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The Value of Delaying Alzheimer's Disease Onset

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Abstract

Alzheimer's disease (AD) extracts a heavy societal toll. The value of medical advances that delay onset of AD could be significant. Using data from nationally representative samples from the Health and Retirement Study (1998–2008) and Aging Demographics and Memory Study (2001–2009), we estimate the prevalence and incidence of AD and the formal and informal health care costs associated with it. We use microsimulation to project future prevalence and costs of AD under different treatment scenarios. We find from 2010 to 2050, the number of individuals ages 70+ with AD increases 153%, from 3.6 to 9.1 million, and annual costs increase from $307 billion ($181B formal, $126B informal costs) to $1.5 trillion. 2010 annual per person costs were $71,303 and double by 2050. Medicare and Medicaid are paying 75% of formal costs. Medical advances that delay onset of AD for 5 years result in 41% lower prevalence and 40% lower cost of AD in 2050. For one cohort of older individuals, who would go on to acquire AD, a 5-year delay leads to 2.7 additional life years (about 5 AD-free), slightly higher formal care costs due to longer life but lower informal care costs for a total value of $511,208 per person. We find Medical advances delaying onset of AD generate significant economic and longevity benefits. The findings inform clinicians, policymakers, businesses and the public about the value of prevention, diagnosis, and treatment of AD.

Keywords

Alzheimer's disease; Medicare; medical expenditures; medical innovation

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1 Introduction

Alzheimer's disease (AD) extracts a heavy toll. Individuals with the disease experience cognitive impairment and need help with basic activities of daily living (ADLs) such as bathing, eating, and dressing. The impaired mobility increases susceptibility to infections such as pneumonia. Furthermore, the disease poses a burden on family members as well. These primary caregivers – a large cross-section of society – provide unpaid assistance and experience reduced quality of life and, in some cases, mental illness (Caspi et al. 2003; Schulz and Martire 2004). The potential social value of interventions that could delay onset of the disease, therefore, could be significant (Butler and Brody 1995).[1]

The scientific community is cautiously optimistic about developing treatments that will significantly delay or even stop AD. A growing understanding of how the disease interferes with brain processes is leading to AD treatments that disrupt the disease process. New treatments focus on immunizing the body against beta-amyloid clumping into plaques and blocking its production. Other research is looking to ways to prevent tau from forming tangles and treating brain cell inflammation using nonsterioidal anti-inflamatory drugs. As of yet, these new therapies have not confirmed their ability to prevent or delay AD but clinical trials for a host of new treatments are underway and brain-imaging technology in combination with drug therapy is increasing our understanding of the efficacy of drug treatment.[2]

Addressing the economic and social costs of AD only increases in urgency as the Baby Boom generation ages and life expectancy continues to increase. According to the US Census, in 2012, 40.3 million Americans were 65 and older, constituting 13% of the population. By 2050, that number will more than double, to 88.5 million, constituting 20% of the population.

Available data and a host of "unknowns" complicate measuring the long-term economic impact of AD and the value of potential interventions to halt the advance of AD. Estimates of prevalence of AD and other dementias vary widely owing to differences in (nonrepresentative) study samples, disease definitions, and methods of diagnosis and identification (Ostbye et al. 2008; Plassman et al. 2008; Taylor et al. 2009; Brookmeyer et al. 2011; Wilson et al. 2011; Hebert et al. 2013). Furthermore, estimates of the costs of caring for AD and dementia patients vary substantially, with some estimates more than 17 times as high as others (Bloom et al. 2003; Lin and Neumann 2013). The informal costs to caregivers and others are not often computed, and their reliability is also open to question. Add to these other unknowns, such as policy changes affecting payer reimbursement rates or medical innovations in the detection, diagnosis, and treatment of the disease (Hurd et al. 2013).[3]

[1]Reducing the staggering social and economic cost of disease by postponing disease and preventing diseases associated with growing older is exceptionally well-described an edited volume, Butler and Brody 1995.

[2]A new trial that begun May 2014 at the Cleveland Clinic uses fMRI in combination with an AD drug therapy (Donepezil) to better understand how the drug acts on the brain.

