

# Financial Presentation of Alzheimer Disease and Related Dementias

Lauren Hersch Nicholas, PhD, MPP; Kenneth M. Langa, MD, PhD; Julie P. W. Bynum, MD, MPH; Joanne W. Hsu, PhD

**IMPORTANCE** Alzheimer disease and related dementias (ADRD), currently incurable neurodegenerative diseases, can threaten patients' financial status owing to memory deficits and changes in risk perception. Deteriorating financial capabilities are among the earliest signs of cognitive decline, but the frequency and extent of adverse financial events before and after diagnosis have not been characterized.

**OBJECTIVES** To describe the financial presentation of ADRD using administrative credit data.

**DESIGN, SETTING, AND PARTICIPANTS** This retrospective secondary data analysis of consumer credit report outcomes from 1999 to 2018 linked to Medicare claims data included 81 364 Medicare beneficiaries living in single-person households.

**EXPOSURES** Occurrence of adverse financial events in those with vs without ADRD diagnosis and time of adverse financial event from ADRD diagnosis.

**MAIN OUTCOMES AND MEASURES** Missed payments on credit accounts (30 or more days late) and subprime credit scores.

**RESULTS** Overall, 54 062 (17 890 [33.1%] men; mean [SD] age, 74 [7.3] years) were never diagnosed with ADRD during the sample period and 27 302 had ADRD for at least 1 quarter of observation (8573 [31.4%] men; mean [SD] age, 79.4 [7.5] years). Single Medicare beneficiaries diagnosed with ADRD were more likely to miss payments on credit accounts as early as 6 years prior to diagnosis compared with demographically similar beneficiaries without ADRD (7.7% vs 7.3%; absolute difference, 0.4 percentage points [pp]; 95% CI, 0.07-0.70) and to develop subprime credit scores 2.5 years prior to diagnosis (8.5% vs 8.1%; absolute difference, 0.38 pp; 95% CI, 0.04-0.72). By the quarter after diagnosis, patients with ADRD remained more likely to miss payments than similar beneficiaries who did not develop ADRD (7.9% vs 6.9%; absolute difference, 1.0 pp; 95% CI, 0.67-1.40) and more likely to have subprime credit scores than those without ADRD (8.2% vs 7.5%; absolute difference, 0.70 pp; 95% CI, 0.34-1.1). Adverse financial events were more common among patients with ADRD in lower-education census tracts. The patterns of adverse events associated with ADRD were unique compared with other medical conditions (eg, glaucoma, hip fracture).

**CONCLUSIONS AND RELEVANCE** Alzheimer disease and related dementias were associated with adverse financial events years prior to clinical diagnosis that become more prevalent after diagnosis and were most common in lower-education census tracts.

*JAMA Intern Med.* 2021;181(2):220-227. doi:10.1001/jamainternmed.2020.6432  
Published online November 30, 2020. Corrected on January 11, 2021.

← Invited Commentary page 227

+ Multimedia

+ Supplemental content

**Author Affiliations:** Johns Hopkins School of Public Health & School of Medicine, Institute for Social Research, Baltimore, Maryland (Nicholas); University of Colorado School of Public Health (Nicholas); Institute for Social Research, University of Michigan Medical School, Ann Arbor, Michigan (Nicholas, Langa); University of Michigan Medical School, Ann Arbor (Langa, Bynum); Institute for Healthcare Policy and Innovation, University of Michigan, Ann Arbor (Langa, Bynum); Veterans Affairs Center for Clinical Management Research, Ann Arbor, Michigan (Langa); Federal Reserve Board of Governors & Howard University, Washington, DC (Hsu); Howard University (Hsu).

**Corresponding Author:** Lauren Hersch Nicholas, PhD, MPP, Johns Hopkins School of Public Health & School of Medicine, 624 N Broadway, Baltimore, MD 21205 (lauren.nicholas@jhu.edu).

About 14.7% of American adults older than 70 years have Alzheimer disease and related dementias (ADRD), neurodegenerative conditions characterized by deteriorating cognitive function that impedes independence in daily activities through deficits in memory and other cognitive domains.<sup>1</sup> Common ADRD symptoms, including memory problems and decreased attention and judgment, frequently impair personal financial management. Erratic bill payments, risky financial decisions, and susceptibility to financial fraud are widely recognized as early indicators of ADRD, though families and physicians often do not detect these behaviors until later in the course of the disease.<sup>2-6</sup> Despite limited research regarding the full extent of dementia-related losses, there have been numerous lay press anecdotes of loved ones first learning of a patient's decline through catastrophic financial events including foreclosure and asset depletion.<sup>7</sup> Cognitively impaired older adults may be particularly vulnerable to financial exploitation, estimated to impact between 3% and 14% of older adults annually.<sup>8,9</sup>

Cognitive impairment often leads patients to overestimate their abilities and continue potentially inappropriate financial roles; 80% of primary financial decision-makers in couples maintain this role after cognitive decline consistent with dementia.<sup>10,11</sup> Self-reported difficulties managing money and poor performance on financial capability tests predict increased risk of dementia.<sup>3,12-14</sup> However, little is known about the overall prevalence and magnitude of ADRD-related financial errors. To date, ADRD studies have typically relied on survey assessment of financial abilities and outcomes in small samples. A 2017 meta-analysis summarizing the literature on financial capabilities and dementia included just 10 studies with a cumulative 1050 participants.<sup>14</sup> The only study, to our knowledge, to examine the effects of ADRD on realized financial outcomes measured in administrative data for a large sample of Medicare beneficiaries found that beneficiaries were less likely to choose the lowest-cost prescription drug plan both before and after a formal diagnosis compared with people without ADRD.<sup>15</sup>

If undiagnosed ADRD leads to costly financial errors, earlier diagnosis could be valuable even without effective treatments or cures. Most Americans routinely use credit products, generating real-time information on borrowing and repayment behavior. Early signs of impaired capabilities may manifest as missing payment on routine bills or inappropriate credit use. We linked administrative health care and demographic data from Medicare, the federal health insurance program for the elderly, to the Federal Reserve Bank of New York/Equifax Consumer Credit Panel (CCP/Equifax) to characterize the financial presentation of ADRD before and after diagnosis.

