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Health Literacy and its Correlates in Informal Caregivers of Adults with Memory Loss

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Abstract

This secondary analysis examined health literacy among informal caregivers of community-dwelling older adults with memory loss and assessed correlates of caregiver health literacy using the Abilities, Skills and Knowledge Model. Caregiver health literacy ($n=91$) was assessed by the Newest Vital Sign. Limited health literacy presented in 38.5% caregivers, with significantly low document literacy. Health literacy was associated bivariately with age, education, global cognitive function, executive function, and working memory (all $p<.001$), as well as medication knowledge ($p=.015$). Hierarchical regression analyses revealed that older age ($p=.017$), and lower global cognitive function ($p<.001$), working memory ($p=.001$), and academic skills (years of education) ($p=.004$), independently predicted lower health literacy ($R^2=.54$). Medication knowledge, however, was not found to be an independent predictor in the model. Findings suggest limited health literacy is a potential issue among informal caregivers of adults with memory loss. Appropriate assessment and personalized support are needed for informal caregivers who are at high risk for poor health literacy.

Keywords

Health literacy; Informal caregivers; Older adults; Cognitive function; Academic skills; Medication knowledge; Memory loss

Introduction

The number of community-dwelling older adults with some form of early cognitive decline resulting in dementia increases with age. Older adults with memory loss often have more care-related needs compared to those adults who are physically impaired but cognitively intact.¹ Informal caregivers who are often family members or kin-like friends, perform an important role in the daily care of these older adults with memory loss, including engaging in the management of their comorbid health conditions by supervising or assuming responsibility for medication taking.^{1–3} While it is widely acknowledged that older adults with memory loss are at risk for medication errors,⁴ there is an increasingly recognized

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possibility for informal caregivers to make medication errors due to factors such as incorrect knowledge about the medications or limited health literacy.⁵⁻⁷ The literature suggests that individuals with inadequate health literacy are less likely to understand basic information about medications⁸ and are less able to recall correct medication name, dosage, and frequency of administration compared to those with adequate health literacy.⁹ As informal caregivers play a vital role in the care of older adults with memory loss, it is important to assess and improve caregivers' capability to understand, appraise and use health information, including information related to medication taking and safety, which potentially influences how effectively caregivers are able to undertake this caregiving responsibility.

Limited published research addresses caregiver health literacy and its assessment.⁵ Most of the literature on this topic focuses on parental caregivers of children rather than caregivers of older adults.^{6, 10} Older adults are a unique population given the possibility for such individuals to have a number of chronic conditions requiring multiple medications. Successful medication management in this patient population is often complicated and challenging for both patients and their caregivers. Assessment of caregiver health literacy, especially key concepts-related health literacy needs of caregivers of older adults, are less developed.⁵ Yuen and colleagues recently developed a measure of health literacy of caregivers of cancer patients. However, this measure may not be applicable to caregivers of older adults with other chronic conditions.¹¹ A good understanding of the key components of caregiver health literacy may contribute to the development and evaluation of measurements and interventions to support informal caregivers in caring for older adults.

Health literacy is a complex social construct with multiple and conflicting definitions and measurements.¹² The most commonly cited definition is from the Institute of Medicine (IOM) indicating health literacy as the individual's capacity "to obtain, process, and understand basic health information and services needed to make appropriate health decisions".¹³ Within and beyond this definition, many conceptual models have been developed to identify components contributing to health literacy, for the purpose of facilitating measurement, and leading to practical interventions.^{14, 15} Ownby and colleagues¹⁶ proposed the Abilities, Skills and Knowledge (ASK) Model that describes health literacy as a composite of general cognitive abilities, academic and other skills, and health-related knowledge. The ASK model focuses on factors underlying health literacy, specifically on the individual's "capacity" included in the IOM definition of health literacy. Using the ASK model as a guide, the current study was designed to examine correlates of caregiver health literacy in informal caregivers of older adults with memory loss.

