



Published in final edited form as:

*J Health Commun.* 2015 October ; 20(0 2): 24–33. doi:10.1080/10810730.2015.1066465.

## Health literacy, smoking, and health indicators in African American adults

Diana W. Stewart, Ph.D.<sup>1</sup>, Jennifer I. Vidrine, Ph.D.<sup>2</sup>, Sanjay Shete, Ph.D.<sup>3</sup>, Claire A. Spears, Ph.D.<sup>4</sup>, Miguel A. Cano, Ph.D.<sup>5</sup>, Virmarie Correa-Fernández, Ph.D.<sup>1</sup>, David W. Wetter, Ph.D.<sup>6,1</sup>, and Lorna H. McNeill, Ph.D.<sup>1</sup>

<sup>1</sup>The Department of Health Disparities Research, The University of Texas MD Anderson Cancer Center, Houston, TX

<sup>2</sup>The Department of Family & Preventive Medicine, The University of Oklahoma Health Sciences Center, Oklahoma City, OK

<sup>3</sup>The Department of Biostatistics, The University of Texas MD Anderson Cancer Center, Houston, TX

<sup>4</sup>The Department of Psychology, The Catholic University of America, Washington, DC

<sup>5</sup>The Department of Epidemiology, Florida International University, Miami, FL

<sup>6</sup>The Department of Psychology, Rice University, Houston, TX

### Abstract

We examined cross-sectional associations of health literacy (HL) with smoking and other established health indicators among 1,467 African American adults. Data emanated from a longitudinal cohort study designed to investigate cancer risk factors among church-going African American adults. We conducted linear and logistic regression analyses to assess associations between HL and health indicators. HL was assessed using an established single-item screening question. Outcomes included indicators of poor physical (cigarette smoking, self-rated general and physical health) and mental health (self-rated mental health, depressive symptoms, perceived stress). Nearly 19% of participants had low HL. Low HL was significantly associated with current smoking, poorer self-rated general and physical health, and higher perceived stress ( $ps < .05$ ) even after controlling for demographic variables (i.e., age, gender, relationship status) and indicators of socioeconomic status (i.e., education, income, insurance status). Low HL appears to be an

---

Corresponding Author: Diana W. Stewart, Ph.D., Instructor, Dept. of Health Disparities Research, Faculty Fellow of the Duncan Family Institute for Cancer Prevention and Risk Assessment, The University of Texas MD Anderson Cancer Center, Unit 1440, P.O. Box 301402, Houston, Texas 77230-1402, Phone: 713.563.7564, Fax: 713.792.7196, [dwstewart@mdanderson.org](mailto:dwstewart@mdanderson.org).

**Conflict of Interest Disclosures:** All authors report no disclosures.

**Additional Contributions:** The authors would also like to acknowledge the research staff at the University of Texas MD Anderson Cancer Center who assisted with the implementation of the original project. We are also appreciative of the church leadership and study participants whose efforts made this research possible.

**Role of Sponsors:** None of the funding sources had any role in the design and conduct of the study; the collection, management, analysis, and interpretation of the data; or the preparation, review, or approval of the manuscript; or decision to submit the manuscript for publication.

**Disclaimer:** The views expressed in this article are those of the authors and do not necessarily reflect the official views of the project supporters.

independent risk factor for smoking and other indicators of poor physical and mental health in a large sample of African American adults. Future directions and clinical implications are discussed.

### Keywords

health literacy; cigarette smoking; mental health; self-rated health; African American

Health literacy (HL) is defined as the “degree to which individuals can obtain, process, and understand basic health information and services needed to make appropriate health decisions (USDHHS, 2000).” Although HL is correlated with general literacy, it also includes critical thinking, information-seeking, decision-making, and communication skills (Nutbeam, 2008). Therefore, it is possible for an individual to have adequate general literacy, but to have difficulty with HL. Results from the 2003 National Assessment of Adult Literacy (NAAL), a nationally-representative household survey including over 19,000 adults, found that nearly half of U.S. adults have HL difficulties (Kutner, Greenberg, Jin, & Paulsen, 2006). The impact of low HL on the U.S. economy is striking, as it ranges from 106 to 238 billion dollars annually (Vernon, Trujillo, Rosenbaum, & DeBuono, 2007). Moreover, low HL accounts for up to 17% of all annual personal healthcare expenditures (Vernon et al., 2007).

Limited HL is associated with adverse health outcomes, and is a stronger predictor of health outcomes than sociodemographic characteristics such as education, income, and race/ethnicity (Berkman, Sheridan, Donahue, Halpern, Viera, et al., 2011). Numerous theoretical frameworks and models have proposed pathways to explain the effects of HL on health (Lee, Arozullah, & Cho, 2004; Nutbeam, 2000; Paasche-Orlow & Wolf, 2007; Sorensen et al., 2012). In one framework, Lee et al. suggested that sociodemographic and cultural factors influence HL skills, and individuals with HL difficulties are more likely to engage in health risk behaviors, have poorer medical knowledge, engage in less preventative care, and have poorer medication adherence (Lee et al., 2004). These factors, in turn, might be associated with worse health status and outcomes, delays in seeking appropriate healthcare, and greater use of emergency services.

Low HL is associated with health risk behaviors (e.g., cigarette smoking, alcohol use, sedentary behavior; Adams et al., 2013; Bostock & Steptoe, 2012; Sudore, Yaffe, et al., 2006; von Wagner, Knight, Steptoe, & Wardle, 2007) and lower health risk and illness-related knowledge (see Berkman, Sheridan, Donahue, Halpern, Viera, et al., 2011). Those with HL difficulties are less likely to engage in preventive behaviors such as cancer screening (Davis, Williams, Marin, Parker, & Glass, 2002; Ramirez et al., 1999). Findings also suggest that individuals with lower HL report worse perceived general and physical health than those with higher HL (Baker, Parker, Williams, Clark, & Nurss, 1997; Bennett, Chen, Soroui, & White, 2009; Gazmararian et al., 1999; Howard, Sentell, & Gazmararian, 2006; Lee, Arozullah, Cho, Crittenden, & Vicencio, 2009; Pop, Brînzaniuc, Sirlincan, Baba, & Chereches, 2013; Sudore, Mehta, et al., 2006; Williams et al., 1995). In the general population, worse perceived health is associated with poor health outcomes including mortality (Idler & Benyamini, 1997). Moreover, low HL is associated with poor mental

health (Bostock & Steptoe, 2012; Guerra & Shea, 2007; Howard et al., 2006; Lee et al., 2009; Sudore, Mehta, et al., 2006; Wolf, Gazmararian, & Baker, 2005), particularly depression (Bennett, Culhane, McCollum, Mathew, & Elo, 2007; Howard et al., 2006; Lincoln et al., 2006; Stewart et al., 2014). Individuals with lower HL often report guilt or shame about their HL difficulties, and many do not tell family, friends, or healthcare providers about these problems (Johnson, Jacobson, Gazmararian, & Blake, 2010; Parikh, Parker, Nurss, Baker, & Williams, 1996). This sense of shame may contribute to stress or a sense of helplessness which may result in depressive symptoms (Stewart et al., 2014).

