Life Expectancy With Cognitive Impairment in the Older Population of the United States

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Objectives. This article provides estimates of the prevalence of cognitive impairment by age and sex for a nationally representative sample of the U.S. population aged 70 and over. From these estimates, years of life with and without cognitive impairment are calculated.

Methods. Using data from the Assets and Health Dynamics of the Oldest Old (AHEAD) survey, the prevalence of cognitive impairment is estimated for a sample representing both the community-dwelling and institutionalized older American population. Sullivan’s method is used to calculate the average number of years an elderly person can expect to live with and without cognitive impairment.

Results. The prevalence of moderate to severe cognitive impairment in the total U.S. population aged 70 and over is 9.5%. At age 70, the average American can expect 1.5 years with cognitive impairment. Expected length of life with cognitive impairment is longer for women than men because of their longer life expectancy.

Discussion. As total life expectancy continues to increase, the length of life with cognitive impairment for the American population will increase unless age-specific prevalence is reduced. There is great potential for improvement in future early treatment and diagnosis of this condition.

Cognitive impairment is a major health problem in old age. It is a major cause of disability and can result in an inability to care for oneself at the oldest ages. Interest is focused on cognitive impairment because it diminishes the quality of life of both the individual with the condition and the family members. Cognitive impairment is also one of the major causes of institutionalization, and a significant proportion of health care resources is spent caring for older people with this condition (Langa et al., 2001). The prevention and treatment of cognitive impairment are the focus of a number of current clinical trials that aim to provide methods of either preventing or retarding the development of dementing conditions.

Length of life with cognitive impairment is a good indicator of the burden of this condition for an average individual in the population. As life expectancy has increased, researchers have begun to explore whether gains in life expectancy have been gains in healthy years or years lived with disease and disability (Robine & Mathers, 1993). Health expectancy measures combine morbidity and mortality rates to provide indicators of healthy and unhealthy life expectancy. Similar to life expectancy, these measures are independent of age structure so they can be compared across population subgroups and time. Because cognitive impairment is a condition that is highly concentrated at the older ages, there is interest in how the length of life with cognitive impairment is likely to be affected by reductions in old age mortality and how differential the burden of cognitive impairment is for groups of the population with different levels of life expectancy.

Utilizing data from a nationally representative sample of older Americans aged 70+, including both the community and institutionalized populations, this analysis provides estimates of the age-specific prevalence of moderate to severe cognitive impairment for men and women. The health expectancy approach is then used to divide life expectancy into expected years with and without cognitive impairment by age and gender to clarify the relative burden this condition places on men and women in the older population. Finally, by using information on past and potential trends in future mortality and cognitive impairment, we simulate how the length of life with and without cognitive impairment might have changed since 1970 and could change in the future.

Background

Prevalence of cognitive impairment from population studies.—Cognitive function is a network of abilities that can be grouped into general categories of memory, conceptualization, attention, language, knowledge, and spatial ability—each of which is influenced by environmental and biological circumstances (Albert, 2002; Perlmutter, 1988). Researchers interested in measuring the cognitive health of large populations have developed tests of these abilities that are appropriate for use in survey research (Herzog & Rogers, 1999). For the purposes of determining the prevalence of cognitive impairment in population-based studies, impairment can be defined as the inability to accomplish multiple tasks of cognitive skill as measured in cognitive survey instruments.

Estimates of the prevalence of cognitive impairment based on a nationally representative sample, including both the community and the institutionalized populations, have not been previously available. Previous estimates of the prevalence of cognitive impairment for the United States have relied on community studies. Prevalence estimates of cognitive impairment from two well-known community studies (Bachman et al., 1992; Evans et al., 1989), as well
as one composite estimate developed by the U.S. General Accounting Office (U.S. GAO, 1998), are shown in Figure 1. Estimates of probable Alzheimer’s disease from East Boston (Evans et al., 1989) are the highest of the three studies illustrated, and are generally higher than community prevalence estimates from other studies (Bachman et al., 1992; U.S. GAO, 1997). Prevalence estimates of moderate to severe cases of dementia and probable senile dementia of the Alzheimer type from the Framingham study fall significantly below estimates for East Boston (Bachman et al., 1992). The prevalence estimates reported for these two community studies vary in part because of differences in the severity of impairment considered and different screening techniques. In East Boston, subjects were drawn from all levels of cognitive performance, whereas in Framingham only those who scored below a cutoff at screening had the potential of being identified as impaired (Bachman et al., 1992).