Relationships between key elements of the ASK Model and the construct of patient health literacy have been reported in literature. For example, cognitive abilities like working memory, processing speed, reasoning, and verbal ability have shown strong associations with a person's health literacy.^{17, 18} Health-related knowledge broadly refers to general health information or specifically to disease- or medication-related knowledge. A significant relationship was identified between medication knowledge and health literacy, after controlling for demographic characteristics.^{8, 19} Devraj et al.²⁰ reported that patients with low health literacy had poor knowledge of pain medications. In addition, older age has repeatedly been reported as associated with limited health literacy,^{21, 22} especially among

older individuals with low levels of education.²³ Although cognitive abilities, academic skills and medication knowledge have each demonstrated an association with patient health literacy, the ASK Model as a whole has not been tested in informal caregivers who engage in medication management for adults with memory loss.

The ASK Model has been tested among Spanish- and English-speaking community-dwelling volunteers, by three common tests for patient health literacy, the Test of Functional Health Literacy in Adults (TOFHLA),²⁴ the Rapid Estimate of Adult Literacy in Medicine (REALM),²⁵ and a Spanish version of the Short Assessment of Health Literacy for Spanish-speaking Adults (SAHLSA)²⁶. The Newest Vital Sign (NVS), another recent commonly used brief assessment tool for health literacy^{27, 28}, was not included in the original ASK model testing. The NVS is efficient to administer in primary care practices while maintaining work flow.²⁹ It has been used to measure medication health literacy,^{20, 30} and has demonstrated high sensitivity across population.^{31, 32} Particularly, the NVS has been recommended as a more sensitive measure of caregiver health literacy.⁵ The NVS was used in the current study to measure caregiver health literacy among informal caregivers who engage in medication management for adults with memory loss.

As there is limited research assessing informal caregivers' health literacy and its underlying components, the first purpose of this study was to characterize health literacy measured by the NVS among informal caregivers of community-dwelling adults with memory loss. Secondly, the study examined relationships between health literacy and caregivers' cognitive abilities, academic skills, and medication knowledge, after controlling for socio-demographic characteristics, based on the ASK Model. It was hypothesized that caregiver health literacy, as measured by the NVS, would be significantly associated with measures of each element of the ASK model.

Material and methods

Participants and Procedure

This study was a secondary analysis of baseline data from a randomized controlled trial (RCT) designed to increase problem-solving skills related to medication management in informal caregivers of adults with memory loss. In the parent trial, adults with memory loss and their informal caregivers (N=91 dyads) were recruited from the community and an Alzheimer Disease Research Center. Community sources included the use of targeted mass mailings, caregiver support groups, brochures placed in pharmacies and clinics, posters and mailings to the community via libraries, adult day care centers, community centers, and the University setting and accounted for most of the contacts. A total of 173 contacts were made; 33 contacts did not meet inclusion criteria, and another 49 declined to participate. Following baseline data collection, eligible dyads were randomized to either intervention or usual care control groups. Inclusion criteria were self-reported memory loss, having an informal caregiver who was assisting with medication taking, and having at least two comorbidities that required prescribed medications. Exclusion criteria were having no caregiver or living in a residential care setting. Details of the inclusion/exclusion and the study procedure of this RCT have been reported elsewhere.² The Institutional Review Board at the University of Pittsburgh approved the RCT. The current study used a descriptive

correlational design to examine the health literacy of the 91 informal caregivers at baseline and factors associated with their health literacy as identified in the ASK Model.

Measures

Socio-demographic characteristics of patients and caregivers, such as age (years), gender (male vs. female), race (white vs. non-white), and education (years), as well as the number of comorbidities were collected by two questionnaires developed for the University of Pittsburgh School of Nursing Center for Research in Chronic Disorders.³³ Information regarding the relationship of caregivers to patients (spouse vs. non-spouse), living arrangement (same household vs. non-same household), caregiving years, and the number of medications managed was also collected.

Health literacy was measured using the Newest Vital Sign (NVS).²⁸ This tool includes 6 questions about an ice cream nutrition label to assess a patient's prose (words, questions 5 & 6), numeracy (numbers, questions 1 & 2), and document (forms, questions 3 & 4) health literacy. Each correct answer is given 1 point; an incorrect answer is recorded as 0. The total score can range from 0 to 6 with higher scores indicating higher literacy. The scores of 0–3 define limited literacy and scores of 4–6 indicate adequate literacy. The total score of each subscale can range from 0 to 2 with higher scores indicating higher subscale of literacy. The NVS has established internal consistency with a Cronbach's alpha of 0.76, and a moderate correlation of 0.54–0.59 with the TOFHLA in patient populations including older adults.^{28, 31} For the present study, the internal consistency based of Cronbach's alpha was 0.73(n=91).

