HEALTH LITERACY AND HEALTH BEHAVIORS IN ADULTS

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Abstract

Health literacy is fundamental to healthcare as it requires individuals to actively participate in decision-making and illness management. Low health literacy leads to increased medical errors, poor use of health services, improper management of health conditions, inadequate self-care skills, and longer and more frequent hospitalizations. This cross-sectional study aimed to assess the health literacy levels in adults and explore the relationships among health literacy, health-related behaviors, and health status. A convenience sample of 230 adults completed online survey or paper-and-pencil survey from October 2019 to November 2019. The study survey included Health Literacy Questionnaire, health status items from Behavior Risk Factor Surveillance System, and International Physical Activity Questionnaire-SF. About a quarter of participants rated their general health status as poor or fair. The mean scores for basic health literacy and advanced health literacy were 3.00 and 2.83, respectively. There were significant differences in health literacy scores among educational level, ethnicity, and body mass index (p <0.05). Simultaneous multiple regression analyses showed that sedentary lifestyle measured by sitting minutes per day was a positive predictor of days of poor physical health (β=0.21; p=0.001) and days of poor mental health (β=0.18; p=0.005). Basic health literacy was a negative predictor of days of poor physical health (β= -0.29; p=0.001) and days of poor daily activities (β=-0.22; p=0.015). In the primary care setting, health care providers are responsible for educating patients on health-related concepts to heal or prevent illnesses. With an understanding of the health literacy needs of certain patient populations, healthcare providers can tailor the education to the literacy needs of individual patients.

Key words: Health literacy, health behaviors, health outcomes, health education

Health literacy (HL) is a basic skill that determines how patients navigate the healthcare system, communicate needs to healthcare providers, and participate in self-care and in decision making process. It is defined by the Institute of Medicine (IOM) as "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" (U. S. Department of Health and Human Services [USDHHS], n.d.). Limited HL is associated with poor health outcomes and affects individuals of all ages, genders, and race (USDHHS, n.d.). It has been directly linked to medication noncompliance, higher medical costs, increased hospitalizations, inadequate disease management, poor understanding of medical conditions, and increased difficulty navigating the health care system (Jayasinghe et al., 2016). Nearly 80% of resources are used by people who frequently use health care services; however, these users account for only 10% of the population. These patients also present more chronic diseases, greater psychological distress, and higher rates of hospitalization and mortality (Couture, Chouinard, Fortin, & Hudon, 2017).

Based on the National Assessment for Adult Literacy (NAAL), only 12% of the adult population have proficient HL which means they possess the skills necessary to manage their health and prevent disease (Hawkins et al., 2017). Similar to HL, health behaviors are associated with poor health outcomes. Health behaviors include exercise, nutrition and dietary choices, and accessing preventative health services. Unhealthy behaviors are related to nearly 40% of premature deaths in the United States; they are also contributory to persistent health disparities (Saint Onge & Krueger, 2017). As health care providers, nurse practitioners (NPs) are responsible for providing safe and effective communication for patients with varying levels of HL (Cafiero, 2013). Nurse practitioners may have the opportunity and resources to address a patient's HL and health behaviors, thereby possibly reducing the risk of negative health behavior-related outcomes.

Literature Review

A report conducted by the Centers for Disease Control and Prevention (CDC) using the National Health Interview Survey (NHIS) found that only 46.1% of individuals in the U.S. met the federal guidelines for physical activity. Adults should engage in at least 150 minutes to 300 minutes a week of moderate-intensity exercise (Piercy, Troiano, & Ballard, 2018); about one fourth of the adults met the guidelines for muscle-strengthening exercise. Muscle-strengthening activities should be done involving major muscle groups on 2 or more days a week; and only one out of five adults met both of the federal guidelines (Schoeborn et al., 2013). The same study found that approximately 62% of adults were overweight or obese and only about 36% were a healthy weight (Schoeborn et al., 2013). An eight-year longitudinal study on aging consisting of 4,345 adults found that 59% of participants with high HL participated weekly in moderate to vigorous physical activity (MVPA) while only 33% of participants with low HL participated in weekly MVPA (Kobayashi, Wardle, Wolf & Von Wager, 2016). The Office of Disease Prevention and Health Promotion (2019) recommends adults engage in moderate-intensity exercises for at least 150 to 300 minutes each week, or 75 to 150 minutes of vigorous-intensity aerobic activity a week, or an equivalent combination of moderate and vigorous activities.