## Methods

### Data

#### Medicare Claims Data

We obtained Medicare beneficiary summary files and exact address data for a 20% sample of Medicare beneficiaries who were alive for at least part of 2014, including all beneficiaries who had 1 or more claims with a diagnostic code indicating ADRD

### Key Points

**Question** Are Alzheimer disease and related dementias (ADRD) associated with adverse financial outcomes in the years before and after diagnosis?

**Findings** In this cohort study of 81 364 Medicare beneficiaries living in single-person households, those with ADRD were more likely to miss bill payments up to 6 years prior to diagnosis and started to develop subprime credit scores 2.5 years prior to diagnosis compared with those never diagnosed. These negative financial outcomes persisted after ADRD diagnosis, accounted for 10% to 15% of missed payments in our sample, and were more prevalent in census tracts with less college education.

**Meaning** Alzheimer disease and related dementias were associated with adverse financial events starting years prior to clinical diagnosis.

and a comparison group without ADRD.<sup>16</sup> We sampled entire zip codes to observe beneficiaries sharing addresses. We kept beneficiaries in our sample if they joined a Medicare Advantage (MA) plan after developing ADRD. Comparison group beneficiaries were included for all quarters that they were in Fee-for-Service (FFS) Medicare.

We used beneficiaries' last known exact address from the Medicare Vital Status June 2018 file to identify beneficiaries living in single-person households (no other beneficiary at exact address). Single-beneficiary households were best suited to this study because the link between ADRD and financial outcomes is not obscured by an unimpaired spouse taking over financial management.<sup>10</sup> Single-beneficiary households have lower income and wealth than couples on average and may be particularly vulnerable to financial harms from ADRD.

We used previously validated algorithms to identify Medicare beneficiaries with arthritis, glaucoma, myocardial infarction, and hip fracture so that we could determine whether adverse credit outcomes around an ADRD diagnosis were unique to ADRD or were related to hospitalization or deteriorating health more broadly.<sup>17</sup> Sex and race/ethnicity (Black, Hispanic, and other including missing) were based on Medicare administrative reports.

### Federal Reserve Bank of New York/Equifax Consumer Credit Panel

The Federal Reserve Bank of New York/Equifax Consumer Credit Panel (CCP/Equifax) tracks credit files of all individuals residing with a randomly selected 5% sample of the US credit file population from 1999 to present.<sup>18,19</sup> Credit data are primarily collected to inform lending decisions and summarize personal financial characteristics related to borrowing and debt repayment. These data are increasingly used to understand financial predictors and consequences of health events.<sup>20-24</sup> We used 2 key indicators of deteriorating financial self-management. The first is an indicator of payment delinquency, meaning 1 or more accounts at least 30 days past due. These individuals failed to make at least a minimum payment for 2 or more consecutive months. The second is an indicator for subprime credit scores based on the Equifax Risk

Score, a proprietary calculation summarizing a person's predicted risk of defaulting on loans over the next 24 months based on their credit history. Scores below 620 are considered subprime, indicating higher default risk. Our CCP/Equifax sample included all members living in single-person households (based on exact address) in the second quarter of 2018, or the year of their death, and were born before 1947.

### Linked Sample

We linked the Medicare and CCP/Equifax samples using census block, birth month and year, and 2012 to 2015 zip codes. Because creditors may not immediately process death, we used an iterative process to link data sets. We first merged Medicare beneficiaries who were alive in June 2018, living in a single-beneficiary household, and uniquely identified by census block, birth year, and zip code history (N = 5 843 037) to the 1305 711 CCP/Equifax sample members meeting these criteria. We then used CCP/Equifax sample members who did not merge to a beneficiary alive in 2018 who were also present in the data in 2017 as potential matches to Medicare beneficiaries dying in 2017. We repeated this process for beneficiaries dying in 2016, 2015, and 2014. Additional details and a participant flow diagram are available in the eMethods and eFigure 1 in the [Supplement](#) appear online.

The linked analysis sample contained 95 234 unique beneficiaries. We excluded 10 220 beneficiaries who entered an MA plan prior to developing ADRD because claims necessary to identify ADRD are not collected once a beneficiary moves into MA, precluding us from observing health conditions. We excluded 3482 beneficiaries who are diagnosed before 2006 because we lacked their MA enrollment information before diagnosis and could not confirm an exact date. We linked the Medicare dates that a beneficiary first exhibited ADRD and other conditions to the quarterly panel of credit data spanning 1999 to 2018, dropping an additional 168 respondents with no credit activity during the study period. Thus, we observed beneficiaries with ADRD before and after they triggered the algorithm and follow comparison beneficiaries over time to account for other factors affecting financial outcomes among all beneficiaries over time. eTable 1 in the [Supplement](#) describes our data timeline. Our secondary analysis of deidentified administrative data was deemed exempt from review by the Johns Hopkins School of Public Health institutional review board.

### Statistical Analysis

#### Adverse Financial Events and ADRD Diagnosis

We studied adverse credit outcomes before and after an ADRD diagnosis using flexible, nonparametric linear probability models. Similar methods have been used to study economic consequences of health events.<sup>21,22</sup> We estimated the probability that a Medicare beneficiary had a delinquent account at least 30 days past due or subprime credit score as a function of time from ADRD diagnosis. We used quarterly indicator variables spanning 28 quarters (7 years) prior to 16 quarters (4 years) after diagnosis compared with Medicare beneficiaries who never developed ADRD during the study period. We adjusted for beneficiary age, sex, race/ethnicity, average credit score at age 65 years, state of residence to account for geographic differ-

ences in ADRD diagnosis and economic conditions and year and quarter of observation to account for cyclical trends in consumer behavior and shocks affecting all consumers. To better isolate financial complications of ADRD, we controlled for comorbid conditions including diabetes, stroke and transient ischemic attack, hypertension, congestive heart failure, ischemic heart disease, chronic obstructive pulmonary disease, chronic kidney disease, atrial fibrillation, and cancer.<sup>17</sup> Standard errors were clustered at the beneficiary level.

