

Research Article

Personality Traits and Health Literacy

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Abstract

Although there is a long history of interest in personality traits and their impact on cognitive abilities, personality traits have been overlooked as an important predictor of low health literacy. We explored and quantified the relationship between personality traits and health literacy among Americans aged 50 and older.

We conducted analyses of 2010 data from the Health and Retirement Study (HRS), a nationally representative sample of Americans aged 50 and older. We used 1,190 respondents who were randomly drawn from one half of the 2010 HRS main survey participants and participated in the health literacy module.

Health literacy was measured using the Rapid Estimate of Adult Literacy in Medicine Revised (REALM-R) and self-reported confidence in filling out medical forms. Personality traits were measured with the five factor model of personality: neuroticism, extraversion, conscientiousness, agreeableness, and openness.

Neuroticism increased the odds of having low health literacy. A one-point increase in the Neuroticism score led to a 72% increase in the odds of falling into low health literacy. Extraversion increased the odds of having low health literacy by 79% while Conscientiousness and Openness reduced these odds by 51% and 29%, respectively. Personality traits were significantly associated with low health literacy for Americans aged 50 and older. In particular, Neuroticism and Extraversion were identified as negative factors for health literacy. This finding indicates a need to utilize personality traits to improve communication between health care providers and patients, and to be included in models to assess and improve individuals' health literacy.

Keywords

- Health literacy
- Psychology
- Doctor-patient relations
- Communication
- Aging

ABBREVIATIONS

HRS: the Health and Retirement Study; REALM-R: Rapid Estimate of Adult Literacy in Medicine-Revised; S-TOFHLA: Short Test of Functional Health Literacy in Adults; ADL: Activities of daily living; IADL: Instrumental Activities of Daily Living

INTRODUCTION

Low health literacy has been well documented as a critical predictor of individuals' health behaviors, health services use, and health outcomes [1]. Only 12 % of English speaking American adults have proficient health literacy skills [2]. Major determinants of low health literacy have been identified such as general literacy levels, past experiences, or cognitive abilities along with individual characteristics, including age or socioeconomic status [3]. In particular, low health literacy was disproportionately prevalent among older adults, racial/ethnic minorities, lower income groups, less educated individuals, or non-native English speakers.

To improve health literacy, the U. S. Department of Health and Human Services and the Institute of Medicine (IOM) emphasize the interaction between individuals/patients and

health professionals regarding health literacy skills [4]. For better interactions with patients, health service providers were encouraged to develop their competencies in patient-centered care, particularly their communication skills [5]. Some effective communication techniques for health professionals have been proposed, such as speaking in plain language, confirming patients' understandings by using "teach-back" techniques, or encouraging questions using an open-ended approach (e. g. , "What questions do you have?" rather than "Do you have any questions?") [6-8].

Recently, these techniques were used for patients and tested among medical residents [9]. The test results show that speaking in plain language improved knowledge and attitudes regarding health literacy, whereas the teach-back and the open-ended approach did not. These results indicate that speaking in plain language can help improve limited health literacy in general; the other techniques with more interaction components, however, may need to take into account individual's personal characteristics, particularly personality traits, to improve health literacy. For example, anxious individuals may hesitate to ask for clarification of instructions or disregard instructions in health care [10]. People high in openness also excel in verbal fluency [11].

Despite the potential impact of personality traits on health literacy, personality traits have been overlooked as a predictor of low health literacy. Given that health literacy generally faces an age-based decline [12-13] and that this decline tends to accelerate in later years [14], it is imperative to examine how personality traits, which are relatively stable throughout the lifespan [15], may influence older adults' health literacy: the ability to obtain, process, and understand basic health information and services needed to make appropriate health decisions [16]. To date, no studies have examined the relationship between personality traits and health literacy. The current study fills this gap by exploring how personality traits are related to the health literacy of American adults aged 50 and older. Because this age group uses more health care services, their need for health literacy accordingly increases.

Link between personality traits and health literacy

Personality traits characterize an individual's stable pattern of feelings, thoughts, and actions, and can be used to predict an individual's behavior [17-18]. Although there is a long history of interest in personality traits and their impact on cognitive abilities [19], personality traits and their relationship with health literacy have not been fully examined in health care fields. The five-factor model of personality, referred to as the "Big Five," consists of five dimensions of personality traits: neuroticism, conscientiousness, extraversion, agreeableness, and openness [20].

