Maintaining Community Residence for People with Long Term Care Needs:

A Literature Review of Factors Associated with Physical Decline, Cognitive Decline, and Nursing Home Placement

Prepared for the RI Executive Office of Health and Human Services

by

Susan M. Allen, Ph.D.

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Executive Summary

The overall purpose of this review of predictors of nursing home placement, cognitive decline and decline in physical functioning is to inform the Medicaid program of risk factors to target in planning for community-based services and preventive interventions to keep people in the community at the highest possible levels of cognitive and physical functioning and in community-based settings for as long as possible. The following is a summary of major lessons for population targeting and program development.

- Absence of social support is a key predictor of nursing home placement, and is likely the most influential factor accounting for people entering nursing homes at relatively low levels of impairment. Early identification of people at risk for placement due to absence of someone to provide assistance at home, with triage to a residential alternative or to home-based services, will be crucial to the success of reducing Medicaid reliance on nursing home care.

- Non-Hispanic white elderly have a higher propensity to use nursing homes than non-Hispanic Black and Hispanic elderly, who in turn have a higher risk of disability.

- It is clear that both physical and cognitive disabilities are the most powerful and proximate reasons that people are placed in nursing homes.

- Cognitive decline and decline in physical functioning share common risk factors, including physical inactivity. Also, cognitive decline can lead to physical decline, and physical decline can lead to cognitive decline, through the pathway of inactivity.

- Evidence from this review strongly indicates the benefits of exercise for elderly people as a means of stabilizing and even improving both physical and cognitive functioning. Exercise and physical activity programs should become central to any community based or institutional living situation if goals of stabilizing physical and cognitive functioning are to be met.

- While older age is a risk factor for nursing home placement, individuals age 65-74 are prime targets for interventions designed to maintain physical and cognitive functioning given that such interventions, although somewhat beneficial to even the most impaired, are proven to be most effective among high functioning or less impaired populations.

- A bad fall can result from decline in functioning or can mark the *beginning* of decline by increasing the reluctance of elderly people to leave their homes or otherwise engage in social and physical activity. There are a variety of effective approaches to reducing falls in the home setting, including: health/environmental screening programs (in both home and residential care settings); programs of

- muscle strengthening and balance training prescribed by a trained health professional; home hazard assessment and modification for older people with histories of falls; withdrawal of psychotropic medication; and Tai Chi group exercise interventions, known for their effectiveness in improving balance.

- Some common risk factors for nursing home placement as well as functional decline identified in this review are subject to modification by medical professionals. Often the challenge is to identify as well as to treat such problems, which may be overlooked in the course of a medical encounter, particularly if a treating physician is not attuned to the needs and risks of geriatric populations. The most important of these risk factors that are amenable to intervention are depression, polypharmacy, incontinence and malnutrition.

- The detection and treatment of modifiable risk factors for physical and cognitive decline is a goal of "preventive home visits" by Geriatric Assessment Teams. Such preventive home visits are part of national policy in several countries, including the United Kingdom, Denmark and Australia, and results of numerous randomized trials suggest that they are effective in preventing decline and reducing risk of nursing home placement. These results suggest that it is not enough to address medical and psychological risk factors in medical settings. Risk factors for decline may be more visible when the assessment occurs at home and interventions are likely to be more successful when conducted in elderly persons' homes, where their daily lives are played out.

- Whether or not home care services reduces nursing home placement has long been a subject of debate. However, recent research suggests that home care does not reduce nursing home care unless it is targeted to the most disabled patients, or to less impaired patients who lack social support to provide needed care at home.

- Use of adult day care appears to increase risk of nursing home placement, but this is likely to be a function of the severity of disability that leads to the use of adult day care initially. Similar dynamics are in play for assisted living. Since randomization to such services is difficult to achieve, there is little research on the ability of such services to delay time to placement.

- Evidence suggests that respite services may have a small positive effect on caregivers in terms of burden and mental or physical health, and generally, caregivers are very satisfied with respite care. Unfortunately, no reliable evidence was found that respite delays entry into residential care.

- Two studies included in this review reported findings that provide confirmation of the potential benefits of expanded community-based service options. One study found that higher state spending on home and community based services resulted in a reduced risk

of nursing home placement for elderly persons without families to care for them. However, there was no reduction of risk for nursing home placement among elderly persons who had children nearby. The home care literature consistently shows that families use formal home care services to supplement (rather than substitute for) their own care when they are no longer able to meet the elder person's needs due to disease progression and decline. Thus, like day care services, formal services may help forestall nursing home placement, but not avoid it altogether.

- A second study also found that a higher percentage of Medicaid spending on HCBS lengthened time to nursing home admission for unmarried Alzheimer's patients, who were likely to lack social support. For married Alzheimer's patients, a greater number of home health agencies in patients' geographic area delayed time to placement, suggesting that system capacity to supply services may be important for persons with some family support in place. The results of both studies focusing on Medicaid spending on HCBS suggest that home care services have the potential to substitute for institutional care for people lacking family to care for them because they enter nursing homes at lower levels of need.

- In conclusion, the results of this review suggest that greater emphasis on the identification of risk factors for physical and functional decline among frail elderly populations, and amelioration of risk factors through wellness programs and medical interventions, may result in reduced risk of vulnerable populations' placement in nursing homes. Findings also suggest that it is not only the person but his or her environment that must be subject to scrutiny. In other words, regardless of whether vulnerable elders remain in their homes with services or are triaged to residential arrangements such as assisted living, it is crucial to ensure that daily living environments are "healthy." Access to interventions to promote both physical and social activity, either at home or in the community, are necessary if the "use it or lose it" principle is to be avoided.   Attention to principals of prevention and amelioration of risk factors will facilitate "aging in place" for people with impairment on Medicaid, thus achieving Medicaid program goals to reduce reliance on institutional care.

- Finally, econometric simulation modeling of various policy approaches to reducing unmet needs found the most effective policy was high spending on community based (relative to nursing home) care, and low LTC spending per recipient; that is, *spending more on community-based care and spreading it across more recipients*. Given recent evidence of the relationship between unmet care needs and nursing home placement, widespread provision of home-based care targeted to those without social support or with high levels of impairment may be the most promising approach for states to take as they seek to balance provision of long term care.

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I. Introduction

The Rhode Island Department of Human Services is poised to embark on a pathway of change in regard to its long term care system for people with chronic conditions and impairments who require assistance with daily living activities. Under the Global Waiver recently proposed to CMS, RI residents applying to Medicaid for long term care services will be classified into one of three levels of care, and those classified as most needy will be triaged to the least restrictive setting possible, including to an array of community-based services and supports.

To ensure the success of the rebalancing of the Rhode Island long-term-care system, it is essential to draw on previous research to understand how services might provide the needed support for people with impairment on Medicaid, thus substituting for more costly nursing home care. In addition, it is essential to begin to think in terms of how to keep people triaged to community-based rather than nursing home care, as well as those who classify for lower levels of care, stable at their current level of functioning. Efforts to intervene in the decline process may forestall the point at which the nursing home is the only residential option available to them, or for some, may result in the avoidance of nursing home placement altogether.

In addition to newly eligible Rhode Islanders on Medicaid, we know based on a recent needs assessment survey that approximately 15% of the current population of community-dwelling elderly on Medicaid is in a Medicaid waiver, and an additional 11% are not in a waiver but have need for help with activities of daily living (ADLs) such as bathing, transferring, toileting, etc. and thus are waiver eligible; 35% are ADL independent (no need for help) but have need for help with instrumental activities of daily living (IADLs) such as shopping, cooking, housekeeping, etc. and are thus at risk of becoming waiver eligible, and 39% had no need for help with ADL or IADL activities at the time of the survey (Allen et al., 2008). Thus, only approximately one quarter of Medicaid community-dwelling elders are currently eligible for community-based services. Upstream efforts may reduce the proportion of the relatively large number of elderly individuals who do not currently need services from declining to the point where they will eventually become eligible for Medicaid-supported community-based care.

Thus, the overall purpose of this review is to inform the Medicaid program of risk factors to target in planning interventions to keep people in the community at high levels of cognitive and physical functioning and in community-based settings for as long as possible. The review summarizes published peer-review studies and their findings regarding three outcomes of interest:

- Risk factors for nursing home placement.
- Risk factors for cognitive decline
- Risk factors for decline in physical functioning

In addition, the implications of findings from this review for Medicaid program direction are discussed in terms of services that may forestall nursing home placement and interventions that have been demonstrated to result in stabilizing and/or improving cognition and physical function in samples of elders at risk.

Wherever possible, systematic reviews of scientifically rigorous interventions designed to reduce nursing home placement, functional decline and/or cognitive decline, and that are evaluated in the context of randomized trials, are cited. Clearly, programs and interventions designed to promote behavior change that results in high physical and cognitive function may also result in the avoidance of need for a nursing home for many elderly people in the long run, and for others may forestall nursing home placement until the final years of life, when decline may no longer be avoided.

II. Methods

We searched the online data base Medline (or Pub Med, a user-friendly version of Medline) for the studies included in this review. Medline is a database of medical and health-related peer-reviewed literature developed and maintained by the National Library of Medicine. The published studies included in this review are longitudinal studies captured by search criteria (see section below) for each of our three reviews in Medline, as well as cross-sectional studies including large numbers of study subjects. Included studies were published within the time frame 1995-2008. This time frame was selected to capture findings based on state of the art data collection and analytic methodologies, and are assumed to build on knowledge gained from earlier work in the field. The majority of studies were conducted in the United States although several recent large sample prospective international cohort studies were included because of their ambitious scope and relevance. Selected studies are presented in tabular form with key features of the population studied, the study design, and relevant findings highlighted In Appendices I-III.

Search Criteria

Predictors of nursing home placement: nursing home placement OR nursing home admission

Predictors of decline in physical functioning: functional decline OR functional impairment OR physical impairment

Predictors of cognitive decline: cognitive decline OR cognitive impairment

Note that studies of a medical nature identifying risk factors that are NOT amenable to public health interventions or Medicaid program development are not included in this review (for example, a study identifying genotypes or neurological abnormalities as risk factors for cognitive decline). This review is confined to studies that identify characteristics of the Medicaid population that are useful for targeting, referral, and program development.

III. Results

In the following sections we highlight risk factors identified in our review. We focus first on the most proximate risk factors for nursing home placement, followed by reviews of studies of risk factors for physical decline and cognitive decline, since the latter reviews allow for a more upstream perspective that points to opportunities to intervene early in the disease or impairment trajectory.

III.a. Predictors of Nursing Home Placement

The Studies: A total of 55 studies published between 1995 and 2008 were identified in Medline and found to be eligible for this review of risk factors for nursing home placement. Characteristics of elderly individuals who are potentially at risk are the sole focus of 39 of these studies, caregiver characteristics that present risk for placement are the sole focus of 6 studies, and both care receiver and caregiver risk factors are studied in 9 papers. The relationship between state Medicaid program characteristics and risk of nursing home admission is reported in 2 studies (sole focus in one study).