Prevalence estimates are also likely to differ between communities with different demographic and socioeconomic characteristics. For example, the East Boston sample is comprised of respondents with lower than average levels of education and many native Italian speakers (Evans et al., 1989). Lower levels of education are associated with diminished performance on tests of cognitive ability (Crum, Anthony, & Bassett, 1993).

In an attempt to provide an estimate of the prevalence of moderate to severe Alzheimer’s disease for the United States, researchers from the U.S. GAO synthesized the results of 18 community studies, four of which were from the United States, including the East Boston and Framingham studies; the remainder were from Europe (U.S. GAO, 1998). The GAO estimates that are based on a synthesis of studies with a variety of approaches to measurement, diverse demographic characteristics, and different populations result in a level of impairment lower than not only East Boston, but also Framingham. None of the studies included in the GAO estimates was representative of the U.S. population, in terms of education, socioeconomic level, ethnicity, and institutional residence, all of which are related to the prevalence of cognitive impairment (Gatz et al., 2001; Whitfield et al., 2000). In addition, genetic factors may also play some role in variability of estimates across countries and communities. For example, the apoE-4 allele, that varies across populations and ethnic subgroups, has been related to higher incidence rates of Alzheimer’s disease and other dementing conditions (Zhu et al., 2000).

**Data Sources**

Data required for calculating health expectancy include age-specific mortality rates and estimates of the prevalence of cognitive impairment reflecting the entire population. Mortality rates are based on the 1993 Vital Statistics of the United States (National Center for Health Statistics, 1997). Because annual life tables are only calculated to age 85+, mortality rates for those 90 years of age and over are based on the 1990 decennial life table (National Center for Health Statistics, 1999).

The prevalence of cognitive impairment is estimated using the Assets and Health Dynamics of the Oldest Old (AHEAD) sample. This nationally representative survey of the community-dwelling population of the United States aged 70 and over was begun in 1993 (Soldo, Hurd, Rodgers, & Wallace, 1997). Although this survey did not originally include the institutional population, information is collected about original sample participants who have moved into institutions after the first wave. Data from the first wave of this survey are used to estimate the cognitive status of the community-dwelling population, and data from the third wave, 5 years after the first interview, are used to estimate cognitive status of the institutionalized population. The institutionalized population should be well-represented by this group because 82% of institutionalized persons 65 and over have been institutionalized for less than 5 years (Gabrel, 2000). Estimates of the relative size of the community population and the population institutionalized for health problems in each age-sex group are derived from Census data and used to weight the prevalence figures obtained from AHEAD (Crimmins, Saito, & Ingegneri, 1997).

Analysis in this paper is based on 7,143 community-dwelling respondents aged 70 and over at the first interview, and 387 institutionalized respondents at the third interview. Three hundred respondents who did not provide answers to items assessing cognitive ability at the first interview are missing from the analysis. Proxy respondents provided answers for 792 community dwellers and 269 institutionalized respondents.

**Measurement of Cognitive Impairment**

Our analysis identifies all types of cognitive impairment among the older population, not just those resulting from Alzheimer’s disease. The measurement of cognitive impairment in AHEAD differs for self- and proxy respondents. For self-respondents, responses to tests indicating four types of mental ability are used to develop a summary measure of cognitive function. The self-respondent summary measure is based on a modified version of the Telephone Interview for Cognitive Status, and tests of immediate and delayed verbal recall (Herzog & Wallace, 1997). The most basic level of cognitive function was assessed by object identification, date identification, and naming the President and Vice President. More difficult cognitive abilities were evaluated by the Serial 7s test, and a verbal recall measure. Scores from each of these individual measures were combined into a single summary measure of cognitive function scaled from 0 to 35, ranging from normal to dementia.
from lower to higher ability. Following the practice of the AHEAD investigators, respondents scoring 8 or less on the summary measure were classified as having moderate to severe cognitive impairment (Herzog & Wallace, 1997). In the results section, we examine the sensitivity of our estimates to this cutoff value by estimating the prevalence and life expectancy assuming cutoffs of 7 and 9.

