Published in final edited form as:

Med Care. 2018 July ; 56(7): 596–602. doi:10.1097/MLR.0000000000000932.

Association of Financial Literacy with Hospitalization in Community-Dwelling Older Adults

Bryan D. James, PhD^{1,2}, Robert S. Wilson, PhD^{1,3,4}, Raj C. Shah, MD^{1,5}, Lei Yu, PhD^{1,3}, Zoe Arvanitakis^{1,3}, David A. Bennett, MD^{1,3}, and Patricia A. Boyle, PhD^{1,4}

¹Rush Alzheimer's Disease Center, Rush University Medical Center, Chicago, IL

²Department of Internal Medicine, Rush University Medical Center, Chicago, IL

³Department of Neurological Sciences, Rush University Medical Center, Chicago, IL

⁴Department of Behavioral Sciences, Rush University Medical Center, Chicago, IL

⁵Department of Family Medicine, Rush University Medical Center, Chicago, IL

Abstract

Background—Lowering the likelihood of hospitalization in older adults is a major public health goal for modern healthcare systems. Emerging data suggest that financial literacy is an important determinant of health outcomes in old age, but the relationship with hospitalization has not been explored.

Objective—To test the hypothesis that better financial literacy is related to lower risk of hospitalization in older persons.

Design—Prospective cohort study.

Participants—Data came from community-dwelling older adults (n=388) without dementia enrolled in the Rush Memory and Aging Project.

Main measures—Participants underwent detailed assessment of financial literacy and cognition. Data on hospitalizations were obtained from linked Medicare claims records (MedPAR file).

Results—Over an average of 1.8 years, 117 participants (30%) were hospitalized, and a third of those hospitalized experienced multiple hospitalizations. In a modified Poisson regression model adjusted for age, sex, education, and cognition, better financial literacy was associated with lower risk of hospitalization. In a model further adjusted for income, physical activity, BMI, smoking,

Corresponding author: Bryan D. James, PhD, Assistant Professor, Rush Alzheimer's Disease Center, 600 S. Paulina Street, Room 1038, Chicago, IL 60612, Phone: (312) 563-2112, Fax: (312) 942-2297, bryan_james@rush.edu. Alternate corresponding author: Patricia A. Boyle, PhD, Associate Professor, Rush Alzheimer's Disease Center, 600 S. Paulina Street, Room 1020B, Chicago, IL 60612, Phone: (312) 942-8749, patricia_boyle@rush.edu.

Prior presentations: A prior version of this work was presented at the Gerontological Society of America 2015 Annual Meeting, Orlando, Florida, USA.

Data availability: In accordance with the Data Use Agreement (DUA) between Rush University Medical Center and the Center for Medicare and Medicaid Services, only named persons on the DUA are granted permission to access Medicare records files. All other data for participants of the Rush Memory and Aging Project is available upon request through the Rush Alzheimer's Disease Center Research Resource Sharing Hub: <https://www.radc.rush.edu/home.htm>

Conflict of interests: The authors declare that they have do not have a conflict of interests.

social network size, chronic conditions, basic and instrumental activities of daily living disability, and depressive symptoms, the association was unchanged. Secondary analyses showed the association was primarily driven by conceptual knowledge rather than numeracy.

Conclusions—Higher financial literacy is related to a lower risk of hospitalization in older persons without dementia, after adjusting for cognitive, health, functional, and socioeconomic factors. The ability to understand and utilize financial concepts may represent a potentially modifiable risk factor for hospitalization in later life.

Introduction

Literacy, the ability to identify, understand, and use pertinent written materials to function optimally in society, is found at low levels in older age groups (1, 2) There is a growing body of evidence that low literacy may pose a threat to the health and well-being of older adults in America.(3-6) Financial literacy—the ability to access, understand, and utilize financial information and concepts (6-8)—is one specific domain of literacy that is essential to maintaining independence and quality of life as we age, especially as the proportion of the lifespan spent post-retirement and living on savings and government subsidies continues to increase. To date, much of the research on financial literacy has focused on financial outcomes such as saving and investment behavior, and planning for retirement;(8-10) however, there is a growing body of literature relating financial literacy to health outcomes, such as self-reported health status, psychological well-being,(11) disability and mental health.(5) One important outcome that has yet to be carefully examined in the context of financial literacy is hospitalization.

While clearly an indicator of health status, hospitalization can be the product of complex decision making processes that involve weighing health benefits against risk of cognitive, psychological, and functional impairments in older patients (12-15), as well as financial considerations. In the long term, these considerations include using financial resources to engage in health promoting behaviors such as eating healthier and exercising, which could reduce risk of hospitalization through better health. Persons with better financial literacy thus may have a lower risk of hospitalization as a result of better health practices over time. In the shorter term, particularly in the case of elective procedures, decisions regarding hospitalization may be influenced by considerations about medical finances, such as whether a procedure is covered by the insurance provider (Medicare, in the case of most older Americans), deductibles and out-of-pocket costs, as well as balancing time away from work and other roles. More financially literate older adults may be better equipped to weigh such financial considerations and their consequences. Thus, whether through improved health or better decision making about medical finances, financial literacy may represent a modifiable risk factor for hospitalization at older ages.

