



# The relationship between electronic health literacy and individual factors among adults with chronic pain: A cross-sectional study

## Research Paper

Geraldine Martorella<sup>1</sup>, Hye Jin Park<sup>1</sup>, Glenna Schluck<sup>1</sup>

<sup>1</sup>College of Nursing, Florida State University, United States of America

**Corresponding author:** G. Martorella ([gmartorella@fsu.edu](mailto:gmartorella@fsu.edu))

### ABSTRACT

**Introduction:** Chronic pain requires individuals to develop self-management skills that rely on health literacy and, more recently, eHealth literacy. Very few studies have investigated potential predictors of eHealth literacy in chronic pain patients. Therefore, the purpose of this study is to explore potential predictors of eHealth literacy among individual characteristics and pain-related clinical factors, as a preliminary step to understanding the multi-variable relationships that could be examined in a larger study. **Methods:** A cross-sectional online survey was distributed to adults living in the United States with various chronic pain conditions using Amazon's Mechanical Turk. A convenience sample of 196 participants was recruited. The independent variables of interest regarding their relationship with eHealth literacy (dependent variable) included demographics, health literacy, chronic pain severity, pain attitudes and coping skills. Chi square tests of association, and independent samples t-tests were used to examine the bivariate relationships. **Results:** The majority of the sample suffered from chronic pain for more than 2 years with 48% suffering from chronic back pain. Most of the sample (n=184, 93.9%) had high eHealth literacy. Significant relationships were found between eHealth literacy and the following variables: marital status, education level, and age, as well as health literacy, chronic pain interference with activities and chronic pain attitudes. These warrant further exploration in a larger study using logistic regression. **Conclusions:** our findings provide new information on the relationship between eHealth literacy levels, pain-related individual factors such as attitudes toward pain, and clinical outcomes, i.e., pain interference with physical and psychological function. Although further research is needed to investigate eHealth literacy predictors and mediators, these findings promote the evidence-based development and evaluation of interventions enhancing eHealth literacy skills, as well as self-management skills of chronic pain patients.

### KEYWORDS

Chronic Pain, eHealth Literacy, Health Literacy, Pain Management, Self-Management

### INTRODUCTION

Chronic pain, an increasing health problem among the most common reasons adults seek healthcare (Dahlhamer et al., 2018; Zelaya et al., 2020), requires individuals to develop and use self-management skills on a daily basis to help deal with their pain. In order to develop these skills, individuals need to go through an educational process (LeFort, 2021). Different key tasks have been identified as being part of the

development of self-management skills, including one that is central - using appropriate resources and managing decisions regarding different treatment approaches (Bodenheimer et al., 2002). These tasks depend to a certain extent on the level of health literacy. Indeed, health literacy is defined as "the degree to which individuals have the ability to find, understand, and use information and services to



inform health-related decisions and actions for themselves and others” (Santana et al., 2021).

Given the widespread importance of the internet in our lives, independent of socioeconomic status, and the increased access to a considerable amount of information, electronic health literacy (i.e., eHealth literacy) has consequently become an important aspect of self-management skills (Chesser et al., 2016; Kim & Xie, 2017; Watkins & Xie, 2014). A survey regarding electronic health behaviors conducted in the United States among adults with a chronic disease reported that 75% of respondents were using the Web to obtain health information (Madrigal & Escoffery, 2019). Another study focused on individuals suffering from various chronic pain conditions reported that 70% of its participants were using internet actively to find health-related information (Castarlenas et al., 2021). eHealth literacy, therefore, is the ability to seek, find, understand, and appraise health information from electronic resources and apply such knowledge to address or solve a health problem (Norman & Skinner, 2006a, 2006b). Moreover, more and more health-related interventions are provided over the Web, an outcome of the Covid-19 pandemic. eHealth literacy level then becomes a variable that will determine the capacity to manage pain and its multidimensional impact.

