Published in final edited form as:

Nurs Res. 2012 ; 61(1): 70–75. doi:10.1097/NNR.0b013e31823b18f4.

Memory Performance, Health Literacy, and Instrumental Activities of Daily Living of Community Residing Older Adults

Graham J. McDougall Jr, PhD, RN, FAAN, FGSA [Professor],
School of Nursing

Michael Mackert, PhD [Assistant Professor], and
Department of Advertising

Heather Becker, PhD [Research Scientist]
School of Nursing, the University of Texas at Austin

Abstract

Background—Health literacy is associated with cognitive function across multiple domains in older adults, and these older adults may face special memory and cognitive challenges that can limit their health literacy and, in turn, their ability to live independently.

Objectives—The aim of this study was to evaluate if an association existed among health literacy, memory performance, and performance-based functional ability in community-residing older adults.

Methods—Forty-five adults participated in this study. Designed to reflect everyday memory, the Rivermead Behavioral Memory Test (RBMT) bridges laboratory-based measures of memory and assessments obtained by self-report and observation. The RBMT classifies individuals into four categories of memory performance: *normal*, *poor*, *mildly impaired*, and *severely impaired*. The participants were recruited in the two categories of *normal* (22) or *impaired* (16) category on the RBMT. The sample consisted of 14 who were in the impaired category and 31 in the normal group. Their average age was 77.11 years, and their average number of years of education was 15.33 years. Health literacy scores measured with the Rapid Estimate of Adult Literacy in Medicine.

Results—Health literacy scores were high ($M = 65.09$, $SD = 2.80$). Thirty-four participants or 76% of the sample scored a 66 out of a possible score of 80. Pearson correlations were calculated for the study variables. Health literacy scores with education and cognition (.30), memory performance groups (normal vs. poor; .25), and performance-based instrumental activities (.50) were associated significantly.

Corresponding author: Graham J. McDougall, Jr., PhD, RN, FAAN, FGSA, School of Nursing, the University of Texas at Austin, 1700 Red River, Austin, TX 78701-1499 (gmcdougall@mail.nur.utexas.edu).

The authors have no conflicts of interest to disclose.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.nursingresearchonline.com).

Discussion—The development of a broader assortment of health literacy instruments would improve the ability of researchers to both compare studies and build on the knowledge and results of others.

Keywords

health literacy; memory performance; older adults; performance-based instrumental activities

Health researchers and professionals are increasingly focusing on how health literacy is related to patient outcomes (Peterson et al., 2011; Yamashita & Kart, 2011). Among certain groups, such as older people, minority populations, and recent immigrants with limited English skills, low health literacy is a more widespread problem (Nielsen-Bohlman, Panzer, & Kindig, 2004). Health care costs can be four times higher for individuals with low literacy skills than for those with sufficient health literacy, attributable mainly to higher rates of hospitalization and more emergency room visits (Cuban, 2006; Weiss, 1999). Given the costs associated with low health literacy, currently estimated to account for \$69 billion of the nation's healthcare budget, health literacy merits further study (Nielsen-Bohlman et al., 2004). The prevalence of low and marginal health literacy measured with the Rapid Estimate of Adult Literacy in Medicine (REALM) and the Test of Functional Health Literacy in Adults was estimated around 20% from a review of 85 studies that included 31,129 subjects (Paasche-Orlow, Parker, Gazmararian, Nielsen-Bohlman, & Rudd, 2005).

In addition to the concern about health literacy in the United States, there is increasing recognition that many of the country's growing numbers of older adults have memory impairment and cognitive problems. Cognitive aging researchers have shown that a decline in memory performance often occurs in individuals of ages 65–85 years (Salthouse, 2003), and this can contribute to depression and loss of independence (Mendes de Leon, Gold, Glass, Kaplan, & George, 2001; Smith, Petersen, Ivnik, Malec, & Tangalos, 1996). Declining memory and cognitive abilities also may have a substantial impact on the ability of older people to successfully navigate the healthcare system and to comprehend the health information they receive.