Exploring whether financial literacy may be related to a lower likelihood of hospitalization could have a major public health impact for older adults, as Americans over age 65 make up one-third of all U.S. hospitalizations each year.(16) Further, hospitalizations among older adults are extremely costly to the American healthcare system(17) and one of the goals of the Affordable Care Act is to reduce hospital readmission for older Americans.(18) A small

handful of studies have shown that low health literacy, the ability to read and comprehend basic medical and health-related materials such as prescription bottles,(19) is high amongst hospital patients(20) and related to increased risk for hospitalization.(19, 21, 22) We seek to extend these findings to the domain of financial literacy and examine the relationship between financial literacy and hospitalization prospectively in older persons living in the community.

Methods

Participants in this study were enrolled in the Rush Memory and Aging Project, a longitudinal study of aging that recruits older adults without known dementia at the time of enrollment from more than 40 senior housing facilities and retirement communities in the greater Chicago area, plus individual homes.(23) Participation requires annual clinical evaluation and interview, and organ donation at the time of death. The study was approved by the Institutional Review Board of the Rush University Medical Center and informed consent was obtained from each participant following a review of the risks and benefits of study participation. The request for Medicare records was reviewed and approved by the Center for Medicare and Medicaid Services (CMS) Privacy Board and research identifiable files (RIF) were shared through a signed data use agreement with CMS.

The Rush Memory and Aging Project began in 1997 and enrollment is ongoing. The assessment of financial literacy was added to the Memory and Aging Project battery in 2008. In 2012, Medicare records for the years 1999 to 2010 were requested from CMS for all participants enrolled in the Memory and Aging Project at that time, and were successfully obtained for 85% of all participants, including 667 persons who had completed the financial literacy assessment. Eligibility for these analyses required at least one year of eligible Medicare Part A claims records after a financial literacy assessment, and the absence of dementia at the time of literacy assessment. Of the 667 for which financial literacy and Medicare data were available, 243 were excluded from analyses because they did not have a financial literacy assessment until after their last year of available Medicare data, 21 were excluded because their initial reason for Medicare enrollment was end stage renal disease or early disability (to isolate persons who enrolled in Medicare due reaching age 65 rather than illness), and 15 were excluded because they did not have at least one consecutive 12 month period of Medicare Part A coverage; this left 388 persons eligible for analyses with at least one year of Medicare records after a financial literacy assessment. Of these 388 participants, 83 of them had mild cognitive impairment (MCI) at first literacy assessment and the rest had no overt cognitive impairment.

Assessment of financial literacy

Financial literacy was assessed using a 23-question assessment.(5, 6) Many of the items were derived from the Health and Retirement Survey.(9, 24) These items required the performance of simple calculations (numeracy) or knowledge of financial concepts (e.g., stocks, bonds, and compound interest; i.e., conceptual knowledge). Item format was either multiple choice or true/false, and each item was scored as correct or incorrect. Subscales for conceptual knowledge (12 items) and numeracy (8 items) were created based on the

corresponding items; 3 items were left out of these subscales as they required both numeracy skills and conceptual knowledge (see appendix for items). The 23-item measure of financial literacy evidenced adequate internal consistency (Cronbach's coefficient $\alpha=0.78$); the conceptual knowledge subscale evidenced Cronbach's coefficient $\alpha=0.73$ and the numeracy subscale evidenced Cronbach's coefficient $\alpha=0.53$. In terms of validity, higher financial literacy scores have been associated with better healthcare and financial decision making,(6) more frequent participation in activities, and better cognition, daily functioning, and mental health in prior work from this cohort.(5) The financial literacy assessment tool was originally published as part of a larger literacy assessment instrument, which included questions on health literacy and did not indicate the items specific to each subscale (permission to republish granted by S. Karger AG, Medical and Scientific Publishers, Basel, Switzerland).(6) The health literacy assessment was not added to the Memory and Aging Project battery until 2010 and thus did not overlap with available Medicare records; we therefore were not able to include health literacy in this analysis.

Assessment of hospitalizations using Medicare claims records

Data on hospitalizations came from Medicare Part A beneficiary records obtained from CMS for Memory and Aging Project participants through the Research Data Assistance Center (ResDAC) research identifiable files (RIF) request system.(25) Information on years of Medicare coverage came from the master beneficiary summary file (MSBF), and data on hospitalizations came from the Medicare provider analysis and review (MedPAR) file, which concatenates all claims for a single hospitalization into a single record; multiple hospitalization records for each participant were possible in any year of follow up. A hospitalization in the MedPAR file is defined as any inpatient hospital admission including both overnight stays and discharges on the same day as admission. Hospital admissions were defined as either elective (patient's condition permitted adequate time to schedule the availability of suitable accommodations), urgent (patient required immediate attention for the care and treatment of a physical or mental disorder), or emergency (patient required immediate medical intervention as a result of severe, life threatening, or potentially disabling conditions; generally, admitted through emergency room). For this analysis, urgent and emergency admissions were combined as nonelective hospitalizations.