For persons who were unable to answer for themselves, proxy reports of symptoms of cognitive impairment were used to classify respondents. Information on cognitive impairment for respondents unable to answer survey questions is essential to estimating prevalence for the entire aged population, because one of the major reasons for using a proxy respondent is the presence of cognitive impairment. Prior research has demonstrated that the use of proxy interviews is a reliable method of data collection for the impaired elderly (Jorm, Scott, & Jacomb, 1989). In the AHEAD survey, proxies were asked to report on a list of seven symptoms of cognitive impairment for persons unable to respond for themselves. Individuals who were reported to demonstrate at least two of the following seven symptoms were classified as cognitively impaired: got lost in familiar environments; frequently wandered; had hallucinations; were unable to be left alone; were poor in making judgments; were poor in organizing daily activities; or were poor in using memory skills. The symptoms listed in the proxy interview are comparable with diagnostic criteria for cognitive impairment and dementing conditions. Impaired respondents in the community averaged 3.6 symptoms; impaired institutionalized respondents averaged 4.4 symptoms.

A number of self-respondents refused to complete all of the cognitive tests and were coded as missing on the summary measure. An exception was made for nonresponse to the Serial 7's task, because the number of respondents who declined to participate in this repeated subtraction computation test was significantly higher than on other cognitive subtests (834 initial refusals on the Serial 7s versus 25–153 initial refusals on other tests). This could have been because of its difficulty relative to other cognitive tests, and indicative of inability to complete the task (Herzog & Wallace, 1997). Those who did not respond to the Serial 7s had significantly lower scores on all of the cognitive tests completed, worse activity of daily living and instrumental activity of daily living functioning, and worse self-assessed memory than other respondents. To estimate the prevalence of cognitive impairment appropriately for this analysis, we assigned to refusers to the Serial 7s a mean score for this test that was equivalent to the relative mean score on other cognitive tests for this group. This approach resulted in assignment of a score of 2.3 on the Serial 7s task for 834 refusers.

Methods for Computing Life Expectancy With Cognitive Impairment

Sullivan's method is used to calculate life expectancy with and without cognitive impairment for the total U.S. population, and for men and women separately. This method uses the current prevalence of health conditions observed in the population combined with the population’s mortality rates to divide life table years lived in each age group into years lived with and without cognitive impairment for the average person in the population. If $L$ is the conventional life table measure of years lived in the interval $\chi$ to $\chi + \eta$, and $P$ is the prevalence of cognitive impairment in that age group, then years lived with
cognitive impairment in the \( \chi \) to \( \chi + n \) age range is \( \text{LCI} = L \cdot P \), and life expectancy with cognitive impairment at age \( \chi \) is \( \text{eCI} = (\Sigma \text{LCI})/l \) from age \( \chi \) upward (Jagger, 1999). Confidence intervals for the calculations of life expectancy in health states are computed based on the size of the sample used to determine the prevalence of cognitive impairment.

**RESULTS**

Estimates of age-specific prevalence of cognitive impairment for the total population of the United States, for men and women, are presented in Table 1. Overall, 9.5% of the U.S. population aged 70 and over has moderate to severe cognitive impairment. Among the community-dwelling population, the prevalence of impairment is 6%, whereas among the institutionalized, slightly more than half are impaired. This estimate for the institutionalized population is close to estimates of cognitive impairment based on a nationally representative U.S. population. However, the proportion of remaining life with cognitive impairment remains relatively stable as age increases; for example, 1.5 years at age 70 and 1.6 years at age 80 for the total population. The average number of years with cognitive impairment for the total population, as well as for men and women separately, is shown in Table 2. At age 70, Americans can expect to live 14 more years on average; of these years, 12.5 will be years without cognitive impairment and 1.5 will be years with cognitive impairment. The confidence interval for years impaired is relatively small: 1.4 years to 1.6 years. The average number of years with cognitive impairment would be 8.6 rather than 9.5; with a cutoff of 9, the prevalence would be 10.5.

The estimated prevalence of moderate to severe cognitive impairment for the nationally representative sample used in this analysis can be compared with the U.S. community studies discussed earlier. Our prevalence estimates of cognitive impairment based on a nationally representative U.S. population are closest to estimates reported from the Framingham study (Bachman et al., 1992; Figure 1). In fact, our prevalence estimates for the community population only are very close to the Framingham age-specific estimates.