To test whether results were unique to ADRD and not characteristic of aging or illness more broadly, we repeated our analysis using negative control diagnoses. These models examine financial outcomes relative to 2 gradual-onset conditions (arthritis and glaucoma), and 2 acute-onset conditions (myocardial infarction and hip fracture). To test the robustness of our findings, we estimated models that restricted our sample to beneficiaries observed for at least 4 quarters before and after diagnosis, excluded beneficiaries with any MA enrollment, and excluded comorbid health conditions.

Because education can protect against ADRD and more highly educated older adults may have additional resources and better financial literacy that protect against adverse financial events, we also stratified our analysis by education.<sup>25-29</sup> We used 2010 American Community Study data to compare beneficiaries living in census tracts with rates of adults aged 65 years or older with more than a high school education above the median level of 38.8% to those living in census tracts with lower levels of older adult education. Education correlates with other measures of socioeconomic status; 2010 median income among elderly households was \$30 199 in the lower education tracts and \$47 182 in the higher education tracts. All analysis was conducted using Stata statistical software (version 16 MP, StataCorp), with  $P < .05$  considered statistically significant.

## Results

Our matched sample included 5 004 842 quarterly observations from 81 364 Medicare beneficiaries. Overall, 54 062 (17 890 [33.1%] men; mean [SD] age, 74 [7.3] years) were never diagnosed with ADRD during the sample period and 27 302 had ADRD for at least 1 quarter of observation (8573 [31.4%] men; mean [SD] age, 79.4 [7.5] years). In unadjusted comparisons averaging across the entire study period, compared with those never diagnosed with ADRD during our study period (n = 54 062), beneficiaries who developed ADRD (n = 27 302) were similarly likely to miss payments (7.8% vs 7.8%,  $P = .58$ ) and less likely to have subprime credit scores (8.5% versus 9.3%,  $P > .001$ ) (**Table**). The linked sample of single beneficiaries was older, more likely to be female, and had higher rates of chronic conditions than a random sample of Medicare beneficiaries (eTable 2 in the [Supplement](#)).

### Timing of Adverse Credit Events Relative to ADRD

After adjusting for demographic and health characteristics, we found important differences in adverse financial events among Medicare beneficiaries who did vs did not develop ADRD that emerged prior to clinical diagnosis. Beneficiaries who devel-

Table. Average Sample Characteristics by Ever-ADRD Status<sup>a</sup>

Characteristic	ADRD, No. (%)	
	Never (n = 54 062)	Ever (n = 27 302)
Any financial delinquency, mean (SD), %	7.8 (15.9)	7.8 (17.8)
Subprime credit scores, mean (SD), %	9.3 (21.0)	8.5 (21.3)
Equifax risk score, mean (SD)	747 (70.1)	754 (71.1)
Male	18 196 (33.7)	8586 (31.4)
Age, mean (SD), y	74.8 (7.3)	79.4 (7.52)
Black	5226 (9.7)	2701 (9.9)
Hispanic	606 (1.1)	648 (2.4)
Other race	1344 (2.5)	1069 (3.9)
Arthritis ever	29 973 (55.4)	21 130 (77.4)
Cancer ever	8082 (14.9)	5533 (20.3)
Diabetes ever	17 820 (33.0)	13 449 (49.3)
CHF ever	14 363 (26.6)	14 491 (53.1)
Stroke ever	7205 (13.3)	10 263 (37.6)
myocardial infarction ever	2871 (5.3)	2607 (9.6)
Glaucoma ever	13 159 (24.3)	9045 (33.2)
Hip fracture ever	2159 (4.0)	3957 (14.5)

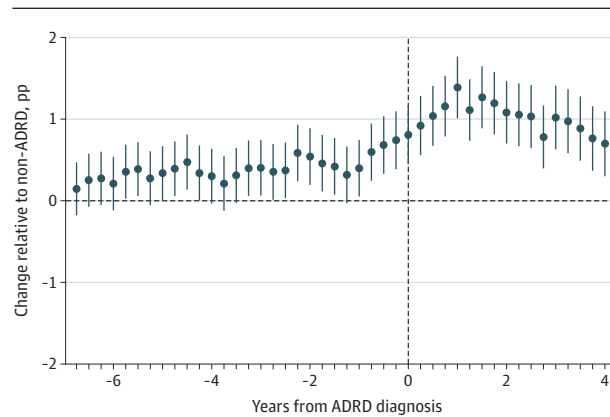
Abbreviations: ADRD, Alzheimer Disease and Related Dementia Status; CHF, congestive heart failure; FRBNY CCP/Equifax, Federal Reserve Bank of New York Consumer Credit Panel/Equifax.

<sup>a</sup> Average characteristics of Medicare beneficiaries who did or did not develop ADRD during our study period (1999-2018). Scores used were the Equifax Risk score, FRBNY CCP/Equifax (credit and age variables) and Medicare Beneficiary Summary File (age, sex, race/ethnicity, and health variables).

oped ADRD were at significantly higher risk of payment delinquency compared with similar beneficiaries who never developed ADRD beginning 6 years prior to diagnosis (7.7% vs 7.3%; absolute difference, 0.4 percentage points [pp]; 95% CI, 0.07-0.7) (Figure 1) (eTable 3 in the Supplement). By the quarter after diagnosis, this absolute difference increased to 1.0 pp (95% CI, 0.7-1.4; 7.9% vs 6.9%). These relationships account for a large share of the overall delinquency rate in our sample; 5.2% at 6 years prior to diagnosis and 17.9% 3 quarters after diagnosis. Similarly, beneficiaries who developed ADRD were more likely to have subprime credit scores starting 2.5 years prior to diagnosis (8.5% vs 8.1%; absolute difference, 0.4 pp; 95% CI, 0.05-0.70), reaching a maximum absolute difference of 1.1 pp (95% CI, 0.7-1.4; 8.4% vs 7.3%) 3 quarters after diagnosis (Figure 2). Beneficiaries with ADRD remained at elevated risk of missed payments and subprime credit scores for at least 3.5 years after diagnosis.