Cognitive evaluation and clinical diagnoses

Cognitive function was assessed annually via a battery of 21 standard tests, including the Mini Mental State Examination to describe the cohort. The scores for 19 of these tests were z-transformed and then averaged to compute a score for global cognitive function as described in detail previously.(26) Clinical diagnoses of dementia were conducted at each evaluation using a three stage process including computer scoring of neurobehavioral tests, clinical judgment by an experienced neuropsychologist, and diagnostic classification by an experienced clinician, as previously described.(27) Diagnosis of dementia and probable AD followed the criteria of the joint working group of the National Institute of Neurologic and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association.(28) A diagnosis of MCI was rendered for individuals found to have cognitive impairment by the neuropsychologist but who did not meet criteria for dementia.(29)

Other covariates

Income was measured using the show card methodology,(27) in which participants were shown a card with 10 possible categories representing their income and asked to choose the corresponding level, from 1: \$0-\$4999 to 10: >\$75000. Physical activity was assessed using questions adapted from the 1985 Health Interview Survey; as described previously, the variable measures the self-reported sum of hours per week that the participant engages in 5 categories of activities: walking for exercise, gardening or yard work, calisthenics/exercise, bicycle riding (including stationary), swimming/water exercises. (30) Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Smoking (never, former, or current) was assessed by self-report. Social network size is the self-reported number of children, family, and friends seen at least once a month.(31) The number of seven common chronic medical conditions (diabetes mellitus, hypertension, heart disease, cancer, thyroid disease, head injury, and stroke) was assessed via self-report.(30) Difficulties with basic activities of daily living (ADLs) were assessed using a modified version of the Katz Index(32) in which participants rated their ability to perform (no help, help, unable to do) six activities: feeding, bathing, dressing, toileting, transferring, and walking across a small room. Difficulties with instrumental activities of daily living (IADLs) were assessed using items from the Duke Older Americans Resources and Services project (33), in which participants rated their ability to perform (no help, help, unable to do) eight activities: telephone use, meal preparation, money management, medication management, light and heavy housekeeping, shopping, and local travel. Depressive symptoms were measured using a 10-item version of the Center for Epidemiologic Studies of Depression scale.(34)

Statistical analysis

We first examined the distributions of baseline financial literacy and hospitalizations and tested bivariate associations of variables with hospitalization using analysis of variance (ANOVA) and Fisher's exact test statistics. We also examined the correlations of the entire financial literacy scale and the two subscales with each other and with covariates using Pearson, or in the case of ordinal covariates, Spearman correlations; ANOVA was used to examine dichotomous distributions by sex and smoking. To test for an association between financial literacy and hospitalization, we fit modified Poisson regression models with hospitalization over follow-up (yes vs no) as the outcome variable and terms for financial literacy, age, sex, and education. The modified Poisson regression with log link function and robust error variance (sandwich estimation) approach provides a direct estimate of relative risk and valid (i.e. not overly wide) confidence intervals for binary outcomes.(35) To test whether the association was independent of differences in cognitive ability, we then fit a model with an additional term for global cognitive function. To further adjust for the influence of financial resources, health behaviors, and health status, we then fit a single model with additional terms for income, physical activities, BMI, smoking, social network size, chronic medical conditions, basic and instrumental activities of daily living disability, and depressive symptoms. We also report on a model with only covariates chosen through backwards stepwise selection. In a follow-up model that incorporated information on multiple hospitalizations, we fit Poisson regression models with number of hospitalizations as the outcome variable, with terms for financial literacy, as well as all of the covariates.

Secondary analyses were performed to test a number of supporting hypotheses. To ensure that findings were not driven by persons with preclinical dementia, we removed persons with MCI and repeated the model with all covariates described in the previous paragraph. We then examined subscales of financial literacy to determine if numeracy or knowledge of financial concepts and institutions were driving the hypothesized association between financial literacy and hospitalizations. To do this, we replaced the financial literacy score with terms for the numeracy and conceptual knowledge subscales first in separate models and then in a single model, with all covariates. Finally, to test whether there was evidence of a stronger relationship between financial literacy and elective hospitalizations than nonelective hospitalizations, analyses were repeated with each type of hospital admission as the outcome and all covariates. All analyses, including model diagnostics such as tests for collinearity, were performed in SAS 9.4.(36)

Results

The 388 participants had an average of 1.8 (SD=0.7) years of complete Medicare claims records after their initial financial literacy assessment, and 117 (30%) were hospitalized at least once. Of the 117 who were hospitalized, 38 (32%) were hospitalized more than once, with a mean of 1.6 (SD=1.1) hospitalizations (Range: 1-6). The average length of hospital stay was 4.2 (SD=3.7) days. There were a total of 183 hospitalizations over follow-up, and 29 (15.8%) of them were elective admissions. Those who were hospitalized were on average older, had more basic ADL and IADL difficulties, and had lower levels of financial literacy (Table 1).

