

# The Impact of Health and Financial Literacy on Decision Making in Community-Based Older Adults

Bryan D. James<sup>a, b</sup> Patricia A. Boyle<sup>a, c</sup> Jarred S. Bennett<sup>a</sup> David A. Bennett<sup>a, d</sup>

<sup>a</sup>Rush Alzheimer's Disease Center and Departments of <sup>b</sup>Internal Medicine, <sup>c</sup>Behavioral Sciences and

<sup>d</sup>Neurological Sciences, Rush University Medical Center, Chicago, Ill., USA

## Key Words

Financial literacy · Health literacy · Decision making

## Abstract

**Background:** Health and financial literacy have been linked to the health and well-being of older adults, yet there are few data on how health and financial literacy actually impact decision making regarding healthcare and economic choices in advanced age. **Objective:** To examine the association of health and financial literacy with decision making in older adults. **Method:** Data came from 525 community-dwelling older persons without dementia from the Rush Memory and Aging Project, an ongoing longitudinal study of aging. Health and financial literacy were assessed via a series of questions designed to measure comprehension of health and financial information and concepts. The two scores were averaged to yield a total literacy score. A modified, 12-item version of the Decision-Making Competence Assessment Tool was used to measure financial and healthcare decision making (6 items each), using materials designed to approximate those used in real world settings. All 12 items were summed to yield a total decision-making score. Associations were tested via linear regression models adjusted for age, sex and education. Secondary models adjusted for global cognitive function, income, depression and chronic medical conditions. **Results:** On average, participants correctly answered 67% of the literacy questions (health literacy = 61.6%,

SD = 18.8% and financial literacy = 72.5%, SD = 16.0%). After adjustment for cognitive function, the total literacy score was positively associated with the decision-making total score (estimate = 0.64, SE = 0.08,  $p < 0.001$ ), as well as healthcare (estimate = 0.37, SE = 0.5,  $p < 0.001$ ) and financial decision making (estimate = 0.28, SE = 0.05,  $p < 0.001$ ). Further, total literacy, health and financial literacy all were independently associated with decision making in models adjusted for covariates including income, depression, and chronic medical conditions (all  $p$  values  $< 0.001$ ). Finally, there was evidence of effect modification such that the beneficial association between literacy and healthcare decision making was stronger among older persons, poorer persons and persons at the lower ranges of cognitive ability. **Conclusion:** Among community based older persons without dementia, higher levels of health and financial literacy were associated with better decision making, suggesting that improvements in literacy could facilitate better decision making and lead to better health and quality of life in later years.

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## Introduction

Literacy is an important determinant of health and well-being across the lifespan [1–3]. Although originally defined as the ability to read and write, the conceptualization of literacy has evolved to focus more broadly on

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Bryan D. James, PhD  
Rush Alzheimer's Disease Center, Rush University Medical Center  
600 S. Paulina Street, Suite 1038  
Chicago, IL 60612 (USA)  
E-Mail [Bryan\\_James@rush.edu](mailto:Bryan_James@rush.edu)

ability to understand and act on information from diverse sources as needed to function optimally [2]. The United Nations Educational, Scientific and Cultural Organization (UNESCO) defines literacy as 'the ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with varying contexts. Literacy involves a continuum of learning in enabling individuals to achieve their goals, to develop their knowledge and potential, and to participate fully in their community and wider society' [4]. Health and financial literacy, the ability to access, understand, and utilize health and financial information and concepts in ways that promote good health and financial outcomes, are two domains of literacy that are particularly germane to successfully functioning in modern society [5–7]. Lower levels of health literacy have been linked to poorer health status [8] and mortality [9, 10], and lower levels of financial literacy are associated with lower earnings and poorer saving and investment behaviors [7, 11].

Whereas Americans on average display surprisingly low levels of literacy [1], in particular health [12] and financial [11] literacy [1], older adults tend to display even lower levels of literacy than adults under age 65 [1]. The problem of low literacy among older persons raises a major public health challenge, as older adults carry a disproportionate burden of disease and hold a large portion of the nation's wealth. Many of life's most difficult and consequential medical decisions (e.g. selecting a beneficial health plan, enrolling in the United States government-sponsored prescription drug coverage plan Medicare Part D, signing up for preventive services, and following prescription directions correctly) and financial decisions (e.g. utilizing retirement savings, making choices about intergenerational transfers of resources, and avoiding scams and fraud) are made at advanced ages. Low levels of literacy may impair decision making in these contexts. However, little research has been conducted on the actual influence of health and financial literacy on older adults' decision making.