Studies have shown that older individuals with low levels of education are likely to have limited health literacy (Baker, Williams, Parker, Gazmararian, & Nurss, 1999; Scott, Gazmararian, Williams, & Baker, 2002; Wolf, Gazmararian, & Baker, 2005, 2007). Low health literacy is not, of course, limited to people with low general literacy; even people with strong literacy skills may have difficulties with health information because of jargon, complicated language, and the context of interactions with healthcare providers (Hayes, 1998; Nielsen-Bohlman et al., 2004). This low health literacy may contribute to many disparities that affect these populations, which range from higher rates of diabetes, hypertension, and heart failure among minority groups (Gerber, Cho, Arozullah, & Lee, 2010; Morrow et al., 2006; Wallace, Carlson, Malone, Joyner, & DeWalt, 2010) to an increased incidence of neural tube defects among Mexican-born immigrants (Velie et al., 2006).

The concept of health literacy is broader than it might first appear if health literacy involves much more than whether or not an individual can walk out of a visit to the doctor

understanding what the provider said or successfully read the information on a medicine bottle. Zarcadoolas, Pleasant, and Greer (2006) described four primary dimensions of health literacy: fundamental literacy, scientific literacy, civic literacy, and cultural literacy. Other facets of health literacy have been noted, including media literacy (Bernhardt & Cameron, 2003) and physical or mental impairment (Bernhardt, Brownfield, & Parker, 2005). Nevertheless, health literacy was associated with cognitive function across multiple cognitive domains in Caucasian older adults (Barnes, Tager, Satariano, & Yaffe, 2004). The field is evolving quickly to incorporate new factors that contribute to the ability of an individual to obtain, understand, and act on health information. In particular, older adults may face special memory and cognitive challenges that can limit their health literacy and, in turn, their ability to live independently.

The ability to live independently is a concern for many older adults, because functional status decreases with age and is an important determinant of independent living. Typically, functional status is divided into activities of daily living (ADLs), defined as self-care habitual activities (ambulating, feeding oneself, washing, toileting, dressing, and communication), and the activities that are related to independent daily living known as instrumental ADLs (IADLs; money management, shopping and meal preparation, using a telephone, taking medications, work and social activities, and the performance of household chores; Burton, Strauss, Hultsch, & Hunter, 2006). Successful completion of IADLs requires sequencing of tasks, judgment, and organizational abilities (Bell-McGinty, Podell, Franzen, Baird, & Williams, 2002). Cognitive and memory decline is associated with declines in IADLs and occurs well before the loss of the ability to perform ADLs (Njegovan, Man-Son-Hing, Mitchell, & Molnar, 2001).

Important predictors of functional capacity include physical disabilities, sensory impairment, medical conditions, and perceived health status (Cahn-Weiner, Malloy, Boyle, Marran, & Salloway, 2000). Emotional status (depression), motivation, social factors of education, and social economic status are also reported to influence the performance of IADLs (Marcopulos, McLain, & Guiliano, 1997). Finally, cognitive ability, as measured by the Mini-Mental Status Examination (MMSE), has been reported as a predictor of IADL performance (Bertrand, Willis, & Sayer, 2001).

Only a few studies have been focused on memory problems among cognitively intact community dwelling older adults. In a study of 27 community-dwelling older adults, executive function and depression accounted for 43% of the variance in IADL scores (Cahn-Weiner et al., 2000). Bell-McGinty et al. (2002) compared 6 community-dwelling older adults, 9 older adults living in long-term care, and 35 older adults who were referred from the community for neuropsychological testing ($n = 50$) to examine the ability of a common test of executive function to predict physical function. Multiple regression showed that the Trail Making Part B and the Wisconsin Card Sorting Test predicted IADL ability among individuals without dementia. The authors also reported that a decrease in executive capacity resulted in a decrease in the ability to manage finances and medications. Health literacy is particularly important for managing medication.

Adults over age 65 years make up 14% of the population in the United States but use over 30% of all prescription medications. In fact, 90% of adults over 65 years of age take at least one prescription medication a week, 40% take at least five different medications, and 12% are taking more than 10 types of medications a week (Gurwitz et al., 2003). Several tests of IADL ability include medication management as a component; however, most are self-report tests that require only memory recall of the procedure. For example, in the Physical Functioning Inventory, participants are asked how they would obtain medications and whether they have any difficulty in taking them (Whetstone et al., 2001). The Everyday Problems Test asks participants to solve problems based on a medication label, telephone use, meal preparation, shopping, money management, transportation, and managing a household (Burton et al., 2006). The Timed IADL Test requires participants to identify and read the label on a medication bottle correctly within a limited space of time (Edwards et al., 2005). Similarly, in use of the Direct Assessment of Functional Status (DAFS) Scale, a labeled medication bottle is presented, and the participant is asked to identify items on the label (Loewenstein et al., 1989).