[3]A study by Hurd et al. (2013) on the cost of dementia addresses some of the limitations of prior cost estimates through use of nationally representative data and high quality diagnosis measures but the study results are not suited for understanding the impact on Medicare and Medicaid expenditure of policy change or the impact on cost of future medical and pharmaceutical innovations in the detection, diagnosis, and treatment of the disease.

In this study, we use a sophisticated simulation to estimate future prevalence of AD and formal and informal costs associated with it given trends in demographics and health conditions. We then quantify the costs savings and reductions in AD prevalence from medical advances that delay onset of AD and calculate the value to individuals. A key advance of this study is the use of nationally representative data, reliable measures of cognition and diagnoses of AD, high-quality data on both formal and informal costs, and use of a microsimulation model of individuals – rather than synthetic cohorts – to identify variance in outcomes.

2 Methods

Primary data sources are the Health and Retirement Study (HRS) and the Aging, Demographics, and Memory Study (ADAMS). HRS is a nationally representative biannual survey of the health, cognition, disability, work and economic status of more than 26,000 Americans age 50 and older conducted since 1992 and ongoing. ADAMS is an in-person, at-home, structured assessment of dementia among a subsample of HRS respondents ages 70 and older, both community dwelling and living in nursing homes. It was first conducted between 2001 and 2003 with 865 respondents and with three follow-up assessments between 2003 and 2009 (Heeringa et al. 2010).[4] It was designed to create national estimates of dementia and AD through a detailed neuropsychological and clinical assessment, and by using of a complex sample design that can be weighted to represent the national population (Bloom et al. 2003; Langa et al. 2005). We also use the 2002–2004 Medicare Current Beneficiary Survey (MCBS) to estimate formal medical spending.

2.1 Microsimulation

We project prevalence of AD and associated formal and informal costs over the next four decades using the Future Elderly Model (FEM) (Goldman et al. 2005). The FEM is a simulation model that projects the health and economic outcomes of individuals using longitudinal data from HRS and incorporating trends in health, education, and demographic characteristics of future cohorts. The multivariate models of cognitive status, AD, disease conditions (e.g., hypertension), disability, mortality, nursing home entrance, caregiving, medical care costs and economic outcomes take as inputs risk factors such as smoking, weight, age, self-reported race and ethnicity, marital status and education, along with prior wave health and financial states. Empirical specification for each model is based on extensive literature review and expert input. Further details on the empirical model and estimates are given below. An appendix contains model detail and estimation results of models of key outcomes: cognitive status, AD, medical care costs and informal caregiving hours.

[4]A sample of 1770 respondents, aged 70 years and older, both community dwelling and living in nursing homes, were selected on the basis of cognitive performance in the HRS on the wave before interview. Those with poor cognitive function were oversampled. From this selected group, 28% refused to participate in ADAMS, 13% were deceased, 3% could not be contacted, and 7% had other reasons for non-participation. This resulted in 856 completed assessments or a 56% participation rate among the non-deceased eligible for ADAMS. Extensive analysis demonstrated no relationship between nonresponse and cognitive status and sampling weights correct for both the selection rules and nonresponse. See Heeringa et al. (2010).

Cognitive functioning of HRS respondents 65 and older is assessed at each wave using an adapted version of the Telephone Interview for Cognitive Status (TICS) or is provided by a proxy respondent, typically a spouse or other family member. We assign cognitive state based on scores from the assessments and find in 2004, 10.1% are demented, 20.4% are cognitively impaired but not demented, and 69.5% are non-care or normal (Ofstedal et al. 2005; Fisher et al. 2013).[5,6] ADAMS data provide 33 diagnoses. We follow Plassman et al. and use both probable and possible AD (Plassman et al. 2007). In the first wave of ADAMS, 9.5% have AD.[7] We use ADAMS waves A–D to estimate transitions to AD (Bloom et al. 2003).[8] We use empirical estimates from the ADAMS sample to predict the presence and onset over time of AD in the full HRS sample. We assume persons younger than 70 do not have AD.

We model the cognitive state of individuals ages 65 and 66 in the HRS using an ordered probit model. We use these models in the simulation as individuals age to 65 and 66 to generate their cognitive state at these ages. Covariates are sex, education, race (non-Hispanic Black, Hispanic, all other races), doctor diagnosed memory-related disease, any difficulty with IADLs, current smoker, has diabetes, ever had a stroke. We find that college education is associated with a higher cognitive state. Being male, Black or Hispanic, having a memory-related disease, having any difficulty with IADLs, smoking, diabetes, and stroke are associated with a lower cognitive state.