In this study of more than 500 nondemented community-based (noninstitutionalized) older adults, we tested the hypothesis that older persons with higher levels of literacy (total, health and financial) would display better decision making (total, healthcare and financial). Decision making was assessed using a measure designed to closely approximate real-world decisions older persons make. Analyses controlled for the influences of age, sex, education, income, cognitive function, depressive symptoms and chronic conditions. We also examined whether these factors modified the association between literacy and decision making.

## Methods

### *Participants*

Participants were 525 older adults from the Rush Memory and Aging Project, an ongoing longitudinal clinical-pathologic study of common chronic conditions of old age that started in 1997 [13]. Study participants are residents of approximately 40 senior housing facilities in the Chicago metropolitan area, including subsidized housing facilities, retirement communities, and retirement homes. Memory and Aging Project participants undergo risk factor assessment and detailed annual clinical evaluations, and are asked about their willingness to donate organs at the time of death. The study was approved by the Institutional Review Board of Rush University Medical Center, and informed consent and an anatomical gift act were obtained from each participant following a detailed presentation of the risks and benefits associated with study participation.

The decision-making project, which includes decision-making and literacy assessment, was added to the Memory and Aging Project evaluation in 2010. At the time of these analyses, 1,461 participants had completed the baseline evaluation; of those, 467 died before the decision-making evaluation began, and 83 refused further participation in the Memory and Aging Project. Of the remaining 911 potentially eligible persons, 269 had not completed their first decision-making evaluation, 13 (1.4%) refused the decision-making assessment, and clinical diagnosis was pending for 34, leaving 595 participants who had completed the decision-making assessment and had a valid diagnosis. Participants were excluded from the analysis if they received a diagnosis of dementia during the annual clinical evaluation. Of the 595 participants who had completed a decision-making assessment with valid diagnosis, 31 met criteria for dementia and an additional 39 were missing decision-making items, resulting in a final group of 525 participants for analysis. The mean age was 82.6 years (SD = 6.7; range: 60–100.8), the mean education was 15.2 years (SD = 3.0; range: 7–28), and 76.0% were women and 91.2% were White and non-Hispanic. The mean score on the Mini-Mental State Examination (MMSE) [14] was 28.2 (SD = 1.8; range: 21–30). Twenty-seven percent of the participants had self-reported annual incomes lower than USD 25,000, 39% had incomes between USD 25,000 and 50,000, and 34% had incomes over USD 50,000.

### *Clinical Diagnoses*

Dementia was diagnosed in a 3-step process, which included (1) an education-adjusted impairment rating based on computer scoring of 11 cognitive tests commonly used for clinical classification of Alzheimer's disease; (2) review of a battery of 20 standard cognitive tests (described below in 'other covariates'), impairment rating, and other clinical and demographic data by an experienced neuropsychologist blind to participant age, sex and race, and (3) evaluation of participants by an expert clinician, who used all cognitive and clinical data to make a final diagnosis [13, 15]. The diagnosis of dementia was based on National Institute of Neurologic and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association criteria, requiring a history of cognitive decline and evidence of impairment in at least two cognitive domains [16].

### *Health and Financial Literacy Assessment*

Health and financial literacy were assessed with a series of questions designed to measure knowledge of health and financial information and concepts, and numeracy (see Appendix for full assessment). There were 9 questions on health literacy, including questions on Medicare, following doctors' prescription instructions, leading causes of death in older persons, and a question framing the same drug risk information in two separate ways (1 in 100 chance of death vs. 99 in 100 chance of survival). There were 23 questions on financial literacy, many of which were adapted for use in older persons (by simplifying some wording) from the Health and Retirement Survey [17]. Other questions dealt with numeracy and assessed the ability to perform simple monetary calculations such as sales and interest rates. Questions also assessed knowledge of financial terms and institutions such as the Federal Deposit Insurance Corporation (FDIC; the US government corporation that guarantees deposits in member banks) and stocks and bonds. All answer choices were multiple choice or true/false with only one correct answer, thus each item was scored as correct or incorrect. Because of the difference in number of items, health and financial literacy, subscores were expressed as the percentage correct out of total items (range = 0–1). The total literacy score was the average of these two percentages. Cronbach's  $\alpha$  was 0.77 for the total literacy score, indicating the measure had adequate internal reliability.