Cognitive abilities were assessed using four cognitive tests. First, the Blessed Orientation-Memory-Concentration Test (BOMCT) is a 6-item measure of global cognitive function with an established test-retest reliability and convergent validity.³⁴ Scores can range from 0 to 28 with higher scores indicating lower cognitive function. Second, the Letter-Number Sequencing Scale, a subtest of the Wechsler Memory Scale, 3rd Edition (WMS-3) was used to measure working memory.³⁵ The scale is comprised of 7 items and each item includes 3 trials. The total score ranges from 0 to 21 with higher scores indicating better working memory (adjusted for age). Finally, executive function was assessed using the Trail Making Test (TMT) Part B³⁶ and the Stroop Test.³⁷ Both are commonly used for assessment of executive function in older adults.³⁸ The TMT Part B performance reflects visual motor skills, visual spatial abilities and mental flexibility. Time for the caregiver to connect alternating numbers (1–13) and letters (A–L) is recorded. Longer time to complete this task indicates poorer executive function. The Stroop Test assesses the effects of interference on reading ability. Individuals are shown words that are the names of colors; the actual words are printed in a different color than the color name they represent. Individuals are asked to name the ink colors as quickly as possible within 45 seconds. Scores are generated using the number of items completed with higher scores indicating better performance. Interference T-scores (adjusted for age) were calculated with higher scores indicating less interference on reading ability and better executive function. As a composite score for executive function is expected to be more sensitive to detect functioning change in a smaller sample size,³⁹ an executive function domain score was calculated and used for the final regression modeling.

Considering the different scaling across the two measures, the TMT Part B T-score was created after the adjustment for age, race, and gender.⁴⁰ The mean of the TMT Part B T-score and the Stroop Interference T-score was used for the domain executive function,⁴¹ with higher scores indicating better executive function.

In the ASK Model, academic skills refer to reading and mathematics skills.¹⁶ These specific skills were not assessed in the parent study. Therefore, years of education was used as a surrogate measure of academic skills, and was obtained from the socio-demographic questionnaire.

Medication knowledge was calculated by the percent accuracy of caregiver knowledge about prescribed US Food and Drug Administration (FDA)-approved patient medications. Medication information was collected by the Worksheet for Medication Management Instrument for Deficiencies in the Elderly (MedMaIDE).⁴² An iterative process was used to determine the overall accuracy of the medication indications provided by caregivers. A set of indication accuracy codes was established by the study team. A medication indication was considered accurate if it reasonably reflected an FDA-approved usage or a well-supported off-label use. The accurate FDA indication and accurate supported off-label indication categories were collapsed into one category labeled “Accurate”, and were assigned a value of 1. The other categories, including “Inaccurate indication”, “Unable to determine”, “Subject did not know”, and “Nearly, but not completely accurate”, were collapsed and labeled “Inaccurate”, and were assigned a value of 0. The alternative/herbal medication or supplement category was excluded from the analysis. The percentage of accurate indications across medications was calculated for each participating caregiver.

Data Analysis

IBM® SPSS® Statistics for Windows (version 24, IBM Corp., Armonk, NY) was used for data analysis. Missing data was limited to a single missing entry for the TMT Part B time. As the missing rate was very low (< 1% missing), mean imputation was applied to this case. Caregivers’ health literacy scores were normally distributed. As appropriate, descriptive statistics, such as means, standard deviations, frequencies, and percentages, were used to summarize caregiver and patient personal characteristics and other baseline variables, including health literacy. The differences across the mean scores of health literacy subscales (prose, numeracy, and document) were assessed by the Friedman test, with the post hoc analysis by the Wilcoxon signed-rank test. Pearson product-moment correlations, Spearman’s rank-order correlations, and point-biserial correlations were used to examine bivariate associations between health literacy and other measures. In accord with the approach by Ownby et al.,¹⁶ a four-step hierarchical multiple linear regression was conducted to assess the impact of each element of the ASK model on caregiver health literacy progressively. With a fixed sample size of 91 for this secondary analysis, we would have at least .80 power to detect a population R^2 as small as 0.157 for the overall regression model with 8 predictors at a significance level of 0.05 for two-sided hypothesis testing with an F-test. Considering the statistical adjustment of socio-demographic characteristics, the first block included socio-demographic characteristics (age, gender, and race). In the second block measures of cognitive abilities (global cognitive function, executive function, and