We estimate models of transitions to the three cognitive states for those aged 67+ using six waves of HRS data, and we use these models to simulate the cognitive paths of surviving individuals aged 67+. Along with the demographic covariates in the stock model, transition models include age and age squared, and lags of cognitive state, doctor-diagnosed memory-related disease, any difficulty with IADLs, underweight, obese, and whether a smoker. Transition models also include lagged indicators of doctor-diagnosed diabetes, heart disease, stroke, lung disease, and cancer. We find that all disease conditions with the exception of cancer are associated with transitions to a lower cognitive state. Model estimates are presented in appendix tables.

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[5]HRS imputed these measures when missing because they are not randomly missing, but tend to be missing for the more cognitively impaired. The imputation method is described in Fisher et al. (2013).

[6]We sum score of 3 cognitive assessments (range 0–27): immediate and delayed word recall (0–20); counting down from 100 by 7's test score (0–5); and counting back from 20 (0–20). For proxy interviews, the cognition scale (range 0–11) sums the following: number of instrumental activities of daily living (IADLs) (0–5); interviewer impairment rating (0=no cognitive limitations, 1=some limitations, 2=cognitive limitations); and proxy informant's rating of the respondent's memory (from 0 [excellent] to 4 [poor]). Cognition scores range as follows: 0–6=demented, 7–11=mild impairment, no dementia, and 12–27=normal. Proxy scores are as follows: 0–2=normal, 3–5=mild impairment, no dementia, and 6–11=demented. Both proxy and nonproxy scores are combined into one variable. See Ofstedal (2005).

[7]We compared the AD diagnosis with cognitive state, and examined cases that were in unusual cells: AD but normal cognitive state, not AD but demented cognitive state. The comparison is shown below. Only six cases show a normal cognitive state with an AD diagnosis. There are 159 cases with a demented cognitive state without an AD diagnosis, but these could represent other types of dementia, such as vascular dementia. When weighted, among those with a demented cognitive state about half (48%) received an AD diagnosis in the Adams study. Among the 159 cases not diagnosed with AD but rated as demented, 16 received a "normal" diagnosis in Adams while the rest received an Adams diagnosis of non-AD dementia or cognitive impairment. The cognitive state was based on cognition measures rather than the proxy measures for all of the 16 cases.

[8]The time between ADAMS waves varies from one to 6.5 years, and the interviews for each wave are conducted over 2–4 years. Because of these varying times, we used a target date of 2 years prior to the ADAMS assessment to find the HRS core wave to provide the appropriate lagged covariates. We selected the HRS core wave closest to the target date and prior to the ADAMS assessment. We used covariates from the HRS core for the wave identified in this manner as lagged measures in the transition model.

We use logistic regression to model the stock of individuals with AD at ages 70 and older using ADAMS data. We then apply this model to the HRS sample of those aged 70+ to generate the AD status of the initial population. Model covariates are sex, education, race, age and age squared, indicators for cognitive state (demented; cognitive impairment, no dementia; normal), memory-related disease, any IADLs, and hypertension or stroke. The only covariates that are statistically significant and positively correlated with AD are demented or cognitively impaired cognitive state, memory-related disease, and any IADLs. We use ADAMS waves A–D to model transitions to AD (Bloom et al. 2003). To be eligible for a transition, the individual must not have AD at the current wave and must have responded in the subsequent wave (Schulz and Martire 2004). We used a probit model, adjusting standard errors to account for individuals with multiple observations. We include demographics, lagged cognitive state, lagged memory-related disease, and an indicator for hypertension or stroke. As expected, cognitive state is the most significant covariate, with lower state associated with higher probability of AD. Memory-related disease is also associated with greater likelihood of AD. Among the demographic variables, being male is negatively associated with transitioning to AD. None of the other covariates are statistically significant. Model estimates are presented in appendix tables.