Neuroticism represents emotional instability characterized by anxiety, fear or stress, which is related to distraction and doubt about one's own abilities to take an appropriate action [21-22]. In health care settings, neurotic people may show a tendency to hesitate or forget to ask for clarification of instructions or disregard instructions [10], leading to limitations of the development and correct use of health literacy. Conscientious individuals are characterized by self-discipline, dutifulness, and rationality [23]. Conscientiousness, therefore, may be related to proactive disease prevention, active medical problem solving, and the accomplishment of health-related goals [24], actions that might promote the usage of healthcare services and health related self-education.

Extraversion has been associated with positive social interaction [25]. On the flip side, characteristics of active response to stimuli from environment (e.g. distracted by noise) [26] and low retention of learned knowledge [27] posed disadvantages to extraverted people in learning. These may explain why high extraversion is associated with poorer performance on tasks requiring more personal efforts to achieve, such as obtaining vocabulary proficiency or using grammatically correct language [28]. In physician-patient communication, extraverts might display their vigor and energy by expressing medical concerns and requesting additional medical help [29-30]. Although extraverts have an advantage in speech and ordinary conversation, they may struggle to recognize the correct medical words and subjects in communication with health care providers. Traits of extraversion, thus, may elevate or reduce health literacy in patient-doctor communication.

Agreeableness has been linked to positive social relationships and low competition, is characterized as "meek" and "obedient"

[22] and is associated with modesty in self-evaluating [23]. When using healthcare, agreeable patients may show their humbleness when faced with new health knowledge and complex treatment procedures. Their temperament may also contribute to greater compliance with medical instructions [31].

Openness manifests itself in curiosity, insight, and the inclination to test new things [23]. In the healthcare field, more open individuals may be more motivated to try a "state of the art" treatment technique and be more open to divergent viewpoints [22] in health science. Moreover, people high in openness excel in verbal fluency [11].

Based on these previous studies and potential links, it is hypothesized that higher neuroticism and extraversion tend to be negatively associated with health literacy, whereas higher conscientiousness, agreeableness, or openness tend to be positively related to health literacy.

MATERIALS AND METHODS

Data

We used data from the Health and Retirement Study (HRS), which is sponsored by the National Institute on Aging. The HRS has been collecting longitudinal data biannually from a nationally representative sample of 22,034 adults over age 50 since 1992. It provides rich information on health status, personality traits, and financial status of older American population [32-33]. The 2010 HRS included a special module on health literacy, enabling us to investigate relationships between personality and health literacy.

To assess health literacy, the 2010 HRS also interviewed a sub sample of 1,791 respondents who were randomly drawn from one half of the 2010 HRS survey participants and then agreed to participate in the health literacy module. Our analytic sample was limited to 1,190 respondents who were 50 years of age and older (67 respondents were younger than 50), and did not have missing variables in health literacy (214 respondents were incomplete), personality traits (273 respondents were incomplete) and health status or demographics (47 respondents were incomplete).

Measures

Health Literacy: We characterized health literacy in two domains. First, respondents in the 2010 HRS health literacy module were asked a single health literacy question for self-assessment: "How confident are you filling out medical forms by yourself?" Response options were extremely, quite, somewhat, a little, or not at all. We used a response of "somewhat confident" or less as a proxy for low health literacy. This measure was suggested by previous studies validating this question in English [34-37] and in Spanish [38] with more commonly used tests of health literacy, such as the Rapid Estimate of Adult Literacy Measure (REALM) and the Short Test of Functional Health Literacy in Adults (S-TOFHLA). Second, the 2010 HRS health literacy module also included the revised, shortened version of the Rapid Estimate of Adult Literacy in Medicine (REALM-R) to measure correct recognitions of eight medical words: osteoporosis, allergic, jaundice, anemia, fatigue, directed, colitis, and constipation. We followed established convention in defining low health literacy as seven or fewer words out of eight pronounced correctly [39-40].

Personality Traits: We measured personality traits with the five factor model of personality [41]. Respondents in the 2010 HRS were asked a series of questions: "Please indicate how well each of the following adjectives describes you". Four adjectives described Neuroticism (e.g. worrying and nervous), five adjectives described Extraversion (e.g. outgoing and friendly), five adjectives described Agreeableness (e.g. helpful and warm), seven adjectives described Openness (e.g. creative and curious) and ten adjectives described Conscientiousness (e.g. organized, responsible and thorough). The response option was a four-point scale (1 = not, 2 = a little, 3 = some, and 4 = a lot). The scores for the adjectives were averaged within each sub-dimension of personality trait. Cronbach's alphas for neuroticism, extraversion, openness, agreeableness, and conscientiousness scales were $\alpha = .71$, $\alpha = .75$, $\alpha = .80$, $\alpha = .79$, and $\alpha = .73$, respectively.