Health Literacy and Nutrition

A cross-sectional study among 74 patients with hypertension or chronic kidney diseases was conducted to assess the relationship between nutrition knowledge and health literacy skills (Patel, Ferris, & Rak, 2016). Patients with higher health literacy and better nutrition knowledge are more likely to adhere to medication regimen. Low health literacy leading to limited understanding of nutrition and dietary restrictions as well as poor medication adherence results in suboptimal health outcomes (Patel et al., 2016). The recommended caloric intake for adult

females ranges from 1,600 to 2,400 calories daily and 2,000 to 3,000 calories daily for adult males (Health.gov, 2015). A study by Gase, Robles, Barragan and Kuo (2014) consisting of 1,041 participants found that fewer than one third of participants were able to correctly identify the recommended daily calorie intake for adults. On average, the participants who correctly identified the recommended daily calorie intake were found to consume less than nine sugar-sweetened beverages (SSBs) per month than the participants who did not (Gase et al., 2014).

Sugar-sweetened beverages are the biggest source of added sugars and a significant contributor of energy in the diets of adults in the United States (Sohyun, Onufrak, Sherry, & Blanck, 2014). Consumption of SSBs is associated with negative health outcomes such as weight gain, type 2 diabetes, increased body mass index (BMI), and metabolic syndrome (Rosinger, Herrick, Gahche, & Park, 2017). On average, individuals consume nearly 39 pounds of sugar per year from SSBs and sodas (American Heart Association [AHA], 2015). According to the National Center for Health Statistics data brief, approximately half of adults in the United States consume at least one SSB per day (Rosinger et al., 2017). A study found the highest proportion of adults consuming SSBs two or more times a day were those between the ages of 18 and 24 years old, male, non-Hispanics with less than high school education (Sohyun, 2014). Most of the participants in this study identified SSB consumption as a contributor to weight gain. According to the CDC, 71.6% of adults over the age of 20 are either overweight or obese (CDC, 2016). The population who knew the specific kilocalorie content of a 24-ounce soda was greatest for adult non-Hispanic whites, college graduates who were between the ages of 25 and 44 years old (Sohyun, 2014). A randomized-controlled trial was conducted to examine the impact of an educational intervention on the consumption of SSB (Zoellner et al., 2016). The study found that after educating participants, SSB intake decreased along with BMI during a 6-month period as

compared to baseline. Health literacy was not identified as an influencing factor on outcomes of this study (Zoellner et al., 2016).

Health Literacy and Health Outcomes

Navigating through the health care system and interpreting medical information can be challenging, especially for individuals who struggle with literacy skills. Over one-third of adults in the US have limited HL resulting in challenges related to reading and understanding information on medication bottles, consent forms, insurance documents, food labels, medical bills and forms, discharge instructions and follow up appointment papers (Hersh, Salzman, & Snyderman, 2015). A Danish study reported that education level is associated with HL levels, and poor HL is associated with unhealthy behaviors, including smoking, decreased physical activity, poor diet, obesity (Friis, Lasgaard, Rowlands, Osborne, & Maindal, 2016). The same study found that HL and the capacity to understand health information mediated the relationship between educational attainment and health behaviors. Differences between the education levels include worse self-reported health status, worse physical abilities, higher morbidity and disability rates and shorter life expectancies (Friis et al., 2016). Primary care providers encounter patients with various levels of education who have developed unhealthy habits and subsequent comorbidities and are tasked with addressing the issues.

A cross-sectional study investigated the impact of health literacy on health-related quality of life (HRQoL) on a sample of patients without known vascular disease (Jayasinghe et al., 2016). The study found that individuals with low health literacy were more likely to smoke, do insufficient physical activity, be overweight, and have lower physical health and lower mental health with large clinically significant effect sizes. Patients with inadequate physical activity were likely to have a lower physical health score and poorer mental health. Poorer physical

health was reported in patients who were less well-educated, unemployed and smokers. (Jayasinghe et al., 2016).

Health Literacy and Primary Care

The aims of this project were to: (1) assess the health literacy level in adults; and (2) explore the relationships among health literacy, health-related behaviors, and health status. Beauchamp et al. (2015) conducted a cross-sectional study with 813 participants and found that the lower health-literate groups were mainly those with lower education, no health insurance, non-native English speaking, or born overseas. These individuals were found to have difficulty actively engaging with healthcare providers, locating health information, navigating the system and had trouble finding adequate social support (Beauchamp et al., 2015). Another cross-sectional study consisting of 611 adults over the age of 65 discussed health perceptions with its study participants (Deniz, Özer, & Sonğur, 2018). In the study, 85.8% of the participants were clinically diagnosed with a chronic disease. This study portrayed that more than general health literacy skills and knowledge were needed for individuals with chronic conditions to manage specific complicated health and health system problems (Deniz et al., 2018).