It is notable that the vast majority of research on HL and health outcomes has been conducted in predominantly elderly and/or non-Latino White populations; however, certain subsets of the general population, particularly racial/ethnic minorities and individuals with low socioeconomic status (SES), are disproportionately burdened by low HL (Howard et al., 2006; Kutner, Greenberg, & Baer, 2005; Kutner et al., 2006; Paasche-Orlow, Parker, Gazmararian, Nielsen-Bohlman, & Rudd, 2005; Paasche-Orlow & Wolf, 2010; Stewart et al., 2013; Sudore, Mehta, et al., 2006; Williams, Baker, Parker, & Nurss, 1998). Results from the 2003 NAAL indicated that two-thirds of African American adults and three-fourths of Latino adults have poor HL, compared to 32% of non-Latino Whites (Kutner et al., 2007). In addition to being at risk for low HL, African Americans, in particular, have historically experienced social disparities in the incidence and mortality of disease (CDC, 2013b). Compared to non-Latino Whites, they are more likely to be overweight/obese, and to suffer from chronic illnesses such as diabetes and hypertension (CDC, 2013b). Although smoking prevalence is similar between African Americans and non-Latino Whites, African Americans tend to have greater difficulty quitting smoking (Honjo, Tsutsumi, Kawachi, & Kawakami, 2006), are at greater risk for experiencing tobacco-related disparities, and have higher incidence and mortality rates for tobacco-related cancers and cardiovascular disease (CDC, 2013b). Further, African Americans have higher mortality rates from heart disease and stroke (CDC, 2013b), from all cancers combined, and from most major cancers individually (i.e., stomach, liver, prostate, colon) compared to other racial/ethnic groups (Howlander et al., 2013). African Americans are also more likely than non-Latino Whites to report poorer self-rated health (Liang et al., 2010), more psychological distress (National Center for Health Statistics, 2012), and more chronic and persistent depressive symptoms (Breslau, Kendler, Su, Gaxiola-Aguilar, & Kessler, 2005).

It is notable that among African Americans, these disparities in health persist even after controlling for established indicators of SES (e.g., income, education; Braveman et al., 2005), suggesting that critical other factors might be overlooked. HL is an important construct that might explain racial/ethnic disparities in health outcomes (Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011). Nevertheless, few peer-reviewed studies have investigated relations between HL and indicators of physical or mental health in African American samples (e.g., Weekes, 2012). The data that do exist indicate that low HL is associated with poor health outcomes (e.g., poor disease knowledge, misunderstanding of informed consent, nonadherence to medication regimens) and contributes to health disparities (Weekes, 2012).

Further, causes and correlates of low HL may be different for African Americans versus other racial/ethnic groups. For example, experiences with racial discrimination may contribute to high levels of medical mistrust (Cuffee et al., 2013), and African Americans tend to report less trust in healthcare providers than non-Latino Whites (Halbert, Armstrong, Gandy, & Shaker, 2006). Among African Americans, greater medical mistrust is associated with lower likelihood of routine health examinations (Hammond, Matthews, & Corbie-Smith, 2010), fewer quality experiences with medical providers (Halbert et al., 2006), and lower medication adherence (Cuffee et al., 2013). A high degree of medical mistrust could prevent individuals from engaging with and asking pertinent questions of their healthcare providers, which could then serve to reduce or maintain low levels of HL. A better understanding of correlates of HL specifically in African Americans will be critical to inform interventions targeting health behaviors and outcomes among those with limited HL.

Notably, most prior studies assessed HL using measures such as the Rapid Estimate of Adult Literacy in Medicine (REALM; Davis et al., 1991) and the Short Test of Functional Health Literacy in Adults (S-TOFHLA; Baker, Williams, Parker, Gazmararian, & Nurss, 1999). These measures are widely used, but focus either on reading skill or are time-consuming to administer, making them difficult to use in clinical settings. Thus, research is needed to examine associations between HL and indicators of health among African Americans, using brief, psychometrically sound measures that can be easily incorporated into clinical practice. Data collected using such measures may be useful in developing and implementing interventions to improve health outcomes and reduce health disparities within this vulnerable group.

Given that African Americans are frequently burdened by low HL and experience disparities in overall health and health outcomes, there is a crucial need to understand how HL might influence indicators of poor health within this vulnerable population. Drawing from the theoretical framework proposed by Lee and colleagues (2004), the current study utilized secondary analyses to examine associations of HL with cigarette smoking (health risk behavior), self-rated general and physical health, self-reported mental health, depressive symptoms, and perceived stress (indicators of poor physical and mental health status and outcomes) in a large sample of African American adults. HL was assessed using a single-item screening question with established validity (e.g., O'Neill, Goncalves, Ricci-Cabello, Ziebland, & Valderas, 2014). This is the first known study to assess HL using this single item in a large sample of African American adults. We were interested in examining these relations among African American adults because this population is at heightened risk for experiencing difficulties with HL and the specified indicators of poor health even after accounting for the effects of commonly-used SES indicators. Low HL was hypothesized to be associated with 1) current smoking, 2) poorer perceived general and physical health, and 3) poorer perceived mental health (i.e., lower ratings of self-reported overall mental health, more severe depressive symptoms, higher perceived stress), even after controlling for sociodemographic characteristics.

## Methods

### Study Population and Procedures

This study utilized baseline data from Project CHURCH (Creating a Higher Understanding of Cancer Research and Community Health), a longitudinal cohort study designed to investigate behavioral, social, and environmental cancer risk factors for church-going African American adults. Participants were recruited from a predominantly African American Methodist mega-church in Houston, Texas via print and televised media at the church. Research personnel also solicited study participation by making announcements during church services and making themselves available before and after services and at a church health fair. Eligible participants were at least 18 years old, able to read and write in English, resided in the Houston metropolitan area, had a valid telephone number, and attended the church (membership was not required).

A total of 1,467 African American adults met eligibility criteria and enrolled in the study between December 2008 and July 2009. Participants were scheduled for in-person baseline assessments at the church, at which time the study was further described. Written consent was obtained, and computer-administered surveys were completed. Each participant was compensated with a \$30 Visa Debit Card following survey completion. All study procedures were approved by a church advisory board and our institution's Institutional Review Board.

### Measures

**Sociodemographics**—Sociodemographic characteristics included age, gender, education, total annual household income, health insurance status, and relationship status. In the present analyses, responses for the following variables were categorized as: education (<Bachelor's Degree vs. Bachelor's Degree), income (<\$50,000 vs. \$50,000), health insurance status (continuously covered by health insurance in the last 12 months vs. not continuously covered), and relationship status (married/living with a partner vs. not married/not living with a partner).