Life expectancy with and without moderate to severe cognitive impairment for the total population, as well as for men and women separately, is shown in Table 2. At age 70, Americans can expect to live 14 more years on average; of these years, 12.5 will be years without cognitive impairment and 1.5 will be years with cognitive impairment. The confidence interval for years impaired is relatively small: 1.4 years to 1.6 years. The average number of years with cognitive impairment remains relatively stable as age increases; for example, 1.5 at age 70 and 1.6 years at age 80 for the total population. However, the proportion of remaining life with cognitive impairment increases markedly as age increases from

### Table 1. Age-Specific Prevalence of Cognitive Impairment in Community, Institutional, and Total 70+ Population in the United States

<table>
<thead>
<tr>
<th>Age</th>
<th>% Impaired in Community</th>
<th>95% Confidence Interval: % Impaired in Community</th>
<th>% Impaired in Institution</th>
<th>95% Confidence Interval: % Impaired in Institution</th>
<th>% Impaired in U.S. Population</th>
<th>95% Confidence Interval: % Impaired in U.S. Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70–74</td>
<td>2.8</td>
<td>2.1–3.4</td>
<td>44.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>31.0–58.6</td>
<td>2.1</td>
<td>3.7</td>
</tr>
<tr>
<td>75–79</td>
<td>4.4</td>
<td>3.5–5.2</td>
<td>44.8</td>
<td>31.0–58.6</td>
<td>4.4</td>
<td>6.1</td>
</tr>
<tr>
<td>80–84</td>
<td>8.2</td>
<td>6.8–9.6</td>
<td>48.4</td>
<td>38.1–58.7</td>
<td>9.7</td>
<td>12.1</td>
</tr>
<tr>
<td>85–89</td>
<td>12.4</td>
<td>10.0–14.9</td>
<td>60.7</td>
<td>51.7–69.7</td>
<td>17.4</td>
<td>20.8</td>
</tr>
<tr>
<td>90+</td>
<td>24.0</td>
<td>19.0–29.1</td>
<td>52.2</td>
<td>43.2–61.1</td>
<td>38.7</td>
<td>34.9</td>
</tr>
<tr>
<td>Total</td>
<td>6.0</td>
<td>5.5–6.5</td>
<td>52.5</td>
<td>47.4–57.5</td>
<td>7.6</td>
<td>9.5</td>
</tr>
</tbody>
</table>


<sup>b</sup>Estimated based on age group 75–79.
There are gender differences in both total life expectancy and in expected life with and without cognitive impairment (Table 2). The average American woman can expect to live more years both with and without cognitive impairment than a man. At age 70, women average 1.7 years with cognitive impairment, compared with the 1.1 years for men. This gender difference in impaired years is similar across the age range. However, the gender difference in the number of years of cognitively intact life expectancy decreases substantially between ages 70 and 90. At age 70, women can expect 2.4 more cognitively intact years than men; however, by age 90, women have only .4 more years intact than men. Up until age 90, the gender difference in the average number of years with and without cognitive impairment is statistically significant. Within each sex group, the virtually constant expected average length of life with cognitive impairment by age indicates that surviving to an older age does not result in a longer average absolute period of moderate to severe cognitive impairment.

The longer survival of females in the United States is the primary reason women experience a greater number of years with cognitive impairment. One way to get a better sense of the role mortality plays in determining sex differences in life expectancy with cognitive impairment is to carry out a simulation that assumes that the two sexes have the same age-specific mortality rates (i.e. the male death rate) and the observed different sex-specific prevalence of cognitive impairment. In the United States, if females had the same mortality or life expectancy rates as males after age 70, they would average only 1.2 years of cognitively impaired life at age 70, which is virtually identical to the 1.1 years estimated for men. This means that women’s longer life at the older ages, when the prevalence of cognitive impairment is higher, is the cause of their greater burden of cognitive impairment.

Since the late 1960s, the older population in the United States has experienced a rapid decline in mortality rates and a marked increase in life expectancy at the older ages. Whether this increase in total life expectancy has been linked to an increase or decrease in the length of cognitively impaired life depends on trends in the prevalence and incidence of cognitive impairment. The trend in cognitive impairment among older Americans has not been clearly specified. Data from the Seattle Longitudinal Study indicate that, whereas cognitive ability has likely improved among younger and middle-aged adults, general mental abilities among adults aged 70 and over have remained relatively constant over the last 40 years (Salthouse, 1991; Schaie, 1983). However, recent papers by Freedman, Aykan, and colleagues (2001) and Manton, Stallard, and Corder (1998) suggest that there have been declines in the proportion of older Americans with severe cognitive impair-
ment in the 1980s and 1990s. Given this limited evidence on trends in cognitive impairment, we simulate the effect of increasing life expectancy on the expected length of cognitively impaired life using observed mortality rates in 1970 and two assumptions about the change in the age-specific prevalence of cognitive impairment between 1970 and 1993. The first assumption is that there has been no change in the age-specific prevalence of cognitive impairment between 1993 and 1970; the second is that the level of cognitive impairment observed in 1993 was a reduction of 50% from the prevalence in 1970 (Table 3).

