

# Today's Research on Aging

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## Dementia Trends: Implications for an Aging America

With Americans living longer and the large baby boom generation reaching ages 65 and beyond, the sheer numbers of people with conditions of old age—including Alzheimer's disease and other dementias—are expected to rise dramatically in coming years. But there is some potentially good news.

While the absolute number of older Americans with dementia is increasing, the proportion of the population with dementia may have fallen over the past 25 years, according to a recent U.S. study (Langa et al. 2017). Researchers say this downward trend may be the result of better brain health—possibly related to higher levels of education and more aggressive treatment of cardiovascular risk factors such as high blood pressure and diabetes.

This report explores the evidence of a decline in dementia and the trends that may shape the future prevalence of this debilitating condition—focusing on recent work by researchers supported by the National Institute on Aging (NIA). It describes what we know (and do not know) about dementia patterns, examining known risk factors and vulnerable groups. This research can guide policymakers and public health professionals as they plan for an aging population and design strategies to address health and lifestyle factors related to dementia risk.

## Growing Evidence of a Declining Dementia Rate

About a dozen studies over the past decade or so have found a decline in the prevalence or incidence of dementia. A few studies have been nationally focused, examining the United States or high-income European countries such as England. Others have focused on cities in the Netherlands, Sweden, Denmark, and the United States (Framingham, Mass.).

Research based on the nationally representative U.S. Health and Retirement Survey (HRS) shows the share of Americans 65 and older with dementia decreased from 11.6 percent in 2000 to 8.8 percent in 2012—representing a 24 percent drop (Langa et al. 2017). A decline of this magnitude translates into roughly one million fewer Americans with dementia in 2012 than if 2000 rates had continued.

Participants with the most education had the lowest risk of dementia and the average years of education among older Americans increased by about one year during this period (from roughly 12 years to 13 years). This drop in the proportion of older Americans with dementia occurred despite increases in cardiovascular factors known to raise the risk of dementia (high blood pressure, diabetes, and obesity).

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*The share of Americans 65 and older with dementia dropped 24 percent between 2000 and 2012, according to analysis of Health and Retirement Study data.*

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Satizabal and colleagues (2016) report similar findings based on the less diverse participants in the Framingham Heart Study, ongoing since 1948 in a high-income Massachusetts community. Results show a continuing decline in dementia incidence (newly diagnosed cases) at any age, with an average reduction of 20 percent per decade since the 1970s. The researchers link these gains to increases in education and better heart health among high school graduates.



A growing share of older Americans are spending less of their lifetimes with cognitive impairments.

The decline in dementia prevalence coupled with longer life expectancy may be contributing to another change: A growing share of older Americans are spending less of their lifetimes with cognitive impairments, another recent study based on HRS data and vital statistics shows (Crimmins, Saito, and Kim 2016). The gains in life expectancy between 2000 and 2010 represent more time older Americans spend cognitively intact, the researchers report. The share of Americans 65 and older without cognitive problems increased by 4.5 percentage points for men and 3.4 percentage points for women during the decade. At the same time, the average time older people spent with dementia or cognitive impairment shortened slightly.

## Understanding Education's Role in Protecting the Brain From Dementia

The decline in dementia prevalence likely reflects the expanded educational opportunities in the United States following World War II that will continue to have an impact for several decades. Hurd, Martorell, and Langa (2015) point out that 25 percent of Americans ages 75 to 94 in 2013 had some college compared with 56 percent of baby boomers (born 1946 to 1964).

Numerous studies have found that more schooling is associated with a lower risk of dementia. Researchers explain this connection in a variety of ways. They suggest that education may directly affect brain development by creating a cognitive reserve (stronger connections among brain cells) that older adults can draw upon if their memory or reasoning ability begins to decline. They also suspect that people with more education may be better able to develop techniques to compensate or adapt in the face of disrupted mental functions. In addition, education brings with it multiple advantages. They point out that people with more education tend to have healthier lifestyles, higher incomes, better health care, and more social opportunities—all associated with better brain health.

The cognitive reserve theory is supported by earlier studies that find that cognitive decline tends to occur later and progresses faster among more-educated adults (Langa et al. 2008). Researchers suggest that cognitive reserve gives adults with more education resilience, enabling them to delay the onset of cognitive impairment—or to mask its detection. This “compression” of cognitive impairment into a shorter time period among those with more education improves quality of life—giving people with more education more years of cognitive health and fewer years of impairment.