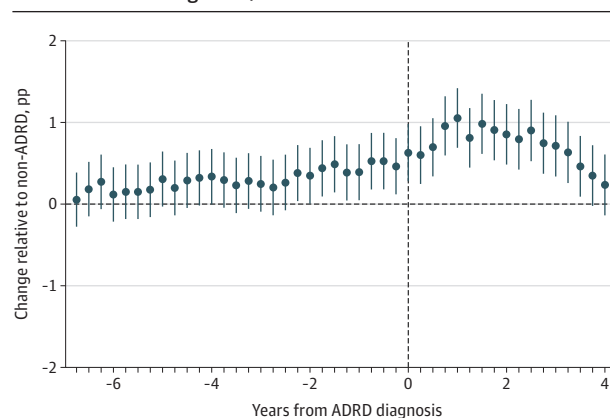
Figure 3, eFigure 2, and eTables 4 to 7 in the Supplement suggest that the increased credit difficulties observed with ADRD are not reflective of a more general problem paying bills related to hospitalization or financial struggles driven by health care costs. There was no evidence of increased delinquency or subprime credit scores prior to diagnosis for arthritis, glaucoma, or hip fracture. Glaucoma was frequently associated with lower risk of missed payments and subprime scores.<sup>30</sup> Incidents of myocardial infarction, which can be caused by financial stress, were preceded by elevated payment delinquency and subprime scores only in the year immediately prior to the event.<sup>31,32</sup>

Figure 1. Change in Proportion With Missed Credit Payments Before and After Alzheimer Disease and Related Dementias (ADRD) Diagnosis Relative to Never Diagnosed, 1999 to 2018



Medicare beneficiaries who eventually developed ADRD experienced higher rates of delinquency than those who never developed ADRD, and these elevated rates were detectable years before diagnosis. Circles are regression coefficients representing the percentage point (pp) increase in payment delinquency at each time point in comparison to payment delinquency rates among Medicare beneficiaries who were never diagnosed with ADRD. The mean rate of missed payment (payment delinquency) was 7.8%. Vertical lines represent 95% CIs. Data sources: Federal Reserve Bank of New York Consumer Credit Panel/Equifax, and Medicare Beneficiary Summary File.

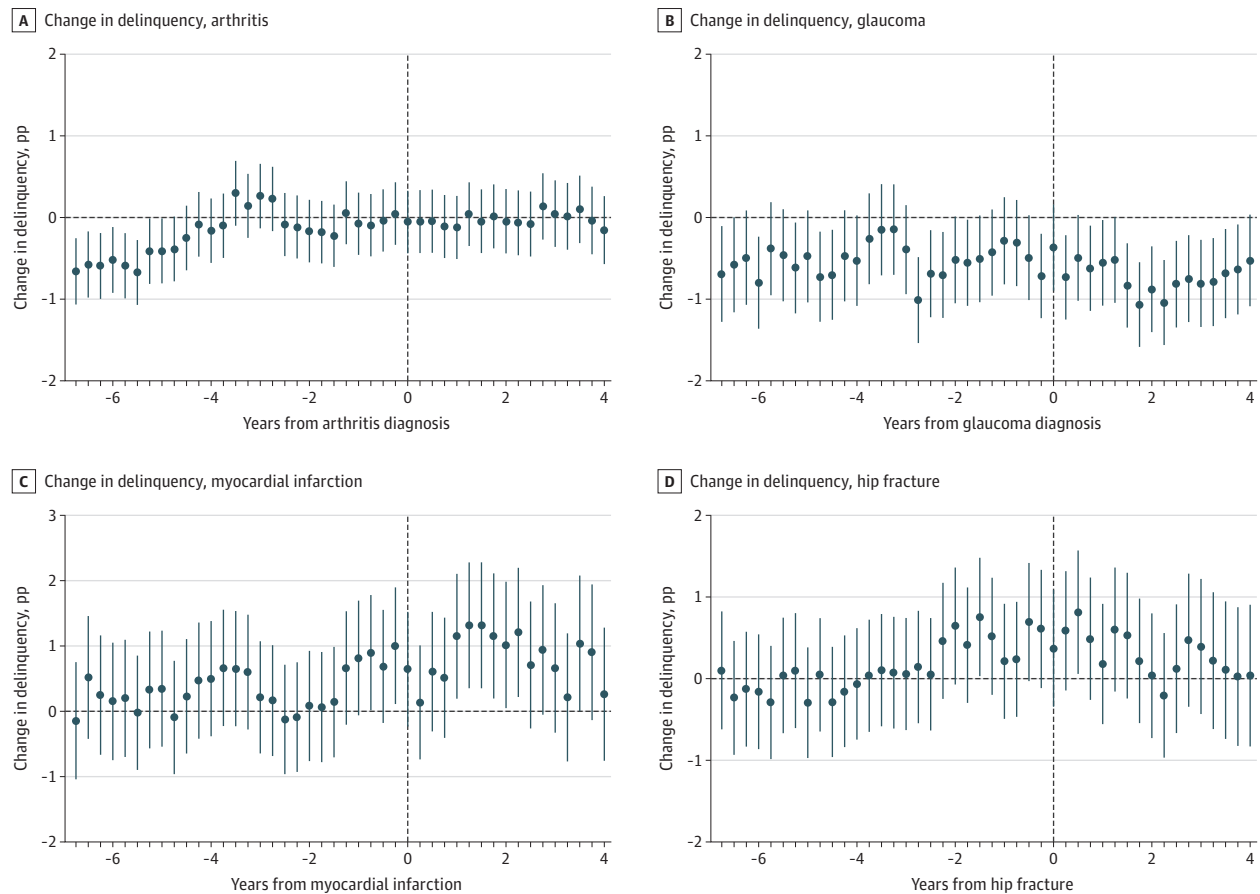
Figure 2. Change in Proportion With Subprime Credit Scores Before and After Alzheimer Disease and Related Dementias (ADRD) Diagnosis Relative to Never Diagnosed, 1999 to 2018



Medicare beneficiaries who eventually developed ADRD experienced higher rates of subprime credit scores (Equifax risk scores) than those who never developed ADRD, and these elevated rates were detectable roughly 2 years before diagnosis. Circles are regression coefficients representing the percentage point (pp) increase in subprime credit scores associated with each time point relative to no ADRD. The mean rate of subprime credit scores in our sample was 9.1%. Vertical lines represent 95% CIs. Data sources: Federal Reserve Bank of New York Consumer Credit Panel/Equifax, and Medicare Beneficiary Summary File.