A randomized controlled trial was conducted with 614 participants to examine the association of health literacy and hospital readmission rates in patients with heart failure in rural areas (Moser et al., 2015). The study found patients in the marginal and inadequate health literacy categories had much greater risk for heart failure readmission or death than those patients with adequate health literacy, even with the consideration of other strong risk factors such as depression and comorbidity burden (Moser et al., 2015). Aoki and Inoue (2017) explored the relationship between HL and patient experience of primary care attributes in Japan. This study illustrated that health literacy was positively related to patient experience of primary care

attributes. Patients with higher health literacy levels have increased health access and better primary care experience (Aoki & Inoue, 2017). These studies further confirmed the importance of health literacy in health care access and the management of chronic diseases.

In contrast, a study examined the relationship between HL and the physical and mental aspects of quality of life among frequent users of health care services among 247 participants in Canada (Couture et al., 2017). The authors suggested that there is no relationship between HL and the physical and mental components of quality of life in individuals who frequently utilize health care services.

The Effects of Tailored Education

A pre-post prospective study with 106 adults with diabetes who were socially and economically disdained examined the effectiveness of a culturally sensitive program (Swavely et al., 2014). After completion of the 12-month educational program, there was a significant improvement in knowledge about diabetes, self-efficacy, and self-care activities including diet, exercise, and foot care. A study by Jones, Treiber, and Jones (2014) found that tailoring patient education had positive effects on promoting medication adherence, specifically in the older adult population. Poor HL has been identified as a significant cause of medication nonadherence. The authors implemented eight simple interventions in an attempt to aid health care personnel in working to improve adherence with medication regimens. The study findings indicated that creating a culture of patient empowerment and knowledgeable engagement enhanced the ability of these older adults to engage more effectively in self-care, reduce their adverse health care outcomes, and positively impact their overall health outcomes (Jones et al., 2014).

The health literacy level varies for different populations and health behaviors are directly related to health outcomes. To help healthcare providers improve approaches to patient education

and disseminate information in an accessible and understandable manner, there is a need for an adequate understanding of health literacy levels and health behaviors for adults. The aims of this project were to assess the health literacy level in adults as well as to explore the relationships among health literacy, health-related behaviors, and health status.

Methods

Design

A cross-sectional design was used in this study.

Sampling

The potential subjects were invited to participate in the study using email, social media, and in person through personal contacts. Inclusion criteria consisted of the following: (a) adults aged 18 and older; (b) male or female; (c) ability to read and understand English or Spanish. Individuals with cognitive disabilities and pregnant women were excluded from participating in the study. Power analysis showed that conventional value of medium effect size (0.30) and a power of (0.80) with a significance level of (0.05) would equate to 85 participants. To lessen the risk of obtaining inaccurate or unreliable results, the estimated sample size was approximately 100 participants.

Instruments

The survey contained a total of 31-item questionnaire, including Health Literacy Questionnaire (HLQ), four selected items from Behavioral Risk Factor Surveillance System (BRFSS), nine items from the International Physical Activity Questionnaire Short Form (IPAQ-SF), and questions related to nutritional knowledge and behavior. Demographic variables of age, gender, ethnicity, educational background, height and weight were also included. The BMI was

calculated, and participants were classified as underweight, normal weight, overweight, or obese based on the CDC's adult BMI categories (CDC, 2019).

The HLQ is a multidimensional tool used to assess health literacy levels; it consists of nine scales with a total of 44 questions (Osborne et al., 2013). Two of the nine scales from the HLQ were used to measure health literacy in this study for a total of 9 items. The two subscales measure different dimensions include: (a) Having sufficient information to manage my health; and (b) Actively managing my health. The first subscale, having sufficient information to manage my health, consisted of 4 items used to assess 'basic' health literacy. The second subscale, actively managing my health, contained 5 items used to assess 'advanced' health literacy. For both subscales, participants rated their agreement to each statement from *strongly disagree* (1) to *strongly agree* (4). Higher score in each subscale indicates higher level of health literacy in the respective dimension. A composite reliability score of all scales were of ≥ 0.8 (Osborne et al., 2013).

The BRFSS is a state-based telephone survey coordinated by the CDC (2018). Self-reported information regarding chronic conditions and health risk behaviors is collected throughout the year using telephone survey. More than 400,000 adults complete the survey annually, making the BRFSS the largest reliable and valid survey in the world (Pierannunzi, Hu, & Balluz, 2013). A few selected items from the BRFSS will be used to collect data regarding general health status and healthy days. The physical health questions asked how many days during the past 30 days was their physical health not good, including physical illness and injury. The mental health status was assessed by asking, "for how many days during the past 30 days was your mental health not good, including stress, depression, and problems with emotions"? Poor daily activities were assessed by asking, "during the past 30 days, for how many days did

poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation"? General health status was assessed with responses ranging from (1) poor to (5) excellent.