working memory) were added to the model. Block 3 added academic skills (education in years) with the final block adding medication knowledge. In each step of modeling, regression model diagnostics were computed. Potentially influential observations were carefully examined using the externally studentized residuals with leverage statistics, and the extent of their influence was quantified using diagnostics assessing the impact on the estimation of predicted values, regression coefficients, and standard errors. Two potential influential cases were identified, and none of them was related to the case with imputed TMT Part B time. As the estimates of predicted values, coefficients, and standard errors did not substantially change with and without two cases in the models, two cases were included for analysis. Residual plots indicated normal residual distributions and mild heteroscedasticity. Tolerance and variance inflation factor indices indicated no multicollinearity. The change in the R^2 value (i.e., incremental R^2) and the significance of the change in R^2 for each step of modeling were reported, as well as the estimated regression coefficients, standard errors for estimated coefficients, and corresponding p-values. Squared semi-partial correlations were reported in the last step of modeling. Statistical significance was set *a priori* at $p < .05$.

Results

Table 1 displays a summary of the sample characteristics of caregivers and patients. Most caregivers and patients were women, white, and with more than high school education. Caregivers had an average age of 67 years and approximately 7 comorbidities, while the patients' average age was 80 years with an average number of comorbidities of 8. More than half of the dyads were spouses and lived together. On average, caregivers had more than 5 years of caregiving experience, and currently managed more than 10 medications for the patients.

Caregivers had an average health literacy score of 4.02, indicating overall adequate literacy. Among the 91 caregivers, 56 (61.5%) had adequate literacy (scored 4–6), and 35 (38.5%) had limited literacy (scored 1–3). A significant difference was found across the three subscales of caregiver health literacy ($\chi^2 = 21.39$, $p < .001$). Specifically, caregivers' document literacy was lower than prose ($Z = -3.32$, $p = .001$) and numeracy literacy ($Z = -3.97$, $p < .001$). On average, caregivers demonstrated good global cognitive function, moderate working memory and executive function, and good medication knowledge. However, there was considerable variability in executive function as measured by the TMT Part B time, and medication knowledge as measured by the percentage of accurate indications across medications (see Table 2).

Table 3 reports the bivariate correlations between study variables. Health literacy showed a small positive correlation with medication knowledge ($p = .02$); moderate positive correlations with executive function (measured by TMT-B time, $p = .001$), working memory ($p < .001$), and education ($p < .001$); a moderate negative correlation with age ($p < .001$), and a large positive correlation with global cognitive function ($p < .001$). Health literacy was not associated with gender as measured by male vs. female ($p = .09$), race as measured by white vs. non-white ($p = .42$), or executive function as measured by the Stroop Test interference T-score ($p = .08$).

The results of the hierarchical regression modeling of health literacy are displayed in Table 4. In the first block, socio-demographics explained 18% of the variability of health literacy ($R^2=.18$, $F_{[3, 86]}=6.68$, $p<.001$), with older age being associated with poorer health literacy, while gender and race were not associated. The addition of cognitive abilities to the model explained an additional 31% of the variability in health literacy ($R^2_{\text{change}}=.31$, $F_{\text{change}}=17.28$, $p<.001$), indicating that older age, more severe cognitive impairment, and poorer working memory were independently associated with poorer health literacy. Next, academic skills (education in years) was added to the model (Block 3, $R^2_{\text{change}}=.05$, $F_{\text{change}}=8.51$, $p=.005$), indicating older age, more severe cognitive impairment, poorer working memory, and lower education years were independently associated with poorer health literacy. In Step 4 medication knowledge was added (R^2 with no change, $F_{\text{change}}=0.01$, $p=.92$), indicating that the addition of medication knowledge did not explain any additional variability in health literacy. The percent of variability (R^2) in health literacy that was accounted for increased from 18% to 54% when cognitive abilities and academic skills (years of education) were added to the model. However, the inclusion of medication knowledge did not significantly increase the value of R^2 . Squared semi-partial correlation coefficients reported in Step 4 indicated that global cognitive function, working memory, and education were the main contributors to the percentage of variability that was explained by the final model (Table 4).