Study Design/Data sources: Nineteen of the 55 studies are based on primary data collection, and 36 are secondary analysis of already collected data. Secondary data are from a variety of sources, and include national longitudinal surveys (AHEAD, HRS, LSOA), Medicare Demonstration Projects, several of the regional EPESE (Epidemiologic Studies of the Elderly; Marshfield, New Haven, Iowa) studies, state administrative data (New York, Arizona), insurance claims data (Kaiser), data from an Alzheimer's Disease Registry, data from the Veterans' Administration, from the PACE program and from the Mayo Clinic.

The Samples: The samples studied in this review include nationally representative samples of the general elderly population, non-representative but large sample studies of people with dementia/Alzheimer's, (e.g., from the Medicare Alzheimer's Demonstration Program (MADDE), samples of day care clients, home care clients, members of Kaiser Health Plan, and samples of elderly individuals with specific health problems (e.g., hip fracture, depression, incontinence). The mix of target populations in this review allows for identification of risk factors that may not be examined in general population surveys.

Findings: Below we describe the findings reported in studies of risk of nursing home placement included in this review. Results are also summarized in tabular form in Appendix A. It should be noted that the frequency of studies in which specific risk factors are reported

are a function of both the reliability of the finding across samples and data sources as well as the high frequency with which some risk factors are investigated (e.g., age, functional status) relative to other factors (e.g., falls, prior service utilization).

Care Receiver Risk Factors

      Demographic Characteristics: Older age is a robust risk factor for nursing home placement, reported in the majority of studies included in Appendix A. This age effect remains even when statistically controlling for the diseases and physical and cognitive impairments associated with old age, suggesting that there are unmeasured factors, often referred to as "frailty" that affect the rate at which people are institutionalized in older ages. Similarly, **women** are more likely to be institutionalized than men, primarily because of men's shorter life expectancy, which leaves many women without someone to care for them in old age. Additionally, since elderly husbands were raised in an era in which married women cooked, cleaned and provided care to sick family members, while men worked outside the home, husbands may be less able than wives to meet the needs of their spouse when care needs are high. Exceptions to the finding that women are at higher risk for nursing home placement is the study by Heyman and colleagues (1997; see Appendix A) of white Alzheimer's patients, which found unmarried men to be at highest risk, and also a study of older African-Americans that reported men to be at higher risk than women (Gaugler et al., 2004; see Appendix A). Since the latter is the only study included in this review that contained only African Americans, it is difficult to determine the generalizability of this finding.

      In the vast majority of studies reporting a race or ethnicity effect on nursing home placement, elderly **non-Hispanic White** people are at higher risk of nursing home placement than either Hispanics or African Americans. However, one multi-ethnic study of dementia patients and their caregivers indicated that Medicaid-eligible Hispanics were at higher risk (Gaugler et al., 2006; see Appendix A). As the US population ages and minorities make up increasingly larger proportions of the older population, historical assumptions that the extended families of African American and Hispanic elderly are protective of nursing home placement may be challenged. In fact, there is evidence that as whites take advantage of increased access to assisted living facilities, the racial gap in nursing home placement is lessening, although Blacks are still 26% less likely to use nursing homes than Whites (Akimbo and Wolinsky, 2007).

      Evidence regarding the influence of indicators of socioeconomic status on nursing home placement is inconsistent. However, several studies included in this review indicate that **higher levels of education** are predictive of nursing home placement, which may be explained in part by greater awareness of nursing homes as an option for care. Evidence regarding **income and other indicators of wealth** are mixed,

with three studies indicating that higher income predicts nursing home placement, while other studies found lower net worth and Medicaid eligibility status as risk factors. These discrepancies in study findings may be due to differences in samples and also the measurement, and timing of measurement, of income, assets and net worth. Finally, where one lives may pose a risk factor for nursing home placement, with one study finding that **residence in less urbanized and thinly populated nonmetropolitan counties** poses a higher risk of placement. This finding may be partly attributable to the lower availability of services to help those who live alone to stay at home, or to supplement family care as care needs escalate.

Social Support Characteristics: There is consensus in the literature that social support is a strong determinant for nursing home placement. Social support is operationalized in many ways in the studies identified for this review and in all cases the results are strong and the direction of effect is clear. Elderly people who are **divorced, widowed, single, who report having no informal caregiver or low social support, who live alone, and/or who have fewer children** are at a significantly increased risk for nursing home placement, regardless of the study design, data source or composition of the sample studied. Given the higher rates of divorce characteristic of the Baby Boom generation relative to the Depression era cohort of elderly, and increasing rates of people living alone as they age, the implications for Medicaid program efforts to provide vulnerable elders on Medicaid with community-based options for care are substantial.

In fact, perhaps the greatest challenge to the deinstitutionalization of elderly persons with disabilities is to develop sufficient options for people who do not have family to provide at least a portion of the community-based care they require. Worst case scenarios related to inadequate or "negative" social support are highlighted by one study's finding that Adult Protective Service referrals for **self-neglect** and **mistreatment** are risk factors for nursing home placement (Lachs et al., 2002; see Appendix A).

Health-related Characteristics: Impairment in ADLs and IADLs, whether operationalized as 'having difficulty performing', 'needing help with', or 'experiencing decline in' (daily activities), is a robust risk factor for nursing home placement across all types of studies, samples and measures, as are indicators of **cognitive impairment** and **cognitive decline**. It is clear that both physical and cognitive disability are the most powerful and proximate reasons that people are placed in nursing homes, i.e., they can no longer perform basic living tasks by themselves, with most people requiring hands-on assistance, and some a combination of hands-on and supervisory help. Since intervention to improve functioning is difficult, although not impossible, at this stage of disease progression, reviews of decline in both physical and cognitive functioning follow in Sections III.b and III.c.

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In addition to physical and cognitive disability, other medical risk factors for nursing home placement include **poor self-rated health, multiple comorbidities, and diagnoses of diabetes, stroke, heart disease, dementia, Alzheimer 's disease and mental illness**. These latter specific diagnoses are associated with high levels of need for care, or in the instance of cognitive impairment, with often round the clock need for supervision. In addition, **incontinence** and **behavioral problems** are reported as significant risk factors for nursing home placement in several studies, again speaking to a need for labor-intensive care. Also, **vision impairment**, the occurrence of **falls**, **greater numbers of medications** taken, and **use of inappropriate medications** are reported as risk factors in a number of studies. Medication issues appear to be particularly salient and may be related to lack of continuity of care, i.e., use of multiple physicians who are unaware of others' prescribing, as well as unmet need for help with medication management in the home setting.

Mood state, operationalized as **depression, low morale, and loneliness** were reported as significant risk factors for nursing home placement in several studies in this review. Treatment for depression, increase in social activities and other interventions designed to improve mood can be targeted upstream as well as downstream, potentially reducing risk for nursing home placement while also slowing processes of physical and cognitive decline, as discussed in Sections III.b and III.c.

Utilization Characteristics: Not surprisingly, utilization patterns that suggest a high level of morbidity are risk factors for nursing home placement, including **prior nursing home use, prior hospitalizations**, **higher levels of hospitalization, and having inpatient and outpatient mental health utilization.** Also, elderly persons who lived in a **retirement community** or **assisted living**, and those who used **adult day services**, are at elevated risk for placement in a nursing home, probably because these types of residences and care arrangements are associated with an already vulnerable risk status, and are interim steps in a decline process that may eventually be deemed inadequate to a vulnerable elder's care needs. For example, Rosenberg et al. (2006; see Appendix A) found that declining health, chronic pain and appetite changes predicted nursing home placement in a sample of elder's residing in assisted living facilities, suggesting that the needs of these residents were no longer being met.

Caregiver Risk Factors

Personal Factors: Like care recipients, **older age** and **White race** of the primary caregiver are consistent risk factors across studies in which caregiver factors are a focus of investigation. Not surprisingly, **poor caregiver health** has been reported in several studies as a risk factor, likely reflecting caregivers' inability to continue to meet loved ones' needs. The identification of **job conflicts** and **caregiver**

residence out of the care recipient's home are risk factors for placement and may reflect the competing demands inherent in attempting to juggle responsibilities, including employment and caring for one's nuclear family, while at the same time caring for aging parents or other relatives. Indicators of **recent entry** into the caregiving role AND **length of caregiving duration** are both positively related to nursing home placement, suggesting two points of caregiver vulnerability: at the onset of caregiving, when role adjustment may be daunting, and after substantial time in the role when the elderly person who requires care may require increasing levels of assistance associated with cognitive and/or physical decline. Finally, one study found that some caregivers do not intend to provide care for extended periods of time but voice the **intention to place** their loved ones in a nursing home when the demands of care become too great.

       Factors Associated with the Caregiving Situation: It is clear from the studies contained in this review that the **more assistance** required by the care receiver, the higher the risk for nursing home placement. Caregivers often persist in their role until it becomes apparent that the care receiver has **unmet needs** due to increasing impairment that exceeds the caregiver's resource (time, physical ability, etc) capacity. High levels of need are the primary predictor of **caregiver burden,** which is the most prevalent reason for nursing home placement reported by caregivers in the studies included in this review, and may reflect subjective (e.g., mood) and objective (e.g., lack of sleep, impact on health) burden. Related caregiver outcomes identified as risk factors are **decreased satisfaction with life** and **increased levels of depression**. Obviously, caregiver burden is a proximate risk factor for placing loved ones in nursing homes; by the point that a caregiver is experiencing severe burden, it may be too late to intervene.

Factors that Reduce Risk

       Life Style Behaviors There are "clues" for interventions that may be developed to delay risk in high need populations. Findings from some studies speak to the behavior of elderly persons that reduces risk for nursing home placement, i.e., elderly people who are **physically active**, **socially active**, and who are **moderate consumers of alcoholic beverages** are at lower risk than those who are sedentary, who are not socially engaged, and who drink heavily OR who do not drink at all.   While intervention research studies demonstrate success in increasing physical activity and improving physical function among elderly people in community-based as well as institutional settings (see Section IV), programs to enhance social support and activity are more elusive for elders who remain in the community, particularly those who live alone. This is particularly disturbing given the increasing number of elderly people who live alone.

Community-based Services In contrast to the identification of utilization patterns that are positively related to nursing home placement, use of **in-home help** (among elderly people with Alzheimer's disease) and receiving **case management** (among a large sample of home care users) were found in separate studies to reduce the risk of nursing home placement. Also, caregivers report a number of strategies to keep loved ones at home, and some of these strategies are reported to significantly decrease risk for nursing home placement. These include **use of community base services**, particularly in the early stages of an elderly person's dementia or impairment trajectory, **counseling** to alleviate or avoid the experience of burden, **family assistance to the primary caregiver**, and **family-supplied respite care** to allow the primary caregiver a break from his/her responsibilities. Unfortunately, recent research comparing national survey data on caregiving networks from the 1980s to a similar studies in the 1990s indicates that the *proportion of primary caregivers who are providing care alone, without the help of other family members, has increased dramatically*, suggesting that today's caregivers may be experiencing particular strains that may result in nursing home placement of the family member receiving home-based care (Spillman and Pezzin, 2000; Wolff and Kasper, 2006).