We estimate three cost models, one for Medicare, Medicaid, and out-of-pocket spending. We base these estimates on pooled, weighted, least squares regression analyses with spending inflated to constant dollars (using the medical component of the Consumer Price Index). We interpret the spending estimates as the resources consumed by the individual given recent US medical practice. We derive cost estimates from a person's demographics (age, sex, race), education, education and race interactions, marital status, AD, other disease conditions and interactions between them, risk factors, whether living in a nursing home, whether in last year of life and interacted with disease status (including AD), interaction between nursing home status and AD, and functional status. In the case of Medicare and Medicaid costs, we first model take-up of benefits and then costs. Medical expenditures, as expected, are highly correlated with age, disability, and disease, and they are higher for high socio-economic status (SES) individuals than low SES individuals. Costs associated with AD are high, even higher in the last year of life and for those living in a nursing home. Model estimates are presented in appendix tables.

We model informal caregiving hours received as follows: whether the individual receives informal care; if so, we estimate separate models for full time care 365 days a year and the hours provided for all other amounts of reported caregiving hours. We also estimate these models separately for co-resident spousal caregivers and other family caregivers. We find that caregiving is correlated with a respondent's demographic characteristics, SES, AD and other disease conditions, functional status, marital status, number of children, and proximity of children (see appendix tables for model estimates). We convert number of hours of informal caregiving received from co-resident spouses and non-spouse caregivers to a dollar amount by multiplying hours by the average wage rate paid to a home health aide hired through an agency ($21 in 2010) in a given year (replacement rate).[9]

[9]The 2012 MetLife Market Survey of Nursing Home, Assisted Living, Adult Day Services, and Home Care Costs. *Metlife Mature Market Institute*. 2012.

In the FEM simulation, a new cohort of 50 year olds enters the model each year with demographic characteristics, health, and SES reflecting trends observed in younger populations. Using the estimated coefficients from our multivariate models, we project the cognitive state, AD, and all other outcomes of individuals at each point in time. Individuals who survive to the next year are used to calculate outcomes such as AD prevalence and formal and informal costs of AD each year from 2010 to 2050. We simulate the effect on AD prevalence and associated costs of a hypothetical new medical technology that delays the onset of AD by 1, 3, and 5 years. Under these scenarios, only the probability of developing AD changes; the risk of acquiring other diseases remains the same and the likelihood of dying is adjusted by the impact of reduction in the probability of AD. A potential limitation to the accuracy of disease dynamics is that we assume prior period's risk factors and health conditions determine future health, cognition, disability, and mortality (Markov process). We do, however, validate the model using various techniques, including comparing model results from early years with actual data available for later years.

3 Results

Figure 1 makes clear the coming dramatic rise in number of Americans with AD. From 2010 to 2030, we project a 61% increase in the number of individuals ages 70+ with AD, from 3.6 to 5.8 million. Between 2030 and 2050, the number of individuals 70+ is projected to rise an additional 57%, to 9.1 million. Increases in longevity coupled with population aging contribute to a striking increase in the number of the "oldest old" (those 85 and older) with AD. Between 2010 and 2050, this population will increase by 187%, or from 1.5 to 4.3 million.

Figure 1 also shows the projected effect on AD prevalence of delaying AD onset by 1, 3, and 5 years. A delay of AD onset by 1 year reduces the population aged 70+ with AD in 2030 from 5.8 (status quo) to 4.7 million, and in 2050 from 9.1 to 7.8 million. A delayed onset of 5 years reduces the AD population in 2050 to 5.4 million, or a 41% decline from what it would have been in 2050 without delayed onset (the status quo) and below the projections for 2030 (5.8 million).

Table 1 shows the estimates of annual per-person costs for individuals aged 70+ with and without AD in the years 2010, 2030 and 2050 (in 2010 dollars). It also presents costs by payer. Estimated annual per capita formal costs in 2010 are $42,074 for an individual over age 70 with AD. That is $26,666 higher than average per capita spending for individuals without AD at that age. Of the total, $17,444 is spending by Medicare, $14,186 is spending by Medicaid, and $10,444 is out-of-pocket expenditures. The annual per person value of informal home care in 2010 was $29,229 for those with AD and $2965 for those without AD. In 2010, the total formal and informal annual cost per person attributable to AD was $71,303. By 2050, total formal costs per person with AD would more than double to $106,389. In contrast, total costs in 2050 per person without AD would be $37,670. In 2050, approximately 75% of total formal costs are attributed to Medicare and Medicaid and 25% to out-of-pocket costs. By 2050, total formal and informal costs per person with AD are estimated to be $140,012.