But cognitive reserve appears to be built not just by years of formal schooling but also by life-long intellectual stimulation and mental challenge. Boots and colleagues (2015) find that older workers with more complex jobs are able to maintain normal cognitive function despite having brain scans that show a smaller volume in the brain's hippocampus and increased atrophy of the whole brain—physical features linked to cognitive decline and typical of Alzheimer's disease. For the study, the researchers gave structural MRI scans and extensive cognitive tests to about 300 people with a parental history of Alzheimer's disease from the Wisconsin Registry for Alzheimer's Prevention. They also evaluated and scored each participant's job history based on complexity in working with data, people, and things.

Subjects with higher levels of occupational complexity are able to tolerate smaller hippocampal volumes and greater whole-brain deterioration and still perform at the same cognitive level as their

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Older workers with complex jobs were most able to preserve their cognitive performance in the face of Alzheimer's-related brain changes.

peers, they document. These findings held even when the researchers controlled for education, socioeconomic status, and cardiovascular risk factors. Individuals with jobs that required the most complex interpersonal interaction (such as mentoring) were most able to preserve their cognitive performance in the face of Alzheimer's-related brain changes. The researchers conclude that the day-to-day mental stimulation of more complex occupations builds cognitive reserve.

Late-life mental training also appears to contribute to better cognitive function. Findings from the Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) study show that certain kinds of cognitive training in older people can improve or maintain function in tests administered as part of the study, with some of the training benefits evident even a decade later (Rebok et al. 2014). More than 2,800 healthy adults ages 65 and older participated in 10 training sessions to strengthen memory, reasoning, and speed of processing. At the end of 10 years, all groups showed declines from their baseline test performance. But the participants who had training in reasoning and speed of processing a decade earlier experienced less decline. These findings offer some support for the idea that cognitive training might help older adults maintain mental abilities and stave off impairment.

A National Academies of Sciences, Engineering, and Medicine (NASEM) committee rigorously reviewed the ACTIVE study and other research related to cognitive training (NASEM 2017). They concluded that the ACTIVE study's findings suggest that cognitive training can delay or slow the age-related cognitive decline that tends to be a normal part of aging. But they emphasize that the overall evidence is insufficient to determine whether cognitive training can prevent, delay, or slow Alzheimer's disease or the mild cognitive impairment that often precedes Alzheimer's. Additionally, they note that consumers should not assume that commercially available computer-based brain training programs will have the same potential cognitive benefits as the ACTIVE study's cognitive training because they use different memory improvement techniques.

Other recent research further underscores the complex relationships among education, brain development, and cognitive health in old age. A large international study identified genes (74 areas of the human genome) associated with educational attainment, suggesting that the amount of brain-protecting schooling people acquire could be partially predetermined by the genes they inherit (Okbay et al. 2016). Other studies suggest that differences in cognitive function and physical activity already evident in childhood can shape cognitive function in late life (Belsky et al. 2015; and Belsky 2016). In low-income countries, the number of people with dementia is rising, in part reflecting population aging and low levels of education, particularly among older women (see Box 1).



Researchers are investigating the complex relationships among education, intellectual stimulation, brain development, and cognitive health in old age.

## BOX 1

### Dementia Trends in Lower-Income Countries

By 2050, the age composition of populations in every world region except Africa will resemble Europe's today, with elderly ages 65 and older outnumbering children younger than 15, the U.S. Census Bureau projects (He, Goodkind, and Kowal 2016). This shift toward an older population—fueled by declines in fertility and increases in life expectancy—brings with it changes in disease patterns. The share of deaths from infectious diseases of childhood is decreasing while the share from noncommunicable diseases of adulthood, including Alzheimer's disease and other dementias, is on the rise.

While dementia affects a greater share of people in high-income countries, the total numbers of people with dementia are rising most rapidly in many low- and middle-income countries, according to estimates from the Global Burden of Disease (GBD) 2013 Collaborators (University of Washington, Institute for Health Metrics and Evaluation 2015). The GBD research—designed to address underestimates due to misclassification of causes of death—finds dementia caused more than 10 percent of all 2013 deaths in the United States and a number of other high-income countries, including Finland, Italy, Iceland, Switzerland, and Canada. But low- and middle-income countries saw the largest relative increases in dementia-related deaths. Between 1990 and 2013, the number of dementia deaths more than doubled in Cambodia, Afghanistan, Eritrea, Niger, Venezuela, Dominican Republic, Nicaragua, and Thailand.

In low- and middle-income countries today, dementia risk among older adults is shaped in part by the amount of schooling they received during youth, particularly for females. Studies show that older adults who had low levels of schooling in childhood score lower than their more-educated peers on cognitive function tests that detect signs of dementia, even after adjusting for social, economic, and health factors (Maurer 2011; and Prince et al. 2012). In low- and middle-income countries, older men tend to outscore older women, who face a higher risk of dementia even after taking into account women's longer life expectancy. (By contrast, older women in high-income countries tend to score the same as or better than their male counterparts.)