### *Decision-Making Assessment*

A modified, 12-item version of the Decision-Making Competence Assessment Tool, which was specifically designed to measure decision making in older adults and has been used in prior studies of aging [18, 19], was used to examine health and financial decision making. The healthcare module involves tables that provide information about health maintenance organization (HMO) plans (the most common type of managed-care plan for health insurance in the USA) while the financial module involves tables that provide financial information about mutual funds. The information presented in the tables was designed to simulate materials used in financial and healthcare settings in the real world. Participants were asked 6 questions of varying difficulty levels for each subscale (3 simple and 3 complex) that assess comprehension and integration of the information in the tables. The complex problems parallel the simple problems but present information about many more options. For example, one of the simple health questions presents information on 3 HMO plans including member satisfaction, preventive care strategies, access to specialists, customer service and premium costs, and asks participants to select the HMO that is not below average on member satisfaction or access to specialists. A complex health question presents similar information about 9 HMO plans and asks participants to select the HMO that is not below average on member satisfaction or customer service, access to specialists, or preventive-care strategies. The total decision-making score is the number of items answered correctly (range = 0–12); the subscale scores for healthcare and financial decision making range from 0 to 6. In previous research, the decision-making measure has been shown to have adequate psychometric properties including high interrater reliability and short-term temporal stability [18, 19].

### *Other Covariates*

Age (based on date of birth and date of decision-making assessment), sex and education (years of schooling) were self-re-

ported. A summary index of global cognition was derived from the average of z-scores from a battery of 19 neuropsychological tests (immediate and delayed recall of story A from Logical Memory, immediate and delayed recall of the East Boston Story, Word List Memory, Word List Recall, Word List Recognition, Boston Naming Test, Verbal Fluency, a 15-item reading test, Digit Span Forward, Digit Span Backward, Digit Ordering, Symbol Digit Modalities Test, Number Comparison, 2 indices from a modified version of the Stroop Neuropsychological Screening Test, a 15-item version of Judgment of Line Orientation, and a 16-item version of Standard Progressive Matrices. One additional test, Complex Ideational Material, is used for diagnostic classification purposes only) [20]. Depressive symptoms over the past week were measured with a 10-item version of the Center for Epidemiologic Studies Depression (CES-D10) Scale [21] that has been shown to have comparable reliability with respect to the full 20-item CES-D form [13]. Chronic medical conditions were the sum of self-reported medical condition items (hypertension, diabetes, heart disease, cancer, thyroid disease, and head injury with loss of consciousness). Income was measured using the show card methodology; participants were shown a card with the following 10 possible categories and asked to choose the level that represented their annual income: (1) USD 0–4,999, (2) USD 5,000–9,999, (3) USD 10,000–14,999, (4) USD 15,000–19,999, (5) USD 20,000–24,999, (6) USD 25,000–29,999, (7) USD 30,000–34,999, (8) USD 35,000–49,999, (9) USD 50,000–74,999, (10) USD >75,000 [13].

### *Statistical Analysis*

We first examined the distributions of all literacy and decision-making variables and tested bivariate associations between literacy and decision-making variables and covariates. We used linear regression models to examine the relationship of literacy (separately for total, health and financial) with decision-making (separately for total, health and financial). All models were adjusted for age, sex and education. Models were then repeated with a term for global cognition. This model was also run for each decision-making outcome variable with both health and financial literacy in the same model to test for the independent effects of each literacy context. A fully adjusted model included terms for age, sex, education, global cognition, as well as depression, chronic medical conditions and income. Finally, interactions with all covariates were tested with interaction terms. All associations are presented in terms of a 10% difference in correct literacy items. Analyses were performed using SAS version 9.2 [22] and all models were validated graphically and analytically.