**Health literacy**—HL was assessed using a single item, "How confident are you filling out medical forms by yourself (Chew, Bradley, & Boyko, 2004)?" Responses were on a 5-point scale and included the following: 1 = "not at all," 2 = "a little bit," 3 = "somewhat," 4 = "quite a bit," and 5 = "extremely." This single HL item has demonstrated adequate face, construct, content, and criterion validity for identifying individuals with limited HL in racially/ethnically diverse populations (Chew et al., 2004; Chew et al., 2008; O'Neill et al., 2014; Powers, Trinh, & Bosworth, 2010; Wallace et al., 2007; Wallace, Rogers, Roskos, Holiday, & Weiss, 2006; Wallston et al., 2014), and is highly correlated with more comprehensive measures of HL including the (REALM; Davis et al., 1991) and the (S-TOFHLA; Baker et al., 1999; Chew et al., 2004; Chew et al., 2008; Parker, Baker, Williams, & Nurss, 1995; Powers et al., 2010; Wallace et al., 2007; Wallace et al., 2006). Regarding scoring, the "somewhat" response has been identified as the optimal cut point to classify individuals as having limited HL (Wallace et al., 2006). Based on this recommendation and consistent with prior research, HL was dichotomized as high vs. low ("not at all," "a little

bit,” “somewhat” = low; “quite a bit,” “extremely” = high; Chew et al., 2008; Wallace et al., 2006).

**Smoking status**—Current smokers were defined as those who reported smoking 100 cigarettes during their lifetime and reported currently smoking every day or some days (CDC, 2013a).

**Self-rated general health**—Self-rated health was assessed with a single item asking participants to rate their general health on a 5-point Likert scale with scores ranging from 1 = “excellent” to 5 = “poor.” Therefore, higher scores indicate worse self-rated health. Consistent with prior research (Pietilainen, Laaksonen, Rahkonen, & Lahelma, 2011), self-rated general health was dichotomized as higher vs. lower (“excellent,” “very good,” “good” = higher; “fair,” “poor” = lower). Research suggests that this item is an adequate substitute for multi-item measures, and it has demonstrated good reliability and validity in diverse populations, including among African Americans (Bierman, Bubolz, Fisher, & Wasson, 1999; Cunny & Perri, 1991; Jylha, 2009; Kempen, 1992).

**Self-reported physical health**—Self-reported physical health was measured using the 12-item Medical Outcome Survey (MOS) Short Form 12 (SF-12) Physical Components Summary (PCS; Ware, Kosinski, & Keller, 1996). Respondents specify whether or not they experienced certain physical limitations within the past four weeks. The SF-12 contains categorical questions as well as questions with Likert response formats. Total scores range from 0 to 100, and are calculated using a scoring algorithm recommended by the MOS; higher scores indicate better perceived physical health (Ware et al., 1996). The PCS has shown good reliability and validity in previous studies, and predicts physical health even among African Americans (Cheak-Zamora, Wyrwich, & McBride, 2009; Gandek et al., 1998; Larson, 2002; Larson, Schlundt, Patel, Beard, & Hargreaves, 2008; Ware et al., 1996).

**Self-reported mental health**—Self-reported mental health was assessed with the 12-item MOS SF-12 Mental Components Summary (MCS; Ware et al., 1996). Participants indicate whether or not they experienced certain emotional problems in the past four weeks. The SF-12 includes categorical and Likert type responses. Total scores range from 0 to 100 with higher scores indicating better perceived mental health. Scores are calculated using a scoring algorithm recommended by the MOS (Ware et al., 1996). The MCS is psychometrically-sound, and has been used as an indicator of perceived mental health in various, diverse samples including African Americans (Cheak-Zamora et al., 2009; Gandek et al., 1998; Larson, 2002; Larson et al., 2008; Salyers, Bosworth, Swanson, Lamb-Pagone, & Osher, 2000; Ware et al., 1996).

**Perceived stress**—The Perceived Stress Scale-4 (PSS-4) is a 4-item scale designed to assess the degree to which respondents find their lives to be stressful (Cohen, Kamarck, & Mermelstein, 1983). Participants indicate how often they experienced certain stressful situations in the past month. Items are rated on a 5-point scale with responses ranging from 0 = “never” to 4 = “very often.” Responses are summed and range from 0–16, with higher scores indicating greater perceived stress. The PSS-4 has displayed good internal consistency (Cohen et al., 1983) and is predictive of unhealthy behaviors and health

outcomes among racially/ethnically diverse samples (Cohen & Williamson, 1988). In his study, Cronbach's alpha for the PSS-4 was 0.73.

**Depressive symptoms**—Depressive symptoms were assessed using The Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), a 10-item self-report measure of depressive symptomatology. The CES-D was designed to measure the degree of depressive symptoms experienced in the last week in non-clinical populations. Response categories are: 0 = “rarely or none of the time (<1 day),” 1 = “some or a little of the time (1–2 days),” 2 = “occasionally or a moderate amount of time (3–4 days),” and 3 = “all the time (5–7 days).” Responses are summed and total scores range from 0 to 30, with higher scores indicating more depressive symptoms. The CES-D has demonstrated good internal consistency and good validity across diverse populations, and higher scores are predictive of poor health outcomes and mortality (Ferketich, Schwartzbaum, Frid, & Moeschberger, 2000; Rowan, Haas, Campbell, Maclean, & Davidson, 2005; Wulsin et al., 2005). Cronbach's alpha for the CES-D was 0.83 in the present study.

### Statistical Analyses

Potential demographic differences between those with low vs. high HL were assessed using Chi Square tests for categorical variables and t-tests for continuous variables. Next, we performed a series of multiple logistic and linear regressions with HL as the independent predictor variable and smoking status, self-rated general health, self-reported physical health, self-reported mental health, perceived stress, and depressive symptoms as dependent variables. All multiple regression analyses testing associations of HL with smoking and other health indicators were adjusted to control for relevant sociodemographic variables found to be significant in the Chi Square analyses (i.e., age, gender, education, income, insurance status, relationship status) as covariates. Internal consistency of different scales was assessed using Cronbach's alpha. There were no missing data on the independent and dependent variables; however, there were some missing sociodemographic data. Fifty-eight participants did not indicate income, two did not report relationship status or health insurance status, and one did not indicate education. In the linear and logistic regression analyses utilized in this study, if a variable had missing data, then that observation was deleted from the analyses. Analyses were conducted using IBM SPSS version 21 and SAS.

## Results

### Demographics

Participants ( $N = 1,467$ ) were African American, predominantly female (75%), and had a mean age of 45.2 years ( $SD = 12.9$ ). Nearly half of participants (48%) reported having at least a Bachelor's Degree, and 35% reported an annual household income of \$50,000 or less. Eighty-one percent of participants indicated that they were continuously covered by health insurance during the past 12 months. Fifty-six percent reported that they were not currently married or living with a partner.

HL was dichotomized as high vs. low, as described previously. Using this criterion, nearly 19% of participants had low HL. Participants with low (vs. high) HL were significantly

more likely to be younger, male, and to have lower education and income. They were also less likely to have been covered by health insurance during the past 12 months, and less likely to be married or living with a partner. Additionally, those with low HL were significantly more likely to be current smokers than participants with higher HL. See Table 1 for further participant characteristics.

### Health Literacy and Smoking

A multiple logistic regression was conducted with smoking status as the dependent variable and HL (low vs. high) as the independent variable. After adjusting for relevant sociodemographic characteristics (i.e., age, gender, education, income, insurance status, relationship status), results indicated that lower HL was significantly associated with increased odds of being a current smoker such that participants with low HL were 68% more likely than those with high HL to be current smokers (OR=1.68,  $p=0.02$ ). See Table 2, Panel A.

### Health Literacy and Perceived General and Physical Health

A multiple logistic regression was performed with self-rated general health as the dependent variable and HL as the independent variable. After controlling for the aforementioned covariates, low HL was significantly associated with poorer self-rated general health (OR=1.42,  $p=0.04$ ). See Table 2, Panel B.