Nevertheless, a systematic review underlined that eHealth literacy is generally not considered in developing eHealth interventions for socially disadvantaged and underserved groups (e.g., older age, less education, lower income, being from an ethnic minority group, or living in a remote area), and, unsurprisingly, evidence on the effectiveness of these interventions in these groups is inconclusive (Cheng et al., 2020). eHealth literacy is more important for underserved communities such as people living in rural areas as they do not have access to high quality pain management resources and may use online resources to fill this gap (DeMonte et al., 2015). However, some resources such as individual blogs or forums may circulate false or misleading information that potentially influences the views of the population consuming this information (Stellefson et al., 2011). Misinformation can also lead to inaccurate self-diagnosis and/or potentially ineffective or

dangerous treatments (Honey, 2010). The consequences can be grave if health information is inaccurate or misleading and leads to poor decisions about how to manage a health problem and when to seek professional help. Increasing eHealth literacy levels may empower people accessing various websites when making choices about the management of their pain (DeMonte et al., 2015).

Health literacy and eHealth literacy have shown to be related and to influence outcomes for individuals living with chronic conditions (Neter, 2019; Stellefson et al., 2019). We previously examined the level of eHealth literacy in a sample of people living with chronic pain and found that it was quite high and that some components of health literacy, e.g., appraisal of health information and ability to find good health information, influenced eHealth literacy levels in this population (Park, 2021). Thus, a logical extension of this research is to determine what factors are associated with eHealth literacy in this population. Recently, two studies found that self-efficacy was influencing eHealth literacy in individuals with chronic back pain and various other chronic pain-related conditions (Castarlenas et al., 2021; Rabenbauer & Mevenkamp, 2021). A study conducted in patients with various chronic conditions living in a low-income country (i.e., Ethiopia) concluded that higher education, living in an urban area, perceived good health status, higher income, daily internet use, good knowledge of availability and importance of online resources, positive attitude toward those resources and higher level of computer literacy were predictors positively associated with higher eHealth literacy level (Shiferaw et al., 2020). Last, a study focused on people with cardiovascular disease showed that although age and education level may play a role, only the time spent on the internet contributed to their level of eHealth literacy (Richtering et al., 2017).

To our knowledge, very few studies specifically examined the contributing factors to eHealth literacy in chronic pain patients. Therefore, the purpose of this study is to explore potential predictors of eHealth literacy among individual characteristics and pain-related clinical factors (demographics, health literacy, chronic pain severity, pain attitudes and coping skills), as a preliminary step to understanding the multi-variable relationships that could be examined in a



larger study. This will allow us to understand how individuals with high levels of eHealth literacy are different from individuals with low levels of eHealth and to develop strategies and specific interventions for enhancing eHealth literacy skills and/or usability of Web-based information and eHealth interventions for adults with chronic pain.

## METHODS

### *Study Design and Procedure*

A cross-sectional online survey was distributed to adults living in the United States (US) with various chronic pain conditions using Amazon's Mechanical Turk (MTurk). More details regarding the methods and procedures are provided in our previous paper describing the primary study focused on health and eHealth literacies (Park, 2021). MTurk is helpful in reaching populations that are typically underrepresented through traditional recruitment techniques (Chandler & Shapiro, 2016) while still obtaining reliable and valid responses (Goodman, 2013), all of which we found beneficial in the context of this study since underserved populations will be even more likely to use the internet to find health-related information.

### *Participants and Ethics*

A convenience sample of 196 participants was recruited based on the sample size needed for the primary study (Park, 2021). Participants in this study were eligible if they: 1) were U.S. residents, 2) had a history of at least a 90% task approval rate for their previous participation in studies using MTurk as indicated in the platform, 3) reported having pain for at least three months, 4) were able to complete a questionnaire in English, and 5) had access to an electronic device and internet to complete the survey.

After obtaining ethical approval from the University's institutional review board (IRB), the survey offer was posted on MTurk. Respondents were redirected to a link of the informed consent. By starting the survey, the participants were agreeing to participate. Respondents received \$2.00 in compensation after completing the survey.

