Screening elders for risk of hospital admission. *J Am Geriatr Soc* 1993 Aug; 41(8):811-7.
307. Stearns SC, Kovar MG, Hayes K, et al. Risk indicators for hospitalization during the last year of life. *Health Serv Res* 1996 Apr; 31(1):49-69.
308. Laditka JN. Hazards of hospitalization for ambulatory care sensitive conditions among older women: evidence of greater risks for African Americans and Hispanics. *Med Care Res Rev* 2003 Dec; 60(4):468-95; discussion 96-508.
309. Wolinsky FD, Stump TE, Johnson RJ. Hospital utilization profiles among older adults over time: consistency and volume among survivors and decedents. *J Gerontol B Psychol Sci Soc Sci* 1995 Mar; 50(2):S88-100.
310. Aliyu MH, Adediran AS, Obisesan TO. Predictors of hospital admissions in the elderly: analysis of data from the Longitudinal Study on Aging. *J Natl Med Assoc* 2003 Dec; 95(12):1158-67.
311. Wolinsky FD, Culler SD, Callahan CM, et al. Hospital resource consumption among older adults: a prospective analysis of episodes, length of stay, and charges over a seven-year period. *J Gerontol* 1994 Sep; 49(5):S240-52.
312. Dewey ME, Saz P. Dementia, cognitive impairment and mortality in persons aged 65 and over living in the community: a systematic review of the literature. *Int J Geriatr Psychiatry* 2001 Aug; 16(8):751-61.
313. Ostbye T, Hill G, Steenhuis R. Mortality in elderly Canadians with and without dementia: a 5-year follow-up. *Neurology* 1999 Aug 11; 53(3):521-6.
314. Saz P, Launer LJ, Dia JL, et al. Mortality and mental disorders in a Spanish elderly population. *Int J Geriatr Psychiatry* 1999 Dec; 14(12):1031-8.
315. Jagger C, Clarke M, Stone A. Predictors of survival with Alzheimer's disease: a community-based study. *Psychol Med* 1995 Jan; 25(1):171-7.
316. Liu CK, Lai CL, Tai CT, et al. Incidence and subtypes of dementia in southern Taiwan: impact of socio-demographic factors. *Neurology* 1998 Jun; 50(6):1572-9.
317. Foley DJ, Monjan AA, Masaki KH, et al. Associations of symptoms of sleep apnea with cardiovascular disease, cognitive impairment, and mortality among older Japanese-American men. *Journal of the American Geriatrics Society* 1999 May; 47(5):524-8.
318. Gale CR, Martyn CN, Cooper C. Cognitive impairment and mortality in a cohort of elderly people. *Bmj* 1996 Mar 9; 312(7031):608-11.
319. Ho SC. Health and social predictors of mortality in an elderly Chinese cohort. *Am J Epidemiol* 1991 May 1; 133(9):907-21.
320. Eagles JM, Beattie JA, Restall DB, et al. Relation between cognitive impairment and early death in the elderly. *BMJ* 1990 Jan 27; 300(6719):239-40.
321. Shapiro E, Tate RB. The impact of a mental status score and a dementia diagnosis on mortality and institutionalization. *J Aging Health* 1991; 3:28-46.
322. Salive ME, Satterfield S, Ostfeld AM, et al. Disability and cognitive impairment are risk factors for pneumonia-related mortality in older adults. *Public Health Rep* 1993 May-Jun; 108(3):314-22.
323. Liang J, Borawski-Clark E, Liu X, et al. Transitions in cognitive status among the aged in Japan. *Soc Sci Med* 1996 Aug; 43(3):325-37.
324. Gussekloo J, Westendorp RG, Remarque EJ, et al. Impact of mild cognitive impairment on survival in very elderly people: cohort study. *Bmj* 1997 Oct 25; 315(7115):1053-4.
325. Arve S, Lehtonen A, Tilvis RS. Prognosis of depression with and without dementia in old age. *Arch Gerontol Geriatr* 1998 Sep-Oct; 27(2):141-6.