The purpose of this study was to determine if an association existed among health literacy, memory performance, and performance-based functional ability in community-residing older adults.

Methods

Design

A selected group of participants from a randomized clinical trial returned for a sixth testing (T6) approximately 20 months after the original study ended (McDougall et al., 2010). The hypothesis tested in the parent study SeniorWISE (Wisdom Is Simply Exploration) was that at-risk older adults who participated in a memory training intervention would show significantly better affective and cognitive outcomes than the individuals in the health training intervention at postclass (2 months after baseline), and these benefits would be maintained over the remaining four assessment points: postclassroom (2 months), postbooster (6 months), postclassroom follow-up (14 months), and end of study (26 months).

Sample

The sample for this pilot study consisted 45 individuals. The participants were screened for cognitive impairment, and the presence of dementia was an exclusionary criterion for enrollment in the parent study. Health literacy was evaluated in this study. Memory performance on the Rivermead Behavioral Memory Test (RBMT) of subjects at Time 5 in the SeniorWISE study (24 months into the study) was used as a basis for enrollment into this pilot study (Cockburn & Smith, 1989). Following institutional review board approval, 105 participants, split evenly into those who previously scored in the *normal* (22) or *impaired* (16) category on the RBMT, were selected from the final SeniorWISE sample and mailed a recruitment letter. Of those contacted, 60 agreed to participate (response rate = 57%), and 45 eventually completed the study. Among those, 34 were women and 11 were men; 3 were African Americans, 36 were Caucasians, and 6 were Hispanics. Furthermore, 14 were in the

impaired category and 31 were in the normal category. Their average age was 77.11 years, and their average number of years of education was 15.33 years. The MMSE was used in this study to assess concurrent validity of the Direct Assessment of Functional Status-Extended (DAFS-E). Approximately 20 months had passed on average from the previous testing.

Measures

Designed to reflect everyday memory, the RBMT bridges laboratory-based measures of memory and assessments obtained by self-report and observation. It has been shown to be appropriate for older adults and relatively resistant to moderate sensory impairment and self-reported anxiety and depression (Cockburn & Smith, 1991). The RBMT was designed to reflect everyday memory performance and served as the memory performance measure. The components included remembering of a name (first name and surname), a hidden belonging, an appointment, picture recognition, a brief news article (immediate and delayed), face recognition, a new route (immediate), a new route (delayed), a message, orientation, and date. A standardized profile score with a range from 0 to 24 provides cutoff points for four groups of memory function: *normal* (22–24), *poor* (17–21), *moderately impaired* (10–16), and *severely impaired* (0–9).

Memory performance on the RBMT of subjects at Time 5 in the SeniorWISE study (24 months into the study) was used as a basis for enrollment into this pilot study (Cockburn & Smith, 1989). Participants' previous RBMT scores were used to assess the criterion validity of the DAFS-E.

The REALM was used to assess participants' health literacy (Davis et al., 1993). The REALM is used to assess a person's ability to read common medical words and terms for body parts and illnesses. The test comprises 66 words, and scores can range from 0 to 66. Participants get a point for every word they pronounce correctly. Reliability and validity evidence is published in the REALM administration manual (Davis et al., 1993). Strong test-retest reliability was established on a group of 100 adult inmates at a penal institution (.99). Interrater reliability was also found between six research assistants for scoring the instrument (.99). Validity was established by correlating the REALM with three reading tests. Correlations ranged from .88 to .97.

The revised DAFS-E was used to assess participants' instrumental activities and served as the primary focus of this study. The DAFS-E assessed participants' performance in the following domains: communication skills, financial skills, shopping skills, and medication skills. There are 55 items in the DAFS-E, 20 of which are in the medication skills domain.

Results

The full SeniorWISE study findings have been published elsewhere (McDougall et al., 2010). At Time 5 of the parent study, the mean differences between variables in the impaired versus the normal memory performance groups were significantly different ($p < .01$). Age was 75.88 years versus 72.52 years; education was 12.21 years versus 14.99 years. The

mean MMSE scores were 27.79 and 29.16, and the memory scores in the impaired and normal groups were 28.00 and 29.03, respectively.