A multiple linear regression was carried out with self-reported physical health as the dependent variable and HL as the independent variable. Adjusted analyses indicated that low HL was significantly associated with poorer self-reported physical health ( $\beta=-2.45$ ,  $p<0.0001$ ). See Table 2, Panel C.

### Health Literacy and Perceived Mental Health and Functioning

A multiple linear regression with self-reported mental health as the dependent variable and HL as the independent variable indicated no significant association ( $\beta=-0.39$ ,  $p=0.58$ ). See Table 2, Panel D.

A multiple linear regression with perceived stress as the dependent variable and HL as the independent variable revealed a significant association between low HL and higher perceived stress after controlling for relevant covariates ( $\beta=0.68$ ,  $p<0.001$ ). See Table 2, Panel E.

A multiple linear regression with depressive symptoms as the dependent variable and HL as the independent variable revealed no significant association ( $\beta=0.50$ ,  $p=0.15$ ). See Table 2, Panel F.

## Discussion

This study investigated associations of HL, smoking, and other indicators of poor physical and mental health in a large sample of African American adults (Chew et al., 2004; Chew et al., 2008; Powers et al., 2010; Wallace et al., 2007; Wallace et al., 2006). Results indicated that approximately one out of every five participants had low HL. Low HL was associated



with several well-established predictors of poor health, including current smoking, poorer self-rated general and physical health, and higher perceived stress. All of these associations were significant even when controlling for relevant sociodemographic characteristics (e.g., age, gender, education, income, insurance status, relationship status). Thus, low HL appears to be an independent risk factor for indicators of poor physical and mental health among African American adults.

### **Health Literacy and Smoking**

Results indicated that participants with low HL were more likely than those with high HL to be current smokers. This finding is consistent with prior research suggesting an association between poor HL and unhealthy behaviors such as smoking (Bostock & Steptoe, 2012; Sudore, Yaffe, et al., 2006; von Wagner et al., 2007); however, it is notable that this the first known study to report an association between low HL and current smoking in a large sample comprised entirely of African American adults, a population at high risk for experiencing social disparities in the incidence and mortality of disease (CDC, 2013b).

Little is known about mechanisms of the association between HL and smoking; however, one study found that among pregnant smokers, those with low HL had less knowledge about the health risks of smoking (Arnold et al., 2001). Further, results from a more recent study found that among low-SES, racially/ethnically diverse smokers, lower HL was associated with certain established predictors of smoking relapse (i.e., nicotine dependence, stronger positive and weaker negative smoking outcome expectancies, less smoking health risk knowledge, and lower smoking risk perceptions), even after controlling for demographic and SES-related characteristics known to predict relapse (Stewart et al., 2013). Factors such as nicotine dependence, smoking health risk knowledge, risk perceptions, and smoking outcome expectancies might serve as important mechanisms of the association between HL and smoking. These and other possible mediators (e.g., stress, discrimination) should be explored in future research.

### **Health Literacy and Perceived General and Physical Health**

As hypothesized, participants with low HL reported poorer perceived general and physical health than those with high HL. This is in line with prior research suggesting that low HL is associated with poorer perceived general health (Baker et al., 1997; Gazmararian et al., 1999; Lee et al., 2009; Pop et al., 2013; Sudore, Mehta, et al., 2006; Williams et al., 1995) and poorer physical health (Bennett et al., 2009; Gazmararian et al., 1999; Howard et al., 2006). Most of this work has been conducted with elderly and non-Latino White adults, and these studies used complex and time-consuming measures of HL. Thus, our results are novel. Additional research is needed to determine whether or not HL influences perceived general and physical health differentially in this vulnerable population.

### **Health Literacy and Perceived Mental Health and Functioning**

It was hypothesized that low HL would be associated with indicators of poor self-reported mental health and functioning (i.e., worse self-reported mental health, more severe depressive symptoms, higher perceived stress). As hypothesized, results revealed a significant association between low HL and higher perceived stress. Notably, this is the first

known study to report a significant association between HL and perceived stress. This is interesting in light of prior research suggesting that individuals with low HL frequently report shame and guilt about their difficulties with understanding health information, and many do not tell their family, friends, or healthcare providers about these problems (Johnson et al., 2010; Parikh et al., 1996). Thus, it is possible that the overall experience of having low HL may be particularly stressful. Nevertheless, future research is needed to further elucidate this association, given that global perceived stress is an important predictor of poor health outcomes and mortality (Cohen, Janicki-Deverts, & Miller, 2007).

The finding that low HL was not significantly associated with perceived mental health or depressive symptoms was inconsistent with hypotheses, and with numerous prior studies indicating significant associations between low HL and worse perceived mental health (Bostock & Steptoe, 2012; Guerra & Shea, 2007; Howard et al., 2006; Lee et al., 2009; Sudore, Mehta, et al., 2006; Wolf et al., 2005) and depressive symptomatology (Bennett et al., 2007; Coffman & Norton, 2010; Howard et al., 2006; Lincoln et al., 2006; Morris, MacLean, & Littenberg, 2006; Stewart et al., 2014; Sudore, Mehta, et al., 2006; Walker et al., 2007). Notably, this study was conducted among churchgoing African American adults, with adequate overall functioning and relatively low levels of self-reported depressive symptoms. Prior research has found that regular church attendance is associated with better mental health, including lower rates of depression (Ellison, Boardman, Williams, & Jackson, 2001; Strawbridge, Shema, Cohen, & Kaplan, 2001). While it is conceivable that attending church served as a protective factor, future research is needed to explore this possibility.

### Clinical Implications

The current results have important clinical implications, as low HL frequently goes unrecognized by healthcare professionals (Meade, McKinney, & Barnas, 1994). Thus, efforts are needed to increase awareness about the potential impact of low HL on indicators of poor health. Educational attainment and income are often used as proxies for HL; however, these proxies tend to overestimate patients' HL (Wallace et al., 2006). Further, analyses indicated that low HL was significantly associated with current smoking status, poorer self-rated general and physical health, and higher stress even after adjusting for education, income, and other key demographic and SES variables. This pattern of results highlights the importance of assessing HL in clinical settings to help guide clinical practice. Thus, healthcare providers should routinely assess and document patients' HL in order to identify individuals who might be at risk for poor health outcomes (Evangelista et al., 2010; Peterson et al., 2011; Powers et al., 2010). The single-item measure of HL used in the present study could easily be incorporated into clinical practice by adding it to intake forms, and it could be quickly administered by office staff or nurses (Wallace et al., 2006). Regarding communication, healthcare providers should receive training in how to communicate with patients with low HL using plain language and specific techniques such as one-on-one teaching and the teach-back method (i.e., asking patients to explain or "teach back" information discussed with them, such as how to take a medication).

## Limitations and Future Directions

This study has several limitations. First, this investigation relied on cross-sectional data. While these results are useful for generating hypotheses, they do not imply causality and should be interpreted cautiously. Longitudinal studies are needed to clarify the temporal nature of the association between HL and indicators of poor health in African American samples. Second, this study utilized a convenience sample of churchgoing African American adults from a large metropolitan city in the South, and the sample was predominately female and well-educated. These factors may limit generalizability. Finally, although analyses controlled for relevant demographic and socioeconomic characteristics, it is possible that other unknown or unmeasured confounders influenced the present findings.