326. Korten AE, Jorm AF, Jiao Z, et al. Health, cognitive, and psychosocial factors as predictors of mortality in an elderly community sample. *J Epidemiol Community Health* 1999 Feb; 53(2):83-8.
327. Fredman L, Magaziner J, Hebel JR, et al. Depressive symptoms and 6-year mortality among elderly community-dwelling women. *Epidemiology* 1999 Jan; 10(1):54-9.
328. Nakanishi N, Tatara K, Ikeda K, et al. Relation between intellectual dysfunctioning and mortality in community-residing older people. *J Am Geriatr Soc* 1998 May; 46(5):583-9.
329. Swan GE, Carmelli D, LaRue A. Performance on the digit symbol substitution test and 5-year mortality in the Western Collaborative Group Study. *Am J Epidemiol* 1995 Jan 1; 141(1):32-40.
330. Li G, Shen YC, Chen CH, et al. A three-year follow-up study of age-related dementia in an urban area of Beijing. *Acta Psychiatrica Scandinavica* 1991 Feb; 83(2):99-104.
331. Jorm AF, Henderson AS, Kay DWK, et al. Mortality in relation to dementia, depression ad social integration in an elderly community sample. *Int J Geriatr Psychiatry* 1991; 6:5-11.
332. Aronson MK, Ooi WL, Geva DL, et al. Dementia. Age-dependent incidence, prevalence, and mortality in the old old. *Arch Intern Med* 1991 May; 151(5):989-92.
333. Evans DA, Smith LA, Scherr PA, et al. Risk of death from Alzheimer's disease in a community population of older persons. *Am J Epidemiol* 1991 Aug 15; 134(4):403-12.
334. Heeren TJ, van Hemert AM, Rooymans HG. A community-based study of survival in dementia. *Acta Psychiatr Scand* 1992 Jun; 85(6):415-8.
335. Skoog I, Nilsson L, Palmertz B, et al. A population-based study of dementia in 85-year-olds. *N Engl J Med* 1993 Jan 21; 328(3):153-8.

References for Appendix E

336. Aevarsson O, Svanborg A, Skoog I. Seven-year survival rate after age 85 years: relation to Alzheimer disease and vascular dementia. *Arch Neurol* 1998 Sep; 55(9):1226-32.
337. Snowdon J, Lane F. The Botany survey: A longitudinal study of depression and cognitive impairment in an elderly population. *Int J Geriatr Psychiatry* 1995; 10:349-58.
338. Hill GB, Forbes WF, Lindsay J, et al. Mortality and cognitive status among elderly Canadians living in the community and in institutions: the Canadian Study of Health and Aging. *Can J Public Health* 1997 Sep-Oct; 88(5):303-4.
339. Ostbye T, Steenhuis R, Wolfson C, et al. Predictors of five-year mortality in older Canadians: the Canadian Study of Health and Aging. *J Am Geriatr Soc* 1999 Oct; 47(10):1249-54.
340. Katzman R, Hill LR, Yu ES, et al. The malignancy of dementia. Predictors of mortality in clinically diagnosed dementia in a population survey of Shanghai, China. *Arch Neurol* 1994 Dec; 51(12):1220-5.
341. Juva K, Sulkava R, Erkinjuntti T, et al. The prognosis of demented patients: One-year follow-up study of a population sample. *Int J Geriatr Psychiatry* 1994; 9:537-41.
342. Meller I, Fichter MM, Schroppel H. Mortality risk in the octo- and nonagenerians: longitudinal results of an epidemiological follow-up community study. *Eur Arch Psychiatry Clin Neurosci* 1999; 249(4):180-9.
343. Bonaiuto S, Mele M, Galluzzo L, et al. Survival and dementia: a 7-year follow-up of an Italian elderly population. *Arch Gerontol Geriatr* 1995 Jan-Feb; 20(1):105-13.