State Medicaid Program Factors: While only two studies (Miller et al., 1998; Muramatsu et al., 2007; see Appendix A) were identified that examined the influence of state policy on person-level outcomes, the results of these studies were consistent. Muramatsu et al.'s large sample study found that higher state spending on home and community based services reduced the risk of nursing home placement for elderly persons without families to care for them, but not for those with children nearby. Miller et al.'s study found that a higher percentage of Medicaid spending on HCBS lengthened time to nursing home admission for unmarried Alzheimer's patients, while a greater number of home health agencies in patients' geographic area delayed time to placement for married patients. Thus, efforts to rebalance LTC by increasing community-based options appear to be a promising direction.

III.b. Predictors of Decline in Physical Functioning

      The Studies: A total of 52 studies published between 1995 and 2008 were identified in Medline and found to be eligible for this review of risk factors for decline in physical functioning in terms of their design, large sample size, and focus on characteristics of the Medicaid population that are useful for targeting, referral, and program development.

      Study Design/Data sources: Thirty studies report findings from primary data collection efforts, many of which involved medical examinations as well as survey interviews. Twenty two are studies based on analyses of previously collected data. The majority of studies based on secondary analysis of previously collected data are from large sample prospective cohort studies, usually including randomly selected samples that are national in scope, including the Women's Health and Aging Study, the National Health and Nutrition Examination Survey, the Nurses' Health Study, the National Survey of Families and Households, the Asset and Health Dynamics among the Oldest-Old (AHEAD), the Longitudinal Study on Aging (LSOA), the Health and Retirement Survey (HRS), the Nun Study, regional epidemiologic studies (EPESE), the Cardiovascular Health Study, the Australian Longitudinal Study on Women's Health and the Hospital Outcomes Project for the Elderly. Primary data collection efforts are studies that generally have smaller samples (but all over 100 participants), subjects may or may not have been randomly selected, and may be regional rather than national in scope. Many of these samples are recruited from clinics, health plans, or hospital settings. All studies are observational, as opposed to experimental (e.g., randomized trials) designs.

      The Samples: The samples studied in this review include nationally representative samples of the general elderly population, samples of people with physical impairment and/or cognitive impairment, specific health conditions such as arthritis, stroke, and depression, and also samples of people who have been hospitalized or who have utilized home health services.

      Findings: Below we describe the findings reported in studies of risk of functional impairment or functional decline included in this review. Results are also summarized in tabular form in Appendix B.

      Demographic Characteristics: In general, fewer demographic risk factors were identified as predictors of functional decline in this review than in our review of nursing home placement, suggesting that medical issues play a more important role in the process of decline in physical functioning than in nursing home placement. In other words, *nursing home placement is driven by medical AND social support factors, while decline in physical functioning in driven primarily by medical factors; additionally, lifestyle behaviors play a major role* (see below).

Of the demographic factors identified, **older age** was the most common across studies. **Women** were identified to be at higher risk for decline than men in some studies, although other studies reported no difference. In terms of socioeconomic indicators, a **lower level of education** was cited as a predictor of functional decline; lack of exposure to higher education places one at a disadvantage in many respects in regard to health status, particularly in regard to its relation to income and the ability to access nutritional foods, occupational opportunities that do not present health hazards, and other health promoting benefits.

Race and ethnicity are also reported to be significant predictors of functional decline, with Blacks at higher risk of decline than whites. This finding is in contrast to the previously reported higher risk of Whites being placed in nursing homes, suggesting that Blacks underutilize nursing home despite higher levels of physical impairment severity.

Social Support Characteristics: There were few significant findings related to social support as either a positive or negative risk factor for functional decline reported in the studies selected for this review. Important exceptions include the finding in one study that unmarried elderly people are more at risk for decline than married (Penninx et al., 1998; see Appendix B), and, interestingly, findings from a national social survey that marital conflict is a predictor of both psychological and physical functioning in a national sample of elderly and middle aged people (Choi and Marks, 2008; see appendix B).

Health-related Characteristics: Not surprisingly, may study findings indicate that participants who report **ADL/ IADL impairment,** or low physical functioning, at baseline are more likely to decline in physical functioning over the course of the study period than participants who are not impaired. Those with **mobility impairment** at baseline are also more likely to decline over time. These findings suggest that functional impairment levels tend not to be static but to change over time, including improvement with particular treatments and the resolution of acute conditions, and decline associated with progression of disease, inactivity and other risk factors discussed in this report.

The most often reported health-related characteristic that is predictive of decline in physical functioning is **cognitive impairment.** *The relationship between physical and cognitive impairment cannot be overstated,* although the direction of causality may vary according to individuals and the nature of their primary medical problem. For example, onset of dementia and associated decline in cognition is likely to eventually lead to decline in physical functioning, and vice versa. However, the latter causal pathway (from physical impairment to cognitive impairment) may be more subject to intervention than the former.

Depression is another major risk factor for physical decline, reported by a number of studies in this review. Particularly among elderly people whose chronic conditions may make them vulnerable to decline, depression may have a greater influence than the conditions themselves, resulting in inactivity, withdrawal from social activities and eventually, inability to perform daily living activities due to the "use it or lose it" principle that is operative in elderly vulnerable populations.

There are particular diagnoses, namely **arthritis, hip fracture, stroke, mental illness, and Alzheimer's disease** that also predict decline in physical functioning over time. These are conditions that are at the top of the list in terms of their disabling impact. The impact of some of these conditions can be ameliorated to a certain extent through rehabilitation and exercise/physical activity interventions and, in the case of depression and other mental conditions, through treatment that reduces symptoms and barriers to participation in physical activities. **Vision impairment** is also a risk factor for functional decline, probably due to fear of falling and venturing outside without another individual; the social support necessary to engage in physical activity may not always be available. In fact **falling** is a major risk factor for functional decline, both because falling is indicative of increasing mobility and balance problems, and because elderly people fear falling, particularly after an injurious fall, again resulting in substantial limitations in physical and social activity that may otherwise prevent decline. Falling may also be related to **home hazards,** reported by one study of community dwelling elders as a risk factor for functional decline.

Other health-related conditions that predict functional decline include both **high (obesity) and low (frailty) body mass index**, and **sleep problems.** Obesity and low weight are very different issues, involving very different processes that influence physical functioning. Obesity may be subject to change in diet, exercise and other interventions, while below-weight status in the elderly is generally indicative of frailty, which may or may not be reversible. Low weight status may also be due to **malnutrition**, associated with both poverty and poor appetite; malnutrition is a major cause of hospitalization as well as functional decline. Similarly, **sleep problems** are ubiquitous in elderly populations, and can promote depression and lower cognition, again resulting in restriction in activity that can lead to decline. Finally, a number of studies report that a **higher number of prescription medications** can result in decline through side effects and drug interactions. Medical care continuity in which a primary care physician is knowledgeable of all the medications prescribed to an individual, and/or medication management programs associated with health plans and institutions, is essential to the maintenance of physical functioning in elderly people with chronic health conditions who require a multiplicity of medications to manage their illnesses.

Lifestyle Characteristics: While few studies examined life style factors as predictors of nursing home placement, there are several studies captured for this review that identify both **former and current smoking** as risk factors for functional decline in elderly populations.

Smoking may be a proxy for shortness of breath, which discourages any type of rigorous or even moderate physical activity and can result in severe activity restriction. Similarly, many studies in this review identify **low levels of social engagement** as a predictor of functional decline; low social activity may cause decline or may be an indicator that an individual has begun a disease-associated decline process, e.g., as in the case of Alzheimer's disease, with valued activities such as socializing and community participation serving as early predictors of subsequent impairment in more basic life activities. Finally, **lack of exercise and/or physical activity** is a very proximate indicator of functional decline identified by many studies in this review, and is likely the defining mechanism through which many of the risk factors discussed in this Section actually operate. The effectiveness of interventions designed to reverse decline by increasing activity levels will be discussed in Section IV.

III.c. Predictors of Cognitive Decline

The Studies: A total of thirty three studies were selected for this review. There are many other studies investigating factors related to decline in cognitive functioning, but the majority focus on the underlying neuropathology responsible for decline, rather than factors that are useful for either targeting or intervention by the Medicaid program or other Public Health entity.

Study Design/Data Sources: Of the thirty three studies, ten are primary data collection projects, and twenty three are secondary data analysis. The latter studies include several of the regional EPESE studies, the Women's Health and Aging Study, the Nun Study, the NIMH ECA study, the MacAuthur Study of Successful Aging, and the Bronx Aging Study. In addition, several studies were secondary analysis of data from cohorts of patients with specific conditions, for example, the Processes, Structures and Outcomes of Care in Cardiac Surgery Study, the Cardiovascular Health and Cognition Study, the Gwangju Dementia and Mild Cognitive Impairment Study, and the ACTIVE Study. Primary data collection efforts included the Oregon Brain Study, a cohort of hip fracture patients, a cohort of patients with probably Alzheimer's disease, and regional cohort studies.

The Samples: The samples of elderly people participating in the studies in this review ranged from cohorts of elderly people from the general population to clinic samples of people with specific impairments and conditions, as noted above.

Findings: The types of factors associated with cognitive decline in the studies selected for this review are a mix of demographic characteristics, indicators of social support, health-related factors, and lifestyle behaviors. *Importantly, the profile of findings related to cognitive decline is very similar to that of factors related to decline in physical functioning.*

Demographic Characteristics: Male gender is reported as a predictor of cognitive decline in several studies in this review, and female gender in several others. Thus, there is no consensus on this finding. In contrast, **older age** is clearly a risk factor for cognitive decline, as it is for both decline in physical functioning and nursing home placement. **Lower levels of education** emerge as a strong predictor of cognitive decline across many studies in this review, although the pathway by which this occurs is not well understood. Finally, **non-white race** predicts cognitive decline, as it does physical decline, although nonwhites are not more likely than whites to be placed in nursing homes.

Social Support Characteristics: Characteristics of elders that are indicative of access to social support predict cognitive decline, to a greater extent than decline in physical functioning. Indicators that indicate less access to social support include **living alone, unmarried status, living with nonrelatives**, and self-report of **no social ties**. In contrast, better emotional support predicts higher cognitive functioning.

While social support is protective of nursing home placement due to the availability of informal care, it is likely that it is a lack of social interaction, and not care, underlying the association between social support and cognitive decline.

Health-related Characteristics: Health-related predictors of cognitive decline are very similar to those that predict decline in physical functioning. **Poorer cognition at study baseline** is the most prevalent finding across studies, and **physical impairment** (as measured by ability to perform Activities of Daily Living, and slower gait speed) is also a common predictor. Not surprisingly, **depression** predicts decline in cognition given that lethargy and inactivity are symptoms of this disorder. Finally, both **stroke and diabetes** are reported as risk factors for cognitive decline, as is **vision impairment**. It should be noted that studies focusing only on medical indications of cognitive decline (e.g., neurological abnormalities) are absent from this review, based on the eligibility criterion for inclusion that the study focus is on factors that may be useful for targeting of populations for Medicaid or public health intervention.