## **Results**

On average, participants correctly answered 67% (interquartile range, IQR: 57–78%; table 1) of the literacy questions [health literacy = 62% (IQR: 44–78%), and financial literacy = 73% (IQR: 61–83%)]. Health literacy was correlated with financial literacy at 0.44 ( $p < 0.001$ ). Total, health and financial literacy were negatively correlated with age and depressive symptoms, and positively correlated with education, global cognition and income;

**Table 1.** Distribution of literacy, decision making, and characteristics (n = 525)

Age, mean $\pm$ SD, years	82.6 $\pm$ 7.5
Education, mean $\pm$ SD, years	15.2 $\pm$ 3.0
Sex (% female), n	399 (76%)
White, non-Hispanic, n	477 (91.2%)
Global cognition, mean $\pm$ SD	0.25 $\pm$ 0.54
Income <sup>1</sup> , mean $\pm$ SD	7.1 $\pm$ 2.4
Depressive symptoms (CESD-10; 0–10) mean $\pm$ SD, %	1.0 $\pm$ 1.6
Chronic conditions, mean $\pm$ SD, %	0.8 $\pm$ 0.9
Total literacy <sup>2</sup> , mean $\pm$ SD, %	67.1 $\pm$ 14.8%
Health literacy (0–9 items), %	61.6 $\pm$ 18.8%
Financial literacy (0–23 items), %	72.5 $\pm$ 16.0%
Total decision making (0–12), mean $\pm$ SD	7.5 $\pm$ 2.8
Healthcare decision making (0–6), mean $\pm$ SD	4.0 $\pm$ 1.7
Financial decision making (0–6), mean $\pm$ SD	3.5 $\pm$ 1.5

<sup>1</sup> Income range: 1 (USD <5,000) to 10 (USD >75,000). A score of 7 represents an annual income of USD 30,000–34,999.

<sup>2</sup> Total literacy is the average of health and financial literacy scores.

there was no correlation with chronic medical conditions (table 2). Females had poorer financial literacy than males, but there was no difference in health literacy by sex. White, non-Hispanic participants had better health and financial literacy than other racial groups. Total, healthcare and financial decision making were also negatively correlated with age and depressive symptoms, and positively correlated with education, global cognition and income (all p values <0.01), and there was no correlation with chronic medical conditions. Females and non-Hispanic whites had poorer total, health, and financial decision-making scores (all p values <0.01).

#### *Association of Literacy with Decision Making*

In regression models, literacy was strongly associated with decision making. As shown in table 3, model 1, the total literacy score, as well as health and financial literacy, were all positively associated with total decision making as well as health and financial decision making after adjustment for age, sex and education. To quantify the association, a 10% higher total literacy score was associated with about a 1 point higher score on total decision making (a scale that ranges from 0 to 12), as well as 0.6 point higher on healthcare decision making and 0.4 point higher on financial decision making (both ranging from 0 to 6). Unexpectedly, the association of financial literacy with healthcare decision making was stronger than the association of financial literacy with financial decision mak-

ing, and the association of financial literacy with healthcare decision making was stronger than the association of health literacy with healthcare decision making.

#### *Association of Literacy with Decision Making after Adjustment for Covariates*

Because it is possible that cognitive abilities could affect both literacy and decision making even in nondemented older persons, we repeated the models after adjustment for global cognitive function. With global cognition in the model, the associations between literacy and decision making were attenuated but remained highly significant (table 3, model 2; all p values <0.001). Further, when both health and financial literacy were put in the same model adjusted for age, sex, education and global cognition, both were independently associated with total decision making (estimate = 0.28, SE = 0.06, p < 0.001 and estimate = 0.38, SE = 0.08, p < 0.001, respectively). Next, because health and socioeconomic factors could confound the associations of literacy with decision making, we adjusted for income, depression and chronic medical conditions. Inferences were not substantially different from model 2 (table 3, model 3).