Future studies are needed to replicate and extend this research while drawing from theoretical frameworks of HL and health outcomes (e.g., Lee et al., 2004). As noted, longitudinal research is needed to investigate temporal relationships of HL, indicators of health, and health outcomes. Studies should also examine potential mechanisms underlying relations between low HL and poor health. Elucidating mechanisms through which HL influences health outcomes among African American adults will help to identify treatment targets in this population and improve current interventions, and may ultimately reduce health disparities and disease burden for this population.

## Conclusions

This study represents the first known investigation of associations between HL and multiple indicators of poor physical and mental health in a large sample of African American adults. Results indicated that nearly one out of every five participants had low HL. This is notable given that the sample consisted of individuals with relatively high levels of education and income. After accounting for relevant sociodemographic covariates, low HL was associated with current smoking, poorer self-rated general and physical health, and higher perceived stress. Results are consistent with previous findings linking low HL with poor health status and outcomes (e.g., Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011; Lee et al., 2004), and provide support for low HL as a risk factor for health risk behaviors such as smoking. Thus, low HL may be an independent risk factor for unhealthy behaviors and indicators of poor physical and mental health even among relatively affluent, highly-educated, churchgoing African Americans adults. Research is needed to elucidate relations between HL and health indicators using longitudinal data, and to explore mechanisms of these associations.

## Acknowledgments

**Funding/Support:** This research is supported by funding from the University of Texas MD Anderson Cancer Center's Duncan Family Institute for Cancer Prevention and Risk Assessment through a faculty fellowship and through the Center for Community-Engaged Translational Research; the Ms. Regina J. Rogers Gift: Health Disparities Research Program; the Cullen Trust for Health Care Endowed Chair Funds for Health Disparities Research; the Morgan Foundation Funds for Health Disparities Research and Educational Programs; and the National Cancer Institute at the National Institutes of Health through the University of Texas MD Anderson's Cancer Center Support Grant (CA016672) and the Community Networks Program Center Grant (U54CA153505).

## References

- Adams RJ, Piantadosi C, Ettridge K, Miller C, Wilson C, Tucker G, Hill CL. Functional health literacy mediates the relationship between socio-economic status, perceptions and lifestyle behaviors related to cancer risk in an Australian population. *Patient Education and Counseling*. 2013; 91(2):206–212.10.1016/j.pec.2012.12.001 [PubMed: 23276386]
- Arnold CL, Davis TC, Berkel HJ, Jackson RH, Nandy I, London S. Smoking status, reading level, and knowledge of tobacco effects among low-income pregnant women. *Preventive Medicine*. 2001; 32(4):313–320. [PubMed: 11304092]
- Baker DW, Parker RM, Williams MV, Clark WS, Nurss J. The relationship of patient reading ability to self-reported health and use of health services. *American Journal of Public Health*. 1997; 87(6): 1027–1030. [PubMed: 9224190]
- 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(1):33–42.10.1016/S0738-3991(98)00116-5 [PubMed: 14528569]
- Bennett IM, Chen J, Soroui JS, White S. The contribution of health literacy to disparities in self-rated health status and preventive health behaviors in older adults. *Annals of Family Medicine*. 2009; 7(3):204–211.10.1370/afm.940 [PubMed: 19433837]
- Bennett IM, Culhane JF, McCollum KF, Mathew L, Elo IT. Literacy and depressive symptomatology among pregnant Latinas with limited English proficiency. *The American Journal of Orthopsychiatry*. 2007; 77(2):243–248.10.1037/0002-9432.77.2.243 [PubMed: 17535122]
- Berkman ND, Sheridan SL, Donahue KE, Halpern DJ, Crotty K. Low health literacy and health outcomes: An updated systematic review. *Annals of Internal Medicine*. 2011; 155(2):97–107.10.7326/0003-4819-155-2-201107190-00005 [PubMed: 21768583]
- Berkman, ND.; Sheridan, SL.; Donahue, KE.; Halpern, DJ.; Viera, AJ.; Crotty, K.; Viswanathan, M. Health literacy interventions and outcomes: An updated systematic review. Rockville: Agency for Healthcare Research and Quality; 2011.
- Bierman AS, Bubolz TA, Fisher ES, Wasson JH. How well does a single question about health predict the financial health of Medicare managed care plans? *Effective Clinical Practice*. 1999; 2(2):56–62. [PubMed: 10538477]
- Bostock S, Steptoe A. Association between low functional health literacy and mortality in older adults: Longitudinal cohort study. *British Medical Journal*. 2012; 344:e1602.10.1136/bmj.e1602 [PubMed: 22422872]
- Braveman PA, Cubbin C, Egerter S, Chideya S, Marchi KS, Metzler M, Posner S. Socioeconomic status in health research: one size does not fit all. *Journal of the American Medical Association*. 2005; 294(22):2879–2888.10.1001/jama.294.22.2879 [PubMed: 16352796]
- Breslau J, Kendler KS, Su M, Gaxiola-Aguilar S, Kessler RC. Lifetime risk and persistence of psychiatric disorders across ethnic groups in the United States. *Psychological Medicine*. 2005; 35(3):317–327. [PubMed: 15841868]
- Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Survey Questionnaire. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2013a.
- Centers for Disease Control and Prevention. CDC health disparities and inequalities report — United States, 2013. *Morbidity and Mortality Weekly Report*. 2013b; 62(3 Suppl):1–187. [PubMed: 23302815]
- Cheak-Zamora NC, Wyrwich KW, McBride TD. Reliability and validity of the SF-12v2 in the medical expenditure panel survey. *Quality of Life Research*. 2009; 18(6):727–735.10.1007/s11136-009-9483-1 [PubMed: 19424821]
- Chew LD, Bradley KA, Boyko EJ. Brief questions to identify patients with inadequate health literacy. *Family Medicine*. 2004; 36(8):588–594. [PubMed: 15343421]
- Chew LD, Griffin JM, Partin MR, Noorbaloochi S, Grill JP, Snyder A, Vanryn M. Validation of screening questions for limited health literacy in a large VA outpatient population. *Journal of General Internal Medicine*. 2008; 23(5):561–566. [PubMed: 18335281]