Participants who were hospitalized scored lower on the conceptual knowledge subscale on average, but not on the numeracy subscale. Correlations between the financial literacy scale and the numeracy and institutional knowledge subscales are presented in Table 2, along with the bivariate correlations with covariates.

We examined the association of financial literacy with hospitalization via modified Poisson regression models adjusted for factors that could potentially influence the association. First, in a model adjusted for demographics (age, sex, and education), better financial literacy was associated with lower risk of hospitalization (Table 3, Model 1). Next, we added a term for global cognitive function. In this model, the association of financial literacy and hospitalization was essentially the same (Table 3, Model 2). To further adjust for financial resources, health behavior, and health status, we added terms for income, physical activities, BMI, smoking, social network size, chronic medical conditions, basic and instrumental activities of daily living disability, and depressive symptoms, to the model; the association was virtually unchanged (Table 3, Model 3). In this fully adjusted model, financial literacy, age, and instrumental disability were the only variables associated with hospitalization. To quantify the association of interest from the fully adjusted model, 1 standard deviation higher financial literacy score (1 S.D.=4.03) was associated with a 35% lower risk of hospitalization compared to the mean (95% C.I.=19% to 48%), which is equivalent to the lower risk of hospitalization associated with being 14.5 years younger in age. Using backwards stepwise regression, the only terms that were significantly associated with hospitalization were financial literacy and IADLs, and the magnitude of the association for

financial literacy was essentially the same (R.R. =0.92, 95% C.I.=0.88 -0.96). In a Poisson model with all covariates in which the count of total hospitalizations was the outcome, the association of financial literacy with risk of hospitalization was similar (R.R.=0.89, 95% C.I.=0.84 -0.94).

In order to determine if results were driven by the inclusion of persons with preclinical dementia, we repeated the analysis with the full financial literacy scale and all covariates after removing 83 persons with diagnosed MCI. The association was virtually unchanged (R.R.=0.90, 95% C.I.=0.84-0.96). To examine whether the association of financial literacy with hospitalizations was driven by one of two key aspects of financial literacy (understanding of financial concepts and institutions and numeracy), we examined the two subscales of financial literacy in separate Poisson regression models with terms for all covariates. The conceptual knowledge subscale was associated with hospitalizations (R.R.=0.87, 95% C.I.=0.80-0.94), while the numeracy subscale showed a trend but was not significantly associated (R.R.=0.89, 95% C.I.=0.78-1.02). When the two subscales were placed in a single model with all covariates, the results were essentially the same (conceptual knowledge R.R.=0.87, 95% C.I.=0.80-0.94; numeracy R.R.=0.88, 95% C.I.=0.76-1.01). Finally, we examined the association of financial literacy with elective hospitalizations as opposed to nonelective (emergency or urgent) hospitalizations. Financial literacy was associated with both types of hospitalization (R.R. for elective hospitalizations=0.81, 95% C.I.=0.68-0.97; R.R. for non-elective hospitalizations=0.90, 95% C.I.=0.85-0.95).

Discussion

To our knowledge, this prospective study of older adults is the first to suggest that better financial literacy is related to lower risk of hospitalization. This association was independent of cognitive function, socioeconomic status, and health factors. Sub-analyses of two key aspects of financial literacy showed that this finding was primarily driven by conceptual knowledge rather than numeracy. There was some evidence that the association was stronger for elective hospitalizations. These findings build on a growing body of research indicating that financial literacy is associated with better health and well-being in old age. Prior work on hospitalizations has largely focused on health literacy, the ability to read and comprehend medical and health-related materials, but present findings indicate that the ability to understand and utilize financial concepts may be also be important to keeping older adults out of the hospital.

Previous studies have shown that financial literacy is associated with health, well-being, and healthcare choices. A survey of British households found that higher financial literacy was associated with better self-reported health and psychological well-being.(11) In a previous study, we showed that lower financial literacy was associated with greater disability, depression, and loneliness.(5) We also found that financial literacy was as strongly associated with healthcare decision making (choosing an optimal health insurance plan) in older persons.(6) Thus, there is precedent for financial literacy being related to more than explicitly monetary situations, although literature on hospitalization outcomes is very limited. One recent study of patients with acute heart failure looked specifically at numeracy

and reported that low numeracy was associated with increased odds of hospital and emergency room recidivism, but the study sample was limited to a specific disease and previously hospitalized patients.(37) A parallel body of literature has examined the role that health literacy plays in hospitalization. One research group found that a high proportion of hospital patients demonstrated illiteracy for health materials(20) and that patients with inadequate health literacy were more likely to report hospitalization in the previous year(21) and twice as likely to be hospitalized prospectively over a two year period.(19) In a small sample of rheumatoid arthritis patients, those with lower literacy had 3 times the number of outpatient visits, though statistical tests were not reported,(38) while a recent study found an inverse association between health literacy and levels of preventable hospitalization at the county level.(22) Taken together, previous literature has demonstrated that financial literacy is associated with health outcomes in older adults, and that functional literacy in specific domains is associated with hospitalization. This study is the first that we are aware of to explore the association of financial literacy with hospitalization in older adults.