#### *Effect Modification of the Association of Literacy and Decision Making*

Finally, because the association of literacy and decision making may be stronger for certain groups of older adults, we tested for effect modification by covariates. In interaction models that included terms for the cross-product of literacy variables and covariates, there was evidence of interaction by age, such that in general, the beneficial association between literacy and decision making was stronger among older persons. There was also evidence of interaction by income, indicating that the association was stronger in poorer persons. Finally, there was evidence of interaction by cognition, indicating that the association was stronger at the lower ranges of cognition. Despite females having poorer financial literacy, there was no interaction by sex. All interactions were driven primarily by the healthcare decision-making subscale. Significant interactions are summarized in table 4.

#### **Discussion**

In a cohort of 525 older persons living in the community without dementia, we found that persons with higher levels of health and financial literacy exhibited better healthcare and financial decision making. Importantly, this association persisted after adjustment for a robust

**Table 2.** Association/correlation of literacy scores with decision making and other characteristics

	Total literacy <sup>1</sup>		Health literacy		Financial literacy	
	correl.	sign.	correl.	sign.	correl.	sign.
Difference in literacy scores						
Female sex <sup>2</sup>	-5.5	p < 0.001	1.8	p = 0.34	-12.8	p < 0.001
White, non-Hispanic <sup>2</sup>	0.11	p < 0.001	0.10	p < 0.001	0.12	p < 0.001
Correlations						
Age	-0.34	p < 0.001	-0.32	p < 0.001	-0.25	p < 0.001
Education	0.40	p < 0.001	0.29	p < 0.001	0.39	p < 0.001
Global cognition	0.61	p < 0.001	0.53	p < 0.001	0.50	p < 0.001
Income <sup>3</sup>	0.37	p < 0.001	0.25	p < 0.001	0.39	p < 0.001
Depressive symptoms (CESD-10)	-0.17	p < 0.001	-0.09	p = 0.038	-0.20	p < 0.001
Chronic conditions	0.04	p = 0.44	0.06	p = 0.17	-0.006	p = 0.89
Total decision making	0.63	p < 0.001	0.51	p < 0.001	0.56	p < 0.001
Healthcare decision making	0.59	p < 0.001	0.48	p < 0.001	0.53	p < 0.001
Financial decision making	0.55	p < 0.001	0.45	p < 0.001	0.49	p < 0.001

<sup>1</sup> Total literacy is the average of health and financial literacy scores.

<sup>2</sup> For dichotomous variables, p value is from ANOVA; estimate is for average difference in percent correct for females as compared to males or for white non-Hispanic race compared to all other racial groups.

<sup>3</sup> Income range: 1 (USD <5,000) to 10 (USD >75,000). A score of 7 represents an annual income of USD 30,000–34,999.

measure of global cognitive function, as well as age, sex, education, income, chronic medical conditions and depression. The beneficial association between literacy and decision making was stronger for older persons, poorer persons and persons at the lower ranges of cognitive ability. This study is among the first to suggest that, among older persons who have not been diagnosed with dementia through standardized diagnostic assessment, those with lower literacy may be ill prepared to make appropriate healthcare as well as financial choices – two realms of decisions that loom large for older persons in modern society. The link between literacy and decision making exists above and beyond the influence of cognitive abilities, socioeconomic status, or health-related factors. Furthermore, the relationship was particularly influential among subgroups of older adults facing other threats to decision-making capacity, such as advanced age, fewer financial resources and lower cognitive performance. These findings may suggest that improvements in literacy in older adults, specifically in high-risk older adults, may lead to better health and quality of life in later years through improved decision making.

These findings have public health implications for our aging society. Between now and 2030, the number of persons over 65 in the USA will nearly double from 40 to 70 million, at which point older Americans will make up

**Table 3.** Associations of literacy with decision making in older adults (estimates ± SE)

Literacy	Decision making		
	total	healthcare	financial
Total			
Model 1	0.98 ± 0.07	0.55 ± 0.05	0.43 ± 0.04
Model 2	0.64 ± 0.08	0.37 ± 0.05	0.28 ± 0.05
Model 3	0.64 ± 0.09	0.37 ± 0.05	0.27 ± 0.05
Health			
Model 1	0.60 ± 0.06	0.33 ± 0.04	0.27 ± 0.03
Model 2	0.35 ± 0.06	0.19 ± 0.04	0.16 ± 0.03
Model 3	0.35 ± 0.06	0.19 ± 0.04	0.16 ± 0.03
Financial			
Model 1	0.78 ± 0.07	0.45 ± 0.04	0.33 ± 0.04
Model 2	0.46 ± 0.08	0.27 ± 0.05	0.19 ± 0.04
Model 3	0.45 ± 0.08	0.28 ± 0.05	0.16 ± 0.05