Physical activity was assessed using the International Physical Activity Questionnaire (IPAQ-SF) which consists of nine questions about the number of days per week and time spent each day doing physical activities (Hagströmer, Pekka, & Sjöström, 2006). The IPAQ-SF specifically questions activity during the previous 7 days and addresses four domains of physical activity: (1) vigorous activity, (2) moderate activity, (3) light activity and (4) time spent sitting (Hagströmer et al., 2006). Vigorous activity was defined as any activity that take hard physical effort and make breathing much harder than normal for at least 10 minutes at a time. Moderate activities referred to activities that take moderate physical effort and make breathing somewhat harder than normal for at least 10 minutes at a time. Light activity was defined as any type of walking done for at least 10 minutes at a time.

One metabolic equivalent (MET) is the of energy used at rest. To calculate MET-minutes per week, all activities were first converted to minutes. The MET value (walking = 3.3, moderate activity = 4, and vigorous activity = 8) was multiplied by the number of minutes the activity was executed and again by the number of days per week the activity was undertaken (Forde, n. d.). A high score on the IPAQ-SF indicates the physical activity is equivalent to approximately one hour of activity a day. A moderate score indicates participation in some physical activity that is equivalent to half an hour of at least moderate activity during a majority of days per week. A low score on the IPAQ-SF indicates failure to meet criteria for moderate or high levels of physical activity (Forde, n.d.).

To assess nutritional knowledge of the recommended daily caloric intake, participants were asked, “How many calories is a healthy adult supposed to consume each day?” Responses between 1,600 and 3,000 calories per day were coded as “correct” as this falls in the recommended caloric intake range identified by the 2015-2020 Dietary Guidelines for Americans (Health.gov, 2015). Responses outside 1,600 to 3,000 range were coded as “incorrect.”

Sugar-sweetened beverage consumption was measured using three questions: “How often do you drink soda (soft drinks excluding diet soda)?”; “How often do you drink fruit juice (orange juice, apple juice, etc.)?”; and “How often do you drink sports/energy drinks?” Respondents were asked to pick from the following five options: (a) two or more a day, (b) once a day, (c) once to 6 times a week, (d) once to 3 times a month, and (e) never (Gase et al., 2014). The original questionnaire was translated into Spanish by one of the co-investigators (VB) and then back-translated into English by a person who is a high school Spanish teacher to ensure accuracy and quality of translation.

Data Collection Procedures

To recruit participants, a recruitment email containing a hyperlink to the Qualtrics online survey hosted by Texas State University was distributed to acquaintances on social media. Concurrently, paper-and-pencil surveys were provided to individuals through personal contacts. Data were collected from October 2018 to November 2018 using a convenience sampling method.

To protect the rights of the human subjects, this study was reviewed and approved by the Institutional Review Board at Texas State University. A waiver of signed informed consent was obtained because this study presented no more than minimal risk to participants. Potential

subjects who met the inclusion criteria were invited to participate from community resources such as churches, and neighborhoods. Participants in the study were provided with a cover letter prior to completing the study questionnaire. The cover letter included a full disclosure regarding the nature of the study, risks, benefits, and alternatives, with an opportunity to ask questions. Completion of the questionnaire indicated their consent to participate in the study.

There were no more than minimal risks involved in completing the study questionnaire. Participants were reminded that their participation in this study was entirely voluntary and they may refuse to participate by not answering the questions or withdraw from the study any time without any penalty. No personal identifiable information was collected. All data were kept in a password-protected computer and only the researchers had access to the data.

Data Analysis

Descriptive statistics of means, standard deviations, medians, interquartile range (IQR), frequencies, and percentages were used to describe the demographic characteristics and study variables. Independent t-tests were performed to compare the mean scores of health literacy among demographic variables. The dependent variables in this study were: Days of poor physical health, days of poor mental health, and days of poor daily activities. Bivariate Pearson's correlation procedures were first performed to explore the associations between various independent variables and three dependent variables. The statistically significant variables form correlations were selected as the potential predictors of the dependent variables. They were entered into simultaneous multiple regression procedures to identify the predictors of the poor physical and mental health and poor daily activities. SPSS version 25 (IBM Corp, Armonk, NY, USA) was used for all data analyses and the level of significance was set at $p < 0.05$.