Assuming no change in age-specific prevalence of cognitive impairment between 1970 and 1993, and the age-specific mortality rates actually experienced in 1970 when total life expectancy at age 70 was 2.2 years less than in 1993, the simulated length of life with cognitive impairment at age 70 would have been 1.1 years or .4 years less than in 1993. Twenty percent of the 2-year increase in total life expectancy since 1970 would have been in life lived with cognitive impairment, whereas 80% would have been in life free of cognitive impairment. The proportion of life cognitively impaired after age 70 for the average member of the total population would have changed slightly from 9% to 10% from 1970 to 1993. Because of their greater gains in life expectancy over the 1970–1993 period, if there has been no change in prevalence, an average woman would have experienced a greater increase in cognitively impaired years than an average man: .4 years versus .2 years, respectively (data not shown). On the other hand, if the prevalence of cognitive impairment has been cut in half since 1970, then the length of life with cognitive impairment could have decreased slightly (from 1.7 years in 1970 to 1.5 years in 1993).

Change in the future length of life with cognitive impairment depends on future trends in both mortality and cognitive impairment. To estimate the burden of cognitive impairment in the future, we assume that mortality changes as expected by the Social Security Administration and that the age-specific prevalence of cognitive impairment either stays constant or is cut in half from 1993 estimates. Life expectancy for the total population at age 70 in 2040 will be 15.7 years, and with no change from the current prevalence of cognitive impairment, 1.8 will be years spent with impairment (Table 3). This is a 20% increase in the length of impaired life from 1993 calculations. If the prevalence of cognitive impairment is reduced by half in 2040, slightly less than 1 year will be spent with impairment. These simulations clarify that the average length of time with cognitive impairment will increase for older adults, unless there are marked declines in prevalence. We should note that, by year 2040, the United States can expect the number of persons over the age of 65 to at least double, whereas the population over age 85 will likely triple (Social Security Administration, 1998). If the age-specific prevalence of cognitive impairment remains constant and the population ages as expected, not only will the length of cognitively impaired life increase, but also the number of cases of cognitive impairment will more than triple by 2040.

**DISCUSSION**

The findings from this analysis are important in that they provide the first estimates of the prevalence of cognitive impairment and life expectancy with cognitive impairment based on a nationally representative survey that includes the institutionalized population. The estimated prevalence based on a representative sample is higher than that from either the Framingham study or the GAO study, both of which attempt to estimate dementia at the same level of severity. Most of the difference between the Framingham study and the AHEAD study estimates is likely because of the inclusion of the institutionalized population. Although it is difficult to determine which study represents the gold-standard estimate of the prevalence of cognitive impairment, the National Institute on Aging criticized the GAO estimates as too low, and many studies make clear that the East Boston estimates are higher than those observed in any other study (Larson, 1989; U.S. GAO, 1998). The estimated prevalence of cognitive impairment from the AHEAD sample is in the expected range and clarifies the importance of including the institutionalized population.

These estimates indicate that the age-specific prevalence of cognitive impairment for males and females does not differ. The longer survival of females in the United States is the primary reason more women are cognitively impaired and experience a greater number of years with cognitive impairment. Females bear a greater burden of cognitive impairment than males because of longer lives.

On average, an older person spends 1.5 years with moderate to severe cognitive impairment. This represents the average current burden of this condition for each older person in the population. Our simulations clarify how increases in life expectancy, unaccompanied by major decrements in the prevalence of cognitive impairment, can lead to increases in the length of life with cognitive impairment and the number of years of care that must be provided for this condition for each person in the older population. These simulations clarify the importance of pursuing all approaches to prevention, delay, and

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**Table 3. Life Expectancy and Expected Years of Life With and Without Cognitive Impairment for the 70+ U.S. Population: 1970 and 2040**