One analysis of data for China and India documents gender disparities in the cognitive function of adults related to past inequitable schooling patterns in both countries, but also shows that nutrition in childhood—reflected in adult height—also may influence cognitive function at older ages (Weir, Lay, and Langa 2014). This study is based on World Health Organization (WHO) data and two studies comparable to the U.S. HRS—the Longitudinal Aging Study in India (LASI) and the China Health and Retirement Longitudinal Study.

In another analysis based on LASI data, Lee and colleagues (2014) find that region-specific patterns also underlie the gender gap in the mental function of older Indians. In southern India, older women's lower scores on cognitive function tests relative to men can be explained by disparities in education, health, and social and economic activity. But in northern India, the disparity between older men and women persisted even after controlling for education and health differences. They point to northern Indian women's low status, household caretaker roles, and lack of labor force participation, suggesting that stress related to discrimination takes a cognitive toll. The researchers argue that "policies that promote equitable access to educational attainment, workforce participation, and health care in India will not only have significant economic benefits but may potentially reduce gender disparities in the prevalence of Alzheimer's disease."

Analysis of data from the Malawi Longitudinal Study of Families and Health provides a rare picture of the risk factors for cognitive impairment at older ages in a rural sub-Saharan African setting (Payne et al. 2016). The researchers were surprised to find that cognitive decline related to aging in Malawi is similar to U.S. patterns for both men and women. They also report that Malawian women are more than twice as likely to be cognitively impaired as men, and women experience a steeper decline in cognitive function as they age. They link strong social ties, socially complex environments, and higher socioeconomic status to a lower risk of cognitive impairment, while they connect limited nutrient intake and low income with higher risks.

Globally, more than half (58 percent) of people with dementia are living in low- and middle-income countries (WHO 2012). By 2050, this share is expected to rise to more than 70 percent. WHO reports that dementia tends to be "absent from or low on the health agendas" of low- and middle-income countries. WHO urges countries to focus on improving early diagnosis, raising public awareness about the disease, reducing stigma, and providing better care to people living with dementia and more support to their caregivers.



In low- and middle-income countries today, dementia risk among older adults is shaped by the amount of schooling they received during youth, particularly for females.

## The Potential Spillover of Treating Cardiovascular Risk Factors

Common conditions such as diabetes and high blood pressure are known to increase dementia risk and diagnosis of these risk factors is on the rise in the older population. Why then does the risk of dementia appear to be declining?

To explain this trend, researchers point to more aggressive treatment of risk factors. For example, participants in the HRS-based study that documented a decline in dementia rates were more likely to report diabetes and high blood pressure in 2012 than in 2000 (Langa et al. 2017). Langa (2015) suggests that the “widespread and intensive medication treatment” of such risk factors for an increasing share of older Americans “is likely having important ‘spillover’ benefits for brain health and the risk of cognitive decline and dementia.”

Researchers also point out that fully treating cardiovascular risk factors will not eliminate dementia risk because there are two types of dementia and people can have both. The two types are Alzheimer’s disease characterized by plaque and tangles in the brain, and vascular dementia that is the result of blood vessel damage, often caused by stroke. While better treatment and control of cardiovascular risk factors addresses the vascular type of dementia, it does not alter Alzheimer’s disease patterns.

## Obesity’s Puzzling Relationship With Dementia

Obesity’s role in dementia risk has puzzled researchers, but age at onset appears to play a pivotal role. A variety of studies link obesity in midlife to lower cognitive function and increased dementia risk in old age. But obesity after age 65 appears to provide some protection from dementia, while being underweight in old age raises dementia risk, as results from the HRS-based study and a number of other studies indicate (Langa et al. 2017).

To explain the relationship between midlife body fat and later life mental function, a number of researchers say we should look to childhood. Preliminary analysis by Herd and Dowd (2016) suggests that midlife obesity and late-life cognitive function are both “a function of early life factors.” They show that the link between midlife obesity and mental decline can be explained when childhood characteristics are taken into account—parental socioeconomic status, adolescent IQ, and educational attainment (factors that tend to be interrelated). These childhood factors influence both obesity and cognitive function later in life, they argue. Their findings are based on data from the Wisconsin Longitudinal Study, which has tracked a cohort of predominantly white high school graduates for 60 years.



A variety of studies link obesity in midlife to lower cognitive function and increased dementia risk in old age. But obesity after age 65 appears to provide some protection from dementia.