Lifestyle Characteristics: As research into the pathways to cognitive decline progresses, it is clear that lifestyle characteristics play an important role in the cognitive functioning of elderly people. A number of studies in this review indicate that **low levels of physical activity** are highly predictive of cognitive decline over time, a finding that is supported by recent research indicating an increase in the number of blood vessels and capillaries in the brains of people who exercise frequently and intensively over time (CITE) Other life style behaviors that are linked to cognitive decline are **daily or frequent drinking** and **substance abuse**. On the other hand some studies report that **moderate drinking, relative to no drinking at all, is protective** of cognitive decline.

Residence: An important finding based on research conducted in a sample of elderly persons with Alzheimer's disease is that **nursing home placement** was associated with a decrease in cognition and an acceleration in the rate of cognitive decline (Wilson et al., 2007; see Appendix C). This finding points to the relevance of the environment on elders' functioning and provides another impetus to expand opportunities for community-based, as opposed to institutional care.

IV. Program and Policy Implications

A variety of predictors of nursing home placement, cognitive decline and functional decline have been identified in this review. Some of these are common to all three outcomes. Identified demographic characteristics such as gender and low levels of education are not subject to modification, but may be useful for targeting elderly people who are at risk of institutionalization. Other risk factors, such as some disease processes, may be modified by medical treatment but not public health or preventive interventions. However, there are a number of risk factors that may be targeted for interventions, with a strong potential for preventing decline and thus forestalling, and perhaps avoiding, nursing home placement. Additionally, there are implications for the consideration of triaging to community-based services and alternatives to institutional care. Below we review evidence of the efficacy of interventions that may be particularly helpful to elderly and disabled Medicaid populations by addressing these risk factors. To the extent possible, we have targeted **systematic reviews** in which the evidence for effectiveness is weighed across a sample of studies selected for their scientific rigor.

Targeting Populations at Risk

Based on the results of this review, it appears that it is not the "young" old (i.e., 65-74) who are at high risk, given that older age is a robust predictor across studies regardless of whether the outcome is physical decline, cognitive decline or nursing home placement. However, *individuals age 65-74 are prime targets for interventions designed to maintain physical and cognitive functioning* given that such interventions, while at least somewhat beneficial even to the most impaired, are proven to be most effective among high functioning populations. In other words, it is easier to preserve high functioning than to reverse decline in low functioning populations. Every attempt should be made to reach the "healthy" elderly Medicaid population before they require services, and to incorporate wellness programs into the community-based service delivery package for those with low levels of impairment.

Our reviews indicate substantial consensus that Non-Hispanic white elderly have a higher propensity to use nursing homes than non-Hispanic Black and Hispanic elderly, who in turn have a higher risk of disability. In fact, recent research suggests that the Black and Hispanic population remain in the community until they reach a more advanced level of physical and cognitive impairment than the non-Hispanic white population (Buchanan et al., 2008). How minority populations manage to remain in the community, and whether or not there are important costs to families and to care recipients themselves in remaining in community-based settings longer than the elderly non-Hispanic White population is a subject for further research, particularly given that representation of these ethnicities among the elderly population is projected to grow in coming decades.

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Although there is no clear consensus across studies regarding education and income predictors of nursing home placement, it is clear that low levels of education and income are predictive of functional and cognitive decline, suggesting that heath-promoting interventions should be particularly targeted to these groups.   In fact, the Medicaid population is characterized by generally low levels of education and by poverty, suggesting that wellness interventions are particularly important to Medicaid program recipients.

Finally, absence of social support is a key predictor of nursing home placement, and is likely the most influential factor accounting for people entering nursing homes at relatively low levels of impairment. Early identification of people at risk for placement due to absence of someone to provide assistance at home and triaging these individuals to Assisted Living or residential alternative, or to home-based services, will be key to the success of reducing Medicaid reliance on nursing home care.   Low social support is also a risk factor for cognitive decline, suggesting that individuals receiving community-based care must have access to ample opportunities for social interactions if home-based options are to be successful over extended periods of time.

Wellness Interventions

Exercise and Physical Therapy There are a variety of exercise and physical therapy interventions tested in the context of clinical trials that have demonstrated success in stabilizing and even improving physical functioning in samples of elderly people ranging from the non-impaired to the wheelchair bound. For example, an early trial conducted by Gill and colleagues (2002) tested a physical therapy intervention for persons age 75 and older who were physically frail and living at home. This six month long intervention conducted in the home setting was individualized and focused on improving underlying impairments in physical abilities, including balance, muscle strength and mobility. Relative to a control group that received an educational program only, participants in the intervention group improved in physical functioning over time, while the control group declined. Additionally, a systematic review of 30 randomized trials testing the effect of exercise interventions on samples of elderly people with dementia suggest that the benefits of exercise are attainable for people with cognitive as well as physical disability. Results of this review found intervention effects across the board, including improvements in strength, physical fitness, functional performance, cognitive performance and behavior (Heyn et al, 2004).

While exercise is generally associated with maintaining and improving physical fitness, there is equivalent evidence that it is also good for maintaining and improving cognitive function. A systematic review identified eleven randomized trials that compared cardiovascular fitness and cognitive functioning outcomes among samples of persons age 55 and older without cognitive impairment and

found improvements in *both* physical fitness and cognitive capacity (Angevaren et al., 2008). Thus, the evidence strongly indicates the benefits of exercise for elderly people as a means of stabilizing and even improving physical and cognitive functioning.

What do these findings imply for the Medicaid program? Nursing homes need not be environments that promote decline. Regular physical activity should be available and encouraged for all residents regardless of physical and cognitive status. Similarly, alternatives to nursing homes such as assisted living, day care services and supportive services in the home setting should include a variety of programs to encourage physical activity. Such programs may go far to keep elderly people in the community and enhance their quality of life at the same time. While most residential facilities currently have such programs, their potential to benefit vulnerable residents has not yet been realized. A little bit of exercise is not going to do it! Similarly, physical therapy and exercise programs can be introduced to the home setting as one element of receipt of home care services. *Physical activity must become central to any community based or institutional living situation if goals of stabilizing physical and cognitive functioning are to be met.*

Cognitive Training: While there is much emphasis on the benefits of physical activity in maintaining cognitive functioning, a newer area of research focuses on cognitive training in the areas of memory, cognitive processing speed, and reasoning. In particular, a large sample trial including several thousand persons (average age 73.6 years, 26% Black) living independently in six cities nationally found that reasoning training resulted in less IADL decline among people in the intervention as compared with controls, and that improved cognition continued 5 years following the initiation of the intervention (Willis et al., 2006). Thus, in the near future, it is likely that physical therapy may be combined with cognitive therapy to keep people at high levels of functioning and in the community for as long as possible.

Fall Prevention: There is evidence that approximately 30% of people over the age of 65 who live in the community fall each year, and that 20% of falls require medical attention. A bad fall can result from decline in functioning or can mark the *beginning* of decline by increasing the reluctance of elderly people to leave their homes or otherwise engage in social and physical activity. There are a variety of approaches to reducing falls in the home setting. A review of 62 randomized trials testing fall interventions indicates the following types of interventions to be beneficial in reducing the incidence of falls among vulnerable community dwelling populations: 1) health/environmental screening programs (in both home and residential care settings); 2) programs of muscle strengthening and balance training prescribed by a trained health professional; 3) home hazard assessment and modification for older people with histories of falls; 4) withdrawal of psychotropic medication; 5) a Tai Chi group exercise intervention (Gillespie et al., 2003).

Alleviation of Medical Risk Factors: There are a number of risk factors for nursing home placement as well as functional decline identified in this review that are subject to modification by medical professionals. Often the challenge is to identify as well as treat such problems, which may be overlooked in the course of a medical encounter, particularly if a treating physician is not attuned to the needs and risks of geriatric populations. The most important of these risk factors that are amenable to intervention are *depression, polypharmacy, incontinence and malnutrition.* Identification of risk in geriatric populations is central to the Geriatric Multidisciplinary Team approach.

Geriatric Assessment and Preventive Home Visits Geriatric assessment teams have proven successful in managing patients in both hospital and nursing home settings, addressing the multiplicity of needs of the elderly from a variety of disciplinary perspectives. However, with the exception of work by Chad Boult and his colleagues (2002), the assessment team approach has largely remained in institutional settings. In contrast, geriatric assessment teams form the core of "preventive home visits" that are part of national policy in several countries, including the United Kingdom, Denmark and Australia. The rationale for such policy and programs is to delay or prevent functional decline and nursing home admissions by primary (e.g., exercise and immunization), secondary (e.g., detection of untreated problems) and tertiary (e.g., medication management) prevention. Results of a systematic review of seventeen trials conducted to determine the efficacy of these programs in achieving intended outcomes indicates that multidimensional geriatric assessment and follow-up in the home setting was successful in preventing decline among older people with relatively good function at baseline (Stuck et al., 2002). The authors hypothesized that this effect is attributable to the detection and treatment of modifiable risk factors with long tem follow-up, through exercise programs, modification of the home environment, treatment of depression, etc. In other words, attention to the modifiable risk factors identified in this review will go far to stabilize functioning among those without impairment, or with mild impairment, but decline may be harder to reverse among the already moderately to severely impaired. *Similarly, this review found that long term implementation of this preventive home visit program can also reduce nursing home placement.*

A more recent systematic review of "complex interventions to improve physical function and maintain independent living in elderly people" assessed the results of 89 randomized trials testing several varieties of interventions (Beswick et al, 2008). The review and meta-analysis found a 14% reduction in the risk of nursing home placement associated with geriatric assessment-focused preventive home visits, and also with community-based care following hospital discharge.

A take-home message associated with all the interventions discussed above is that it is not enough to address medical and psychological risk factors in medical settings. Risk factors for decline may be more visible when the assessment occurs at home and

interventions are likely to be more successful when conducted in elderly persons' homes, where their daily lives are played out. Also, it is likely that there is a multiplicity of risk factors that need to be addressed among vulnerable populations, some of which may involve modification of the home environment and/or important changes in elderly individuals' self-care practices, such as improvements in routines involved in taking medications, and rearrangement of the home to avoid falls.

Social Activities One clear finding from this review is that social support is crucial not only to provide concrete assistance to vulnerable elderly persons but also to alleviate loneliness and depression and to provide the mental stimulation necessary to prevent cognitive decline.

Community Based Services Whether or not **home care services** reduce nursing home placement has long been a subject of debate. National demonstrations conducted in the 1980s found no effect of home care on placement (e.g., Christianson, 1988). A study in the early 1990s indicated more generous home care benefits for Medicaid recipients led to less nursing home use (Ettner, 1994). *Further work in this area has lead to the conclusion that home care does not reduce nursing home care unless it is targeted to the most disabled patients* (Greene et al., 1995; Weissert et al, 2003).