### *Data Collection*

#### **eHealth Literacy**

The eHealth literacy scale, eHEALS, was used (Norman & Skinner, 2006a). eHEALS is a 8-item self-report questionnaire that focuses on knowledge and understanding of what health information is available on the Internet, how to use the Internet, where one can find helpful health resources, how to access this information, the skills to evaluate the online health information, and the ability to discern reliable health resources on the Internet. Each item is rated on a five point-Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Total scores of the eHEALS are summed to range from 8 to 40, with higher scores representing higher self-perceived eHealth literacy. Good internal consistency reliability along with good test-retest reliability have been reported (Norman & Skinner, 2006a). Two supplemental items recommended by the authors of eHEALS, using a similar 5-point Likert scale, were included in order to assess perceived usefulness of the Internet for making health decisions and perceived importance of being able to access health resources on the Internet for a total of 10 items.

#### **Health Literacy**

The Health Literacy Questionnaire (HLQ) was also used (Osborne et al., 2013). This instrument focuses on health literacy strengths and weaknesses. The HLQ includes 9 subscales for a total of 44 items. Each subscale provides a score. Four out of nine subscales that are specifically related to the ability to find, appraise, understand and use health information (subscales #2 [having sufficient information to manage my health, 4 items], #5 [appraisal of health information, 5 items], #8 [ability to find good health information, 5 items], #9 [understanding health information, 5 items]) were used for a total of 19 items. The HLQ has been shown to have strong psychometric properties with Cronbach's alpha >0.8 for all scales (Osborne et al., 2013).

#### **Chronic pain severity**

The Brief Pain Inventory (BPI) was used to assess chronic pain severity (Cleeland & Ryan, 1994). The BPI



includes 10 items with numeric rating scales: three items focus on pain intensity, i.e., at rest, on average, worst (0 for “no pain” to 10 for “worst possible pain”), and seven evaluate the impact of pain on general activity, mood, walking, work, relationships, sleep and enjoyment of life with the anchors being “does not interfere” (0) and “completely interferes” (10). Participants were asked to base their ratings on their pain experience in the previous seven days. Each item represents a subscale and can be scored and analyzed individually. The BPI has shown internal consistency, reliability and validity across cultures and settings (Cleeland & Ryan, 1994).

### **Coping skills and pain attitudes**

Short forms of the Chronic Pain Coping Inventory (CPCI) (Jensen et al., 1995) and the Survey of Pain Attitudes (SOPA) (Jensen et al., 1994) were utilized. The short forms of these questionnaires have demonstrated validity and are adequate for studies with larger samples (Jensen et al., 2003). The CPCI short form includes 8 items, which refer to the following subscales: guarding, resting, asking for assistance, relaxation, task persistence, exercise/stretch, seeking and coping self-statements. The scores on each item represents the score on the subscale. The SOPA short form includes 7 items, which refer to the following subscales: pain control, disability, harm, emotion, medication, solicitude, and medical cure. Thus, scores on each item represent the score on the subscale. Of note, given the negative wording of items 1 and 2, their score needs to be reversed before analysis to reflect the appropriate scoring direction.

### **Data Analysis**

The purpose of this secondary analysis was to examine the bivariate relationships between eHealth literacy and the various demographics and characteristics of chronic pain as a preliminary step to understanding the multi-variable relationships that could be examined in a larger study powered for such an analysis. Chi square tests of association, and independent samples t-tests were used to examine the bivariate relationships. Since this analysis was not the primary objective of the study (Park, 2021), we do not have sufficient power for a more in-depth analysis

using logistic regression. Thus, the required sample size for an independent samples t-test is 51 per group (102 total) assuming equal group allocation, moderate effect size, 80% power, and 5% probability of making a Type I error.

Although no formal cutoff has been established for the eHEALS, a cutoff was set at 26 (high [eHEALS<26] vs. low [eHEALS≥26]) based on several studies with similar populations, i.e., adults with chronic disease (Choi & Dinitto, 2013; Milne et al., 2015; Neter & Brainin, 2012; Richtering et al., 2017; Tennant et al., 2015). We favored this approach over an artificial categorization based on median splits as this strategy has been criticized for the risk of increasing type I and type II errors, especially when a sample varies on the distribution of the measure (DeCoster, 2011; McClelland, 2015). The independent variables of interest were demographics (gender, ethnicity, marital status, work status, education level, health literacy, location of chronic pain, and duration of chronic pain), chronic pain severity (BPI: average intensity and interference), chronic pain attitudes (SOPA – 7 subscales), and chronic pain coping skills (CPCI – 8 subscales). Given our previous results with health literacy (Park, 2021), we also included health literacy as an independent variable in our analysis. All demographic variables with multiple response options were dichotomized for analysis purposes. For instance, work status was categorized as “working full time” vs “not working full time”.