- Coffman MJ, Norton CK. Demands of immigration, health literacy, and depression in recent Latino immigrants. *Home Health Care Management & Practice*. 2010; 22:116–122.10.1177/1084822309347343
- Cohen S, Janicki-Deverts D, Miller GE. Psychological stress and disease. *Journal of the American Medical Association*. 2007; 298(14):1685–1687.10.1001/jama.298.14.1685 [PubMed: 17925521]
- Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *Journal of Health and Social Behavior*. 1983; 24(4):385–396. [PubMed: 6668417]
- Cohen, S.; Williamson, G. Perceived stress in a probability sample of the United States. In: Spacapan, S.; Oskamp, S., editors. *The social psychology of health*. Newbury Park: Sage; 1988. p. 31-68.
- Cuffee YL, Hargraves JL, Rosal M, Briesacher BA, Schoenthaler A, Person S, Allison J. Reported racial discrimination, trust in physicians, and medication adherence among inner-city African Americans with hypertension. *American Journal of Public Health*. 2013; 103(11):e55–62.10.2105/AJPH.2013.301554 [PubMed: 24028222]
- Cunney KA, Perri M 3rd. Single-item vs multiple-item measures of health-related quality of life. *Psychological Reports*. 1991; 69(1):127–130. [PubMed: 1961779]
- Davis TC, Crouch MA, Long SW, Jackson RH, Bates P, George RB, Bairnsfather LE. Rapid assessment of literacy levels of adult primary care patients. *Family Medicine*. 1991; 23(6):433–435. [PubMed: 1936717]
- Davis TC, Williams MV, Marin E, Parker RM, Glass J. Health literacy and cancer communication. *CA: a cancer journal for clinicians*. 2002; 52(3):134–149. [PubMed: 12018928]
- Ellison CG, Boardman JD, Williams DR, Jackson JS. Religious involvement, stress, and mental health: Findings from the 1995 Detroit Area Study. *Social Forces*. 2001; 80(1):215–249.
- Evangelista LS, Rasmussen KD, Laramee AS, Barr J, Ammon SE, Dunbar S, Yancy CW. Health literacy and the patient with heart failure--implications for patient care and research: A consensus statement of the Heart Failure Society of America. *Journal of Cardiac Failure*. 2010; 16(1):9–16.10.1016/j.cardfail.2009.10.026 [PubMed: 20123313]
- Ferketich AK, Schwartzbaum JA, Frid DJ, Moeschberger ML. Depression as an antecedent to heart disease among women and men in the NHANES I study. *National Health and Nutrition Examination Survey*. *Archives of Internal Medicine*. 2000; 160(9):1261–1268. [PubMed: 10809028]
- Gandek B, Ware JE, Aaronson NK, Apolone G, Bjorner JB, Brazier JE, Sullivan M. Cross-validation of item selection and scoring for the SF-12 Health Survey in nine countries: Results from the IQOLA Project. *International Quality of Life Assessment*. *Journal of Clinical Epidemiology*. 1998; 51(11):1171–1178. [PubMed: 9817135]
- Gazmararian JA, Baker DW, Williams MV, Parker RM, Scott TL, Green DC, Koplan JP. Health literacy among Medicare enrollees in a managed care organization. *Journal of the American Medical Association*. 1999; 281(6):545–551. [PubMed: 10022111]
- Guerra CE, Shea JA. Health literacy and perceived health status in Latinos and African Americans. *Ethnicity & Disease*. 2007; 17(2):305–312. [PubMed: 17682363]
- Halbert CH, Armstrong K, Gandy OH Jr, Shaker L. Racial differences in trust in health care providers. *Archives of Internal Medicine*. 2006; 166(8):896–901.10.1001/archinte.166.8.896 [PubMed: 16636216]
- Hammond WP, Matthews D, Corbie-Smith G. Psychosocial factors associated with routine health examination scheduling and receipt among African American men. *Journal of the National Medical Association*. 2010; 102(4):276–289. [PubMed: 20437735]
- Honjo K, Tsutsumi A, Kawachi I, Kawakami N. What accounts for the relationship between social class and smoking cessation? Results of a path analysis. *Social Science & Medicine*. 2006; 62(2): 317–328.10.1016/j.socscimed.2005.06.011 [PubMed: 16039765]
- Howard DH, Sentell T, Gazmararian JA. Impact of health literacy on socioeconomic and racial differences in health in an elderly population. *Journal of General Internal Medicine*. 2006; 21(8): 857–861.10.1111/j.1525-1497.2006.00530.x [PubMed: 16881947]
- Howlander, N.; Noone, AM.; Krapcho, M.; Garshell, J.; Neyman, N.; Altekruse, SF.; Cronin, KA. *SEER Cancer Statistics Review, 1975–2010*. Bethesda: National Cancer Institute; 2013.

- Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. *Journal of Health and Social Behavior*. 1997; 38(1):21–37. [PubMed: 9097506]
- Johnson VR, Jacobson KL, Gazmararian JA, Blake SC. Does social support help limited-literacy patients with medication adherence? A mixed methods study of patients in the Pharmacy Intervention for Limited Literacy (PILL) study. *Patient Education and Counseling*. 2010; 79(1): 14–24.10.1016/j.pec.2009.07.002 [PubMed: 19647967]
- Jylha M. What is self-rated health and why does it predict mortality? Towards a unified conceptual model. *Social Science & Medicine*. 2009; 69(3):307–316. [PubMed: 19520474]
- Kempen GI. The MOS Short-Form General Health Survey: Single item vs multiple measures of health-related quality of life: Some nuances. *Psychological Reports*. 1992; 70(2):608–610. [PubMed: 1598378]
- Kutner, M.; Greenberg, E.; Baer, J. National assessment of adult literacy: A first look at the literacy of America's adults in the 21st century. Washington DC: U.S. Department of Education, National Center for Education Statistics; 2005. NCES 2006–470
- Kutner, M.; Greenberg, E.; Jin, Y.; Boyle, B.; Hsu, Y.; Dunleavy, E. Literacy in everyday life: Results from the 2003 National Assessment of Literacy. Washington DC: US Department of Education, National Center for Education Statistics; 2007. NCES 2007–480
- Kutner, M.; Greenberg, E.; Jin, Y.; Paulsen, C. The health literacy of America's adults: Results from the 2003 National Assessment of Adult Literacy. Washington DC: US Department of Education, National Center for Educational Statistics; 2006. NCES 2006–483
- Larson CO. Use of the SF-12 instrument for measuring the health of homeless persons. *Health Services Research*. 2002; 37(3):733–750. [PubMed: 12132603]
- Larson CO, Schlundt D, Patel K, Beard K, Hargreaves M. Validity of the SF-12 for use in a low-income African American community-based research initiative (REACH 2010). *Preventing Chronic Disease*. 2008; 5(2):A44. [PubMed: 18341779]
- Lee SYD, Arozullah AM, Cho YI. Health literacy, social support, and health: a research agenda. *Social Science & Medicine*. 2004; 58(7):1309–1321.10.1016/S0277-9536(03)00329-0 [PubMed: 14759678]
- Lee S-YD, Arozullah AM, Cho YI, Crittenden K, Vicencio D. Health literacy, social support, and health status among older adults. *Educational Gerontology*. 2009; 35(3):191–201.
- Liang J, Quinones AR, Bennett JM, Ye W, Xu X, Shaw BA, Ofstedal MB. Evolving self-rated health in middle and old age: how does it differ across Black, Hispanic, and White Americans? *Journal of Aging and Health*. 2010; 22(1):3–26.10.1177/0898264309348877 [PubMed: 19952367]
- Lincoln A, Paasche-Orlow MK, Cheng DM, Lloyd-Travaglini C, Caruso C, Saitz R, Samet JH. Impact of health literacy on depressive symptoms and mental health-related: quality of life among adults with addiction. *Journal of General Internal Medicine*. 2006; 21(8):818–822.10.1111/j.1525-1497.2006.00533.x [PubMed: 16881940]
- Meade CD, McKinney WP, Barnas GP. Educating patients with limited literacy skills: The effectiveness of printed and videotaped materials about colon cancer. *American Journal of Public Health*. 1994; 84(1):119–121. [PubMed: 8279598]
- Morris NS, MacLean CD, Littenberg B. Literacy and health outcomes: A cross-sectional study in 1002 adults with diabetes. *BMC Family Practice*. 2006; 7:49.10.1186/1471-2296-7-49 [PubMed: 16907968]
- National Center for Health Statistics. [Accessed on March 7 2014] Health, United States, 2011: With special feature on socioeconomic status and health. 2012. Retrieved from <http://www.cdc.gov/nchs/data/hsr/hsr11.pdf>
- Nutbeam D. Health literacy as a public health goal: A challenge for contemporary health education and communication strategies into the 21st century. *Health Promotion International*. 2000; 15(3):259–267.
- Nutbeam D. The evolving concept of health literacy. *Social Science & Medicine*. 2008; 67(12):2072–2078.10.1016/j.socscimed.2008.09.050 [PubMed: 18952344]
- O'Neill B, Goncalves D, Ricci-Cabello I, Ziebland S, Valderas J. An overview of self-administered health literacy instruments. *PloS one*. 2014; 9(12):e109110.10.1371/journal.pone.0109110 [PubMed: 25478813]