Results

Demographic Characteristics

A total of 230 participants completed the study questionnaire. The mean age was 34 years and the majority were female (66.1%) (Table 1). More than half of the participants were ethnic minority groups (52.2%), college graduates (52.2%) and had a BMI in the overweight or obese category (53.5%).

Health Status and Health-Related Behaviors

About a quarter of them rated their general health status as poor or fair (23.9%) (Table 2). The mean days of poor mental health and physical health during the past 30 days were 3.7 days and 6.1 days, respectively. The mean days of poor daily activities because of poor physical and mental health during the past 30 days were 2.7 days. The median physical activity measured by MET-minutes per week were 10,678 and the median sitting minutes per day were 300 minutes. Sixty-three participants out of 230 (27.4%) reported drinking sugar-sweetened beverage more than once a day and 149 of participants (64.8%) had a correct answer of daily recommended calories intake for adults, 1,600 – 3,000 calories/day.

Health Literacy and Demographic Characteristics

The mean scores for basic health literacy and advanced health literacy were 3.00 and 2.83, respectively (Table 3). There were significant differences in basic health literacy scores in educational level (non-college vs college= 2.92 vs 3.07; p=0.047) and ethnicity (non-Hispanic vs Hispanic = 3.07 vs 2.80; p=0.035). The advanced health literacy score was significantly high among non-obese participants compared to obese participants (2.88 vs 2.69; p=0.033).

Predictors of Poor Health Status

Table 4 shows the correlations among poor health status and demographic variables, health-related behaviors, and health literacy level. For days of poor physical health, physical

activity of MET-minutes/week (r=0.15; p=0.02) and sitting minutes per day (r=0.20; p=0.003) had positive correlations, whereas basic health literacy (r = -0.23; p<0.001) and advanced health literacy (r = -0.16; p=0.016) had negative correlations. For days of poor mental health, physical activity of MET-minutes/week (r=0.15; p=0.02), sitting minutes per day (r=0.18; p=0.007), and poor nutrition knowledge (r=0.15; p=0.022) had positive correlations. In contrast, age (r = -0.16; p=0.014), Caucasian ethnicity (r = -0.15; p=0.029), and basic health literacy (r = -0.13; p=0.046) had negative correlations. For days of poor daily activities, age (r = -0.17; p=0.012), Caucasian ethnicity (r = -0.16; p=0.017), and basic health literacy (r = -0.15; p=0.020) had negative correlations.

The results of simultaneous multiple regression analyses predicting poor health status are shown in Table 5. The model assumptions of normality, homoscedasticity, and linearity were met. The potential predictors explained 16.2% of the variance in days of poor physical health (R^2=0.162, p<0.001). Physical activity of MET-minutes per week (β=0.21; p=0.002), sitting minutes per day (β=0.21; p=0.001), and basic health literacy (β= -0.29; p=0.001) were statistically significant predictors of the days of poor physical health. For the days of poor mental health, the potential predictors explained 13.0% of the variance (R^2=0.130, p<0.001). Physical activity of MET-minutes per week (β=0.17; p=0.013), sitting minutes per day (β=0.18; p=0.005), and poor nutrition knowledge (β= 0.16; p=0.013) were statistically significant predictors of the days of poor mental health. The potential predictors explained 9.2% of the variance in days of poor daily activities (R^2=0.092, p<0.001) and the significant predictor was basic health literacy (β= -0.22; p=0.015).

Discussion

This cross-sectional study explored the relationship among health literacy, health-related behaviors, and health status. First, the study findings indicate that basic health literacy had significant negative correlations with poor health status and was a negative predictor of days of poor physical health and days of poor daily activities. Interestingly, advanced health literacy had a significant negative correlation with days of poor physical health in a bivariate correlation, but it was not a predictor in a multivariate regression model. In comparison of advanced health literacy level, the non-obese individuals have a significant higher score compared to obese persons. Second, having more sedentary hours per day showed significant positive correlations with days of poor physical and mental health and was a positive predictor of days of poor physical and mental health as well. Lastly, having poor nutrition knowledge was a positive predictor of days of poor mental health.

Basic health literacy was assessed by asking participants if they had sufficient information to manage their health. In this study, the lack of basic health literacy was related to poor health status and served a significant predictor for poor physical and poor daily activities. Several previous studies concluded similar results in health literacy and health status. A longitudinal study revealed that poor health literacy was associated with decreased quality of life in adults with type 2 diabetes (Sayah, Qiu, & Johnson,2016). Another cross-sectional study conducted by Glassman et al. (2019) found patients with lumbar degenerative diseases who had low health literacy experienced worse back and leg pain in comparison to patients with high health literacy. It is possible that people with low basic health literacy may not have proper knowledge to make healthy choices such as regular exercise and strength training that can improve their health and well-being in general. In addition, people with low health literacy may have limited understanding of their disease process, medication regimen, and adverse effects.