Increased rates of payment delinquency and subprime credit scores were more prevalent among single Medicare beneficiaries in census tracts with lower levels of educational attainment (Figure 4) (eTables 8 and 9 in the Supplement). Both indicators of impaired financial management emerged years earlier for Medicare beneficiaries eventually diagnosed with ADRD in the lower

**Figure 3. Change in Proportion With Missed Credit Payments Before and After Acute and Chronic Health Conditions Relative to Never-Diagnosed, 1999 to 2018**



In contrast to Alzheimer disease and related dementias (Figure 1 and Figure 2), beneficiaries who developed these acute or chronic health conditions did not exhibit systematically elevated delinquency rates before or after diagnosis. Subprime credit follows a similar pattern (eFigure 2 in the Supplement). Plotted coefficients are regression coefficients representing the percentage point (pp)

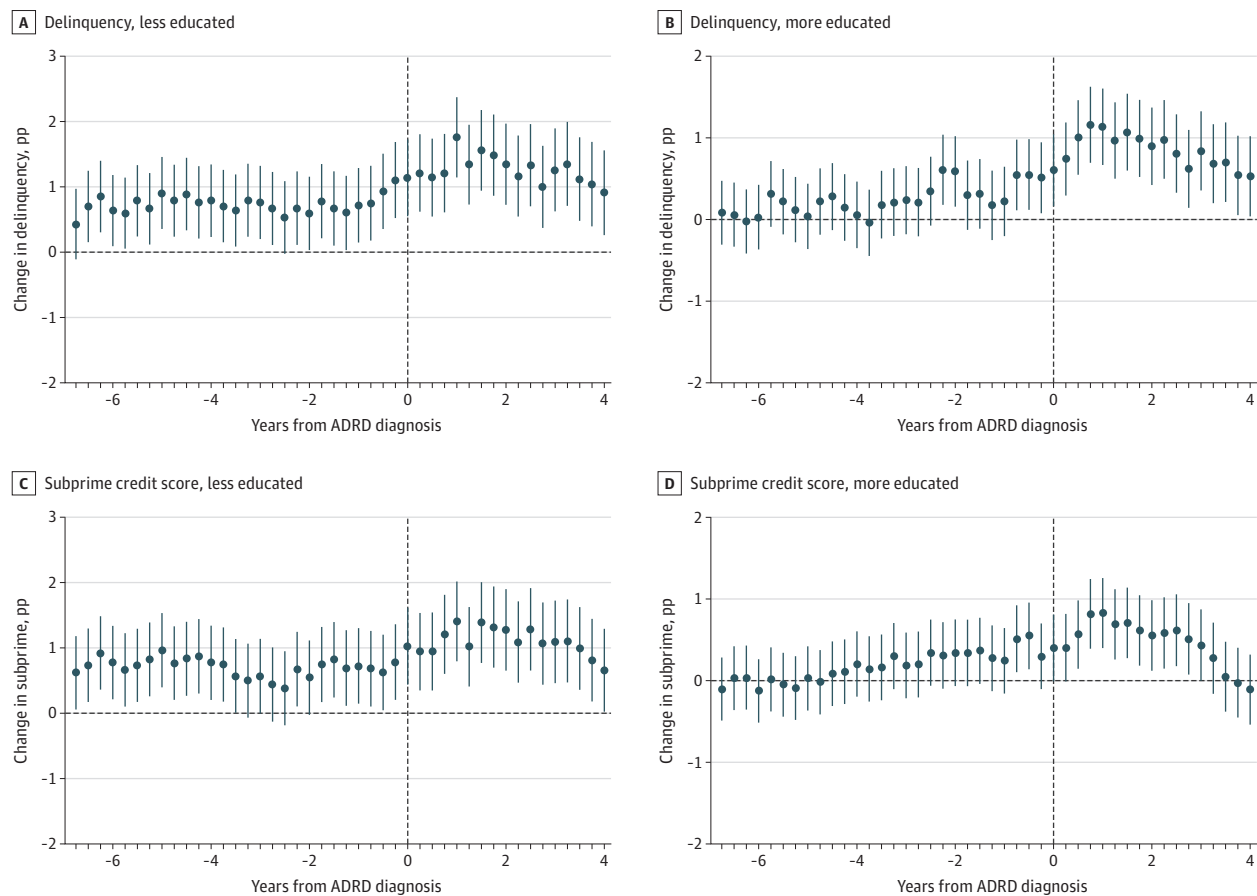
change in rates of missed payments relative to Medicare beneficiaries who were never diagnosed with each of the placebo conditions during the study period. Vertical lines represent 95% CIs. Data sources: Federal Reserve Bank of New York Consumer Credit Panel/Equifax, and Medicare Beneficiary Summary File.

education tracts relative to those in more highly educated tracts and affected a larger share of beneficiaries. Payment delinquency rates were higher for ADRD beneficiaries in the lower education tracts starting almost 7 years prior to diagnosis, compared with 2.5 years prior to diagnosis in the higher education tracts. Coefficients in the lower education models are generally outside the CIs of the higher education models, indicating a significantly larger adverse financial impact of ADRD among beneficiaries in low education census tracts. Our results were robust to sample exclusions including omitting Medicare beneficiaries with any MA enrollment, restricting our sample to a more balanced panel, and limiting the study to 2005 to 2014 when we could also control for Medicaid enrollment. The ADRD coefficients were generally larger in magnitude and more precisely estimated when we did not include controls for any of comorbid health conditions (eFigures 3-6 in the Supplement). There was no relationship between adverse financial events and timing of cancer diagnosis (eFigure 7 in the Supplement).