Similarly, Belsky and colleagues (2013) find lower IQ scores among children who later develop obesity and children with lower IQ scores are at greater risk of becoming obese. The researchers suggest that efforts to address obesity must begin earlier than midlife and take into account the role of childhood factors.

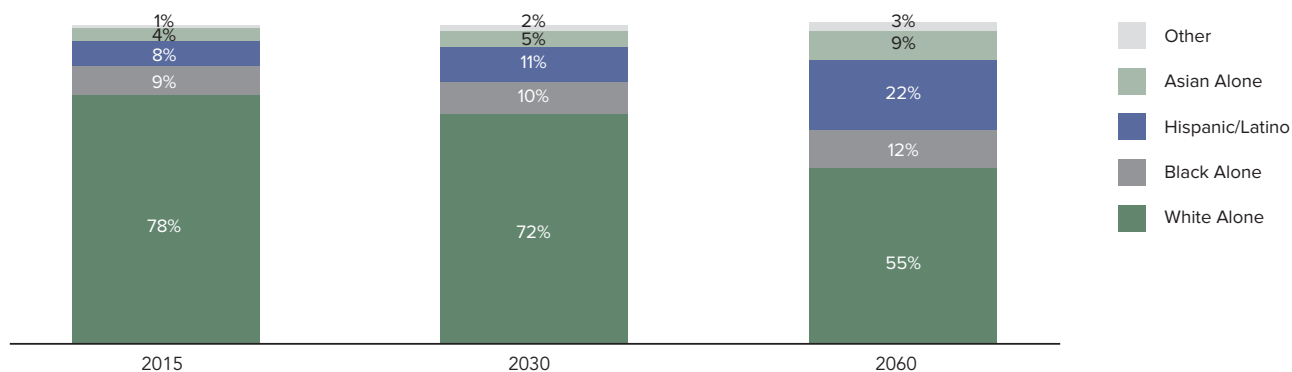
## Probing Racial/Ethnic Disparities

The U.S. population is becoming more racially and ethnically diverse. By 2060, nearly half of older adults are projected to be racial/ethnic minorities—roughly the same share as those under age 20 today (see figure). Compared with the non-Hispanic white population, research suggests that some racial and ethnic groups face higher risks for cognitive decline and dementia, perhaps reflecting socioeconomic differences (Yaffe et al. 2013). Trends among today’s minority groups will drive future rates of dementia among older Americans.

### FIGURE

## Racial and Ethnic Minorities Will Make Up an Increasing Share of the U.S. Older Population.

Percent Distribution of Population Ages 65 and Older by Race/Ethnicity, 2015, 2030, and 2060



**Note:** Racial groups exclude persons of Hispanic origin. “Other” includes American Indians and Alaska Natives, Native Hawaiians and Other Pacific Islanders, and people who identify with more than one race. Numbers may not sum to 100 due to rounding.

**Source:** PRB analysis of data from the U.S. Census Bureau.

A 2016 study based on the medical records of 270,000 northern Californians shows that the share of new cases of dementia was higher among older African Americans, American Indians/Alaska Natives, and Hispanics than among older whites and Asian Americans (Mayeda et al. 2016). This study, which compared rates among a diverse population, echoes findings of earlier studies that compared specific minority groups with the white population. The disparities remained even after the research took account of health care access and other conditions, such as cardiovascular disease.

New research is looking beyond years of education and income to try to fully explain racial and ethnic differences in dementia patterns. Not just years of schooling but also the quality of that schooling appears to matter. Lower-quality education early in life and poor literacy skills late in life explain nearly one-third of the disparity in late-life cognition between one population of U.S.-born African Americans and non-Hispanic whites ages 65 and older living in New York state (Sisco et al. 2014). The researchers speculate that “poorer early-life educational quality may limit one’s

occupational choices, which may result in greater risk for poverty and chronic stress (a factor harmful to cognition), while also limiting opportunities for occupation-related cognitive enrichment (a factor enhancing cognition).”

Other studies find older U.S. Hispanics living in East Coast cities and in southern California tend to develop dementia several years earlier than their U.S. non-Hispanic white counterparts (Livney et al. 2011; Fitten et al. 2014). In the California study, these differences remained even after the researchers controlled for education levels, dementia severity, and health risk factors (high cholesterol, high blood pressure, and diabetes). Because the Alzheimer’s-linked APOE e4 gene appeared less frequently in Hispanics than the non-Hispanic whites in the study, they speculate that other genetic or environmental risk factors play a role in earlier dementia onset among Hispanics. The researchers note that if identified, environmental risk factors can be prevented and possibly reversed.