Because it is unknown whether the association of financial literacy with hospitalization is general in nature or driven by key aspects of financial literacy, we examined the relationship of numeracy(37) as well as knowledge of financial concepts and institutions, which to our knowledge has not been examined in the context of hospitalization. We found that the conceptual knowledge subscale was associated with hospitalization while the numeracy subscale showed a nonsignificant trend. This may indicate that being familiar with important financial institutions and concepts for living in modern society is as, or more, important to staying out of the hospital than general ability to work with numbers. Conceptual knowledge reflects financially-relevant skills, experiences, and resources gained over the life span, while numeracy is likely more related to current cognitive flexibility and/or general cognitive function. Thus, broad financial knowledge and experience gained over many years may be related to hospitalization in old age, though more research is needed to confirm this. Alternately, we cannot rule out knowledge of financial concepts and institutions being a proxy for experience and familiarity with other institutional entities such as government, education, legal, and the health system. Similarly, we cannot rule out the possibility that conceptual knowledge captures some aspect of affluence or privilege beyond education and income that is related to a lower likelihood of hospitalization.

A number of factors may link financial literacy to hospitalization. First, the association could work through socioeconomic pathways, as higher financial literacy could promote higher socioeconomic status (SES), which in turn may be related to lower likelihood of being hospitalized in older age. However, in our analyses, the association was significant after controlling for education and income. Second, the association could be driven by persons with higher levels of financial literacy experiencing better health status. The findings, however, were essentially unchanged after adjustment for indicators of physical and mental health. Third, problems with financial literacy may be a marker for preclinical cognitive impairments. We controlled for global cognition and conducted a secondary analysis removing persons diagnosed with MCI, and results were unchanged. Financial literacy is a complex ability reflecting lifelong experience, accumulation of knowledge, resources, and adaptations that affects multiple factors related to health, and additional work is needed to determine the basis of the association with hospitalization. One consideration is

that some hospitalizations, particularly elective ones, are not merely indicators of health status but also involve financial considerations such as coverage for procedures, out-of-pocket costs and deductibles, and time off of work. There was some evidence that the association with financial literacy may be stronger for elective hospitalizations, which may suggest that medical decision making and financial considerations may also be important factors to explore further.

This study has a number of strengths and limitations. Strengths include the use of a community-based sample of older adults without dementia who underwent detailed assessment of financial literacy and were followed prospectively rather than a retrospective review of a hospital cohort. The linkage of survey and clinical data with Medicare records provides a robust method to observe all or the majority of hospitalizations for participants within the observation period. In addition, the availability of detailed data on health, SES, and other covariates allowed us to adjust for a number of potential confounders. A limitation is that sufficient data on health literacy was not available, so a direct comparison of the relationships of financial and health literacy with hospitalizations was not feasible. However, health literacy assessment began in 2010, which will allow for this comparison in our future research. The numeracy subscale displayed poor internal consistency and we cannot rule out the possibility that this did not contribute to the findings regarding numeracy. Another limitation is the brief follow-up time of less than two years on average, which did not allow for more complicated modeling of multiple hospitalizations or time-to-event analyses. Hospitalizations that did not involve claims submitted to Medicare would not be observable in this dataset; however, over 90% of the participants in the parent study provided a Medicare ID, and less than 1% reported Veterans Affairs as their primary healthcare service, suggesting that the vast majority of hospitalizations were captured. This dataset does not include data regarding why persons with higher financial literacy were less likely to be hospitalized; namely, whether they were less likely to become sick or less likely to elect to go to the hospital at the same level of sickness. While this analysis controlled for the influence of a number of factors, we cannot rule out unmeasured confounding, especially by socioeconomic factors and health status. Finally, the participants of this study were predominantly white, female, and highly educated, and therefore the results may not be generalizable to other populations of older adults.

These findings are the first that we are aware of to support the notion that the ability to access, understand, and utilize financial concepts may represent a potentially modifiable risk factor associated with a lowered likelihood of being hospitalized in later life. In contexts where it may not be possible to enhance financial literacy, such as populations that are educationally or cognitively challenged, low financial literacy may still serve as an identifier of persons at elevated risk of hospitalization requiring interventions such as added assistance, counseling, or social services. The study serves as proof of principle that financial literacy may be associated with risk of hospitalization. Further work is necessary to further explore the specific pathways underlying this association and to extend the results beyond a well-educated cohort of older persons.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding: This research was supported by National Institute on Aging Grants K01AG050823, R01AG17917, and R01AG033678.