Comprehension of patient education material and ability to follow instructions for self-management may be challenging for patients with low health literacy. Furthermore, they may not have adequate knowledge to navigate healthcare system and access medical care in a timely manner.

Advanced health literacy evaluates the ability of actively managing health such as making plans to improve health and achieve fitness goals. This study found that advanced health literacy was significantly correlated with physical health, but it was not a predictor for poor days of health status. Although the reason for this is not fully understood, a possible explanation may be that even if participants had advanced health literacy, they knowingly chose to make decisions that resulted in poor health. Possibly people with advanced health literacy may not have determination or self- discipline to implement health plans consistently. More than half of our study participants were overweight or obese and a large percentage of participants reported at least one sugar-sweetened beverage consumption daily. Overweight and obesity are associated with increased risks for health conditions and diseases (CDC, 2017). In this study, advanced health literacy scores were significantly higher among non-obese participants when compared to obese participants. These findings are compatible with those from another study which found that higher BMIs were associated with lower health literacy scores (Cheng et al., 2018).

This study revealed daily sedentary hours was positively correlated with days of poor physical and mental health, as well as being a predictor of days of poor physical and mental health. In addition, this study concluded that individuals with higher advanced health literacy were more prone to engaging in regular physical activity in comparison to those individuals with lower health literacy. A cross sectional study found that low health literacy was significantly associated with current smoking, poorer self-rated general and physical health, and higher

perceived stress (Hoover et al., 2015). Patients with inadequate physical activity were found to have a lower physical health scores and poorer mental health (Jayasinghe et al., 2016). According to Peterson (2017), insufficient exercise leads to cardiovascular dysfunction and psychological impairment. Sedentary lifestyle predisposes individuals to many health problems including fatigue, low self-esteem, sleep disorders, obesity, prediabetes, and metabolic syndrome (Buttaro et al., 2017). This study confirmed findings from the previous studies and supported physical inactivity and sedentary lifestyle are significantly related to poor mental and physical health.

Poor nutritional knowledge was a positive predictor of days of poor mental health in this study. A previous cross-sectional study found that patients with higher health literacy and more knowledge in nutrition had increased medical regimen adherence among patients with hypertension and chronic kidney disease (Patel et al., 2016). On the other hand, patients with low health literacy had limited comprehension in nutrition and health management which lead to poor medication adherence and compromised health outcomes. Another study showed that people consuming more Western or highly processed diet had a higher risk for developing psychiatric symptoms such as depression and anxiety (Sánchez-Villegas, Ruíz-Canela, Gea, Lahortiga, and Martínez-González, 2016). Specifically, eating a Mediterranean diet was shown to have protective properties against developing a mental disorder by reducing the risk of depression by 50%. Although this study showed a relationship between poor days of mental health and nutritional knowledge, it can be implied that most people with poor nutritional knowledge follow a Western diet that is highly processed. People with poor nutritional knowledge tended to have low health literacy, and are more like to choose traditional Western diet, which is low in fruits and vegetables and high in red meat and processed foods. Unhealthy

diet practices can lead to increased risk for many diseases, resulting in poor physical and mental health.

This study also found college education was positively associated with health literacy. A study by Dolezel, Shanmugam, and Morrison (2018) concluded that most college students displayed adequate health literacy. In this study, age was significantly related to health literacy, when holding college classification constant. This study confirmed that college educated participants had a higher health literacy.

More than half of participants in this study were able to correctly identify the recommended daily calorie intake for adults. Similarly, a study by Gase et al., (2014) found less than one third of participants were able to do so. Gase et al. (2014) speculated that participants with correct knowledge of recommended calorie intake might have been underreported due to the stigma about SSBs. It was concluded that knowledge of recommended calorie intake is poor in the general population. However, this study was conducted in a low-income area of Los Angeles where the prevalence of obesity is high (Gase et al., 2014). The difference in results between the two studies may be due to the majority of participants in this study were college graduates.

The National Center for Health Statistics Data Brief found that approximately half of the adults in the U.S. consume at least one SSB per day (Rosinger et al., 2017). Consumption of SSBs had been related to individual and social factors such as attitudes, social norms, and self-control (Gase et al., 2014). Compared to other drinks, SSBs are inexpensive and readily available which makes this obesogenic food such an easy choice. Informing individuals about the excessive calorie intake associated with SSBs has led to changes in attitudes as well as rates of purchasing sugar-sweetened beverages (Gase et al., 2014). In contrast, results from this study

found that only one-fourth of participants consumed more than one SSB per day. Sugar-sweetened beverage consumption may be lower due to the majority having higher education levels, as suggested in the study by Gase et al., (2014), which suggested increased levels of knowledge can also impact SSB consumption.