## **RESULTS**

### ***Demographic characteristics and levels of eHealth literacy***

Sociodemographic characteristics for the sample as a whole are presented in our previous paper (Park, 2021). The majority of the sample suffered from chronic pain for more than 2 years with 48% suffering from chronic back pain. Most of the sample (n=184, 93.9%) had high eHealth literacy. There were no statistical differences in the demographics among the low eHealth literacy and high eHealth literacy groups ([Table 1](#)) although there were some notable differences in the sample demographics. A higher percentage of participants with low eHealth literacy are white or married compared to those with high



eHealth literacy. A higher percentage of participants with high eHealth literacy work full-time, report shorter durations of chronic pain, and have more education compared to those with low eHealth literacy ([Table 1](#)).

### ***Relationships and potential predictors among demographic and clinical characteristics***

Psychometrics and summary statistics (min, median, mean, max, and standard deviation) computed from the total sample have been previously reported (Park, 2021). Only scales/subscales with more than one item were assessed for internal consistency. The BPI showed good internal consistency in this study (Cronbach's  $\alpha=.91$ ). [Table 2](#) displays the valid sample size, mean, and standard deviation for each scale reported by eHealth literacy level along with the p-value for an independent-samples t-test. Note that p-values less than .002 are statistically significant at a family-wise error rate of .05. No variables have statistically significant differences among groups given this threshold. Participants with low eHealth literacy have slightly less favorable outcomes (such as increased pain intensity and interference or decreased health literacy) than those with high eHealth literacy.

Because the purpose of this study is to examine bivariate relationships as a preliminary step to a larger study examining a full logistic regression model, logistic regression model building guidelines proposed by Hosmer and Lemeshow (2000) are considered. Variables with bivariate relationship (p-values  $<.25$ ) should be included for consideration in a logistic regression model in addition to other variables identified through literature and subject matter expertise. Therefore, among demographics, marital status, education level, and age warrant further exploration in a larger study using logistic regression, as well as health literacy (HLQ subscales: having sufficient information, critical appraisal, and finding good health information), chronic pain severity (BPI: interference), chronic pain attitudes (SOPA: pain control, disability, and medical cure), and chronic pain coping skills (CPCI: muscle relaxation).

## **DISCUSSION**

eHealth literacy is an important component of self-management for people with chronic conditions. This study is one of the few examining sociodemographic and clinical factors in relation to the level of eHealth literacy and is the first to explore the contribution of chronic pain attitudes and coping skills.

Most of participants (94%,  $n=184$ ) had high eHealth literacy with an eHEALS score of 26 or higher, which is consistent with previous studies with individuals facing chronic pain (Castarlenas et al., 2021) or other chronic conditions (Richtering et al., 2017). This is also consistent with participants being recruited online, thus most likely to be using internet resources.

Among sociodemographic data, although no statistically significant differences were found between the high and low eHealth literacy groups probably due to the unbalanced repartition of the sample between high and low levels of eHealth literacy, it was found that older age, lower education level, and being married were associated with lower levels of eHealth literacy. These converge with previous results with bivariate analyses showing that older age and lower levels of education are associated with lower eHealth literacy (Richtering et al., 2017; Shiferaw et al., 2020).

These sociodemographic characteristics have also been recognized as contributing to the risk and maintenance of chronic pain in relation to their impact on self-efficacy and eHealth literacy (Rabenbauer & Mevenkamp, 2021). For instance, being married and having less education can lead to reliance on family members as opposed to developing self-efficacy skills and potentially eHealth literacy. Nonetheless, regarding age more specifically, Castarlenas et al. (Castarlenas et al., 2021) did not find that the level of eHealth literacy was associated with age in chronic pain patients. Indeed, another study with a cardiovascular population observed that this relationship seems to disappear when included in a logistic regression model to let "time spent on the internet" prevail (Richtering et al., 2017).