Health Status: We measured health status in several ways. First, overall health status was assessed with self-rated health (1 if current self-rated health was fair or poor and 0 for excellent, very good, or good). Second, chronic disease condition was measured with a self-report of seven physical chronic diseases (hypertension, arthritis, diabetes, heart problems, stroke, lung disease, or cancer) with 1 if any of these and 0 otherwise (i.e. no condition). Third, functional impairment was assessed with 1 if a self-report of difficulty with any of the ADLs or IADLs and 0 otherwise: Activities of daily living (ADL) included dressing, walking, bathing, eating, getting into or out of bed, or using the toilet, and Instrumental activities of daily living (IADL) included preparing meals, grocery shopping, using the phone, taking medication, or handling money.

Fourth, cognitive impairment was measured with 1 if a composite score was 11 or lower and 0 otherwise (i.e. 12-27). The composite score (0-27) was computed based on results of three tests: 1) immediate word recall test (0-10) and delayed recall test (0-10) of memory, 2) a serial 7s subtraction test of working memory (0-5), and 3) counting backwards to assess attention and processing speed (0-2). This approach has been validated using the HRS data and applied [42-43].

Demographics: We included the following demographic characteristics: age, gender, race/ethnicity, educational attainment, marital status, retirement status and household income. Natural logarithm of household income was used in regression analyses to attenuate the impact of potential outliers, which is very common in income data.

Analysis

We conducted descriptive and logistic regression analyses by using Stata version 13 (StataCorp LP, College Station, TX). To be nationally representative of the US population aged 50 and older, all results of descriptive and regression analyses were weighted by the HRS provided sampling weight for the 2010 leave behind questionnaire subsample.

RESULTS

The sample characteristics are presented in Table (1). About 36.5% of study participants reported low self-assessed health literacy measured by a confidence level in filling out medical forms while 28.4% of the respondents had low health literacy

based on REALM-R measure (medical words recognition). The respondents on average had a high agreeable personality score (3.5 out of 4) and were less likely to be neurotic (2.03 out of 4). Most respondents (84.8%) had one or more chronic health conditions. About 25.6 % were functionally impaired, while 14.3% had cognitive impairment.

Table (2) shows differences in the scores of personality traits between the respondents with and without low health literacy. Those with low health literacy had a significantly higher score of Neuroticism than those without low health literacy, but had lower scores of the remaining traits (Extraversion, Agreeableness, Conscientiousness and Openness). This indicates significant differences in personality traits between respondents with and without low health literacy.

Table (3) presents the results of logistic regressions to estimate associations between personality and low health literacy

Table 1: Characteristics of Study Participants (N=1,190)*

	Percentage	Number	
Low health literacy (self-assessed)	36.5	463	
Low health literacy (REALM-R)	28.4	371	
Personality	Mean (SD)	Minimum	Maximum
Neuroticism	2.03 (0.62)	1	4
Extraversion	3.17 (0.56)	1	4
Agreeableness	3.50 (0.49)	1	4
Conscientiousness	3.27 (0.39)	1	4
Openness	2.94 (0.56)	1	4
Fair or poor self-rated health	20.7	280	
Chronic health conditions	84.8	1,039	
Functional impairment	25.6	332	
Cognitive impairment	14.3	201	
Age category			
50-59	36.4	316	
60-69	32.3	343	
70-79	18.7	343	
80+	12.7	188	
Sex female	54.8	687	
Race/ethnicity			
White	83.5	918	
Black	7.8	155	
Other race/ethnic groups	8.7	117	
Education category			
Less than high school	11.7	166	
High school graduate	35.6	448	
Some college	26.0	295	
College and above	26.7	281	
Marital status			
Married/partnered	67.1	790	
Separated/divorced/never married	19.9	205	
Widowed	13.1	195	
Retired	42.8	621	
Household income (\$)	Mean (SD)	Minimum	Maximum
	74,184 (79,520)	0	566,000

*All percentages and means are weighted.

after controlling for other covariates. These results highlight that personality traits are related to low health literacy, whether self-assessed or measured using the REALM-R. For the self-assessed measure, Neuroticism increased the odds of having low health literacy while the other traits were not related to health literacy. A one point increase in the Neuroticism score led to a 72% increase in the odds of falling into low health literacy (OR=1.72 [95 % CI