Contributors: We thank the participants of the Memory and Aging Project, and the staff of the Rush Alzheimer's Disease Center. We are indebted to the statisticians at the Alzheimer's Disease Center, especially Rush Woojeong Bang, for help with statistical programming.

Funders: This work was funded by the National Institute on Aging Grants K01AG050823 (James), R01AG17917 (Bennett, James), and R01AG033678 (Boyle, James).

References

1. Kirsch, I., Jungeblut, A., Jenkins, L., et al. Adult Literacy in America: A First Look at the Findings of the National Adult Literacy Survey. 3rd. Washington, DC: National Center for Education Statistics, US Dept of Education; p. 2002
2. Baker DW, Gazmararian JA, Sudano J, et al. The Association Between Age and Health Literacy Among Elderly Persons. The Journals of Gerontology Series B: Psychological Sciences and Social Sciences. 2000; 55:S368–S374.
3. Kutner, M., Greenberg, E., Jin, Y., Paulsen, C. The Health Literacy of America's Adults: Results From the 2003 National Assessment of Adult Literacy (NCES 2006-483). U.S. Department of Education. , editor. Washington, DC: National Center for Education Statistics; 2006.
4. Dewalt DA, Berkman ND, Sheridan S, et al. Literacy and health outcomes: a systematic review of the literature. J Gen Intern Med. 2004; 19:1228–1239. [PubMed: 15610334]
5. Bennett JS, Boyle PA, James BD, et al. Correlates of health and financial literacy in older adults without dementia. BMC geriatrics. 2012; 12:30. [PubMed: 22691341]
6. James BD, Boyle PA, Bennett JS, et al. The Impact of Health and Financial Literacy on Decision Making in Community-Based Older Adults. Gerontology. 2012; 58:531–539. [PubMed: 22739454]
7. Braunstein S, Welch C. Financial Literacy: An Overview of Practice, Research, and Policy. Federal Reserve Bulletin. 2002; 88:445.
8. Lusardi, A., Mitchell, OS. Financial Literacy and Planning: Implications for Retirement Wellbeing. Netherlands Central Bank, Research Department; p. 2006
9. Lusardi A, Mitchell OS. Financial Literacy and Retirement Preparedness: Evidence and Implications for Financial Education. Business Economics. 2007; 42:35–44.
10. Hilgert MA, Hogarth JM, Beverly SG. Household financial management: the connection between knowledge and behavior. Federal Reserve Bulletin. 2003:309–322.
11. Taylor, M., Jenkins, S., Sacker, A. Financial Capability and wellbeing. Evidence from the BHPS. In: Financial Services Authority. , editor. Occasional Paper Series. 2009.
12. Wilson RS, Hebert LE, Scherr PA, et al. Cognitive decline after hospitalization in a community population of older persons. Neurology. 2012; 78:950–956. [PubMed: 22442434]
13. Ehlenbach WJ, Hough CL, Crane PK, et al. Association between acute care and critical illness hospitalization and cognitive function in older adults. JAMA. 2010; 303:763–770. [PubMed: 20179286]
14. Mathews SB, Arnold SE, Epperson CN. Hospitalization and cognitive decline: Can the nature of the relationship be deciphered? Am J Geriatr Psychiatry. 2014; 22:465–480. [PubMed: 23567430]
15. Iwashyna TJ, Ely EW, Smith DM, et al. Long-term cognitive impairment and functional disability among survivors of severe sepsis. JAMA. 2010; 304:1787–1794. [PubMed: 20978258]
16. Wier, LM., Thomson Reuters. Pfuntner, ATR., Steiner, CA. HCUP Statistical Brief # 103. Rockville, MD: Agency for Healthcare Research and Quality; 2010. Hospital Utilization among Oldest Adults, 2008.

17. Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the Medicare fee-for-service program. *N Engl J Med*. 2009; 360:1418–1428. [PubMed: 19339721]
18. Kocher RP, Adashi EY. Hospital readmissions and the Affordable Care Act: paying for coordinated quality care. *JAMA*. 2011; 306:1794–1795. [PubMed: 22028355]
19. Baker DW, Parker RM, Williams MV, et al. Health literacy and the risk of hospital admission. *J Gen Intern Med*. 1998; 13:791–798. [PubMed: 9844076]
20. Williams MV, Parker RM, Baker DW, et al. Inadequate functional health literacy among patients at two public hospitals. *JAMA*. 1995; 274:1677–1682. [PubMed: 7474271]
21. Baker DW, Parker RM, Williams MV, et al. The relationship of patient reading ability to self-reported health and use of health services. *Am J Public Health*. 1997; 87:1027–1030. [PubMed: 9224190]
22. Cimasi, RJ., Sharamitaro, AP., Seiler, RL. Journal of health care finance. 2014. The association between health literacy and preventable hospitalizations in Missouri: implications in an era of reform.
23. Bennett DA, Schneider JA, Buchman AS, et al. Overview and Findings From the Rush Memory and Aging Project. *Curr Alzheimer Res*. 2012; 9:646–663. [PubMed: 22471867]
24. Lusardi A, Mitchell OS. Baby Boomer retirement security: The roles of planning, financial literacy, and housing wealth. *Journal of Monetary Economics*. 2007; 54:205–224.
25. Research Data Assistance Center (ResDAC). [Accessed 3, 2017] Research Identifiable Files (RIF) Requests. Available at: <https://www.resdac.org/cms-data/request/research-identifiable-files>
26. Wilson RS, Barnes LL, Krueger KR, et al. Early and late life cognitive activity and cognitive systems in old age. *J Int Neuropsychol Soc*. 2005; 11:400–407. [PubMed: 16209420]
27. Bennett DA, Schneider JA, Buchman AS, et al. The Rush Memory and Aging Project: study design and baseline characteristics of the study cohort. *Neuroepidemiology*. 2005; 25:163–175. [PubMed: 16103727]
28. McKhann G, Drachman D, Folstein M, et al. Clinical diagnosis of Alzheimer's disease: report of the NINCDS-ADRDA Work Group under the auspices of Department of Health and Human Services Task Force on Alzheimer's Disease. *Neurology*. 1984; 34:939–944. [PubMed: 6610841]
29. Bennett DA, Wilson RS, Schneider JA, et al. Natural history of mild cognitive impairment in older persons. *Neurology*. 2002; 59:198–205. [PubMed: 12136057]
30. Wilson RS, Mendes De Leon CF, Barnes LL, et al. Participation in cognitively stimulating activities and risk of incident Alzheimer disease. *JAMA*. 2002; 287:742–748. [PubMed: 11851541]
31. Bennett DA, Schneider JA, Tang Y, et al. The effect of social networks on the relation between Alzheimer's disease pathology and level of cognitive function in old people: a longitudinal cohort study. *Lancet Neurol*. 2006; 5:406–412. [PubMed: 16632311]
32. Katz S, Akpom CA. A measure of primary sociobiological functions. *Int J Health Serv*. 1976; 6:493–508. [PubMed: 133997]
33. Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. *Gerontologist*. 1969; 9:179–186. [PubMed: 5349366]
34. Radloff L. The CES-D Scale: a self-report depression scale for research in the general population. *Applied Psychological Measurement*. 1977; 1:385–401.
35. Zou G. A modified poisson regression approach to prospective studies with binary data. *Am J Epidemiol*. 2004; 159:702–706. [PubMed: 15033648]
36. SAS Institute Inc. SAS/STAT ® 9.4 User's Guide. Cary, NC: SAS Institute Inc; 2015.
37. McNaughton CD, Collins SP, Kripalani S, et al. Low numeracy is associated with increased odds of 30-day emergency department or hospital recidivism for patients with acute heart failure. *Circulation Heart failure*. 2013; 6:40–46. [PubMed: 23230305]
38. Gordon MM, Hampson R, Capell HA, et al. Illiteracy in rheumatoid arthritis patients as determined by the Rapid Estimate of Adult Literacy in Medicine (REALM) score. *Rheumatology*. 2002; 41:750–754. [PubMed: 12096223]

Table 1
Distribution of financial literacy and other characteristics by hospitalization status

	Hospitalized (n=117)	Not hospitalized (n=271)	p for difference
Financial literacy, mean (SD) Range: 1 – 23	11.1 (3.0)	13.1 (4.3)	<0.001
Numeracy, mean (SD) Range: 1 – 8	5.8 (1.3)	6.0 (1.4)	0.13
Conceptual knowledge, mean (SD) Range: 0 – 12	4.9 (1.9)	6.0 (2.7)	<0.001
Age, years, mean (SD) Range: 66.9 – 100.3	84.4 (5.9)	81.5 (6.9)	<0.001
Female sex, n (%)	91 (77.8%)	200 (73.8%)	0.41
Education, years, mean (SD) Range: 7 – 28	15.1 (2.9)	15.2 (3.2)	0.75
Global cognition score, mean (SD) Range: -1.6 – 1.6	0.20 (0.51)	0.27 (0.54)	0.30
Income *, mean (SD) Range: 1 – 10	6.9 (2.6)	7.2 (2.2)	0.19
Physical activity, hours per week, mean (SD) Range: 0 – 27.3	3.2 (3.1)	3.7 (3.7)	0.17
BMI, mean (SD) Range: 17.7 – 49.6	26.6 (4.8)	27.3 (5.4)	0.27
Smoking (former or current) **, n (%)	48 (41.4%)	109 (40.2%)	0.83
Social networksize, mean (SD) Range: 0 – 54	7.0 (7.1)	7.2 (6.4)	0.78
Medical conditions ***, mean (SD) Range: 0 – 4	0.80 (1.07)	0.75 (0.84)	0.60
Basic activities of daily living (ADL) difficulties, mean (SD) Range: 0 – 5	0.48 (1.15)	0.25 (0.79)	0.023
Instrumental activities of daily living (IADL) difficulties, mean (SD) Range: 0 – 8	1.9 (2.0)	1.0 (1.6)	<0.001
Depressive symptoms (CESD-10 scale score), mean (SD) Range: 0 – 10	1.2 (1.8)	0.9 (1.6)	0.079
Number of hospitalizations, n (%) 1 2+	79 (67.5%) 38 (32.5%)	--	--