Discussion

In this study, more than one-third of the informal caregivers had limited health literacy, and the mean literacy score on the NVS was at the lower end of the defined adequate literacy range of 4 to 6. The subscale scores suggested that caregivers' document literacy was significantly lower than their prose literacy and numeracy, indicating that caregivers may have limited abilities to understand and use non-continuous texts in various formats, which could include medication labels.⁴³ Informal caregivers in this study were themselves older adults with an average age of 67 years. However, their characteristics were consistent with the broader caregiving literature with regard to their distributions in age, gender, spousal relationships of informal caregivers of adults with memory loss, as well as their burden of caregiving (years of caregiving), the number of patient medications managed, and the number of patient co-morbidities reported.⁴⁴

Based on the ASK (Abilities, Skills, and Knowledge) Model, this study assessed and demonstrated that cognitive abilities (global cognitive function and working memory) and academic skills (education) were strong contributors to health literacy in informal caregivers of adults with memory loss. In addition to these two elements of the ASK model, age was identified as a significant predictor of health literacy in this population, when controlling for other demographic characteristics (gender and race) in the model. Analyses indicated that our statistical model explained more than 50% of the variability in caregiver health literacy. As reported in the literature, the relationships of commonly used health literacy measures to each element of the ASK Model may vary widely,¹⁶ the current study demonstrated that the elements of the ASK Model were not equally represented in caregiver health literacy measured by the NVS.

Both global cognitive function and working memory were strong predictors of caregivers' health literacy in this study, which is congruent with the literature.^{17, 18} Working memory reflects the person's capacity to process and remember new information at the same time. Therefore, deficits in working memory can specifically affect caregivers' ability to follow health providers' instructions and adhere to the medication regimen.⁴⁵ Findings from the study suggest that caregiver working memory is one of the key components that contribute to health literacy; its influence should be considered when measuring caregiver health literacy among informal caregivers who engage in medication management for adults with memory loss. It is interesting that we did not find that executive function significantly contributed to caregivers' health literacy in the model, even though research shows that deficits in executive function are associated with limited health literacy⁴⁶ and medication non-adherence.⁴⁵ It is possible that the effect of executive function on caregiver health literacy was compensated for by other cognitive function measures, such as global cognitive function and working memory in the regression model. The bivariate correlation analysis did reveal a strong association between executive function (measured by the TMT Part B) and health literacy. Another possible explanation may be the selection of the executive function domain measure in the model. Although both the TMT Part B and Stroop Test reflect the measures of mental flexibility, the TMT Part B focuses more on visual motor and visual spatial abilities, while the Stroop Test focuses on reading ability. The findings from our study seem to suggest that the sub-domains of executive function should be considered when assessing the association between executive function and health literacy. This consideration will need to be explored further in a future study.

Caregivers' medication knowledge was not found to be an independent predictor of caregiver health literacy in the hierarchical multiple linear regression. There are arguments in the literature regarding whether health-related knowledge should be part of health literacy. The IOM considers conceptual knowledge as one of domains of health literacy.¹³ However, other researchers suggest that knowledge or health-related information can be an outcome of health literacy.¹² In the conceptual model of the relationship between individual capacities, health literacy, and health outcomes, Baker¹⁴ actually separates knowledge as "prior knowledge" and "new knowledge", and considers prior knowledge as a resource to facilitate health literacy, but does not think conceptual knowledge itself constitutes health literacy. In the bivariate correlation analysis, we found that medication knowledge was significantly associated with caregiver health literacy. We suspect that individual capacity, such as cognitive abilities and academic skills, may affect representation of knowledge in the model; this area will need future further exploration. In addition, the way we measured medication knowledge may not represent caregiver medication knowledge precisely. Asking the indication for a medication is a simple way to assess medication knowledge.⁴⁷ However, many studies assess patients' medication knowledge by asking not only medication indication but also dose, frequency, precautions, adverse effects, contradictions, and effectiveness,^{48, 49} which may more completely reflect the person's knowledge of medications.