1.29 to 2.29]). For REALM-R measure, Extraversion increased the odds of having low health literacy by 79% (OR=1.79 [95 % CI 1.16 to 2.77]) while Conscientiousness and Openness reduced these odds by 51% (OR=0.49 [95 % CI 0.29 to 0.82]) and 29% (OR=0.71 [95 % CI 0.51 to 1.00]), respectively. In addition, cognitive impairment significantly increased the odds of low health literacy by 77% to 97% regardless of the low literacy

Table 2: Associations Between Personality Traits and Health Literacy, Mean (SD)*

	Health literacy†		
	Low	Not low	P value (difference)
Neuroticism	2.16 (0.68)	1.96 (0.56)	<0.001
Extraversion	3.09 (0.60)	3.21 (0.54)	0.004
Agreeableness	3.41 (0.53)	3.56 (0.46)	<0.001
Conscientiousness	3.18 (0.46)	3.32 (0.34)	<0.001
Openness	2.78 (0.57)	3.04 (0.52)	<0.001

*All mean scores are weighted.

†Defined as in the self-assessed measure: a confidence level of filling out medical forms.

Table 3: Multivariate Determinants of Low Health Literacy.

Variables	Self-assessed			REALM-R		
	Odds ratio	95% CI	p value	Odds ratio	95% CI	p value
Personality						
Neuroticism	1.72***	1.29-2.31	<0.001	0.89	0.68-1.16	0.38
Extraversion	1.23	0.79-1.91	0.35	1.79**	1.16-2.77	0.01
Agreeableness	0.84	0.55-1.28	0.42	1.16	0.80-1.69	0.42
Conscientiousness	0.76	0.50-1.16	0.20	0.49**	0.29-0.82	0.01
Openness	0.70	0.48-1.02	0.06	0.71*	0.51-1.00	0.05
Fair or poor SRH	1.23	0.85-1.79	0.27	1.08	0.67-1.76	0.74
Chronic health conditions	0.96	0.54-1.72	0.90	0.68	0.38-1.22	0.19
Functional impairment	1.81***	1.24-2.64	<0.001	1.20	0.70-2.05	0.51
Cognitive impairment	1.97***	1.27-3.07	<0.001	1.77*	1.03-3.05	0.04
Age category						
50-59	Reference					
60-69	1.37	0.84-2.25	0.21	1.05	0.61-1.82	0.85
70-79	1.50	0.82-2.75	0.19	0.82	0.46-1.47	0.50
80+	1.90	0.95-3.83	0.07	0.53	0.25-1.13	0.10
Female	0.53***	0.39-0.72	<0.001	0.28***	0.19-0.42	<0.001
Race/ethnicity						
White	Reference					
Black	1.37	0.80-2.33	0.25	4.91***	2.77-8.72	<0.001
Other race/ethnic groups	1.46	0.78-2.73	0.24	1.35	0.70-2.58	0.36
Education category						
Less than high school	5.27***	2.96-9.38	<0.001	7.27***	3.01-17.55	<0.001
High school graduate	1.99**	1.21-3.29	0.01	4.55***	2.34-8.87	<0.001
Some college	1.41	0.84-2.37	0.19	2.53***	1.42-4.52	<0.001
College and above	Reference					
Marital status						
Married/partnered	Reference					
Separated/divorced/never married	0.84	0.50-1.42	0.52	0.42***	0.28-0.64	<0.001
Widowed	0.98	0.54-1.78	0.94	0.75	0.46-1.23	0.25
Retired	0.86	0.53-1.38	0.53	0.93	0.57-1.52	0.75
Household income (\$)	0.96	0.82-1.13	0.64	0.72***	0.61-0.87	<0.001
N		1,173			1,179	

*statistically significant at p<0.05, ** at p<0.01, *** at p<0.001

Abbreviation: SRH: Self-Rated Health

measures. Functional impairment was also positively related to low health literacy in the self-assessed measure. Being African American, and having a low level of education (less than college) increased the odds of having low health literacy. Similarly, being male, married and low household income also increased these odds.

DISCUSSION

We explored how personality traits are related to health literacy with a nationally representative sample aged 50 or older from the 2010 HRS data. We found that personality traits are a significant predictor of low health literacy. Among the five personality traits, respondents who are more open and conscientious were less likely to have low health literacy while those who are more neurotic and extraverted were more likely to have low health literacy. These findings are consistent with the relationships between personality traits and health literacy that we hypothesized. These findings merit further discussion for implications to improve health literacy for older adults, communications between health care providers and patients, and further study for roles of personality in improving health literacy.