## Discussion

Using a novel administrative data linkage including 20 years of data on more than 80 000 Medicare beneficiaries in single-person households, we found that a diagnosis of ADRD was associated with higher rates of missed payments and subprime credit scores years prior to diagnosis. The ADRD-linked missed payments and subprime credit scores were sufficiently common to be detected in our population-based study; at their peak representing nearly 20% of missed payments and subprime scores in our sample, and disproportionately affected residents of census tracts with lower levels of college education. Many beneficiaries continued to experience adverse financial outcomes after ADRD diagnosis, suggesting persistent unmet needs managing financial obligations. To our knowledge, these results represent the first large-scale evidence of financial harms related to preclinical and diagnosed ADRD.

**Figure 4. Change in Proportion With Missed Credit Payments and Subprime Credit Scores Before and After Alzheimer Disease and Related Dementias (ADRD) Diagnosis Relative to Never-Diagnosed, 1999 to 2018: More vs Less Education Census Tracts**



Payment delinquency and subprime credit scores (Equifax risk scores) were more common among single Medicare beneficiaries who eventually developed ADRD compared with those who did not in census tracts above and below median education, though a larger share of ADRD beneficiaries in lower education tracts experienced adverse financial outcomes and these difficulties spanned a longer time horizon. Plots show percentage point (pp) change in payment delinquency and subprime credit scores relative to Medicare

beneficiaries never diagnosed with ADRD among Medicare beneficiaries in more educated census tracts (more than 38.8% of adults aged  $\geq 65$  had more than a high school education in the 2010 American Community Survey) compared with less educated census tracts ( $\leq 38.8\%$  of those aged  $\geq 65$  had more than a high school education). Vertical lines indicate 95% CIs. Regression models follow Figure 1 and Figure 2. Our sample averaged 7.8% payment delinquency and 9.1% had subprime credit scores.

The emergence of adverse credit events years before ADRD diagnosis and their persistence after diagnosis have important implications for patient and family financial security. Payment delinquency triggers penalty interest and fees, which we estimate would cost households in our sample \$383 to \$670 in the 4 years prior to dementia diagnosis alone. Credit for subprime borrowers is more difficult and costly to access; compared with those with prime scores, subprime borrowers pay an estimated \$1085 to \$1426 more in credit card interest annually due to higher rates.<sup>33</sup> Credit data do not include utility payments, where nonpayment could result in a loss of service. The extended period between financial indicators of ADRD and its diagnosis raises concerns about catastrophic financial events resulting from preclinical or undiagnosed ADRD for older adults. Rates of adverse financial events continued to increase for single adults after diagnosis, suggesting a role for financial guidance following diagnosis.

Financial difficulties emerged earliest relative to time of ADRD diagnosis for Medicare beneficiaries living in census tracts with lower levels of education. We were unable to determine whether this is due to later ADRD detection, fewer financial resources, or a combination of factors, though both interpretations raise particular concerns about the health and financial well-being of this especially vulnerable population.

These findings add to a growing literature characterizing the links between consumer behavior and underlying health status.<sup>20,24</sup> They suggest that ADRD is associated with adverse financial outcomes even in the prediagnosis stage, raising concern that patients with compromised financial abilities may also be at high risk and susceptible to financial fraud. As the number of older adults living with dementia continues to increase, so does the need to develop policies that protect these patients from the harms of poor financial self-management and financial fraud and abuse. For example, financial institutions could potentially play

a larger role in tracking uncharacteristic transactions and other behaviors consistent with cognitive impairment similar to the data we put together in this study. Tools for screening patients for financial self-management difficulty could be useful to improve detection of dementia in clinical practice.

### Limitations

This study has several limitations. First, our claims-based ADRD metric can only identify Medicare beneficiaries with ADRD if they have a health care claim with the diagnosis.<sup>16,34</sup> Thus, it is likely that our non-ADRD group included patients who truly did not have ADRD and those who were not yet diagnosed or were diagnosed outside of the Medicare-reimbursed care system (for example, at a Veterans Affairs clinic), whereas the ADRD cohort also included false-positive participants. However, Medicare claims generally capture the most severe ADRD cases. We excluded people who entered Medicare Advantage before developing ADRD because their utilization cannot be observed; thus, our study was only representative of FFS Medicare beneficiaries. Medicare Advantage beneficiaries are typically less well-off, and may have different characteristic financial behaviors.<sup>35,36</sup>

We only included people in single-person households at their most recent address, which likely excluded people living in assisted living and other facilities where social support or assistance may be available. Findings may not generalize to married couples and those in group living quarters. However, the most Medicare beneficiaries with ADRD live in single-person households (eAppendix in the Supplement). In addition, the relationship between ADRD and financial outcomes

would be confounded by the presence of a spouse who may be managing finances and studying single beneficiaries highlights this subgroup's particular financial vulnerability. Finally, our payment delinquency measure was limited to consumer debts reported to credit bureaus and excludes accounts such as utilities, rent, and medical collections. Because it is unlikely that ADRD differentially affects payment delinquencies for some types of accounts vs others, this omission leads us to understate financial losses due to dementia but does not bias our comparison of beneficiaries with and without ADRD. We study debts, and lack access to bank and brokerage accounts where signs of financial exploitation might be observed. Data availability could help monitor financial trajectories of patients with ADRD, potentially helping the growing population of the oldest old retain financial independence.

### Conclusions

Medicare beneficiaries in single-person households began to miss bill payments and experience other adverse financial events several years prior to ADRD diagnosis and adverse financial events persist after diagnosis. These findings highlight the important adverse financial consequences of cognitive decline and impairment. Even without effective medical treatments, earlier detection of cognitive impairment might help protect older adults and their families from adverse financial outcomes. Families should be counseled about the potential need to help with financial management following ADRD diagnosis.