Regarding clinical factors, again, although groups were not different and had similar levels of pain intensity, an association was found between the level



of eHealth literacy and pain interference with physical and psychological functions (total score). A previous study with chronic pain patients found that levels of eHealth literacy were not associated with pain interference (total score), however they were associated with anxiety and depression (Castarlenas et al., 2021), which can be interpreted as proxy measures of pain interference with psychological function. These results are consistent with previous conclusions relating higher eHealth literacy to better health outcomes (Xesfingi & Vozikis, 2016; Xie et al., 2022). In this study, we also found that eHealth literacy levels were associated with some attitudes toward pain and its control. The group with high levels of eHealth literacy scored higher on *“There is little I can do to ease my pain”* (pain control), lower on *“my pain does not stop me from leading a physically active life”* (disability) and higher on *“I trust that doctors can cure my pain”* (medical cure), suggesting that individuals with more negative attitudes toward pain and their ability to control it will search more information online in a quest for solutions and that this process will in turn make them develop eHealth literacy skills.

However, although participants in this group reported increased levels of negative attitudes toward pain and its control, they seemed to experience less interference of pain. This might be partially explained by self-efficacy. Self-efficacy has been found to help explain the benefits of eHealth literacy in chronic pain patients and other populations with chronic conditions (Castarlenas et al., 2021; Choi, 2020; Rabenbauer & Mevenkamp, 2021). For instance, Castarlenas et al. (2021) found that self-efficacy fully explained the relationship between eHealth literacy and depression (i.e., psychological function). Our findings then suggest that eHealth literacy, likely through self-efficacy enhancement, helps overcome the potential impact of maladaptive beliefs toward pain on clinical outcomes.

### LIMITATIONS

First, we obtained a sample with high e-Health literacy and an unequal repartition of participants between the low and high eHealth literacy groups. However, studies focusing on eHealth literacy and chronic pain patients have observed high levels of

eHealth literacy and eHealth use (Castarlenas et al., 2021; Ledel Solem et al., 2019; Rabenbauer & Mevenkamp, 2021). Moreover, the method of recruitment used in this study may have created a bias of self-selection which hinders the generalizability of our findings. Another potential limitation is that the data collection relies on self-report. Lastly, although the scales used have been validated, Cronbach’s alpha could not be calculated for one-item scales and a larger sample would have potentially increased their psychometric properties (Jensen et al., 2003).

Several implications for research and practice can be suggested. Our study provides some insight regarding several sociodemographic and clinical variables that deserve to be further explored in larger studies using logistic regression in order to develop a prediction model regarding eHealth literacy levels in chronic pain patients.

Additionally, eHealth literacy skills seem to lead to better outcomes for people living with chronic pain regardless of their attitudes toward pain. Thus, beside the potential benefits on self-efficacy, it would be relevant to examine what people living with chronic pain learned by using eHealth resources. These preliminary results need to be further validated and mediators of this relationship should be explored in order to guide the development of appropriate interventions. Regarding clinical practice, these findings suggest that eHealth skills are high among chronic pain patients, making eHealth platforms a promising tool to reach them, which confirms what has been clearly expressed in a qualitative study with chronic pain patients and their spouse (Ledel Solem et al., 2019) and that enhancing eHealth literacy skills is a relevant avenue for interventions promoting better health in chronic pain patients, which converges with another study highlighting the role of self-efficacy in this therapeutic process (Castarlenas et al., 2021).

### CONCLUSIONS

This study is one of the few to provide some evidence regarding potential contributors to eHealth literacy skills in a chronic pain population and it indicates which variables warrant further study with a larger sample. It also provides new information on the





relationship between eHealth literacy levels, pain-related individual factors such as attitudes toward pain and clinical outcomes, i.e., pain interference with physical and psychological function. Further research needs to address potential mediators and the development and evaluation of interventions enhancing eHealth literacy skills, as well as the development and evaluation of eHealth platforms specifically addressing the needs of chronic pain patients in terms of pain self-management.