Table 2 shows the costs of AD to the US economy. The increases in AD costs over time reflect changes in the size of the population with AD and increases in prevalence rates owing to changes in health, such as the higher rates of vascular disease in younger cohorts, and a growing Hispanic population, who for example are more likely to rely on informal caregiving, as well as growth in the cost of medical care. Annual formal and informal costs of individuals aged 70+ with AD were $307 billion in 2010, including $181 billion in formal costs and $126 billion in informal costs. By 2030, total costs are projected to rise to $624 billion, and to $1.5 trillion by 2050.

Table 2 also shows results for the impact of delaying AD. A 1-year delay reduces formal costs in 2030 by $70 billion and informal costs by $43 billion, which are a 17% reduction in formal costs and a 20% reduction in informal costs compared with the status quo. By 2050, a 1-year delay saves $219 billion, or a 15% reduction in total costs relative to the status quo. Three and 5-year delays result in projected savings of $415 billion and $599 billion, respectively, by 2050. In the 5-year scenario, total costs in 2050 are projected to be $902 billion with significant formal (39%) and informal cost savings (43%) relative to the status quo.

Table 3 shows the effect of a new medical or pharmaceutical innovation that delays the onset of AD in a representative cohort of 70–74 year olds who will acquire AD at some point in the remaining years of life. Under the status quo of no innovation, the average person can expect to live 15.6 more years, 9.8 of which will be without AD, on average. Nearly 2 years will be spent in a nursing home. In the 1-, 3-, and 5-year delay scenarios, AD prevalence for this cohort would be reduced from 100% to 89%, 79%, and 69%, respectively. For this cohort, conditional on being alive at age 70, a medical or pharmaceutical innovation that delays AD onset for 5 years would add 2.7 more years of life. There is a 3-month reduction in time spent in a nursing home.

Table 3 also summarizes the cost implications of the three delay scenarios. Remaining lifetime spending on formal care is 3.6% higher for those experiencing a 5-year delay in AD onset compared with the status quo, and informal costs are 23% lower. These changes reflect both greater longevity associated with delayed onset of AD and fewer years with AD and thus less need for informal care. The decline in informal care costs does not take into account the benefit to caregivers, which could be substantial. Lifetime total costs (formal and informal) are reduced. Moreover, if we value the AD-free life-year conservatively at $100,000 and calculate a per person economic gain plus the gain from reduction in informal costs minus the increases in formal costs, the result is an economic gain of $183,227 for a 1-year delay, $355,222 for the 3-year delay, and $511,208 for a 5-year delay. Although these results do not take into account the cost of the intervention, the economic gain demonstrates that the intervention is highly valuable for an individual.

4 Discussion and Conclusion

Our projections suggest that from 2010 to 2050, the number of individuals aged 70 and older with AD will increase 153%, from 3.6 to 9.1 million. Annual formal and informal costs for those individuals will increase to $1.5 trillion by 2050, up from $307 billion in 2010 ($181

billion in formal costs and $126 billion in informal costs). In 2010, annual per person total costs of AD were $71,303 and will almost double by 2050. About 75% of the formal costs are attributed to Medicare and Medicaid.

A medical or pharmaceutical innovation that delays the onset of AD for 5 years would result in a 41% lower prevalence of AD in 2050 among those aged 70+ than if onset had not been delayed, and a reduction in societal costs of about 40%. Delaying AD by 5 years leads to 2.7 additional years of life, and 4.8 additional AD-free years for an individual who would have acquired AD, and is worth over $500,000.

Our projected future prevalence of AD is high, but it is substantially lower than frequently cited estimates by the Alzheimer's Association, whose estimates are typically higher than other prevalence estimates based on nationally representative data (Wilson et al. 2011). Our findings of total costs to society, however, are higher than recent estimates of costs attributed to dementia reported in Hurd et al. also based on HRS and ADAMS data. They rely on self-reported out-of-pocket expenditures and utilization from the HRS and while the quality of these data is generally good, there is substantial non-response in some categories of spending (Goldman et al. 2011; Lin and Neumann 2013). Another difference is we value costs of persons with AD, not costs attributed to dementia. Furthermore, we estimate future prevalence of AD that adjusts for the increasing prevalence of cardiovascular and other disease associated with AD and the increasing proportion of Hispanics over time – a group with higher rates of AD.