Increased physical activity and blood pressure control for those with hypertension are two interventions that may lower dementia risk.

## Policy and Program Implications

While the future is difficult to predict, demographic research makes clear that the total numbers of people with dementia will rise because of population aging, although the increase may be smaller than previously projected. A number of recent studies estimate and project the social and economic impact of dementia, focusing on health care costs for U.S. families and for government programs now and in the future. They show that dementia is one of the nation’s most expensive old-age health conditions and the most time consuming for family caregivers (see Box 2). An understanding of future dementia patterns and the related costs is vital as policymakers plan for an aging population and individuals plan for old age.

Researchers point out that continued declines in the share of the older population with dementia are not guaranteed (Jones and Greene 2016). Gains related to education are expected to level off eventually. Increases in cardiovascular disease, obesity, and diabetes threaten to erase existing progress. The growing racial and ethnic diversity of the U.S. population will reshape risk factors and disease patterns.

In their extensive scientific review of strategies to prevent or reduce the risk of dementia and cognitive impairment, the NASEM committee (2017) identified “encouraging although inconclusive” evidence for three specific types of interventions:

- Cognitive training.
- Blood pressure control for people with hypertension.
- Increased physical activity.



## BOX 2

### Estimating the Costs of Dementia

The main type of care people with dementia need is supervision and help with personal care—services not covered by the federal Medicare program. Four out of five older adults with dementia live in settings other than nursing homes and unpaid family members provide the vast majority of their care (Spillman et al. 2014; Kasper et al. 2015). Baby boomers are less likely than the previous generation to have a spouse or an adult child nearby to provide care, which may mean less reliance on unpaid caregivers and increased demand for paid services in the future (Ryan et al. 2012).

Dementia care is time intensive. Using data from the 2011 National Health and Aging Trends Study, Kasper, Freedman, and Spillman (2014) calculated unpaid hours of help to persons ages 65 and older receiving assistance in settings other than nursing homes. They found that unpaid hours of help to persons with probable dementia were more than double those to persons with no dementia (221 hours versus 105 hours per month). Dementia also puts a disproportionate burden on families in terms of out-of-pocket costs of medical care. Kelley and colleagues (2015) find for Medicare beneficiaries that average out-of-pocket health care costs in the last five years of life are significantly higher for those with dementia than they are for those with heart disease, cancer, or other medical conditions (\$62,000 versus \$34,000).

Altogether, the monetary cost of dementia, including the value of unpaid caregiving, is enormous and projected to grow. Hurd and colleagues (2013) estimated a cost ranging from \$159 billion to \$215 billion for 2010, depending on how unpaid care is valued. If dementia prevalence rates from the early 2000s had remained unchanged, the annual costs associated with dementia care could have increased by more than 100 percent by 2040 when the baby boom generation reaches advanced ages (Hurd et al. 2013). But if declines in dementia prevalence persist, costs in 2040 are projected to increase by about 60 percent, despite a larger share of older people in the population (Hurd, Martorell, and Langa 2015). The wild card is yet undiscovered treatments or approaches that could prevent or delay dementia, leading to fewer dementia cases and lower health care spending.



New treatments and approaches that prevent or delay dementia could lead to fewer dementia cases and lower health care spending.

Improvements in understanding, diagnosing, preventing, and treating Alzheimer’s disease and other dementias are top NIA priorities. The 2011 National Alzheimer’s Project Act and related legislation lay the foundation and provide new funding for “an aggressive and coordinated national plan to accelerate research.” This initiative includes research designed to better answer the following questions:

- What roles do education and intellectual stimulation play in delaying or preventing dementia?
- What are the connections among dementia, cardiovascular disease, obesity, and diabetes?
- What are the best ways to reduce the dementia risks that minority group members face?

Refining our understanding of the answers to these questions can enable policymakers and planners to design and test prevention strategies that can contribute to continued future decline in dementia prevalence. ■

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### The NIA Centers on the Demography and Economics of Aging

The National Institute on Aging (NIA) of the National Institutes of Health supports research centers on the demography and economics of aging at the universities and organizations listed above.

This publication summarizes new aging-related research, with emphasis on work conducted at the NIA demography and economics centers. Our objective is to provide decisionmakers in government, business, and nongovernmental organizations with up-to-date scientific evidence relevant to policy debates and program design. These reports can be accessed at [www.prb.org/About/ProgramsProjects/Aging/TodaysResearchAging.aspx](http://www.prb.org/About/ProgramsProjects/Aging/TodaysResearchAging.aspx)

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