* From show card method with 10 levels of income ranging from 1: \$0-\$4999 to 10: >\$75000; only 368 participants provided information on income

** Only 8 participant were current smokers

*** Sum of seven common chronic medical conditions (diabetes mellitus, hypertension, heart disease, cancer, thyroid disease, head injury, and stroke)

Table 2
Correlations of financial literacy scale and subscales with each other and covariates

	Financial literacy	Numeracy	Conceptual knowledge
Numeracy [*]	0.50, <.001	--	--
Conceptual knowledge [*]	0.92, <.001	0.22, <.001	--
Age, years [*]	-0.31, <.001	-0.20, <.001	-0.29, <.001
Sex (means for female, male) ^{***}	(12.0, 13.9) F=16.22, <.001	(5.8, 6.5) F=20.32, <.001	(5.4, 6.5) F=12.79, <.001
Education, years [*]	0.26, <.001	0.36, <.001	0.21, <.001
Global cognition score [*]	0.26, <.001	0.42, <.001	0.20, <.001
Income, 10-level scale [*]	0.26, <.001	0.31, <.001	0.24, <.001
Physical activity, hours per week ^{**}	0.09, 0.075	0.13, 0.010	0.07, 0.16
BMI [*]	-0.02, 0.76	-0.06, 0.25	-0.02, 0.71
Smoking (means for former/current smokers, nonsmokers) ^{***}	(12.7, 12.3) F=0.93, 0.33	(5.9, 6.0) F=0.75, 0.39	(6.0, 5.5) F=3.36, 0.068
Social networksize ^{**}	0.01, 0.93	0.08, 0.11	-0.03, 0.51
Chronic medical conditions, number ^{**}	0.10, 0.04	0.05, 0.30	0.06, 0.25
ADL difficulties, number ^{**}	-0.11, 0.038	-0.12, 0.023	-0.13, 0.0096
IADL difficulties, number ^{**}	-0.25, <.001	-0.27, <.001	-0.21, <.001
Depressive symptoms, CESD-10 score [*]	-0.14, 0.0067	-0.11, 0.032	-0.14, 0.0067
Number of hospitalizations ^{**}	-0.24, <.001	-0.09, 0.089	-0.23, <.001

^{*} Pearson correlation coefficient, p-value

^{**} Spearman correlation coefficient, p-value

^{***} F value from ANOVA, p-value

Table 3
Association of financial literacy and subscales with risk of hospitalization (n=388)

	Model 1, RR (95% CI), p-value	Model 2, RR (95% CI), p-value	Model 3*, RR (95% CI), p-value
Financial literacy, scale range 1-23	0.92 (0.87, 0.96), <0.001	0.91 (0.87, 0.96), <0.001	0.90 (0.85, 0.95), <0.001
Age, years	1.03 (1.01, 1.06), 0.005	1.03 (1.01, 1.06), 0.005	1.03 (1.01, 1.06), 0.029
Sex (male)	0.92 (0.63, 1.35), 0.68	0.94 (0.64, 1.38), 0.76	1.15 (0.78, 1.68), 0.48
Education, years	1.03 (0.98, 1.08), 0.20	1.03 (0.98, 1.08), 0.31	1.02 (0.96, 1.09), 0.43
Global cognitive function, z-score		1.09 (0.81, 1.47), 0.58	1.32 (0.98, 1.78), 0.069
Income (1-10) *			1.00 (0.93, 1.08), 0.97
Physical activity, hours per week			0.99 (0.94, 1.04), 0.64
BMI			0.98 (0.95, 1.01), 0.21
Smoking (former or current)			1.02 (0.75, 1.40), 0.88
Social network size			1.00 (0.98, 1.02), 0.73
Chronic medical conditions, number			1.15 (0.97, 1.35), 0.099
ADL difficulties, number			0.97 (0.81, 1.63), 0.76
IADL difficulties, number			1.18 (1.05, 1.32), 0.006
Depressive symptoms, CESD-10 score			1.06 (0.98, 1.15), 0.16
<u>Subscales</u>			
Conceptual knowledge **	0.87 (0.81, 0.94), <0.001	0.87 (0.81, 0.94), <0.001	0.87 (0.80, 0.94), <0.001
Numeracy **	0.96 (0.86, 1.08), 0.52	0.97 (0.85, 1.09), 0.58	0.89 (0.78, 1.02), 0.10

From modified Poisson regression models with log link function and robust error variance. RR=Relative risk, 95% CI=95% confidence interval

* Model 3 had 365 participants because some individuals did not provide information on their income

** Estimates derived from separate models (not included in model with total financial literacy scale or other subscale); parameter estimates for covariates not shown