Limitations

There are several limitations in this study. First, the study findings of basic health literacy as a significant predictor of days of poor physical health and poor daily activities in this cross-sectional study should not be taken as cause-and-effect relationships. Second, self-reporting of physical activity level of the study questionnaire may have overestimated their perception of the exercise. Third, a majority of the participants were females and highly educated, which may introduce selection bias. Primarily using social media to disseminate the survey may also contribute to selection bias of the sample as it did not easily allow individuals without social media to access the survey. Lastly, the study findings from this cross-sectional study may not be generalizable to other populations due to the potential sample selection bias and the lack of randomization.

Future studies are needed to determine if basic health literacy is in fact a significant predictor of days of poor physical health and poor daily activities. Future studies may revise the self-reporting tool in order to prevent overestimation of physical activity level. The participants in future studies would also be more diverse in age and education level to decrease bias. Lastly, future studies are needed to examine patient-tailored strategies that can improve health literacy and its impact on physical and mental health status. Randomized controlled studies are recommended to evaluate the effects of physical activities on health status among diverse

population. In addition, it will be beneficial to explore the mediating factors impacting the relationship between health literacy and health status.

Implications for Practice

Healthcare providers in primary care settings see numerous patients a day and are responsible of providing patient education on health promotion, disease prevention, and health-related behaviors, such as physical exercise, recommended daily calorie intake and SSB consumption. By assessing an individual patient's health literacy level or having a general idea for the patient population's literacy level, health providers can have discussions that specifically address health behaviors and ensure the patient leaves with office with a better understanding of his or her health needs.

As healthcare providers, nurse practitioners are at forefront of providing quality care to patients. Part of providing quality care is ensuring the information that is being conveyed to patients is comprehended. Nurse practitioners have the opportunity and resources to address a patient's HL and health behaviors, thereby possibly reducing the risk of negative behavior-related outcomes.

Studies have shown that low literacy skills increase the risk for many adverse health outcomes, such as more emergency department visits, hospitalizations, and deaths. Patients with higher literacy are healthier both physically and mentally and have fewer days per month feeling sick. Although providers have no control over literacy rates, changes can be made in how they teach patients by providing education that is understood by the patient. By tailoring education methods to meet the individual needs of patients, there is a higher chance that the patient will be compliant with the treatment. Higher rates of compliance will keep the patients out of the hospital, drive down health care costs, and improve patient outcomes.

In addition to educating patients to improve health knowledge individually, nurse practitioners can initiate community programs to promote health literacy and improve treatment compliance. Community events such as health fairs and educational classes can be conducted in the clinic or in a community setting by clinicians to provide health related education. Providing education pertaining to disease management and prevention by providing the education based on an individual's health literacy can result in an increase in knowledge comprehension and can increase medical regimen compliance.

Conclusion

Understanding the importance of health literacy and its impact on health-related behaviors is essential for healthcare professionals who will be in the best position to educate patients and families and promote lifestyle modification and disease prevention. This study has shown that basic literacy skills are associated with improved physical and mental health as well as increased daily physical activities. Poor health literacy and sedentary lifestyles result in suboptimal physical health condition, leading to escalated risk for many adverse health outcomes. Because this study only supports correlations and not cause-and effect relationships, more rigorous interventional and experimental studies are needed to determine if there truly exists a cause and effect relationship between health literacy and health outcomes.

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Table 1. Sample characteristics (*N*=230)

	n (%)
Age, mean (range), year	24 (18-85)
Gender	
Male	77 (33.5)
Female	152 (66.1)
Ethnicity	
Non-Hispanic Caucasian	110 (47.8)
Hispanic	84 (36.5)
African American	3 (1.3)
Asian/Pacific Islander	22 (9.6)
Other	10 (4.3)
Education	
High school graduates or less	34 (14.8)
Some college	73 (31.7)
College graduate	120 (52.2)
Body Mass Index (BMI)†	
Underweight	3 (1.3)
Normal weight (18.5–24.9 kg/m^2)	98 (42.6)
Overweight (25.0–29.9 kg/m^2)	71 (30.9)
Obese (≥ 30 kg/m^2)	52 (22.6)

Note. Values are expressed as *n* (%) unless otherwise indicated.
Percentages may not add up to 100% because of missing data or rounding.
†Body mass index (BMI) category per CDC Adult BMI calculator.