As discussed earlier in this review, use of **adult day care** appears to enhance use of nursing home placement, but this is likely to be a function of the severity of disability that leads to the use of adult day care to begin with. Because of the difficulties inherent in randomizing people who have the same level of disability to services such as adult day care, we do not yet have a good understanding of the ability of such services to *forestall* nursing home placement, although it is likely that it does. In fact, we know that many family members try a variety of arrangements to keep their loved ones at home in the course of the pathway of decline that parallels disease progression, but often levels of need reach a point at which families decide that nursing home placement is the only remaining option. Similar dynamics are in play for **assisted living.**

Are **respite services** effective in reducing caregiver burden enough to forestall nursing home placement? A recent review of randomized trials concludes that some programs may have a small positive effect on caregivers in terms of burden and mental or physical health., and generally, caregivers are very satisfied with respite care. Unfortunately, no reliable evidence was found that respite delays entry into residential care (Mason et al., 2007).

State Policy Finally, two studies included in this review reported findings that provide confirmation of the potential benefits of expanded community-based service options. One study found that higher spending on state spending on home and community based services resulted in a reduced risk of nursing home placement for elderly persons without families to care for them, but not for those with children nearby. A second study also found that a higher percentage of Medicaid spending on HCBS lengthened time to nursing home admission for unmarried Alzheimer's patients, while a greater number of home health agencies in patients' geographic area delayed time to placement for married patients, suggesting that access to supplementary services may be an issue for persons with some social support in place..

Additionally, based on surveys of dual eligible elderly populations in six states, Kasper et al (2005) found that unmet needs for care among persons with impairment were quite high; however, the greater the use of paid home care in a given state, the lower the likelihood of unmet need. Further, econometric simulation modeling of various policy approaches to reducing unmet needs found the most effective policy was high spending on community based (relative to nursing home) care, and low LTC spending per recipient; that is, *spending more on community-based care and spreading it across more recipients* (Rice et al., 2008). Given recent evidence of the relationship between unmet care needs (i.e., the ability of available helping resources to meet care recipients' needs) and nursing home placement, widespread provision of home-based care targeted to those with the highest level of need may be the most promising approach for states to take as they seek to balance provision of long term care.

In conclusion, the results of this review suggest that greater emphasis on the identification of risk factors for physical and functional decline among frail elderly populations, and amelioration of risk factors through wellness programs and medical interventions, may result in reduced risk of vulnerable populations' placement in nursing homes. Findings also suggest that it is not only the person but his or her environment that must be subject to scrutiny. In other words, regardless of whether vulnerable elders remain in their homes with services or are triaged to residential arrangements such as Assisted Living, it is crucial to ensure that daily living environments are "healthy." In addition, access to interventions to promote both physical and social activity, either at home or in the community, are crucial if the "use it or lose it" principle is to be avoided. Attention to principals of prevention and amelioration of risk factors will allow for people with impairment on Medicaid to remain in the community for as long as possible, thus achieving Medicaid program goals to reduce reliance on institutional care.

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APPENDIX A

Predictors of Nursing Home Placement:

Tabular Summary of Studies and Associated Bibliography

Predictors of Nursing Home Placement

Author (Year)	Sample size and composition	Study design	Significant findings
Aharonoff et al. (2004)	89723 hip fracture patients admitted to hospitals in New York State from 1986 to 1996	Secondary data analysis (hospital discharge data from New York State Department of Health's Statewide Planning and Research Cooperative System—SPARCS)	**Care recipient predictors**: older age (85+); being female; being white; having 3+ comorbidities; history of dementia
Akamigbo and Wolinsky (2006)	6242 respondents 70 years of age and older who were either Caucasian or African American	Secondary data analysis (data from Assets and Health Dynamics Among the Oldest Old—AHEAD)	**Care recipient predictors**: older age; prior hospitalization or nursing home use; lower self-rated health; difficulties w/ ADLs or IADLs **Factors reducing risk**: being married; having children; good cognitive function
Andel, Hyer, and Slack (2007)	1943 newly enrolled Medicare/Medicaid beneficiaries aged 65 or older	Secondary data analysis (data from Florida Medicaid data files; Comprehensive Assessment Review and Evaluation Services (CARES) or Client Information Registration and Tracking System (CIRTS); Florida Department of Health death certificates)	**Care recipient predictors**: older age; being white; diabetes; incontinence; stroke; difficulties with IADLs **Factors reducing risk**: having a caregiver; being widowed; diagnoses of arthritis, heart disease
Banaszak-Holl et al. (2004)	representative sample of 6676 community-dwelling older individuals in the U.S.	Secondary data analysis (data from AHEAD)	**Care recipient predictors**: dementia; being female; older age; absence of potential caregivers; low net worth; worsening level of functional disability; self-reported stroke, diabetes, heart disease, incontinence, or fall

Bauer (1996)	2923 non-institutionalized elderly and physically disabled who had a home- and community-based long-term care placement in the Arizona Long-Term Care System (ALTCS)	Secondary data analysis (program administrative data from ALTCS)	**Care recipient predictors**: older age; being white; having Alzheimer's Disease
Bharucha et al. (2004)	1147 community-dwelling adults aged 66 and older	Primary data collection (survey in southwestern Pennsylvania)	**Care recipient predictors**: dementia; older age; IADL disability; worse/less social support; number of prescription medications
Black, Rabins, and German (1999)	881 residents of urban public housing developments for elderly people	Secondary data analysis	**Care recipient predictors**: high impairment in IADLs; functional decline; cognitive disorder; mental morbidity
Buhr, Kuchibhatla, and Clipp (2006)	2200 caregivers of elderly veterans with dementia	Secondary data analysis (data from National Longitudinal Caregiver Study)	**Caregiver predictors**: white; little satisfaction with life; high task burden; poor health **Caregivers' reasons for placement**: the need for more skilled care; the need for more ADL assistance; difficulty of the patient's dementia-related behaviors;
Chan et al. (2003)	449 cognitively impaired elders and their knowledgeable informants	Primary data collection (observational study conducted in Baltimore and rural Maryland)	**Care recipient predictors**: being white; presence of behavioral and psychological symptoms; fair or poor physical health rating; difficulty with ADLs; dementia
Cohen-Mansfield and Wirtz (2007)	201 community residing participants in Maryland	Primary data collection (five senior adult day care centers in Montgomery County, Maryland)	**Care recipient predictors:** depressed affect, low frequency of socializing, higher number of psychiatric diagnosis, increased age

Coward, Horne, and Peek (1995)	719 elders who at baseline lived in community settings and reported problems with urinary incontinence	Secondary data analysis (data from the Longitudinal Study on Aging)	**Care recipient predictors**: living in less urbanized and thinly populated nonmetropolitan counties
Eaker, Vierkant, and Mickel (2002)	811 community dwelling elders with AD or other dementia and age-matched elders without AD or other dementia	Secondary data analysis (data from the Marshfield Epidemiologic Study Area—MESA)	**Care recipient predictors**: AD/dementia; having either Medicare only or Medicare and Medicaid as health insurance; greater number of comorbidities; more prescription medications
Fischer et al. (2003)	18143 living enrollees in Social HMO	Secondary data analysis (data from administrative databases at HealthPartners and Kaiser Permanente Northwest)	**Care recipient predictors**: termination of Social HMO increased risk of nursing home placement by 40%
Fisher and Lieberman (1999)	164 caregivers of elderly patients with dementia	Primary data collection (survey of caregivers)	**Caregiver and family characteristics**: emotional closeness; negative family feelings; low family efficiency
Freidman et al. (2005)	4646 participants aged 55 or older who enrolled in Medicare- and Medicaid-capitated PACE (Program of All-Inclusive Care for the Elderly) programs	Secondary data analysis (data from DataPACE records)	**Care recipient predictors**: older age; IADL dependence; bowel incontinence; being white; prior nursing home use
*Gaugler et al. (2000)	304 elderly relatives with dementia and their Primary caregivers	Secondary data analysis (data from Adult Day Care Collaborative Study—ADCCS); Primary data collection (interviews with caregivers)	**Care recipient predictors**: older age; higher income **Caregiver/family characteristics reducing risk**: increased duration of care and greater subjective health; family assistance with ADLs and with overnight respite care

Gaugler et al. (2003)	3944 persons with dementia who resided in a home setting at baseline	Secondary data analysis (data from Medicare Alzheimer's Disease Demonstration Evaluation—MADDE)	**Care recipient predictors for earlier placement**: male, White, older age, lived alone, Medicaid eligible, more IADL impairments; ADL decline; behavioral problems; lower cognition; low utilization of in-home chore services **Caregiver characteristics**: older age; high burden; poor self-rated health; IADL decline; report of unmet needs with recipient's ADL or IADL care demands
Gaugler et al. (2004)	667 older African-Americans with dementia	Secondary data analysis (data from MADDE)	**Care recipient predictors**: being male; being Medicaid-eligible; older age; more severe cognitive impairment **Caregiver characteristics**: higher burden
*Gaugler et al. (2005)	4761 care recipients with dementia and their caregivers	Secondary data analysis (data from MADDE)	Medicaid eligibility; ADL dependencies **Caregiver characteristics**: higher burden; being a more recent caregiver vs. caregivers in different stages of their caregiving careers
*Gaugler, Kane, Kane, and Newcomer (2005)	4761 care recipients with dementia and their caregivers	Secondary data analysis (data from MADDE)	**Care recipient predictors**: Unmet care needs **Caregiver characteristics reducing risk**: utilization of in-home help services earlier in dementia caregiving careers

*Gaugler, Kane, Kane, and Newcomer (2006)	324 Latino, 701 African-American, and 7100 Caucasian dementia patients and their caregivers	Secondary data analysis (data from MADDE)	**Care recipient predictors**: Medicaid-eligible Latinos **Caregiver characteristics (Latinos)**: more assistance to recipients; greater depression; greater use of adult day services
Gill TM, Allore HG, Han L (2006)	754 community-living persons, 70 years old or older, who were nondisabled in four essential activities of daily living	prospective study that followed participants monthly via telephone interviews for a median of 75 months	**Care recipient predictors:** persistent disability in bathing is associated with the risk of a long-term nursing home admission, but has no effect on short-term admissions
Harris (2007)	140774 community-based adults aged 65 and older enrolled in Medicare+ Choice and capable of responding for themselves at survey administration	Secondary data analysis (data from Medicare Health Outcomes Survey, Minimum Data Set)	**Care recipient predictors**: older age; being female; being white; depression
Heyman et al. (1997)	727 white patients with AD enrolled in the Consortium to Establish a Registry for Alzheimer's Disease (CERAD)	Primary data collection (survey of patients in CERAD)	**Care recipient predictors**: older age; being an unmarried male; more severe dementia
Holroyd-Leduc, Mehta, and Covinsky (2004)	5872 elders aged 70 or older who had complete information on continence status and did not require a proxy interview at baseline	Secondary data analysis (data from AHEAD)	**Care recipient predictors**: urinary incontinence; older age; comorbidities; worse baseline functional status; depression; sensory impairment
Kales et al. (2005)	82 people with depression alone, dementia alone, or coexisting dementia and depression (CDD)	Primary data collection (survey of recruited patients)	**Care recipient predictors**: CDD; severity of functional impairment and mood