#### ARTICLE INFORMATION

**Accepted for Publication:** September 13, 2020.

**Published Online:** November 30, 2020.  
doi:10.1001/jamainternmed.2020.6432

**Author Contributions:** Drs Nicholas and Hsu had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

**Concept and design:** Nicholas, Bynum, Hsu.

**Acquisition, analysis, or interpretation of data:** Nicholas, Langa, Hsu.

**Drafting of the manuscript:** Nicholas, Bynum, Hsu.

**Critical revision of the manuscript for important intellectual content:** All authors.

**Statistical analysis:** Nicholas, Hsu.

**Obtained funding:** Nicholas.

**Administrative, technical, or material support:**

Nicholas, Bynum, Hsu.

**Supervision:** Nicholas, Bynum, Hsu.

**Correction:** This article was corrected on January 11, 2021, to correct an omission in the Conflicts of Interest section.

**Conflict of Interest Disclosures:** Dr Nicholas reported grants from National Institute on Aging and grants from Social Security Administration during the conduct of the study. Dr Langa reported grants from National Institute on Aging, grants from Alzheimer's Association, and personal fees from a law firm for expert witness testimony regarding the impact of Alzheimer's disease on decision-making capacity outside the submitted work. No other disclosures were reported.

**Funding/Support:** We acknowledge funding from the National Institute on Aging (R21 AG053698) and the Social Security Administration (Retirement Research Consortium through the University of Michigan Retirement Research Center Award RRC08098401-10).

**Role of the Funder/Sponsor:** The National Institute on Aging, the Social Security Administration, and the University of Michigan Retirement Research Center had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

**Disclaimer:** The analysis and conclusions set forth are those of the authors and do not indicate concurrence by other members of the research staff or the Board of Governors of the Federal Reserve System, the National Institute on Aging, or the Social Security Administration.

**Additional Contributions:** We thank Micah Baum, BA, Johns Hopkins Bloomberg School of Public Health; Jackie Blair, BA, Federal Reserve Board; and Sasmira Matta, MHS, Johns Hopkins Bloomberg School of Public Health, for assistance with data management for which they received compensation. We appreciate comments from seminar and meeting participants at the American Society of Health Economists, Dartmouth, the Federal Reserve Credit Bureau Data Users' Group, Georgia State University, Hopkins H2LED, the National Bureau of Economic Research Summer

Institute, the RAND Behavioral Finance Forum, and the University of Colorado.

#### REFERENCES

- Alzheimer's Association. 2018 Alzheimer's disease facts and figures. *Alzheimer's & Dementia*. 2018;14(3):367-429. doi:10.1016/j.jalz.2018.02.001
- Boyle PA, Yu L, Wilson RS, Gamble K, Buchman AS, Bennett DA. Poor decision making is a consequence of cognitive decline among older persons without Alzheimer's disease or mild cognitive impairment. *PLoS One*. 2012;7(8):e43647. doi:10.1371/journal.pone.0043647
- Marson DC. Loss of financial competency in dementia: Conceptual and empirical approaches. *Aging, Neuropsychology, and Cognition*. 2001;8(3):164-181. doi:10.1076/janec.8.3.164.827
- Okonkwo OC, Wadley VG, Griffith HR, et al. Awareness of deficits in financial abilities in patients with mild cognitive impairment: going beyond self-informant discrepancy. *Am J Geriatr Psychiatry*. 2008;16(8):650-659. doi:10.1097/JGP.0b013e31817e8a9d
- Widera E, Steenpass V, Marson D, Sudore R. Finances in the older patient with cognitive impairment: "He didn't want me to take over". *JAMA*. 2011;305(7):698-706. doi:10.1001/jama.2011.164
- Spreng RNP, Karlawish J, Marson DCM. Cognitive, social, and neural determinants of diminished decision-making and financial exploitation risk in aging and dementia: A review and new model. *J Elder Abuse Negl*. 2016;28(4-5):320-344. doi:10.1080/08946566.2016.1237918