344. Baldereschi M, Di Carlo A, Maggi S, et al. Dementia is a major predictor of death among the Italian elderly. ILSA Working Group. Italian Longitudinal Study on Aging. *Neurology* 1999 Mar 10; 52(4):709-13.
345. Tsuji I, Minami Y, Li JH, et al. Dementia and physical disability as competing risks for mortality in a community-based sample of the elderly Japanese. *Tohoku J Exp Med* 1995 Jun; 176(2):99-107.
346. Asada T, Yamagata Z, Kinoshita T, et al. Prevalence of dementia and distribution of ApoE alleles in Japanese centenarians: an almost-complete survey in Yamanashi Prefecture, Japan. *J Am Geriatr Soc* 1996 Feb; 44(2):151-5.
347. Engedal K. Mortality in the elderly - a 3-year follow-up of an elderly community sample. *Int J Geriatr Psychiatry* 1996; 11:467-71.
348. Aguero-Torres H, Fratiglioni L, Winblad B. Natural history of Alzheimer's disease and other dementias: review of the literature in the light of the findings from the Kungsholmen Project. *Int J Geriatr Psychiatry* 1998 Nov; 13(11):755-66.
349. Johansson B, Zarit SH. Prevalence and incidence of dementia in the oldest old: A longitudinal study of a population-based sample of 84-90-year-olds in Sweden. *Int J Geriatr Psychiatry* 1995; 10:359-66.
350. Gurland BJ, Wilder DE, Lantigua R, et al. Rates of dementia in three ethnoracial groups. *Int J Geriatr Psychiatry* 1999 Jun; 14(6):481-93.
351. Albert SM, Costa R, Merchant C, et al. Hospitalization and Alzheimer's disease: results from a community-based study. *J Gerontol A Biol Sci Med Sci* 1999 May; 54(5):M267-71.
352. Banaszak-Holl J, Fendrick AM, Foster NL, et al. Predicting nursing home admission: estimates from a 7-year follow-up of a nationally representative sample of older Americans. *Alzheimer Dis Assoc Disord* 2004 Apr-Jun; 18(2):83-9.
353. Dukers DF, Vermeer MH, Jaspars LH, et al. Expression of killer cell inhibitory receptors is restricted to true NK cell lymphomas and a subset of intestinal enteropathy-type T cell lymphomas with a cytotoxic phenotype. *J Clin Pathol* 2001 Mar; 54(3):224-8.
354. Hastings SN, Purser JL, Johnson KS, et al. Frailty predicts some but not all adverse outcomes in older adults discharged from the emergency department. *J Am Geriatr Soc* 2008 Sep; 56(9):1651-7.
355. Harris T, Kovar MG, Suzman R, et al. Longitudinal study of physical ability in the oldest-old. *Am J Public Health* 1989 Jun; 79(6):698-702.
356. Wolinsky FD, Johnson RJ. The use of health services by older adults. *J Gerontol* 1991 Nov; 46(6):S345-57.
357. Wolinsky FD, Callahan CM, Fitzgerald JF, et al. Changes in functional status and the risks of subsequent nursing home placement and death. *J Gerontol* 1993 May; 48(3):S94-101.
358. Anderson RT, James MK, Miller ME, et al. The timing of change: patterns in transitions in functional status among elderly persons. *J Gerontol B Psychol Sci Soc Sci* 1998 Jan; 53(1):S17-27.
359. Naeim A, Keeler EB, Reuben D. Perceived causes of disability added prognostic value beyond medical conditions and functional status. *J Clin Epidemiol* 2007 Jan; 60(1):79-85.
360. Grabowski DC, Ellis JE. High body mass index does not predict mortality in older people: analysis of the Longitudinal Study of Aging. *J Am Geriatr Soc* 2001 Jul; 49(7):968-79.
361. Rakowski W, Hickey T. Mortality and the attribution of health problems to aging among older adults. *Am J Public Health* 1992 Aug; 82(8):1139-41.
362. Ravaglia G, Forti P, Lucicesare A, et al. Development of an easy prognostic score for frailty outcomes in the aged. *Age Ageing* 2008 Mar; 37(2):161-6.