## REFERENCES

- Bodenheimer, T., Lorig, K., Holman, H., & Grumbach, K. (2002, Nov 20). Patient self-management of chronic disease in primary care. *JAMA*, *288*(19), 2469-2475. <https://doi.org/10.1001/jama.288.19.2469>
- Castarlenas, E., Sanchez-Rodriguez, E., Roy, R., Tome-Pires, C., Sole, E., Jensen, M. P., & Miro, J. (2021, Nov 28). Electronic Health Literacy in Individuals with Chronic Pain and Its Association with Psychological Function. *International Journal of Environmental Research and Public Health*, *18*(23). <https://doi.org/10.3390/ijerph182312528>
- Chandler, J., & Shapiro, D. (2016). Conducting Clinical Research Using Crowdsourced Convenience Samples. *Annual Review of Clinical Psychology*, *12*, 53-81. <https://doi.org/10.1146/annurev-clinpsy-021815-093623>
- Cheng, C., Beauchamp, A., Elsworth, G. R., & Osborne, R. H. (2020, Aug 13). Applying the Electronic Health Literacy Lens: Systematic Review of Electronic Health Interventions Targeted at Socially Disadvantaged Groups. *Journal of Medical Internet Research*, *22*(8), e18476. <https://doi.org/10.2196/18476>
- Chesser, A., Burke, A., Reyes, J., & Rohrberg, T. (2016). Navigating the digital divide: A systematic review of eHealth literacy in underserved populations in the United States. *Informatics for Health and Social Care*, *41*(1), 1-19. <https://doi.org/10.3109/17538157.2014.948171>
- Choi, M. (2020, Oct 28). Association of eHealth Use, Literacy, Informational Social Support, and Health-Promoting Behaviors: Mediation of Health Self-Efficacy. *International Journal of Environmental Research and Public Health*, *17*(21). <https://doi.org/10.3390/ijerph17217890>
- Choi, N. G., & Dinitto, D. M. (2013, May 2). The digital divide among low-income homebound older adults: Internet use patterns, eHealth literacy, and attitudes toward computer/Internet use. *Journal of Medical Internet Research*, *15*(5), e93. <https://doi.org/10.2196/jmir.2645>
- Cleeland, C. S., & Ryan, K. M. (1994, 3/1994). Pain assessment: global use of the Brief Pain Inventory. *Annals of the Academy of Medicine of Singapore*, *23*(2), 129-138. <http://www.ncbi.nlm.nih.gov/pubmed/8080219> (Not in File)
- Dahlhamer, J., Lucas, J., Zelaya, C., Nahin, R., Mackey, S., DeBar, L., Kerns, R., Von Korff, M., Porter, L., & Helmick, C. (2018, Sep 14). Prevalence of Chronic Pain and High-Impact Chronic Pain Among Adults - United States, 2016. *MMWR Morbidity and Mortality Weekly Report*, *67*(36), 1001-1006. <https://doi.org/10.15585/mmwr.mm6736a2>
- DeCoster, J., Gallucci, M., & Iselin, AM. (2011). Best Practices for Using Median Splits, Artificial Categorization, and their Continuous Alternatives. *Journal of Experimental Psychopathology*, *2*(2), 197-209. <https://doi.org/10.5127/jep.008310>
- DeMonte, C. M., DeMonte, W. D., & Thorn, B. E. (2015). Future implications of eHealth interventions for chronic pain management in underserved populations. *Pain Management*, *5*(3), 207-214. <https://doi.org/10.2217/pmt.15.9>
- Goodman, J. K., Cryder, C. E., & Cheema, A. (2013). Data collection in a flat world: The strengths and weaknesses of Mechanical Turk samples. *Journal of Behavioral Decision Making*, *26*(3), 213-224.
- Honey, M. L., Bycroft, J., Tracey, J., Boyd, M.A., McLachlan, A. (2010). Quality processes that maximise the Health Navigator web portal as an enabler for consumers and health professionals. *Health Care and Informatics Review Online* *14*(1), 12-18.
- Hosmer, D., Lemeshow, S. (2000). Model-Building Strategies and Methods for Logistic Regression. In D. Hosmer, Lemeshow, S (Ed.), *Applied Logistic Regression, Second Edition*. Wiley & sons, Inc.
- Jensen, M. P., Keefe, F. J., Lefebvre, J. C., Romano, J. M., & Turner, J. A. (2003, Aug). One- and two-item measures of pain beliefs and coping strategies. *Pain*, *104*(3), 453-469. <https://www.ncbi.nlm.nih.gov/pubmed/12927618>