In this sample, health literacy scores measured with the REALM were on the high end of the scale ($M = 65.09$, $SD = 2.80$). Thirty-four participants or 76% of the sample scored 66 (Figure 1; also see Supplemental Digital Content 1, which illustrates the health literacy histogram in color, <http://links.lww.com/NRES/A66>). Forty-two individuals scored in the high school equivalent category of 61–66. Three individuals scored 60 or below, which categorized them as seventh or eighth grade equivalent range. These scores were consistent with the years of education for those three individuals, but not for the remaining 11 individuals in the memory-impaired group.

Pearson correlations were calculated for the study variables (Figure 2; see also Supplemental Digital Content 2, which illustrates correlations with health literacy in color, <http://links.lww.com/NRES/A67>). Health literacy correlations with the demographic variables of education (.19) and age (–.15) were nonsignificant, although education and cognition (.30) were associated significantly. Health literacy was associated significantly with RBMT memory performance groups (normal vs. poor; .25) and DAFS-E scores (.50).

Discussion

Although the original intent of this project was to investigate the impact of a memory intervention on the cognitive functioning of older adults, it was a fortuitous result that both treatment and control conditions actually improved on cognitive outcomes. This is particularly important when one considers a broader conception of health literacy, which includes whether individuals have the requisite cognitive abilities to process and recall the health information they receive.

Subjects in this study showed improvements in their cognitive ability, memory, functional abilities, and use of memory strategies over the course of the study; some of the results varied based on the characteristics of the participants before the study began (e.g., higher verbal memory scores at baseline led to greater improvements in verbal memory) or demographic characteristics of the participants (e.g., older subjects made greater gains in visual memory over the course of the study). It is also worth noting that some of the results, such as improvements in functional abilities, persisted only through the end of classes.

Interestingly, the REALM did not detect the manner in which these older adults' health literacy improved. Health literacy was associated significantly with memory performance groups (normal vs. poor) and DAFS-E scores. Skill development in one dimension (e.g., memory performance) can help build skills in another, and inadequate skills in one dimension can be compensated for by superior skills in another or by creative strategies to overcome such deficiencies (McCray, 2005; Zarcadoolas et al., 2006). Older individuals with low levels of education have been found to be likely to have limited health literacy (Scott et al., 2002; Wolf et al., 2005, 2007); however, in the current study, education was not related to health literacy scores.

It would seem that simply making health a topic on which older adults focused on several times per week—whether in the context of memory training or health promotion discussions—enhanced their ability to deal with health issues (e.g., through improvements in their functional abilities) and to recall and process information (e.g., through improvements in memory and use of memory strategies).

The results highlight a current area of much-needed research in the health literacy field—the development and validation of instruments that can assess dimensions of health literacy not operationalized by established measures. Development of a broader assortment of health literacy instruments would improve the ability of researchers to both compare studies and build upon the knowledge and results of others. The REALM was considered a robust measure of health literacy; however, Shea et al. (2004) found large and conflicting differences between African American and Caucasian older adults' health literacy scores with similar education.

This research points to several particularly interesting avenues for future studies. It would be helpful to further investigate the manner in which each of these interventions improved the health literacy of older adults, using measures of health literacy, preferably measures of health literacy that can detect the kinds of improvements likely to result from the interventions. Other work could test the impact that these types of interventions have on the health outcomes of older adults, further strengthening the links between health literacy and health status. Also, because some study findings did not persist beyond the end of intervention classes, it would be useful to refine the frequency of classes required to maintain consistent improvements in health literacy levels. Finally, it is important to delve more deeply into the disparities that exist between White and minority older adults regarding cognitive and memory abilities and develop targeted strategies to help bridge those gaps.

The cross-sectional nature of this study with a small sample resulted in limited findings. Nevertheless, the strength of this study was the measurement and validation of health literacy with other robust cognitive function and performance-based functional ability measures with community-living older adults.

Acknowledgments

Support for this research was provided by National Institute of Aging Grant R01 AG 15384 and additional pilot funding from the Center for Health Promotion and Disease Prevention Research in Underserved Populations at the School of Nursing (NINR 5P30 NR005051) at the University of Texas at Austin.

We thank Drs. Taylor Acee and Phillip Vaughan for assisting with data analysis.

References

- Baker DW, Williams MV, Parker RM, Gazmararian JA, Nurss J. Development of a brief test to measure functional health literacy. *Patient Education and Counseling*. 1999; 38:33–42. [PubMed: 14528569]
- Barnes DE, Tager IB, Satariano WA, Yaffe K. The relationship between literacy and cognition in well-educated elders. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*. 2004; 59:390–395.