7. Kolata G. Money Woes Can Be Early Clues to Alzheimer's. *New York Times*. October 31, 2010: 1.
8. Peterson JC, Burnes DP, Caccamise PL, et al. Financial exploitation of older adults: a population-based prevalence study. *J Gen Intern Med*. 2014;29(12):1615-1623. doi:10.1007/s11606-014-2946-2
9. Burnes D, Henderson CR Jr, Sheppard C, Zhao R, Pillemer K, Lachs MS. Prevalence of financial fraud and scams among older adults in the United States: a systematic review and meta-analysis. *Am J Public Health*. 2017;107(8):e13-e21. doi:10.2105/AJPH.2017.303821
10. Hsu JW, Willis R. Dementia risk and financial decision making by older households: the impact of information. *J Hum Cap*. 2013;2013(4):45.
11. Triebel KL, Marson DC. The warning signs of diminished financial capacity in older adults. *Generations-J Am Soc Aging*. 2012;36(2):39-45.
12. Barnes DE, Beiser AS, Lee A, et al. Development and validation of a brief dementia screening indicator for primary care. *Alzheimer's & Dementia*. 2014;10(6):656-665.e651. doi:10.1016/j.jalz.2013.11.006
13. Boyle PA, Yu L, Schneider JA, Wilson RS, Bennett DA. *Scam Awareness Related to Incident Alzheimer Dementia and Mild Cognitive Impairment: A Prospective Cohort Study* Scam Awareness, Alzheimer Dementia, and Mild Cognitive Impairment. 2019. doi:10.7326/M18-2711
14. Sudo FK, Laks J. Financial capacity in dementia: a systematic review. *Aging Ment Health*. 2017;21(7):677-683. doi:10.1080/13607863.2016.1226761
15. Bishop KC, Ketcham JD, Kuminoff NV. *Hazed and Confused: the effect of air pollution on dementia*. National Bureau of Economic Research; 2018. doi:10.3386/w24970
16. Taylor DH Jr, Fillenbaum GG, Ezell ME. The accuracy of medicare claims data in identifying Alzheimer's disease. *J Clin Epidemiol*. 2002;55(9):929-937. doi:10.1016/S0895-4356(02)00452-3
17. CMS Chronic Condition Warehouse. Chronic Condition Algorithms. 2020. Accessed March 1, 2020. <https://www2.cdwdata.org/web/guest/condition-categories>
18. Avery RB, Calem PS, Canner GB, Bostic RW. An Overview of consumer data and credit reporting. *Fed Res Bull*. 2003;89:47.
19. Lee D, Van der Klaauw W. An introduction to the frbny consumer credit panel. FRB of New York Staff Report. 2010(479). Accessed November 2, 2020. [https://www.newyorkfed.org/medialibrary/media/research/staff\\_reports/sr479.pdf](https://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr479.pdf)
20. Dean LT, Nicholas LH. *Using Credit Scores to Understand Predictors and Consequences of Disease*. American Public Health Association; 2018. doi:10.2105/AJPH.2018.304705
21. Dobkin C, Finkelstein A, Kluender R, Notowidigdo MJ. The economic consequences of hospital admissions. *Am Econ Rev*. 2018;108(2):308-352. doi:10.1257/aer.20161038
22. Dobkin C, Finkelstein A, Kluender R, Notowidigdo MJ. Myth and measurement - the case of medical bankruptcies. *N Engl J Med*. 2018;378(12):1076-1078. doi:10.1056/NEJMp1716604
23. Hu L, Kaestner R, Mazumder B, Miller S, Wong A. The effect of the affordable care act Medicaid expansions on financial wellbeing. *J Public Econ*. 2018;163:99-112. doi:10.1016/j.jpubeco.2018.04.009
24. Houle JN, Collins JM, Schmeiser MD. Flu and finances: influenza outbreaks and loan defaults in US cities, 2004-2012. *Am J Public Health*. 2015;105(9):e75-e80. doi:10.2105/AJPH.2015.302671
25. Ott A, Breteler MM, van Harskamp F, et al. Prevalence of Alzheimer's disease and vascular dementia: association with education: the Rotterdam study. *BMJ*. 1995;310(6985):970-973. doi:10.1136/bmj.310.6985.970
26. Stern Y, Gurland B, Tatemichi TK, Tang MX, Wilder D, Mayeux R. Influence of education and occupation on the incidence of Alzheimer's disease. *JAMA*. 1994;271(13):1004-1010. doi:10.1001/jama.1994.03510370056032
27. Stern Y. Cognitive reserve in ageing and Alzheimer's disease. *Lancet Neurol*. 2012;11(11):1006-1012. doi:10.1016/S1474-4422(12)70191-6
28. Card D. Estimating the return to schooling: progress on some persistent econometric problems. *Econometrica*. 2001;69(5):1127-1160. doi:10.1111/1468-0262.00237
29. Lusardi A, Mitchell OS. How ordinary consumers make complex economic decisions: financial literacy and retirement readiness. *Quarterly Journal of Finance*. 2017;7(03):1750008. doi:10.1142/S2010139217500082
30. Ko Y-C, Hwang D-K, Chen W-T, Lee C-C, Liu CJ. Impact of socioeconomic status on the diagnosis of primary open-angle glaucoma and primary angle closure glaucoma: a nationwide population-based study in Taiwan. *PLoS One*. 2016;11(2):e0149698. doi:10.1371/journal.pone.0149698
31. Moran KE, Ommerborn MJ, Blackshear CT, Sims M, Clark CR. Financial stress and risk of coronary heart disease in the Jackson heart study. *Am J Prev Med*. 2019;56(2):224-231. doi:10.1016/j.amepre.2018.09.022
32. Currie J, Tekin E. Is there a link between foreclosure and health? *Am Econ J Econ Policy*. 2015;7(1):63-94. doi:10.1257/pol.20120325
33. Albanesi S, Vamossy DF. Predicting consumer default: A deep learning approach. *arXiv*. 2019:0898-2937. doi:10.3386/w26165
34. Taylor DH Jr, Østbye T, Langa KM, Weir D, Plassman BL. The accuracy of Medicare claims as an epidemiological tool: the case of dementia revisited. *J Alzheimers Dis*. 2009;17(4):807-815. doi:10.3233/JAD-2009-1099
35. Neuman P, Jacobson GA. Medicare advantage checkup. *N Engl J Med*. 2018;379(22):2163-2172. doi:10.1056/NEJMhpr1804089
36. Newhouse JP, McGuire TG. How successful is Medicare Advantage? *Milbank Q*. 2014;92(2):351-394. doi:10.1111/1468-0009.12061

## Invited Commentary

## Desktop Medicine and the Practice of Wealth Care

Jason Karlawish, MD

A fellow geriatrician received an unusual letter from a patient. Enclosed was one of those many forms Medicare sends its beneficiaries, the one with the beguiling header "THIS IS NOT A BILL" and yet, enclosed as well was a check for \$331.00 made out to my colleague.

This patient was paying for a recent visit where the physician had diagnosed her with Alzheimer disease (the dollar value of the check was the Alzheimer disease *International Classification of Diseases, Ninth Revision* code). The disease was quite plainly costing her money. Her error was both a sign of the disease and the need to rally her caregivers to address her failing financial capacity.

In this issue of *JAMA Internal Medicine*, "Financial Presentation of Alzheimer Disease and Related Dementias" reported that, among Medicare beneficiaries diagnosed with Alzheimer disease or Alzheimer disease-related dementias

(AD/ADRD), financial behaviors displayed a distinct pattern.<sup>1</sup> Up to 7 years prior to diagnosis, these patients were more likely than those not diagnosed to miss payments on credit accounts and develop subprime credit scores. These financial problems persisted for at least 3 and one-half years after diagnosis.

The sample of 81 364 patients with and without AD/ADRD came from Medicare billing claims and the financial data from the Federal Reserve Bank of New York/Equifax Consumer Credit Panel. The financial data were payments on credit accounts, most commonly a credit card, and the Equifax Risk Score. The latter, calculated based on a person's credit history, predicts the 2-year risk of defaulting on a loan. Think of it as a kind of financial well-being index created out of behaviors like missing payments on a monthly credit card bill or mortgage. The financial data did not include a person's performance paying bills for utilities, health