- 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(2):175–184.10.1111/j.1525-1497.2005.40245.x [PubMed: 15836552]
- Paasche-Orlow MK, Wolf MS. The causal pathways linking health literacy to health outcomes. *American Journal of Health Behavior*. 2007; 31(Suppl 1):S19–26.10.5555/ajhb.2007.31.supp.S19 [PubMed: 17931132]
- Paasche-Orlow MK, Wolf MS. Promoting health literacy research to reduce health disparities. *Journal of Health Communication*. 2010; 15(Suppl 2):34–41.10.1080/10810730.2010.499994 [PubMed: 20845191]
- Parikh NS, Parker RM, Nurss JR, Baker DW, Williams MV. Shame and health literacy: The unspoken connection. *Patient Education and Counseling*. 1996; 27(1):33–39.10.1016/0738-3991(95)00787-3 [PubMed: 8788747]
- Parker RM, Baker DW, Williams MV, Nurss JR. The test of functional health literacy in adults: A new instrument for measuring patients' literacy skills. *Journal of General Internal Medicine*. 1995; 10(10):537–541. [PubMed: 8576769]
- Peterson PN, Shetterly SM, Clarke CL, Bekelman DB, Chan PS, Allen LA, Masoudi FA. Health literacy and outcomes among patients with heart failure. *Journal of the American Medical Association*. 2011; 305(16):1695–1701.10.1001/jama.2011.512 [PubMed: 21521851]
- Pietilainen O, Laaksonen M, Rahkonen O, Lahelma E. Self-rated health as a predictor of disability retirement--the contribution of ill-health and working conditions. *PloS one*. 2011; 6(9):e25004.10.1371/journal.pone.0025004 [PubMed: 21949830]
- Pop OM, Brînzaniuc A, Sirlincan EO, Baba CO, Chereches RM. Assessing health literacy in rural settings: A pilot study in rural areas of Cluj County, Romania. *Global Health Promotion*. 2013; 20(4):35–43.10.1177/1757975913502686 [PubMed: 24307167]
- Powers BJ, Trinh JV, Bosworth HB. Can this patient read and understand written health information? *Journal of the American Medical Association*. 2010; 304(1):76–84.10.1001/jama.2010.896 [PubMed: 20606152]
- Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*. 1977; 1:385–401.10.1177/014662167700100306
- Ramirez AJ, Westcombe AM, Burgess CC, Sutton S, Littlejohns P, Richards MA. Factors predicting delayed presentation of symptomatic breast cancer: A systematic review. *Lancet*. 1999; 353(9159):1127–1131.10.1016/S0140-6736(99)02142-X [PubMed: 10209975]
- Rowan PJ, Haas D, Campbell JA, Maclean DR, Davidson KW. Depressive symptoms have an independent, gradient risk for coronary heart disease incidence in a random, population-based sample. *Annals of Epidemiology*. 2005; 15(4):316–320. [PubMed: 15780780]
- Salyers MP, Bosworth HB, Swanson JW, Lamb-Pagone J, Osher FC. Reliability and validity of the SF-12 health survey among people with severe mental illness. *Medical Care*. 2000; 38(11):1141–1150. [PubMed: 11078054]
- Sorensen K, Van den Broucke S, Fullam J, Doyle G, Pelikan J, Slonska Z, Brand H. Health literacy and public health: A systematic review and integration of definitions and models. *BMC Public Health*. 2012; 12:80.10.1186/1471-2458-12-80 [PubMed: 22276600]
- Stewart DW, Adams CE, Cano M, Correa-Fernandez V, Li Y, Waters AJ, Vidrine JI. Associations between health literacy and established predictors of smoking cessation. *American Journal of Public Health*. 2013; 103:e43–e49.10.2105/AJPH.2012.301062 [PubMed: 23678912]
- Stewart DW, Reitzel LR, Correa-Fernandez V, Cano M, Adams CE, Cao Y, Vidrine JI. Social support mediates the association between health literacy and depression in diverse smokers with low socioeconomic status. *Journal of Behavioral Medicine*. 2014; 37:1169–1179.10.1007/s10865-014-9566-5 [PubMed: 25391450]
- Strawbridge WJ, Shema SJ, Cohen RD, Kaplan GA. Religious attendance increases survival by improving and maintaining good health behaviors, mental health, and social relationships. *Annals of Behavioral Medicine*. 2001; 23(1):68–74.10.1207/S15324796ABM2301\_1 [PubMed: 11302358]