Most caregivers in the study were white, reflecting the distribution of ethnicities in our recruitment area. This lack of diversity in our sample is a potential limitation in this study. One previous study identified that minority race was negatively associated with health

literacy among caregivers of patients with Type 2 Diabetes,⁵⁰ however, this relationship was not presented in our study. The potential sample selection biases may have occurred because participants in our study volunteered from the community and clinic. Our sample had a relatively high level of education, showing a positive correlation between educational attainment and health literacy. As the parent trial did not have a specific measure of academic skills, we used years of education as the surrogate measure, which may not exactly capture caregivers' academic achievement in reading comprehension and mathematic skills.¹⁶ In addition, the study had a small sample size for regression analysis. In an earlier report of the parent study, our sample did not demonstrate a large number of medication errors.⁵¹ In this analysis, we combined some measures, such as using the executive function domain score, to decrease the number of predictors to eight in the final model with a sample size of 91 caregivers. Lastly, we used the ASK model as a starting point to explore factors underlying caregiver health literacy. However, considering the diverse definitions of health literacy, the ASK model may not be comprehensive enough to capture the multidimensional interpretation of health literacy.^{12, 15} Given that some definitions indicate health literacy should consider not only individual capacities in reading, vocabulary, and health knowledge, but also the complexity of health care environments that individuals would be likely to encounter, the individual level of health literacy measures may be inadequate.¹⁴

Conclusion

This study examined health literacy and tested the ASK (Abilities, Skills, and Knowledge) Model in informal caregivers of community-dwelling older adults with memory loss who were engaged in medication management. Measured by the Newest Vital Sign, limited health literacy presented among more than one-third informal caregivers, and caregiver health literacy was explained by cognitive abilities and academic skills, when holding socio-demographic characteristics constant. Although medication knowledge did not show a significant contribution to health literacy in the model, bivariate correlations between medication knowledge and health literacy were demonstrated. As informal caregivers frequently engage in medication management of adults with memory loss, it is important for nurses to assess caregivers' health literacy when conducting interventions about medication management. As older age, lower education, and poor cognitive functioning are independent predictors of inadequate health literacy, targeted interventions may need to be developed to help those caregivers who are at high risk for limited health literacy. Also, any special needs of informal caregivers with limited health literacy need to be recognized and addressed by the nurses. Future research with larger samples is warranted to explore change in caregivers' health literacy over time, including the contribution of medication knowledge to health literacy improvement, and the association between caregiver medication health literacy and specific patient outcomes.

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Highlights

- Limited health literacy presented in more than one-third of informal caregivers of older adults with memory loss
- Caregiver cognitive abilities and academic skills (education years) independently predicted caregiver health literacy
- Medication knowledge was associated with health literacy among informal caregivers engaged in patient medication management

Table 1

Description of Sample Characteristics

Characteristics	Caregiver (N=91)	Patient (N=91)
	<i>n (%)</i>	<i>n (%)</i>
Gender, female	64 (70)	54 (60)
Race, white	77 (85)	77 (85)
	Mean (SD)	Mean (SD)
Age (years)	67.4 (11.8)	80.2 (8.8)
Education (years)	14.9 (3.3)	13.1 (3.3)
Comorbidities (number)	6.9 (3.6)	8.7 (3.8)
Caregiver & Patient Dyads		
	<i>n(%)</i>	
Relationship, Spouse	52 (57)	
Living Arrangements, Same household	79 (87)	
	Mean (SD)	
Patient medications managed (number)	10.5 (5.3)	
Caregiving time (years)	5.4 (9.2)	

Notes. SD, standard deviation.