All p values <0.001. For each model, 9 separate regressions were run for each combination of literacy and decision-making variables. Model 1: adjusted for age, sex, and education (n = 525). Model 2: adjusted for age, sex, education, and global cognition (n = 525). Model 3: adjusted for age, sex, education, global cognition, income, depression, and chronic conditions (n = 505). Estimates are for a 10% increase in correct items out of total items for each literacy index (total literacy is an average of health and financial literacy scores).

**Table 4.** Significant interactions of literacy with covariates on decision-making ability

Literacy	Decision making								
	total			healthcare			financial		
	covariates	estimates ± SE	p	covariates	estimates ± SE	p	covariate	estimates ± SE	p
Total mean	age	0.018 ± 0.007	0.015	age	0.010 ± 0.004	0.018	age	<i>0.007 ± 0.004</i>	<i>0.085</i>
	income	-0.069 ± 0.028	0.013	income	-0.052 ± 0.017	0.002			
				cognition	-0.174 ± 0.064	0.007			
Health mean	age	<i>0.011 ± 0.006</i>	<i>0.053</i>	income	-0.030 ± 0.013	0.023	age	<i>0.006 ± 0.003</i>	<i>0.078</i>
				cognition	-0.101 ± 0.056	0.071			
Financial mean	age	0.016 ± 0.007	0.020	age	0.011 ± 0.004	0.008			
	income	-0.045 ± 0.025	0.069	income	-0.026 ± 0.015	0.088			
	cognition	-0.199 ± 0.097	0.040	cognition	-0.170 ± 0.059	0.004			

All interactions with p values < 0.10 displayed. p values between 0.05 and 0.10 are shown in italics.

20% of the total US population [23]. Older Americans must contend with an increased burden of disease and face an array of challenging healthcare decisions including Medicare Part D plan selection, transitions to assisted living or nursing home, and advance directives and other end-of-life decisions. Older persons must also deal with complex financial decisions, such as social security distribution, investment of retirement savings and accumulated wealth and intergenerational transfers of wealth, all while living mostly off accumulated savings. Unfortunately, while older adults are faced with a myriad of complex healthcare and financial decisions, they are highly vulnerable to poor decision making [24, 25]. For example, older persons are more likely to passively defer to physicians and others during medical decision making [26] and comprise the majority of financial fraud victims in the USA [27, 28]. Therefore, research into potentially modifiable determinants of poor decision making in older adults, beyond advancing age and deteriorating cognitive abilities, could provide the ability to target older adults at high risk of making bad decisions and suggest potential avenues to improve decision making. Our research indicates that health and financial literacy may be modifiable risk factors for decision making in older adults. Furthermore, our results indicate that certain groups of older adults may benefit most from better health literacy, namely persons who are older, poorer and have lower levels of cognitive function. Better literacy may lessen the effect of these risk factors for poor decision making, and targeted improvements in these high-risk groups may have particularly beneficial effects.

The medical community has identified poor health literacy as a major public health issue [5], and it has been related to multiple aspects of health, including health status [8, 29, 30], mortality [9, 10] and use of services [31]. However, there has been little research to show that these outcomes might be mediated by the quality of healthcare decision making. One study demonstrated that older adults with poor health literacy were less likely to receive preventive services, such as vaccinations and mammograms [32]. A few studies have examined how numeracy can influence the perception of risks and benefits [33, 34], which can lead to biases in medical decision making, and another showed that numeracy was related to performance on simulated Medicare Part D decision making [35]. Our findings add to this literature by showing that older adults with higher levels of health literacy perform better when choosing an optimal healthcare plan from an array of available options. Similarly, economists have identified poor financial literacy as a widespread problem among older adults [11, 36], associated with unsuccessful financial planning and outcomes in later life [7, 37]. In order to justify and inform initiatives to improve functional literacy in older adults to improve health and financial outcomes, it is important to show that older adults with low literacy are at high risk of making poor decisions, and conversely, that older adults who are highly literate actually utilize these skills to make beneficial decisions. This is important because the gerontological literature is replete with examples of discordance between what older adults can do and what they actually do [38]. Our study shows that older adults possessing the literacy skills necessary for informed decision making ac-

tually do tend to make better decisions that can impact their health, well-being and independence.