Kersting (2001)	7,527 non institutionalized persons 70 years of age . nationally representative sample of U.S. population except for persons in the military or group homes	Secondary data analysis (data from the Longitudinal Study on Aging—LSOA)	**Care recipient predictors**: higher levels of functional disability; older age; **Factors reducing risk:** living with spouse or children, being socially active, having higher income, being black, being female all reduced risk of placement.
Knopman (1999)	341 community-dwelling AD patients with an identified caregiver	Primary data collection (survey of patients enrolled in ADCS clinical trial of tocopherol and selegiline)	**Care recipient predictors**: dementia progression
Lachs et al. (2002)	2812 community-dwelling older adults aged 65 or older in 1982	Secondary data analysis (data from New Haven Established Populations for Epidemiologic Studies in the Elderly—New Haven EPESE)	**Care recipient predictors**: Adult Protective Services (APS) referrals for self-neglect and for elder mistreatment
Lachs et al. (2006)	2321 community-residing older adults older than 65	Secondary data analysis (data from New Haven EPESE and police records)	**Care recipient predictors**: having experienced violent crime; having one or more ADL impairments; cognitive impairment; older age
McCallum J et al (2007)	1233 men and 1572 women 60 years and older living in the community	longitudinal study of an elderly cohort living in Dubbo, New South Wales, Australia. Participants were examined in 1988 and followed to 2002 for diagnosis of dementia and nursing home placement	**Factors reducing risk:** moderate alcohol intake, the maintenance of physical activity, especially daily gardening, and improvement of respiratory function, and the treatment of depression delay or prevent major negative late-life experiences.
McCann et al. (2005)	516 adult day care clients with AD and persons with AD not using adult day care	Primary data collection (survey of persons from 16 adult day programs and from an AD diagnostic center)	**Care recipient predictors**: number of days of day care attendance (greater effect for men than for women); greater disability; more hospitalizations **Caregiver characteristics**: higher burden; older age

Miller et al. (1998)	639 non-Latino white individuals with AD	Secondary data analysis (data from CERAD and from states in which patients resided)	**State health care system characteristics**: higher percentage of Medicaid LTC spending on home- and community-based services and greater number of home health agencies delayed NHP
Miller, Prohaska, and Furner (1999)	122 African Americans with AD	Secondary data analysis (data from CERAD)	**Care recipient predictors**: being unmarried; ADL limitations
Miller and Rosenheck (2006)	3,952,229 patients receiving treatment in the VA system nationally during FY 2000 and having no evidence of nursing home utilization during FY 1999 or FY 2000	Secondary data analysis (data from several national workload data files that include information from 141 VA medical centers)	**Care recipient predictors**: AD or other dementia; older age; being male; being white; being single; having higher income; greater service-related disability; having inpatient medical or surgical visits; having 3 or more outpatient medical visits; having inpatient mental health days; having outpatient mental health visits
Mittelman et al. (1996)	206 spouse-caregivers of AD patients	Primary data collection (randomized controlled intervention for referred persons at an outpatient research clinic in New York City metro area)	**Caregiver supports that reduce risk**: counseling significantly delayed placement of care recipients
Muramatsu et al. (2007)	5224 Health and Retirement	Secondary data analysis (data	**Care recipient predictors**: having

	Study (HRS) respondents born in 1923 or earlier who were at risk for first long-term nursing home admission as of 1995	from HRS)	fewer family resources; older age; more education; worse self-rated health; lower physical and cognitive functioning; **Factors reducing risk:** African American race, Hispanic ethnicity, high wealth For seniors with no living children, higher state home- and community-based services (HCBS) expenditures were associated with lower risk of admission; state HCBS expenditures had little impact on risk among those who lived with or close to children and among those who had children but not nearby
Onder G et al (2007)	Three thousand two hundred ninety-two older adults receiving home care (mean age 82.3±7.3).	Retrospective cohort study. Eleven European countries.	**Factors reducing risk**: Receives case management
Onder G et al (2007)	2718 older adults entering the study was 82.4 (SD = 7.3) years, 2047 (75.3%) were women, and 331 (12.2%) were depressed	longitudinal analysis using data from the Aged in Home Care (AdHOC) database, which contains information on older adults receiving home care services in 11 European countries	**Care recipient predictors**: depression
Phillips and Diwan (2003)	204 clients with dementia	Primary data collection (data from a random sample of clients discharged during fiscal year 1996 from four Georgia Community Care Service Program regions	**Care recipient predictors**: having dementia-related problem behaviors
Rosenberg et al. (2006)	198 participants randomly	Primary data collection –	**Risk factors for transition to**

	sampled from AL facilities	prospective cohort	**SNF:** declining health, chronic pain, appetite changes, being widowed
Rudberg, Sager, and Zhang (1996)	1265 noninstitutionalized persons	Secondary data analysis (data from Hospital Outcomes Project for the Elderly)	**Care recipient predictors**: geographic site; increasing age; living alone; low baseline ADL independence; length of hospital stay; decline in ADL independence
Russell et al. (1997)	3763 rural older Iowans	Secondary data analysis (data from the Iowa portion of the Established Populations for Epidemiologic Studies of the Elderly)	**Care recipient predictors**: older age; higher income; greater education; poorer mental status; worse physical health; lower morale; loneliness
Schur and Whitlatch (2003)	127 Primary caregivers from existing clientele of social services sector of Benjamin Rose (BR) and the Cleveland Chapter of the Alzheimer Association	Primary data collection (survey interviews)	**Care recipient predictors**: problems with household tasks **Caregiver characteristics**: whether caregiver felt he/she was providing good care; whether caregiver or other family members were awakened during the night by care recipient
Smith et al. (2001)	985 cognitively normal participants and cognitively impaired patients from a AD Patient Registry (ADPR)	Primary data collection (survey of patients enrolled in ADPR)	**Care recipient predictors**: older age; year of enrollment; being widowed; living in a retirement community at initial evaluation; being female
Smith, Kokmen, and O'Brien (2000)	637 patients with dementia and control group	Secondary data analysis (data from the Mayo Clinic Medical Records linkage system)	**Care recipient predictors**: older age; being divorced; being single; living in a retirement or assisted living apartment; more daily assistance required
*Stevens et al. (2004)	215; caregiver/care recipient dyads (Primary family	Primary data collection (survey of dyads in the University of	**Care recipient predictors**: White race more likely than

	caregiver and individual with AD or other progressive dementia)	Alabama at Birmingham Family Caregiver Research Project)	African-American; older age **Caregiver characteristics**: higher SES; appraised memory and behavior problems as stressful
Thom, Haan, and Van Den Eeden (1997)	5986 elders aged 65 or older who were members of Kaiser Foundation Health Plan of Northern California	Secondary data analysis (data from inpatient and outpatient medical records and computerized hospitalization data)	**Care recipient predictors**: urinary incontinence
Tinetti and Williams (1997)	1103 people at least 72 years of age living in the New Haven community	Primary data collection (survey in New Haven)	**Care recipient predictors**: risk for placement increased progressively for single noninjurious fall, multiple noninjurious falls, and at least one fall causing serious injury
Tsuji, Whalen, and Finucane (1995)	334 homebound patients	Primary data collection (retrospective chart review of patients in southeast Baltimore)	**Care recipient predictors**: diabetes mellitus; bowel incontinence **Caregiver characteristics**: living separate from patient; having time conflicts because of job; being stressed by caregiving
Van Houtven and Norton (2004)	4752 single parents aged 70 or older with at least one living adult offspring or stepchild	Secondary data analysis (data from AHEAD and the Health and Retirement Survey—HRS)	**Care recipient predictors**: older age; more education; being white; non-workers; having proxy respondent; having Medicaid in past two years **Factors reducing risk**: informal care, having a child with higher education, and being in a higher wealth category all reduced chance of placement.
Wilson et al. (2007)	432 older persons with AD	Primary data collection (survey of persons with AD from	**Care recipient predictors**: decrease in level of cognition and

		health care settings in Chicago)	acceleration of cognitive decline; more education
Yaffe et al. (2002)	5788 community-living persons with advanced dementia	Secondary data analysis (data from MADDE)	**Care recipient predictors**: white race; living alone; 1 or more dependencies in ADLs; high cognitive impairment; 1 or more difficult behaviors **Caregiver characteristics**: aged 65 or older; high burden
*Young (2003)	573 community living AD patients and their Primary caregivers	Primary data collection (survey of persons recruited from support group meetings of Alzheimer Association chapters)	**Care recipient predictors**: *for women with AD*, more ADL deficits; greater memory impairment *for men with AD*, more behavioral impairment; lack of social support by the care provider; fewer hours of care weekly **Caregiver characteristics**: previously expressed intention to place the patient (for both male and female patients)
Zuckerman et al. (2006)	487,383 Medicare beneficiaries with employer-sponsored supplemental health insurance	Secondary data analysis (data from the MarketScan Medicare Supplemental and Coordination of Benefits database)	**Care recipient predictors**: inappropriate drug use; use of any drugs

*respondents include both care recipients and caregivers

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APPENDIX B

Predictors of Decline in Physical Functioning:

Tabular Summary of Studies and Associated Bibliography

Predictors of Decline in Physical Functioning

Author (Year)	Sample size and makeup	Study design	Significant findings
Atkinson et al. (2005)	558 community-dwelling older women in the Baltimore area with moderate to severe disability	Secondary data analysis (study of participants in the Women's Health and Aging study I who had Mini-Mental State Examination (MMSE) score of 24 or greater and walking speed greater than 0.4 m/s at baseline)	**Predictors:** older age; nonwhite race; former smoking; slower baseline walking speed; IADL impairment
Auyeung et al. (2008)	4,000 community-dwelling Chinese elderly aged >65 years	Primary data collection (using the cognitive part of the Community Screening Instrument of Dementia)	**Predictors:** weaker grip strength poorer physical function at baseline
Chen H, Guo X	1,684 elderly (≥60 years) women and 1,611 elderly men	Secondary data analysis: cross-sectional from National Health and Nutrition Examination Survey (NHANES) 1999–2004, United States	**Predictors:** obesity
Cheng et al. (2000)	21,290 female registered nurses who completed the Karasek's job questionnaire and a modified version of the short form 36 questionnaire (SF-36) as used in the medical outcomes study	Secondary data analysis: the Nurses' Health Study	**Predictors**: low job control; high job demands; low work-related social support
Choi H and Marks N.F(2008)	1,832 community dwelling middle age and elderly respondents to three waves of the National Survey of Families and Households	Secondary data analysis using 3 waves of data from the National Survey of Families and Households	**Predictors:** marital conflict
Covinsky et al. (1997)	572 hospitalized medical patients older than 70 years of age	Primary data collection (longitudinal study of patients who were admitted to the general medical service of	**Predictors**: depressive symptoms