Table 2

Descriptive Statistics for Measures of Health Literacy, Cognitive Ability, Academic Skills and Medication Knowledge

Category	Variable	Measure	Mean (SD)	Range
Health Literacy	Total		4.02 (1.81)	0–6
	Prose	Newest Vital Sign	1.47 (0.86)	0–2
	Numeracy		1.47 (0.78)	0–2
	Document		1.08 (0.83)	0–2
Cognitive Ability	Global Cognitive Function	Blessed Orientation-Memory-Concentration Test	2.96 (2.93)	0–14
	Working Memory	Letter-Number Sequencing, Wechsler Memory Scale	9.67 (2.20)	5–16
	Executive Function	Trail Making Test Part B (time)	80.50 (36.66)	27–234
		Stroop Test (interference T-score)	49.65 (7.35)	28–70
Academic Skill	Education	Sociodemographic Questionnaire (year)	14.91 (3.31)	9–30
Medication Knowledge	Percentage of Accuracy	Worksheet for Medication Management Instrument for Deficiencies in the Elderly	85.20 (22.77)	0–100

Table 3

Correlation Matrix of Study Variables

	Health Literacy	Male	White	Age	GCF	EF (TMT-B)	EF (ST)	Working Memory	Education
Male [#]	-.18								
White [#]	-.09	.18							
Age	-.42 ^{**}	.38 ^{**}	.35 ^{**}						
GCF [§]	-.54 ^{**}	.10	-.08	.10					
EF (TMT-B) [§]	-.40 ^{**}	.25 [*]	.13	.54 ^{**}	.21 [*]				
EF (ST)	.18	.08	.13	-.04	-.23 [*]	-.28 [*]			
Working Memory	.48 ^{**}	-.30	-.06	-.36 ^{**}	-.20	-.23 [*]	.21 [*]		
Education [§]	.37 ^{**}	.14	-.02	-.26 [*]	-.09	-.20	.07	.19	
Medications Knowledge [§]	.25 [*]	-.12	.09	-.22 [*]	.31 [*]	-.20	.03	.24 [*]	.05

Notes. GCF=Global Cognitive Function; EF=Executive Function; TMT-B=Trail Making Test Part B (time); ST=Stroop Test (inference T-score).

* $p < .05$;

** $p < .01$.

[#]Point-biserial correlation coefficient displayed.

[§]Spearman's rank-order correlation displayed.

Table 4

Summary of Hierarchical Regression Modeling (with the order of entry into the model being socio-demographic characteristics [Block 1], cognitive abilities [Block 2], academic skills [Block 3], and medication knowledge [Block 4])

	Block 1			Block 2			Block 3			Block 4		
	<i>R</i> ²	<i>p</i>		<i>R</i> ²	<i>p</i>		<i>R</i> ²	<i>p</i>		<i>R</i> ²	<i>p</i>	Part ²
	0.18	.001		0.31	<.001		0.05	.005		<.01		.92
	<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>	<i>SE</i>	<i>p</i>	<i>b</i>	<i>SE</i>	<i>p</i>
Intercept	8.06	1.03	<.001	4.66	1.62	.005	2.41	1.73	0.17	2.47	1.82	.18
Male	-0.12	0.41	.79	0.34	0.34	.33	0.06	0.34	0.86	0.06	0.34	.85
White	0.39	0.55	.49	-0.03	0.45	.95	-0.07	0.43	0.87	-0.07	0.43	.88
Age (years)	-0.07	0.02	<.001	-0.04	0.01	.01	-0.03	0.01	0.02	-0.03	0.01	.02
Global Cognitive Function				-0.28	0.05	<.001	-0.26	0.05	<.001	-0.26	0.05	<.001
Executive Function (domain)				0.01	0.02	.79	0.01	0.02	0.64	0.01	0.02	.63
Working Memory				0.26	0.07	.001	0.23	0.07	0.001	0.23	0.07	.001
Education (years)							0.13	0.04	0.01	0.13	0.04	.01
Medication Knowledge										-0.001	0.01	.92
												.0001

Notes. *R*², R square change; *b*, estimated unstandardized regression coefficient; *SE*, Standard Error of *b*; Part, semi-partial correlation coefficient.