An alternate explanation for an observed link between literacy and decision making is that both are affected by a common factor, such as educational attainment or, especially in the case of older adults who are at high risk of cognitive impairment, cognitive abilities. Decision-making ability is impaired in older persons with cognitive impairment [39] and may be suboptimal even among persons without overt cognitive impairment [25]. Likewise, the ability to understand health and financial concepts and to perform simple calculations as required for the literacy assessment is affected by cognitive abilities as well. Therefore, it is important to establish that the link between literacy and decision making exists above and beyond cognitive abilities. After adjustment for a robust measure of cognitive function, we saw an attenuation of the associations between literacy and decision making, but all associations remained strong and statistically significant, indicating that the association was not driven by the inclusion of older persons with cognitive impairment. Furthermore, this association was independent of educational attainment, as well as socioeconomic status as measured by income, and the presence of chronic medical conditions and depression, indicating that literacy is an independent predictor of decision-making performance.

This study has a number of strengths including detailed assessment of literacy and decision making in health and financial contexts in a fairly large cohort of older persons living in the community free of dementia. A further strength was the ability to adjust for a robust measure of global cognition, as well as other important correlates that could account for the main associations. Unexpectedly, the associations between literacy and decision making within the same context (health and finance, respectively) were not stronger than the associations across context (e.g. health literacy with financial decision making). This may partially be explained by the correlation between both domains of literacy and both domains of decision making, indicating partially overlapping constructs, utilizing many of the same cognitive abilities and processes and acquired knowledge. It may also be due to the financial literacy score being a more psychometrically stable measure than the health literacy score due to the larger number of items; further research is needed to determine whether measurement properties account for this unexpected finding. A limitation of this study is the use of a predominantly White, fairly highly educated volunteer cohort who may be more literate or have better

decision making than the general older population, thereby potentially limiting generalizability. Another limitation to this study is that we were not able to measure participants' actual decisions regarding healthcare plans and financial planning in the real world, relying instead on a simulation. However, our decision-making assessment was designed to closely approximate the types of healthcare and financial decision faced by older persons in real world settings. Moreover, decisions in the real world are more complex and therefore disparities between those with poor and high literacy are likely to be larger. Further studies are needed to understand whether improvements in the health and financial literacy of older adults could lead to improvements in decision making in these contexts and consequently to improvements in the health and financial well-being and quality of life of older persons.

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### Appendix

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#### Health literacy assessment (note question 6 counts as 3 points)

1. *Question:* What is Medicare?
    - 1 A private health insurance plan for persons aged 65 or older.
    - 2 A government-run health insurance plan for persons aged 65 or older or younger persons with permanent disabilities.
    - 3 A government-run health insurance plan for any person who cannot afford health insurance.

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  2. *Question:* Medicare Part D covers which of the following?
    - 1 Inpatient hospital services
    - 2 Outpatient physician services
    - 3 Prescription drug benefits

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  3. *Question:* True or false? Medicare routinely covers costs associated with extended long-term care, such as nursing home care lasting more than 1 month.
    - 1 True
    - 2 False

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  4. *Question:* Suppose your doctor has given you a new prescription with the following instructions: "Take 2 pills twice daily with food for 7 days. Which of these choices represents the BEST way for you to take this medicine?"
    - 1 Take 2 pills when you wake up and 2 before bed
    - 2 Take 2 pills daily for 7 days
    - 3 Take 2 pills with breakfast and 2 with dinner for 7 days
-

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5. *Question:* You go to see your doctor and he recommends you get your flu vaccine. He tells you that the flu is the most common cause of death in older people but warns that there is a 1 in 100,000 chance that you will develop a life-threatening complication if you get the vaccine. Would you get the vaccination?