		University Hospitals of Cleveland)	
Covinsky et al. (2006)	5,239 elders with a mean age of 77 who reported that they could do each of 5 ADLs (bathing, dressing, toileting, transferring, and eating) without the assistance of another person at baseline	Secondary data analysis (data from Asset and Health Dynamics Among the Oldest Old—AHEAD)	**Predictors:** older age (older than 80); diabetes; difficulty walking several blocks; difficulty bathing or dressing; need for help with personal finances; difficulty lifting 10 pounds; inability to name the Vice President; history of falling; low body mass index
Dodge et al. (2006)	953 elderly at least 65 years of age without dementia living in Southwestern Pennsylvania	Primary data collection (Monongahela Valley Independent Elders Survey— MoVIES Project—in Southwestern Pennsylvania)	**Predictors:** lower baseline scores on all cognitive domains; more prescription medications; lower frequency of social engagement
Dunlop et al. (2002)	4,205 community-dwelling elderly	Secondary data analysis (data from the Longitudinal Study of Aging—LSOA)	**Predictors:** older age; being female; being African American; history of cerebrovascular disease; diabetes; incontinence; vision impairment; arthritis
Dunlop et al. (2005)	5,715 adults aged 65 or older with arthritis	Secondary data analysis (data from the Health and Retirement Study—HRS)	**Predictors**: being female; being Hispanic or African American; lack of regular vigorous physical activity; older age; cognitive impairment; depressive symptoms; diabetes; physical limitations; no alcohol use; stroke; vision impairment
Ferrar et al. (2008)	176 nonagenarians were evaluated	Primary data collection (Lawton-Brody index, the Barthel Index, Mental State Exam and the Charlson score)	**Predictors**: worse cognitive status and lower capacity to perform instrumental activities of daily living at baseline
Ford et al. (1996)	171 patients diagnosed with AD or other dementia	Primary data collection (survey using Mini-Mental State Exam—MMSE)	**Predictors**: low MMSE scores

Formiga et al. (2007)	97 nonagenarians subjects not previously severely dependent were evaluated	Primary data collection (Lawton-Brody index, the Barthel Index, Mental State Exam, a short version of the Mini-Nutritional Assessment, Charlson score, lower-extremity function and Gait Rating Scale)	**Predictors**: A lower IADL score and visual impairment were associated with functional decline. Lower IADL scores a history of a previous stroke and higher Charlson Index scores were associated with recently acquired, severe dependency
Fujiwara et al. (2008)	1,544 subjects 65 years of age or older living in Yoita town, Niigata prefecture, Japan	Primary data collection	**Predictors**: poor self-rated health and cognitive function
Gill et al. (1996)	945 community-living adults aged 72 and older who reported no disability in ADLs	Primary data collection (physical and cognitive assessments of subjects)	**Predictors**: poor physical performance; poor cognitive status
Gill et al. (1997)	1,813 community-living persons aged 72 and older who were independent in their ADL function at baseline	Primary data collection (survey in a general community in New Haven, CT)	**Predictors**: impairments in orientation and short-term memory
Gill et al. (2003)	680 community-living persons, 70 years or older	Primary data collection (assessments completed in the home, while monthly assessments of restricted activity were completed over the telephone)	**Predictors**: For older persons who are not otherwise at high risk for ADL disability, restricted activity is an important predictor of functional decline
Goldman et al (2007)	2,889 women, mean age 83.5 years,	Primary data collection (study of women participating in the 2002–2004 examination of the Study of Osteoporotic Fractures)	**Predictors**: poorer sleep
Gregg et al. (2002)	8,344 community-dwelling white women aged 65 and older	Secondary data analysis (data from the Study of Osteoporotic Fractures)	**Predictors**: diabetes Among women with diabetes, older age; higher body mass index; coronary heart disease;

			arthritis; physical inactivity; and severe visual impairment at baseline
Greiner et al. (1996)	629 members of the School Sisters of Notre Dame religious congregation aged 75 to 106	Secondary data analysis (data from the Nun Study, a longitudinal study of aging and Alzheimer's disease)	**Predictors**: worse self-rated function
Hebert et al. (1999)	504 subjects 75 years and older living in Sherbrooke (Quebec, Canada)	Primary data collection (health questionnaire, together with standardized instruments measuring disabilities, cognitive status and depressive mood administered)	**Predictors**: number of days off regular activities and cognitive status. Weight loss and living alone were significant protective factors
Hughes et al. (1997)	485 persons older than 60 years of age and included continuing care retirement community (CCRC) residents, chronically homebound older persons, and ambulatory older adults	Primary data collection (observational study in ambulatory general medicine clinics, residences of homebound individuals, and a CCRC)	**Predictors**: older age; less education; poorer grip strength
Hustey et al. (2007)	650 community-dwelling adults aged 65 and older discharged from emergency departments	Secondary data analysis of a randomized, controlled trial	**Predictors**: a Triage Risk Screening Tool (TRST) score of 2 or more was moderately predictive of decline in ADLs or IADLs, but not perceived physical health
Idler and Kasl (1995)	2,812 community-dwelling persons aged 65 and older	Secondary data analysis (data from New Haven Established Populations for Epidemiologic Studies of the Elderly—EPESE)	**Predictors**: worse self-ratings of health
Ishizaki et al. (2000)	583 Japanese people aged 65 to 89	Primary data collection (prospective cohort study)	**Predictors**: age of ≥ 75, less hand grip strength and a history of

			hospitalization during the past 1 year
Jensen and Friedmann (2002)	2,634 Medicare managed risk program participants aged ≥ 65 in Rural Pennsylvania	Primary data collection (prospective cohort study)	**Predictors**: BMI of 35 or greater, weight loss of 10 pounds and weight gain of 20 pounds
Kamper et al. (2005)	5,804 community dwelling subjects aged 70 to 82 years	Secondary analysis of longitudinal data gathered over an average 3.2 years of follow-up	**Predictors**: age, female, diabetes, history of vascular disease and smoking
Landi et al. (2006)	355 patients who suffered a stroke	Secondary data analysis from the database of the national home care program named Silver Network Home Care project in Italy	**Predictors**: cognitive impairment, pressure ulcer, urinary incontinence and hearing impairment
Landi et al. (2007)	2,005 subjects aged 65 or older admitted to home care programs in 11 European Home Health Agencies	Secondary data analysis (data from the AgeDin Home Care (Adhoc) project)	**Predictors**: lower levels and lower intensity of physical activity
Lee (2000)	7,527 persons aged 70 years or older	Secondary data analysis (data from the US Longitudinal Study of Aging (LSOA))	**Predictors**: poorer physical and mental health
Lopez et al. (1999)	179 mildly to moderately impaired patients with probably AD	Primary data collection (assessment of and semi structured interviews with patients enrolled in longitudinal study of dementia at the University of Pittsburgh)	**Predictors**: development of psychosis; agitation; use of antipsychotic medication
Mahoney et al. (1999)	1,212 community-dwelling adults aged 70 and older hospitalized for acute medical illness	Secondary data analysis (data from the Hospital Outcomes Project for the Elderly)	**Predictors**: mobility impairment
Markides et al. (1996)	3,050 noninstitutionalized Mexican-American men and	Secondary data analysis (data from the Hispanic EPESE)	**Predictors**: older age; previous diagnoses of stroke and hip

	women aged 65 and older and residing in the Southwestern U.S.		fracture
McCusker et al. (2002)	Hospitalized patients 60 or older	Review: longitudinal studies of predictors of physical functional decline	**Predictors**: older age, diagnosis, activities of daily living, cognitive impairment and residence in an institution
McDermott et al. (2006)	389 men and women with PAD	Primary data collection (Prospective cohort study)	**Predictors**: greater BMI and weight gain
McGuire L.C, Ford E.S Ajani U.A (2006)	559 US adults (232 males and 327 females) ≥ 70 years old who had diabetes and who were free from cognitive impairment	Secondary data analysis (Secondary data from the Longitudinal Study of Aging—LSOAII)	**Predictors**: Older adults with low normal levels of cognition were approximately 20% more likely to die and 13% more likely to become disabled than those with higher levels of cognitive functioning over a 2-year period.
Mehta et al. (2002)	5,697 older people	Primary data collection (Prospective cohort study)	**Predictors**: for participants with no ADL dependence at baseline, cognitive impairment and depressive symptoms are risk factors for decline. For participants with dependence in ADL at baseline, cognitive impairment but not depressive symptoms, is a risk factor for additional decline.
Mendes de Leon et al. (1997)	6,884 men and women aged 65 and older living in New Haven and in a five-county area in the Piedmont in North Carolina	Secondary data analysis (data from the New Haven and North Carolina sites of the EPESE)	**Predictors**: in New Haven and in North Carolina, being black (predictive at age 65); less education; lower income; higher body mass index; worse cognitive function; more chronic illnesses
Moritz et al. (1995)	1,856 community-dwelling elderly persons who were initially free of ADL	Primary data collection (survey of persons living in New Haven, CT)	**Predictors**: cognitive impairment

	limitations		
Nordstrom et al (2007)	3,684 persons aged 65 and older in the United States	Primary data collection (Cardiovascular Health Study, a longitudinal, population-based examination of coronary heart disease and stroke among persons)	**Predictors**: among independent-living elderly, socioeconomic position (SEP) affected development of mobility impairment into later life
Penninx et al. (1998)	1,286; persons aged 71 years and older living in the communities of Iowa and Washington counties, IA	Secondary data analysis (data from the Iowa EPESE)	**Predictors**: depressive symptoms; older age; less education; being unmarried; coronary heart disease; lung disease
Ruo et al. (2007)	417 patients with PAD	Primary data collection (prospective cohort study)	**Predictors**: New depressive symptoms and persistent depressive symptoms
Russell et al. (2006)	300 community dwelling individuals, aged 60 years or older	Primary data collection (cross-sectional study)	**Predictors**: polypharmacy, home hazards, decreased balance and arthritis
Sager et al. (1996)	1,279 community-dwelling patients aged 70 and older hospitalized for acute medical illness	Primary data collection (multicenter survey of patients for the Hospital Outcomes Project for the Elderly)	**Predictors**: older age; preadmission IADL disability; lower mental status scores
Salvi et al. (2008)	275 elderly patients admitted to an acute medical ward	Primary data collection	**Predictors**: malnutrition
Sarkisian et al. (2000)	6,632 community-residing women older than age 65	Primary data collection (survey administered in four geographic regions in the U.S.)	**Predictors**: slow gait; short-acting benzodiazepine use; depression; low exercise level; obesity
Sibbritt et al. (2007)	12,432 women aged 70 to 75 years	Secondary data analysis (data from the Australian Longitudinal Study on Women's Health)	**Predictors**: lower satisfaction with physical ability; problems with feet; more prescription medication