As Americans live longer, the landscape of disease and associated medical costs will change dramatically. Recognizing the role of AD in the landscape, President Barack Obama signed into law the National Alzheimer's Project Act (NAPA) in 2011, following up with a historic $156 million investment to tackle AD and immediately increasing AD research funding. Since then additional resources each year have been dedicated to advancing the goals of NAPA. The President's fiscal year 2014 budget proposal includes $100 million in additional funding in support of the plan – $80 million dedicated for research. Yet $80 million is just 0.03% of the $307 billion in total cost to society of AD in 2010.

The Federal Drug Administration has approved several drugs that halt or slow the advancing symptoms of AD for about 6–12 months on average. However, the number of pharmaceutical companies developing new drugs is growing quickly. The experimental drug solanezumab is the focus of a new clinical trial to find out if this new drug therapy can delay AD onset. The focus of these more recent therapies is on altering disease process rather than treating symptoms. To accelerate discovery, an alliance of pharmaceutical companies, nonprofit foundations and government advisors have forged a partnership to share data from AD clinical trials – the Coalition Against Major Diseases (CAMD). This alliance will share data from more than 4000 study participants and is expected to speed the development of more effective therapies. Researchers have discovered a new drug compound that inhibits the negative effects of a protein key to regulation of learning and memory and was found to reverse the effects of AD in mice. Although, not yet tested in human clinical trials, it nevertheless moves AD research forward (Xu et al. 2014). Other trials are focusing on health behavior interventions such as healthier diets and increased exercise to lower blood pressure

that may lead to lower risks of AD. Future interventions that delay or slow AD by 3 or 5 years are becoming increasingly probable.

Physicians are able to now identify individuals at earlier stages of AD, which may also aid in delaying the disease's onset. Earlier diagnosis and treatment may increase costs, especially if early diagnosis relies on expensive neuroimaging technologies and chemical biomarkers. Moreover, it will identify a greater number of individuals and treatment will be over a longer period of time. Who will bear these costs will also be a matter for policy and the public to decide. Our tool can help others measure and compare the cost of intervention.

This research provides an important advance in estimating reliable projections of AD and its formal and informal cost and who is paying for those expenditures over the coming decades. Promoting health and preventing AD is the responsibility of individuals and society. Individuals can adopt healthy behaviors that may lower the risk of acquiring AD. As a society, we must educate the public, support biomedical research and support and elect officials who will work toward public health goals. This research showing that the economic consequences of not preventing or postponing AD are staggering can be used to educate the public and policymakers on the value of delaying AD and the costs of not doing so. While the ultimate goal of therapies for AD is to cure individuals, this research illustrates that more readily available and likely treatments can prove to be extremely valuable to individuals through more AD-free years of life, to their caregivers through lower caregiving demands and to society as a whole.