- 1 Yes
- 2 No

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6–8. *Question:* Please name the 3 leading causes of heart disease and stroke that are treatable with medication. (Choose all that apply.)

- 1 High blood pressure/hypertension
- 2 High cholesterol
- 3 Diabetes
- 4 Other

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9. *Question:* Your doctor offers you two drugs. Drug A has a 1 in 100 chance of death. Drug B has a 99 in 100 chance of survival. Which one is more risky?

- 1 Drug A
- 2 Drug B
- 3 They are equally risky

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**Financial literacy assessment (note question 9 counts as 4 points)**

1. *Question:* Which of these percentages represents the biggest risk of getting a disease?

- 1 1%
- 2 10%
- 3 5%

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2. *Question:* A store is offering 15% off a television that is normally priced at USD 1,000. How much money would you save on the TV during this sale?

- 1 15
- 2 150
- 3 1,500

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3. *Question:* If a television set is on sale for USD 899, which is USD 200 off its normal price, what is the normal price?

- 1 USD 699
- 2 USD 1,099
- 3 USD 1,299

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4. *Question:* If 5 people all have the winning numbers in the lottery and the prize is USD 2 million, how much will each of them receive?

- 1 USD 200,000
- 2 USD 400,000
- 3 USD 600,000

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5. *Question:* If the chance of getting a disease is 10%, how many people out of 1,000 would be expected to get the disease?

- 1 100
- 2 10
- 3 90
- 4 900

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6. *Question:* Suppose you had USD 100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow: more than USD 102, exactly USD 102, or less than USD 102?

- 1 more than USD 102
- 2 Exactly USD 102
- 3 Less than USD 102

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7. *Question:* Again, suppose you had USD 100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow: more than USD 110, exactly USD 110, or less than USD 110?

- 1 more than USD 110
- 2 Exactly USD 110
- 3 Less than USD 110

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8. *Question:* Imagine that the interest rate on your savings account is 1% per year and inflation is 2% per year. After 1 year, will you be able to buy more than, exactly the same as, or less than today with the money in your account?

- 1 More than today
- 2 Exactly the same as today
- 3 Less than today

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9–12. *Question:* What do the initials FDIC stand for?

- 1 Federal
- 2 Deposit
- 3 Insurance
- 4 Corporation

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13. *Question:* What does the FDIC do?

- 1 Approves new drugs for clinical use
- 2 Protects the funds people or depositors place in banks and savings Institutions
- 3 Underwrites mortgages and other loans

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14. *Question:* A mutual fund is an investment that holds what – only stocks, only bonds, or stocks AND bonds?

- 1 Only stocks
- 2 Only bonds
- 3 Stocks and bonds

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15. *Question:* When interest rates go up, what do bond prices do: go down, go up, or stay the same?

- 1 Go down
- 2 Go up
- 3 Do not change

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16. *Question:* True or false. Buying a single company stock usually provides a better return than a stock mutual fund.

- 1 True
- 2 False

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17. *Question:* True or false. An older person with USD 100,000 to invest should hold riskier financial investments than a younger person with USD 100,000 to invest.

- 1 True
- 2 False

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18. *Question:* True or false. Using money in a bank account to pay off credit card debt is usually wise.

- 1 True
- 2 False

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19. *Question:* True or false. To make money in the stock market, you have to buy and sell stocks often.

- 1 True
- 2 False

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20. *Question:* True or false. Stocks and mutual funds generally produce higher average returns above inflation compared to fixed-income investments such as bonds.

- 1 True
- 2 False

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21. *Question:* Imagine you receive a gift of USD 10,000. If you were to invest the money on your own for the next 5 years, what percentage on average do you think you could earn per year? Please provide a number from 0 to 100.

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22. *Question:* Again, imagine you receive a gift of USD 10,000. If you were to invest the money in a government bond, what percentage on average do you think you could earn per year? Please provide a number from 0 to 100.

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23. *Question:* Again, imagine you receive a gift of USD 10,000. If you were to invest the money in a mutual fund, what percentage on average do you think you would earn per year? Please provide a number from 0 to 100.

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