- Sudore RL, Mehta KM, Simonsick EM, Harris TB, Newman AB, Satterfield S, Yaffe K. Limited literacy in older people and disparities in health and healthcare access. *Journal of the American Geriatrics Society*. 2006; 54(5):770–776.10.1111/j.1532-5415.2006.00691.x [PubMed: 16696742]
- Sudore RL, Yaffe K, Satterfield S, Harris TB, Mehta KM, Simonsick EM, Schillinger D. Limited literacy and mortality in the elderly: the health, aging, and body composition study. *Journal of General Internal Medicine*. 2006; 21(8):806–812. [PubMed: 16881938]
- United States Department of Health and Human Services. *Healthy People 2010, With understanding and improving health and objectives for improving health. 2*. Washington DC: US Government Printing Office; 2000.
- Vernon, J.; Trujillo, A.; Rosenbaum, S.; DeBuono, B. Low health literacy: Implications for national policy. 2007. ([http://sphhs.gwu.edu/departments/healthpolicy/CHPR/downloads/LowHealthLiteracyReport10\\_4\\_07.pdf](http://sphhs.gwu.edu/departments/healthpolicy/CHPR/downloads/LowHealthLiteracyReport10_4_07.pdf))
- von Wagner C, Knight K, Steptoe A, Wardle J. Functional health literacy and health-promoting behaviour in a national sample of British adults. *Journal of Epidemiology and Community Health*. 2007; 61(12):1086–1090. [PubMed: 18000132]
- Walker D, Adebajo A, Heslop P, Hill J, Firth J, Bishop P, Helliwell PS. Patient education in rheumatoid arthritis: the effectiveness of the ARC booklet and the mind map. *Rheumatology*. 2007; 46(10):1593–1596. [PubMed: 17767002]
- Wallace LS, Cassada DC, Rogers ES, Freeman MB, Grandas OH, Stevens SL, Goldman MH. Can screening items identify surgery patients at risk of limited health literacy? *The Journal of Surgical Research*. 2007; 140(2):208–213. [PubMed: 17509266]
- Wallace LS, Rogers ES, Roskos SE, Holiday DB, Weiss BD. Brief report: Screening items to identify patients with limited health literacy skills. *Journal of General Internal Medicine*. 2006; 21(8):874–877. [PubMed: 16881950]
- Wallston KA, Cawthon C, McNaughton CD, Rothman RL, Osborn CY, Kripalani S. Psychometric properties of the brief health literacy screen in clinical practice. *Journal of General Internal Medicine*. 2014; 29(1):119–126.10.1007/s11606-013-2568-0 [PubMed: 23918160]
- Ware J Jr, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. *Medical Care*. 1996; 34(3):220–233. [PubMed: 8628042]
- Weekes CV. African Americans and health literacy: A systematic review. *The ABNF Journal*. 2012; 23(4):76–80. [PubMed: 23311265]
- Williams MV, Baker DW, Parker RM, Nurss JR. Relationship of functional health literacy to patients' knowledge of their chronic disease: A study of patients with hypertension and diabetes. *Archives of Internal Medicine*. 1998; 158(2):166–172. [PubMed: 9448555]
- Williams MV, Parker RM, Baker DW, Parikh NS, Pitkin K, Coates WC, Nurss JR. Inadequate functional health literacy among patients at two public hospitals. *Journal of the American Medical Association*. 1995; 274(21):1677–1682. [PubMed: 7474271]
- Wolf MS, Gazmararian JA, Baker DW. Health literacy and functional health status among older adults. *Archives of Internal Medicine*. 2005; 165(17):1946–1952. [PubMed: 16186463]
- Wulsin LR, Evans JC, Vasan RS, Murabito JM, Kelly-Hayes M, Benjamin EJ. Depressive symptoms, coronary heart disease, and overall mortality in the Framingham Heart Study. *Psychosomatic Medicine*. 2005; 67(5):697–702. [PubMed: 16204426]



**Table 1**

Participant Characteristics

Variable	Total Sample (N=1467), Mean(SD)/%	Low Health Literacy (n=275), Mean(SD)/%	High Health Literacy (n=1192), Mean(SD)/%	Chi-square/t	p
Age (years; range 18–86 years)	45.19 (12.86)	42.54 (15.04)	45.80 (12.23)	-3.80	<0.001
Gender				21.66	<0.001
Female	1095 (74.6%)	175 (16.0%)	920 (84.0%)		
Male	372 (25.4%)	100 (26.9%)	272 (73.1%)		
Educational Level				32.77	<0.001
<Bachelor's Degree	756 (51.5%)	184 (24.3%)	572 (75.7%)		
Bachelor's Degree	710 (48.5%)	90 (12.7%)	620 (87.3%)		
Total Annual Household Income				8.40	<0.01
<\$50,000	513 (35.0%)	112 (21.8%)	401 (78.2%)		
\$50,000	905 (61.7%)	142 (15.7%)	763 (84.3%)		
Health Insurance in Past 12 Months				11.19	0.001
Yes	1185 (80.8%)	202 (17.0%)	983 (83.0%)		
No	280 (19.1%)	72 (25.7%)	208 (74.3%)		
Relationship Status				3.75	0.05
Married/living with partner	638 (43.5%)	105 (16.5%)	533 (83.5%)		
Not married/not living with partner	827 (56.4%)	169 (20.4%)	658 (79.6%)		
Health Literacy					
Low	275 (18.7%)				
High	1192 (81.3%)				
Smoking Status				17.72	<0.001
Non-smoker	1338 (91.2%)	233 (17.4%)	1105 (82.6%)		
Smoker	129 (8.8%)	42 (32.6%)	87 (67.4%)		
Alcohol Use (drinks per week)	2.85 (4.45)	3.38 (5.55)	2.73 (4.17)	1.90	0.058
Self-Rated General Health	2.74 (.87)	2.89 (.85)	2.70 (.87)	3.27	0.001
Self-Reported Physical Health (SF-12, PCS)	49.74 (9.14)	47.65 (9.41)	50.22 (9.02)	-2.56	<0.001
Self-Reported Mental Health (SF-12, MCS)	50.30 (10.33)	49.78 (10.30)	50.41 (10.34)	-9.06	0.37

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Variable	Total Sample (N=1467), Mean(SD)/%	Low Health Literacy (n=275), Mean(SD)/%	High Health Literacy (n=1192), Mean(SD)/%	Chi-square/t	p
Perceived Stress (PSS-4)	4.59 (3.04)	5.30 (3.02)	4.43 (3.03)	4.26	<0.001

**Table 2**  
Effect Sizes for association of Health Literacy with Smoking Status and Health Indicators.

		Age	Sex	Education	Income	Insurance Status	Relationship Status	Health Literacy
<b>Panel A Smoking Status</b>	Odds Ratio	1.01	0.38	0.39	0.50	0.64	1.07	1.68
	CI	0.99–1.02	0.25–0.58	0.25–0.61	0.33–0.78	0.41–1.00	0.69–1.65	1.09–2.58
	P-value	0.2903	<0.0001	<0.0001	0.0018	0.0503	0.7747	0.019
<b>Panel B General Health</b>	Odds Ratio	1.00	1.42	0.63	0.52	0.90	1.19	1.42
	CI	0.99–1.01	0.99–2.05	0.47–0.86	0.38–0.71	0.63–1.29	0.86–1.64	1.01–2.01
	P-value	0.9960	0.0572	0.0031	<0.0001	0.575	0.2998	0.047
<b>Panel C General Health</b>	Estimate	-0.1445	-0.5816	2.28523	1.32733	-0.73904	-0.15575	-2.454
	SD	0.0194	0.55998	0.49412	0.55101	0.6386	0.52084	0.6247
	P-value	<0.0001	0.2992	<0.0001	0.0161	0.2474	0.765	<0.0001
<b>Panel D Mental Health</b>	Estimate	0.1231	-2.2828	0.0662	1.51856	0.84259	-0.32586	-0.3967
	SD	0.0224	0.64831	0.57205	0.63792	0.73933	0.60299	0.7232
	P-value	<0.0001	0.0004	0.9079	0.0174	0.2546	0.589	0.5834
<b>Panel E Perceived Stress</b>	Estimate	-0.0384	0.51756	-0.53323	-0.8274	-0.24154	-0.26288	0.6798
	SD	0.0065	0.18754	0.16557	0.18493	0.21429	0.17474	0.2093
	P-value	<0.0001	0.0059	0.0013	<0.0001	0.2599	0.1327	0.0012
<b>Panel F Depressive Symptoms</b>	Estimate	-0.0344	0.71635	-1.22116	-1.28	-0.02505	0.27798	0.5029
	SD	0.0108	0.31208	0.27581	0.30748	0.35667	0.29071	0.3484
	P-value	0.0015	0.0219	<0.0001	<0.0001	0.944	0.3391	0.1492