- Bell-McGinty S, Podell K, Franzen M, Baird AD, Williams MJ. Standard measures of executive function in predicting instrumental activities of daily living in older adults. *International Journal Geriatric Psychiatry*. 2002; 17:828–834.
- Bernhardt, J.; Cameron, K. Accessing, understanding, and applying health information: The challenge of health literacy. In: Thompson, T.; Dorsey, A.; Miller, K.; Parrott, R., editors. *Handbook of health communication*. Manwah, NJ: Erlbaum; 2003. p. 583-605.
- Bernhardt, J.; Brownfield, E.; Parker, R. Understanding health literacy. In: Schwartzberg, J.; VanGeest, J.; Wang, C., editors. *Understanding health literacy: Implications for medicine and public health*. Chicago, IL: AMA Press; 2005. p. 3-16.
- Bertrand R, Willis SL, Sayer A. An evaluation of change over time in everyday cognitive competence among Alzheimer patients. *Aging, Neuropsychology, and Cognition*. 2001; 8:192–212.
- Burton CL, Strauss E, Hultsch DF, Hunter MA. Cognitive functioning and everyday problem solving in older adults. *The Clinical Neuropsychologist*. 2006; 20(3):432–452. [PubMed: 16895857]
- Cahn-Weiner DA, Malloy PF, Boyle PA, Marran M, Salloway S. Prediction of functional status from neuropsychological tests in community-dwelling elderly individuals. *The Clinical Neuropsychologist*. 2000; 14:187–195. [PubMed: 10916193]
- Cockburn, J.; Smith, P. *The Rivermead Behavioural Memory Test Supplement 3: Elderly people*. Bury St. Edmonds, United Kingdom: Thames Valley Test Company; 1989.
- Cockburn J, Smith PT. The relative influence of intelligence and age on everyday memory. *Journal of Gerontology*. 1991; 46:31.
- Cuban S. Following the physician's recommendations faithfully and accurately: Functional health literacy, compliance, and the knowledge-based economy. *Journal for Critical Education Policy Studies*. 2006; 4
- Davis TC, Long SW, Jackson RH, Mayeaux EJ, George RB, Murphy PW, Crouch MA. Rapid Estimate of Adult Literacy in Medicine: A shortened screening instrument. *Family Medicine*. 1993; 25:391–395. [PubMed: 8349060]
- Edwards JD, Wadley VG, Vance DE, Wood K, Roenker DL, Ball KK. The impact of speed of processing training on cognitive and everyday performance. *Aging and Mental Health*. 2005; 9:262–271. [PubMed: 16019280]
- Gerber BS, Cho YI, Arozullah AM, Lee SY. Racial differences in medication adherence: A cross-sectional study of Medicare enrollees. *The American Journal of Geriatric Pharmacotherapy*. 2010; 8:136–145. [PubMed: 20439063]
- Gurwitz JH, Field TS, Harrold JR, Rothschild J, Debellis K, Seger AC, Bates DW. Incidence and preventability of adverse drug events among older persons in the ambulatory setting. *JAMA*. 2003; 289:1107–1116. [PubMed: 12622580]
- Hayes KS. Randomized trial of geragogy-based medication instruction in the emergency department. *Nursing Research*. 1998; 47:211–218. [PubMed: 9683116]
- Loewenstein DA, Amigo E, Duara R, Guterman A, Hurwitz D, Berkowitz N, Gittelman B. A new scale for the assessment of functional status in Alzheimer's disease and related disorders. *Journal of Gerontology*. 1989; 44:114–121.
- Marcopulos BA, McLain CA, Guiliano AJ. Cognitive impairment or inadequate norms? A study of healthy, rural older adults with limited education. *The Clinical Neuropsychologist*. 1997; 11:111–131.
- McCray AT. Promoting health literacy. *Journal of the American Medical Informatics Association*. 2005; 12:152–163. [PubMed: 15561782]
- McDougall GJ Jr, Becker H, Pituch K, Acee TW, Vaughan PW, Delville CL. The SeniorWISE study: Improving everyday memory in older adults. *Archives of Psychiatric Nursing*. 2010; 24:291–306. [PubMed: 20851321]
- Mendes de Leon CF, Gold DT, Glass TA, Kaplan L, George LK. Disability as a function of social networks and support in elderly African Americans and Whites: The Duke EPESE 1986–1992. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*. 2001; 56:S179–S190.
- Morrow D, Clark D, Tu W, Wu J, Weiner M, Steinley D, Murray MD. Correlates of health literacy in patients with chronic heart failure. *The Gerontologist*. 2006; 46:669–676. [PubMed: 17050758]