This research is important for considering whether the current level of investment in AD research is sufficient and suggests that it may not be. Future research can use the modeling infrastructure we developed to compare the cost and value of interventions that decrease chronic diseases that are associated with AD such as hypertension. How valuable is it to make investments based on already known treatments that reduce incidence of chronic diseases associated with AD? How does that compare with the cost and value of directly treating AD? It may also be used to better understand the costs and value of early detection of elevated risk of AD and early treatment – even if some treated would never go on to acquire AD in the absence of treatment – as compared to the value of treatment after AD symptoms appear. The findings are important to inform clinicians, policy makers, businesses and the public about the value of prevention, diagnosis, and treatment of Alzheimer's disease.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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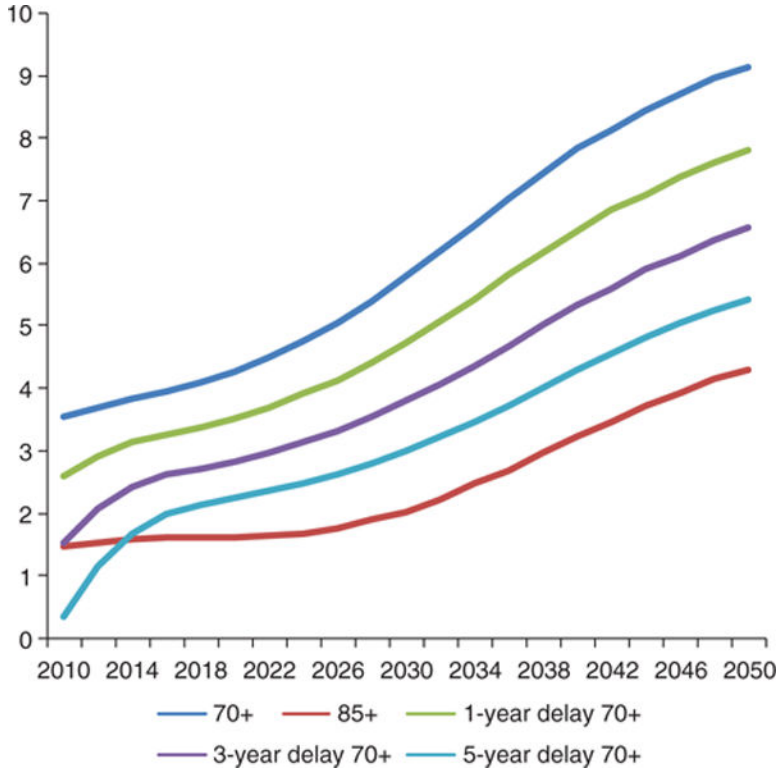

Figure 1.
Number Of Americans (in Millions) With AD 2010 To 2050 For Ages 70+ and 85+ And 1, 3 And 5 Year Delay In Onset Scenarios.

Table 1

Per Capita Annual Costs Of Person Ages 70+ With and Without AD, 2010–2050 (2010 Dollars).

	Individuals without AD			Individuals with AD		
	2010	**2030**	**2050**	**2010**	**2030**	**2050**
Formal care						
Medicare	10,904	16,143	27,000	17,444	25,576	41,914
Medicaid	1700	1949	3772	14,186	19,421	37,980
OOP	2804	4129	6898	10,444	15,319	26,495
Total care costs						
Formal care	15,408	22,220	37,670	42,074	60,316	106,389
Informal care	2965	2563	3498	29,229	31,744	33,623
Total	18,374	24,783	41,167	71,303	92,060	140,012

Source: FEM simulation results using data from HRS, ADAMS, and the Medicare Current Beneficiary Survey.

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Table 2

Total Costs Of Person Ages 70+ With AD 2010–2050 For Status Quo and Year (s) Delay In Onset Scenarios (2010 Dollars, Billions).

	Status Quo	1-year delay	3-years delay	5-years delay
2010				
Formal	181	127	76	37
Informal	126	77	25	18
Total	307	204	101	55
2030				
Formal	409	339	277	225
Informal	216	173	138	107
Total	624	512	415	332
2050				
Formal	1140	980	834	697
Informal	361	302,301	251	205
Total	1501	1282	1086	902

Source: FEM simulation results using data from HRS, ADAMS, and the Medicare Current Beneficiary Survey.

Table 3

Per Capita Health Effects, Formal And Informal Costs Of 70–74 Year Olds For Status Quo and Year(s) Delay In Onset Scenarios.

	Status Quo	1-year delay	3-years delay	5-years delay
70–74 year olds with AD at death (%)	100%	89%	79%	69%
Life years				
Remaining	15.6	16.6	17.5	18.3
Without AD	9.8	11.5	13.2	14.6
In a nursing home	1.94	1.81	1.70	1.59
Per Capita Spending Over Remaining Life Years (2010 Dollars)				
Formal ($)	493,837	500,256	507,125	511,558
Informal ($)	218,315	198,797	181,729	168,735
Value of Treatment Total[a] ($)		183,227	355,222	511,208

Source: FEM simulation results using data from HRS, ADAMS, and the Medicare Current Beneficiary Survey.

[a]Value of treatment calculated as the benefit from additional AD-free life years ($100,000 per year) minus the change in formal and informal costs.