Stel et al. (2004)	204 community dwelling persons aged 65 or older	Secondary data analysis (data from Longitudinal Aging Study Amsterdam)	**Predictors**: female, higher medication use and depressive symptoms
Studenski et al. (2003)	487 persons aged 65 and older, living in the community within a 20-mile radius of the ambulatory clinic site, and in the same healthcare system for at least 1 year	Primary data collection (assessments of persons recruited from a VA network site and a Medicare HMO serving a common geographic area)	**Predictors**: slow gait; poor Established Population for Epidemiologic Studies of the Elderly (EPESE) battery scores
Volpato et al (2007)	1,686 patients aged 65 and older who independent in BADL 2 weeks before hospital admission	Primary data collection (1998 Longitudinal Pharmacoepidemiology in the Elderly Study	**Predictors**: preexisting conditions associated with the frailty syndrome, including physical and cognitive function, comorbidity, body composition, and inflammatory markers, characterize patients at high risk of functional decline
Wang et al. (2002)	2,581 persons aged 65 and older and cognitively intact at baseline	Primary data collection (survey of a random sample selected from the Group Health Cooperative members in Seattle; data make up the Adult Changes in Thought Study— ACT)	**Predictors**: diabetes; hypertension; coronary heart disease; CVD; osteoporosis; arthritis; cancer; low cognitive function; depression; smoking
Winograd et al. (1997)	507 acutely ill hospitalized male veterans aged 65 years and older	Primary data collection (survey of male veterans at a tertiary VA medical center)	**Predictors**: high baseline physical performance; at least moderate self-report limitations on physical functioning
Wu et al. (2000)	804 nonelective hospital	Secondary data analysis (data	**Predictors**: limitations in ability

	admissions aged 80 and older	from the Hospitalized Elderly Longitudinal Project—HELP)	to perform ADLs at baseline; worse baseline functional status and quality of life; presence of dementia, depression, or incontinence; being bedridden; older age; medical record documentation of need for nursing home

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APPENDIX C

Predictors of Cognitive Decline:

Tabular Summary of Studies and Associated Bibliography

Predictors of Cognitive Decline

Author (Year)	Sample size and makeup	Study design	Significant findings
Albert et al. (1995)	1192 community-dwelling persons aged 65 and older	Secondary data analysis (Secondary data from three cohorts of the EPESE—East Boston, MA; New Haven, CT; and Durham, NC)	**Predictors:** higher total cognitive score at baseline; less education; lower income; less physical activity; being non-white
Anttila et al. (2004)	1464 persons aged 65-79 living in Eastern Finland	Secondary data analysis (Secondary data from the cardiovascular risk factors, aging and dementia (CAIDE) study)	**Predictors:** no alcohol and frequent alcohol were more likely to have cognitive impairment.
Atkinson et al. (2005)	558 community-dwelling older women in the Baltimore area with moderate to severe disability	Secondary data analysis (study of participants in the Women's Health and Aging study I who had Mini-Mental State Examination (MMSE) score of 24 or greater and walking speed greater than 0.4 m/s at baseline)	**Predictors:** older age; lower baseline MMSE score
Bassuk et al. (1999)	2812 noninstitutionalized elderly persons aged 65 and older	Secondary data analysis (Secondary data from the New Haven EPESE)	**Predictors:** having few or no social ties; older age; less education; lower income; worse physical or mental health
Butler et al. (1996)	678 Catholic sisters ranging in age from 75 to 102	Secondary data analysis (Secondary data from the Nun Study)	**Predictors:** less education; older age
Chodosh et al. (2002)	1189 elderly aged 70 to 79 who were in the top third of this age group, based on physical and cognitive	Primary data collection (three-site longitudinal study in Durham, NC; East Boston, MA; and New Haven, CT)	**Predictors:** poor delayed recall and recognition

	functional status		
Djaiani et al. (2003)	417 patients undergoing coronary artery bypass graft (CABG) surgery	Primary data collection	**Predictors:** older age; fewer years of education; lower baseline cognitive index
Farmer et al. (1995)	14,883 persons 18 years and older from the community and from three types of institutions: mental hospitals, long-term care facilities, and prisons	Secondary data analysis (Secondary data from the National Institute of Mental Health Epidemiologic Catchment Area—ECA—Study)	**Predictors:** less education; older age; lifetime diagnosis of substance abuse; being non-white
Galasko et al. (2000)	299 patients with a research diagnosis of possible or probable AD	Primary data collection (survey of patients with probable or possible AD enrolled at the Alzheimer's Disease Research Center at the University of California, San Diego)	**Predictors:** more severe dementia; longer duration of dementia; younger age at onset of dementia; fewer years of education
Gruber-Baldini et al. (2003)	674 hip fracture patients aged 65 and older living in the community before fracture	Primary data collection (survey of hip fracture patients admitted to eight Baltimore hospitals)	**Predictors:** older age; being male; less education; higher physical activities of daily living (PADL) impairment
Ho et al. (2004)	939 patients undergoing CABG-only surgery at 14 VA medical centers between 1992 and 1996	Secondary data analysis (Secondary data from the Processes, Structures, and Outcomes of Care in Cardiac Surgery study—PSOCS)	**Predictors:** cerebrovascular disease (CVD); peripheral vascular disease; chronic disabling neurologic illness; living alone; less education; postoperative complications
Jonker et al. (2002)	1007 elderly individuals aged 62-85 years	Secondary data analysis (Secondary data from the Longitudinal Aging Study Amsterdam (LASA)).	**Predictors:** use of low dose aspirin was protective of cognitive decline in persons 75 years and older
Landi et al. (2001)	364 elderly individuals 80 years and older	Secondary data analysis (Secondary data from baseline evaluation of the ilSIRENTE Study)	**Predictors:** individuals with a history of high intensity physical activity had a significantly higher Cognitive Performance Score
Laurin et al. (2001)	9008 randomly selected men and women 65 years or older	Primary data collection (Prospective cohort study of dementia (Canadian Study of	**Predictors:** compared with no exercise, physical activity was associated with lower risks of

		Health and Aging))	cognitive impairment, Alzheimer disease, and dementia of any type
Lee et al. (2007)	2934 subjects over the age of 60	Secondary data analysis (Secondary data from the Gwangju Dementia and Mild Cognitive Impairment Study (GDEMCIS)).	**Predictors:** moderate or high nutritional risk
Lopez et al. (2003)	3608 participants who had an MRI of the brain between 1991 and 1994	Secondary data analysis (Secondary data from the Cardiovascular Health Study Cognition Study)	**Predictors:** African American race, low level of education, lower Modified Mini-Mental State Examination and Digit Symbol Test scores, and measurements of depression
Lopez et al. (1999)	179 mildly to moderately impaired patients with probably AD	Primary data collection (assessment of and semistructured interviews with patients enrolled in longitudinal study of dementia at the University of Pittsburgh)	**Predictors:** lower MMSE scores
Lyketsos et al. (1999)	1488 adult household residents of eastern Baltimore	Secondary data analysis (Secondary data from the Batlimore cohort of the ECA Study)	**Predictors:** having 8 years or less of formal education; being African American; being female
Marquis et al. (2002)	108 persons 65 years or older, without comorbid conditions, mentally healthy by mental status examination, and without memory impairment by self-report or proxy	Primary data collection (assessment of subjects in the Oregon Brain Aging Study)	**Predictors:** older age; worse logical memory test score; slower gait
Nguyen et al. (2002)	1759 older Mexican Americans residing in the Southwestern U.S.	Secondary data analysis (Secondary data from the Hispanic Established	**Predictors:** vision impairment; stroke; diabetes; older age; less education; living with others; being unmarried

		Population for the Epidemiological Study of the Elderly—EPESE)	
Rasmusson et al. (1996)	132 patients with probable AD	Secondary data analysis (Secondary data from the Johns Hopkins Alzheimer's Disease Research Center—ADRC longitudinal study)	**Predictors:** more education; history of dementia in a first degree relative; younger age at entry; earlier age of onset; longer illness duration *all predict more rapid decline*
Ravaglia et al. (2008)	667 subjects 65 years or older residents without cognitive impairment	Primary data collection (Prospective, population based, longitudinal cohort study)	**Predictor:** Baseline depressive symptoms were associated with increased risk of mild cognitive impairment
Reyes-Ortiz et al. (2005)	2140 noninstitutionalized Mexican Americans aged 65 and older	Secondary data analysis (Secondary data from Hispanic EPESE)	**Predictors:** vision impairment; older age; less education; being unmarried; having depressive symptoms; more ADL limitations
Samper-Ternent et al (2008)	1370 hundred seventy noninstitutionalized Mexican-American men and women aged 65 and older	Secondary data analysis (Secondary data were from the Hispanic Established Population for the Epidemiological Study of the Elderly).	**Predictors:** Frailty in older Mexican Americans with MMSE scores of 21 or higher at baseline is an independent predictor of MMSE score decline over a 10-year period
Seeman et al. (2001)	1189 initially high-functioning older adults	Secondary data analysis (Secondary data from the MacArthur Studies of Successful Aging)	**Predictors:** greater baseline emotional support is associated with *better cognitive functioning* over time
Tervo et al. (2004)	806 subjects aged 60-76 from a population based sample of cognitively healthy elderly	Primary data collection (Prospective cohort study)	**Predictors:** higher age, low educational level; medicated hypertension predicted mild cognitive impairment
van den Kommer et al. (2008)	2021 non-demented individuals aged 58-88 years	Secondary data analysis (Secondary data from the Longitudinal Aging Study Amsterdam (LASA) an	**Predictors:** age, having memory problems, low education and a lower MMSE score

		ongoing population based study)	
Verghese et al. (2006)	437 subjects older than 75, initially free of dementia or MCI	Secondary data analysis (Secondary data from the Bronx Aging Study)	**Predictors:** cognitive (but not physical) leisure activity participation was associated with lower risk of mild cognitive impairment
Wadley et al (2007)	2832 volunteers (mean age 74 years; 26% African American) living independently, recruited from senior housing, community centers, and hospitals and clinics.	Secondary data from the longitudinal, multi-site Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) study	**Predictors**: Mild Cognitive Impairment (MCI) predicts progression to dementia and also predicts physical functional decline.
Wang et al. (2006)	5437 people aged 55 years and older with normal baseline Mini-Mental State Examination score annually for 5 years	Primary data collection (demographic, smoking and drinking, medical conditions, neuropsychological evaluation, leisure activities data were collected)	**Predictors:** women, lower education, blue-collar occupation, current smoking, daily drinking, older age, more co morbidities, lower MMSE and higher ADL scores
Whitfield et al. (1997)	224 elderly African Americans aged 70 to 79	Secondary data analysis (Secondary data from the MacArthur Successful Aging Study)	**Predictors:** being male; less education; negative self-rating of current health
Wilson et al. (2007)	432 older persons with Alzheimer's disease	Primary data collection from subjects recruited from health care settings in the Chicago area	**Predictors:** Nursing home placement was associated with a decrease in the level of cognition and acceleration in the rate of cognitive decline.
Wright CB et al (2006)	community-based cohort of Hispanic, black and white individuals (n = 1,428)	Primary data collection (prospective cohort study)	**Predictors:** No alcohol consumption was associated with cognitive decline.

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