363. Pilotto A, Ferrucci L, Franceschi M, et al. Development and validation of a multidimensional prognostic index for one-year mortality from comprehensive geriatric

assessment in hospitalized older patients. *Rejuvenation Res* 2008 Feb; 11(1):151-61.
364. Song X, Mitnitski A, MacKnight C, et al. Assessment of individual risk of death using self-report data: an artificial neural network compared with a frailty index. *J Am Geriatr Soc* 2004 Jul; 52(7):1180-4.
365. Albertsson DM, Mellstrom D, Petersson C, et al. Validation of a 4-item score predicting hip fracture and mortality risk among elderly women. *Ann Fam Med* 2007 Jan-Feb; 5(1):48-56.
366. Schonberg MA, Davis RB, McCarthy EP, et al. Index to predict 5-year mortality of community-dwelling adults aged 65 and older using data from the national health interview survey. *J Gen Intern Med* 2009 Oct; 24(10):1115-22.
367. Garcia-Gonzalez JJ, Garcia-Pena C, Franco-Marina F, et al. A frailty index to predict the mortality risk in a population of senior mexican adults. *BMC Geriatr* 2009; 9:47.
368. Carey EC, Walter LC, Lindquist K, et al. Development and validation of a functional morbidity index to predict mortality in community-dwelling elders. *J Gen Intern Med* 2004 Oct; 19(10):1027-33.
369. Levine SK, Sachs GA, Jin L, et al. A prognostic model for 1-year mortality in older adults after hospital discharge. *Am J Med* 2007 May; 120(5):455-60.
370. Pijpers E, Ferreira I, van de Laar RJ, et al. Predicting mortality of psychogeriatric patients: a simple prognostic frailty risk score. *Postgrad Med J* 2009 Sep; 85(1007):464-9.
371. Markides KS, Black SA, Ostir GV, et al. Lower body function and mortality in Mexican American elderly people. *J Gerontol A Biol Sci Med Sci* 2001 Apr; 56(4):M243-7.
372. Gill TM, Gahbauer EA, Allore HG, et al. Transitions between frailty states among community-living older persons. *Arch Intern Med* 2006 Feb 27; 166(4):418-23.
373. Purser JL, Kuchibhatla MN, Fillenbaum GG, et al. Identifying frailty in hospitalized older adults with significant coronary artery disease. *J Am Geriatr Soc* 2006 Nov; 54(11):1674-81.
374. Mitnitski AB, Graham JE, Mogilner AJ, et al. Frailty, fitness and late-life mortality in relation to chronological and biological age. *BMC Geriatr* 2002 Feb 27; 2:1.
375. Drame M, Novella JL, Lang PO, et al. Derivation and validation of a mortality-risk index from a cohort of frail elderly patients hospitalised in medical wards via emergencies: the SAFES study. *Eur J Epidemiol* 2008; 23(12):783-91.
376. Frazier AL, Colditz GA, Fuchs CS, et al. Cost-effectiveness of screening for colorectal cancer in the general population. *JAMA* 2000 Oct 18; 284(15):1954-61.
377. Vijan S, Hwang EW, Hofer TP, et al. Which colon cancer screening test? A comparison of costs, effectiveness, and compliance. *Am J Med* 2001 Dec 1; 111(8):593-601.
378. Ness RM, Holmes AM, Klein R, et al. Cost-utility of one-time colonoscopic screening for colorectal cancer at various ages. *Am J Gastroenterol* 2000 Jul; 95(7):1800-11.
379. Loeve F, Brown ML, Boer R, et al. Endoscopic colorectal cancer screening: a cost-saving analysis. *J Natl Cancer Inst* 2000 Apr 5; 92(7):557-63.
380. Song K, Fendrick AM, Ladabaum U. Fecal DNA testing compared with conventional colorectal cancer screening methods: a decision analysis. *Gastroenterology* 2004 May; 126(5):1270-9.