<table>
<thead>
<tr>
<th>Year</th>
<th>Mortality</th>
<th>Cognitive Impairment</th>
<th>Total Life Expectancy</th>
<th>Cognitively Intact Life Expectancy</th>
<th>Life Expectancy With Cognitive Impairment</th>
<th>% of Life With Cognitive Impairment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>Observed 1993</td>
<td>Observed 1993</td>
<td>70</td>
<td>14.0</td>
<td>12.5</td>
<td>1.5</td>
</tr>
<tr>
<td>1970</td>
<td>Observed 1970</td>
<td>Observed 1993</td>
<td>70</td>
<td>11.8</td>
<td>10.7</td>
<td>1.1</td>
</tr>
<tr>
<td>1970</td>
<td>Observed 1970</td>
<td>Twice observed 1993</td>
<td>70</td>
<td>11.8</td>
<td>10.1</td>
<td>1.7</td>
</tr>
<tr>
<td>2040</td>
<td>Projected 2040</td>
<td>Observed 1993</td>
<td>70</td>
<td>15.7</td>
<td>13.9</td>
<td>1.8</td>
</tr>
<tr>
<td>2040</td>
<td>Projected 2040</td>
<td>Half observed 1993</td>
<td>70</td>
<td>15.7</td>
<td>14.8</td>
<td>0.9</td>
</tr>
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treatment if the burden of this condition is not going to increase in the future.

Although we can only speculate on past trends, a number of factors could have reduced the level of cognitive impairment in recent years and could continue to reduce the level in the future. For instance, control of the effects of conditions known to be related to cognitive impairment, such as hypertension and stroke, is now possible. In addition, there has been an increase in the use of medications that could have reduced the prevalence of cognitive impairment as an unintended consequence of treatment for other conditions. For example, statins, widely used medications for cholesterol control (Jick, Zornberg, Jick, Seshardi, & Drachman, 2000), nonsteroidal anti-inflammatory drugs, commonly used among those with arthritis (Breitner & Zandi, 2001), and hormone replacement therapy, currently prescribed to maintain bone density among women, are all thought to reduce the likelihood of the onset of cognitive impairment (Tang et al., 1996). Whereas the effects of these drugs on cognitive impairment have yet to be proven in experimental research, clinical trials are currently underway.

Increased knowledge about the relationships between various biological markers and the onset of cognitive impairment can also lead to future progress in prevention and treatment of this condition. For instance, a high level of homocysteine has been identified as a risk factor for dementia and Alzheimer’s (Seshadri et al., 2002); homocysteine, however, can be reduced by increasing the intake of folate and B vitamins. The U.S. government’s recent requirement for the addition of folic acid to a number of foods could serve to reduce the level of homocysteine and the consequence of cognitive impairment for succeeding generations of older persons. Levels of antioxidants have also been related to the onset of cognitive impairment (Schmidt, Hayn, Fazelas, Kapeller, & Esterbauer, 1996). It may be possible to change the population level of antioxidants with dietary changes and/or supplementation; clinical trials on the effects of antioxidants and vitamins on cognitive decline are also in process.

Although currently approved drugs for cognitive impairment have fairly modest effects, a number of drugs are currently undergoing clinical trials, and some of these are likely to provide greater delay in the progression of this condition than exists at present. Earlier diagnosis of Alzheimer’s disease using new imaging techniques may allow identification of those who should undertake treatment in the future (Albert, 2002; Killiany et al., 2000). It is also possible to identify those genetically at risk for Alzheimer’s and to begin prevention and treatment measures as they become available. Finally, there are a number of behavioral interventions that are currently being tested as mechanisms for retaining cognitive ability, including cognitively stimulating activity (Wilson et al., 2002) and physical exercise. Eventually, vaccination against Alzheimer’s may be possible, because this approach has been successful in mice (Weiner et al., 2000). This would reduce both the prevalence and years lived with cognitive impairment to zero, which is the ultimate goal. In the meantime, our analyses demonstrate the importance of continuing to work to delay onset and progression of cognitive impairment that is now present in one-fourth of the years lived after age 85.

Our analysis does have some limitations. Our estimates of prevalence are based on combining unlike measures for self- and proxy respondents. Although this approach is used in most studies attempting to estimate population levels of impairment, the validity of combining two different measures requires further study. In addition, our estimates of the length of life with cognitive impairment are based on cross-sectional estimates of the prevalence of cognitive impairment. This approach uses information about cognitive impairment over lifetime rather than limiting analysis to recent onset of impairment as an incidence study would. Whereas current prevalence accurately represents current population characteristics, if there have been major changes in the incidence of cognitive impairment over time, the life expectancy estimates may differ from those that would represent current conditions. Finally, the Sullivan approach provides only population averages without any indications of the variability across the population. It does not clarify how many people ever experience cognitive impairment before dying, what the distribution of the length of cognitive impairment is across the population, or how different life expectancy is for those with and without cognitive impairment. All of these questions can be addressed with longitudinal data and life table estimates derived from multistate methods. Future research should attempt to use these methods to estimate cognitively impaired life expectancy.

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