Table 2. Health status (*N*=230)

	n (%)
General health status	
Poor	3 (1.3)
Fair	52 (22.6)
Good	99 (43.0)
Very good	62 (27.0)
Excellent	13 (5.7)
Days of poor physical health/month, mean (SD)	3.7 (7.3)
Days of poor mental health/month, mean (SD)	6.1 (8.2)
Days of poor daily activities/month, mean (SD)	2.7 (5.7)
Physical activity, MET-minutes/week, median (IQR)	10678 (3061, 29029)
Sitting minutes/day, median (IQR)	300 (180, 480)
SSB consumption > once a day	63 (27.4)
Recommended calories intake for adults, 1600-3000 cal/day	149 (64.8)
Basic health literacy, mean (SD)	3.00 (0.60)
Advanced health literacy, mean (SD)	2.83 (0.55)

Note. Values are expressed as *n* (%) unless otherwise indicated.
Percentages may not add up to 100% because of missing data or rounding.
MET, Metabolic equivalent; SSB, sugar-sweetened beverage; IQR, Interquartile range.
Health literacy, possible maximum score = 4.00
Basic health literacy = Having sufficient information to manage my health
Advancedhealth literacy = Actively managing my health

Table 3. Health literacy scores (M±SD) and demographic characteristics (*N*=230)

	Basic HL vs Advanced HL	*p* value
Age, <65 yr vs ≥ 65 yr	Basic HL: 3.01±0.60 vs 2.98±0.63	0.885
	Advanced HL: 2.83±0.54 vs 2.87±0.70	0.859
Male vs female	Basic HL: 3.04±0.55 vs 2.98±0.63	0.436
	Advanced HL: 2.84±0.55 vs 2.83±0.55	0.877
Non-college vs college	Basic HL: 2.92±0.57 vs 3.07±0.62	0.047*
	Advanced HL: 2.78±0.57 vs 2.87±0.53	0.232
Non-Hispanic vs Hispanic	Basic HL: 3.07±0.59 vs 2.89±0.61	0.035*
	Advanced HL: 2.80±0.54 vs 2.90±0.57	0.235
Non-obese vs obese	Basic HL: 2.99±0.58) vs 3.04±0.63	0.642
	Advanced HL: 2.88±0.54 vs 2.69±0.53	0.033*

Note. Comparisons of scores by independent *t*-test; * $p<0.05$
M, Mean; SD, Standard deviation; HL, Health literacy.

Table 4. Correlations with poor health status (*N*=230)

	Days of poor physical health	Days of poor mental health	Days of poor daily activities
Age	0.03	-0.16*	-0.17*
Female	0.06	0.09	0.10
Caucasian ethnicity	-0.08	-0.15*	-0.16*
Hispanic ethnicity	0.09	0.15*	0.12
College graduate	-0.04	0.004	-0.01
BMI	0.09	0.07	0.12
MET-minutes/week	0.15*	0.15*	0.08
Sitting minutes/day	0.20**	0.18**	0.08
SSB ≥ once per day	0.03	0.08	0.06
Poor nutrition knowledge	0.13	0.15*(p=0.022)	0.11
Basic health literacy	-0.23***	-0.13*	-0.15*
Advanced health literacy	-0.16*	-0.07	-0.04

Note. Correlations by bivariate Pearson's; * $p<0.05$; ** $p<0.01$, *** $p<0.001$
MET, Metabolic equivalent; SSB, sugar-sweetened beverage;
Poor nutrition knowledge measured by incorrect knowledge of daily calories recommendation;
Basic health literacy = Having sufficient information to manage my health
Advanced health literacy = Actively managing my health

Table 5. Simultaneous multiple regression model predicting poor health status (*N*=230)

Variables	Days of poor physical health		Days of poor mental health		Days of poor daily activities	
	β	*p*	β	*p*	β	*P*
MET-minutes/week	0.21	0.002**	0.17	0.013*	0.09	0.177
Sitting minutes/day	0.21	0.001**	0.18	0.005**	0.08	0.258
Poor nutrition knowledge	0.11	0.090	0.16	0.013*	0.13	0.06
Basic health literacy	-0.29	0.001**	-0.17	0.054	-0.22	0.015*
Advanced health literacy	0.02	0.790	0.05	0.598	0.10	0.275
	$R^2 = 0.162$ $F_{(8,212)} = 5.109$***		$R^2 = 0.130$ $F_{(8,212)} = 3.976$***		$R^2 = 0.092$ $F_{(8,212)} = 2.680$***	

Note. * $p<0.05$; ** $p<0.01$, *** $p<0.001$