First, the finding that personality traits are an important predictor of low health literacy is new and has been overlooked in the field of health literacy. This finding indicates that personality traits should be considered one major predictor of health literacy, along with existing predictors such as general literacy levels, past experiences, functional and cognitive abilities, age and socioeconomic status [3]. In fact, personality traits such as Neuroticism and Extraversion were quantitatively similar or better predictors of low health literacy than chronic health conditions or functional and cognitive impairments. Currently personality traits have been mostly ignored in research and education to improve health literacy. Our finding implies incorporation of personality traits into models to assess and improve individuals' health literacy.

Second, among the five personality traits, Neuroticism and Extraversion were identified as negative factors for health literacy. This finding indicates a need to utilize personality traits to improve communication between health care providers and patients. Health care professionals have been encouraged to use a proven method such as the teach-back method for communication with patients. However, this approach may not be effective for all individuals with different personalities [6-9]. Urging forced responses from the teach-back method may cause extra anxiety and discomfort for more neurotic and extraverted individuals, leading to a counter-effect. Note that more neurotic people tend to have emotional instability; more extraverted people tend to perform poorly on learning related tasks [26-28,44-45]. Given the personality difference between doctors and patients [46], it could be important to narrow the personality gap by building an environment to "fit" the patients' personality [47]. In particular, if a patient is more neurotic, then health care providers can create environments that fit neurotic patients, for example, not talking in a way that causes anxiety or discomfort by routinely using the teach back technique.

Third, some personality traits (i.e. Neuroticism and Extraversion) were sensitive in predicting low health literacy

by the health literacy measure. Neuroticism was a significant predictor of low health literacy in the self-assessment measure but not in the REALM-R measure. In contrast, Extraversion was a significant predictor of low health literacy in the REALM-R but not in the self-assessment measure. These findings indicate that the relationships between personality traits and health literacy could be domain specific. Recall that the self-assessment measure assessed a level of confidence in filling out the medical forms, while the REALM-R was medical-word recognition and pronunciation test for screening adult reading ability in medical settings. Practically, this finding suggests that neurotic individuals may need more help filling out medical forms, while extraverted individuals may not need the same consideration, but may need more attention in communication with health care professionals. Both filling out the medical forms and recognizing medical terms presumably require a reading ability. However, it is unclear why specific personality traits predict low health literacy in specific domain of health literacy. Further studies merit examining this finding.

Our study has several limitations. First, our analytical sample included individuals 50 and older only. These middle-aged and older adults have lower health literacy levels than younger adults [48]. Thus, our results could be overestimated for the general population of American adults. However, as we mentioned, this age group may need more health literacy skills and knowledge than any other age group. Despite this limitation, our findings can provide important implications for improving health literacy in the health care field for this age group. Second, our final sample included 1,190 respondents out of the total number of 1,791 who participated in the HRS health literacy module. We excluded 601 respondents including 273 respondents with missing health literacy scores and 214 respondents who did not complete personality traits items, reaching an effective response rate of 66.4%. We found some demographic differences between our analytical sample and the excluded one. Respondents in the excluded sample were older, less educated, with poorer self-rated health and higher cognitive impairment rate, indicating potential biases. However, there was no difference between two samples in chronic health conditions, functional impairment, sex, race, marital status, retirement status and household income between two samples. Third, our health literacy measures from the HRS module were intended to quickly screen those with limited health literacy in a busy clinical setting. Confidence levels in filling out the medical forms is a self-assessment and may measure individual perception. And the test of medical word recognition and correct pronunciation may assess reading ability only. Health literacy is conceptually defined as the ability to obtain, process, and understand basic health information and services needed to make appropriate health decisions. Practically, in addition to reading, health literacy can encompass other abilities such as speaking, listening and writing. It is possible that our findings do not capture conceptually and practically a broader meaning of health literacy.

CONCLUSION

Our results show how personality traits are related to health literacy. The findings shed light on approaches to improving health literacy and patient-doctor communication by

accommodating patients' personality traits in health care service. Moreover, education on health literacy may also be designed based on personality traits for optimal learning outcome. Future studies may examine cognitively impaired individuals and test the robustness of the role of personality on health literacy in the context of cognition decline.

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