- Nielsen-Bohlman, L.; Panzer, A.; Kindig, D., editors. Health literacy: A prescription to end confusion. Washington, DC: National Academy of Sciences; 2004.
- Njegovan V, Man-Son-Hing M, Mitchell SL, Molnar FJ. The hierarchy of functional loss associated with cognitive decline in older persons. *The Journals of Gerontology, Series A. Biological Sciences and Medical Sciences*. 2001; 56:M638Y–M643.
- Paasche-Orlow MK, Parker RM, Gazmararian JA, Nielsen-Bohlman LT, Rudd RR. The prevalence of limited health literacy. *Journal of General Internal Medicine*. 2005; 20:175–184. [PubMed: 15836552]
- Peterson PN, Shetterly SM, Clarke CL, Bekelman DB, Chan PS, Allen LA, Masoudi FA. Health literacy and outcomes among patients with heart failure. *JAMA*. 2011; 305:1695–1701. [PubMed: 21521851]
- Salthouse TA. Memory aging from 18 to 80. *Alzheimer Disease and Associative Disorders*. 2003; 17:162–167.
- Scott TL, Gazmararian JA, Williams MV, Baker DW. Health literacy and preventive health care use among Medicare enrollees in a managed care organization. *Medical Care*. 2002; 40:395–404. [PubMed: 11961474]
- Shea JA, Beers BB, McDonald VJ, Quistberg DA, Ravenell KL, Asch DA. Assessing health literacy in African American and Caucasian adults: Disparities in Rapid Estimate of Adult Literacy in Medicine (REALM) scores. *Family Medicine*. 2004; 36:575–581. [PubMed: 15343419]
- Smith GE, Petersen RC, Ivnik RJ, Malec JF, Tangalos EG. Subjective memory complaints, psychological distress, and longitudinal change in objective memory performance. *Psychology and Aging*. 1996; 11:272–279. [PubMed: 8795055]
- Velie EM, Shaw GM, Malcoe LH, Schaffer DM, Samuels SJ, Todoroff K, Block G. Understanding the increased risk of neural tube defect-affected pregnancies among Mexican-born women in California: Immigration and anthropometric factors. *Paediatric and Perinatal Epidemiology*. 2006; 20:219–230. [PubMed: 16629696]
- Wallace AS, Carlson JR, Malone RM, Joyner J, DeWalt DA. The influence of literacy on patient-reported experiences of diabetes self-management support. *Nursing Research*. 2010; 59:356–363. [PubMed: 20808193]
- Weiss, B., editor. 20 Common problems in primary care. New York, NY: McGraw-Hill Professional; 1999.
- Whetstone LM, Fozard JL, Metter EJ, Hiscock BS, Burke R, Gittings N, Fried LP. The Physical Functioning Inventory: A procedure for assessing physical function in adults. *Journal of Aging and Health*. 2001; 13:467–493. [PubMed: 11813737]
- Wolf MS, Gazmararian JA, Baker DW. Health literacy and functional health status among older adults. *Archives of Internal Medicine*. 2005; 165:1946–1952. [PubMed: 16186463]
- Wolf MS, Gazmararian JA, Baker DW. Health literacy and health risk behaviors among older adults. *American Journal of Preventive Medicine*. 2007; 32:19–24. [PubMed: 17184964]
- Yamashita T, Kart CS. Is diabetes-specific health literacy associated with diabetes-related outcomes in older adults? *Journal of Diabetes*. 2011; 3:138–146. [PubMed: 21599867]
- Zarcadoolas, C.; Pleasant, A.; Greer, D. Advancing health literacy: A framework for understanding and action. San Francisco, CA: Jossey-Bass; 2006.

FIGURE 1.
Rapid Estimate of Adult Literacy in Medicine (REALM) scores.

FIGURE 2.

Mini-Mental State Examination (MMSE) correlated with health literacy. Rivermead Behavioral Memory Performance Test (RBMT) standard profile scores correlated with health literacy. Age correlated with health literacy. Education in years correlated with health literacy. Direct Assessment of Functional Status-Extended (DAFS-E) correlated with health literacy.