- Jensen, M. P., Turner, J. A., Romano, J. M., & Lawler, B. K. (1994, Jun). Relationship of pain-specific beliefs to chronic pain adjustment. *Pain*, *57*(3), 301-309.  
<https://www.ncbi.nlm.nih.gov/pubmed/7936708>
- Jensen, M. P., Turner, J. A., Romano, J. M., & Strom, S. E. (1995, Feb). The Chronic Pain Coping Inventory: development and preliminary validation. *Pain*, *60*(2), 203-216.  
<https://www.ncbi.nlm.nih.gov/pubmed/7784106>
- Kim, H., & Xie, B. (2017, Jan 28). Health literacy in the eHealth era: A systematic review of the literature. *Patient Education and Counseling*.  
<https://doi.org/10.1016/j.pec.2017.01.015>
- Ledel Solem, I. K., Varsi, C., Eide, H., Kristjansdottir, O. B., Mirkovic, J., Borosund, E., Haaland-Overby, M., Heldal, K., Schreurs, K. M., Waxenberg, L. B., Weiss, K. E., Morrison, E. J., & Solberg Nes, L. (2019, Apr 1). Patients' Needs and Requirements for eHealth Pain Management Interventions: Qualitative Study. *Journal of Medical Internet Research*, *21*(4), e13205.  
<https://doi.org/10.2196/13205>
- LeFort, S., McGillion, M. (2021). *Promoting Chronic Pain Self-Management Education*. International Association for the Study of Pain  
<https://www.iasp-pain.org/resources/factsheets/promoting-chronic-pain-self-management-education/>
- Madrigal, L., & Escoffery, C. (2019, Mar 5). Electronic Health Behaviors Among US Adults with Chronic Disease: Cross-Sectional Survey. *Journal of Medical Internet Research*, *21*(3), e11240.  
<https://doi.org/10.2196/11240>
- McClelland, G., Lynch Jr, JG, Irwin, JR, Spiller, SA, & Fitzsimons, G. (2015). Median splits, Type II errors, and false-positive consumer psychology: Don't fight the power. *Journal of Consumer Psychology*, *25*(4), 679-689.  
<https://doi.org/10.1016/j.jcps.2015.05.006>
- Milne, R. A., Puts, M. T., Papadakos, J., Le, L. W., Milne, V. C., Hope, A. J., Catton, P., & Giuliani, M. E. (2015, Dec). Predictors of High eHealth Literacy in Primary Lung Cancer Survivors. *Journal of Cancer Education*, *30*(4), 685-692.  
<https://doi.org/10.1007/s13187-014-0744-5>
- Neter, E., & Brainin, E. (2012, Jan 27). eHealth literacy: extending the digital divide to the realm of health information. *Journal of Medical Internet Research*, *14*(1), e19. <https://doi.org/10.2196/jmir.1619>
- Neter, E., Brainin, E. (2019). Association between health literacy, eHealth literacy, and health outcomes among patients with long-term conditions: A systematic review. *European Psychologist*, *24*(1), 68-81.  
<https://doi.org/10.1027/1016-9040/a000350>
- Norman, C. D., & Skinner, H. A. (2006a, Nov 14). eHEALS: The eHealth Literacy Scale. *Journal of Medical Internet Research*, *8*(4), e27.  
<https://doi.org/10.2196/jmir.8.4.e27>
- Norman, C. D., & Skinner, H. A. (2006b, Jun 16). eHealth Literacy: Essential Skills for Consumer Health in a Networked World. *Journal of Medical Internet Research*, *8*(2), e9.  
<https://doi.org/10.2196/jmir.8.2.e9>
- Osborne, R. H., Batterham, R. W., Elsworth, G. R., Hawkins, M., & Buchbinder, R. (2013, Jul 16). The grounded psychometric development and initial validation of the Health Literacy Questionnaire (HLQ). *BMC Public Health*, *13*, 658.  
<https://doi.org/10.1186/1471-2458-13-658>
- Park, H., Martorella, G., Schluck, G. (2021). Electronic health literacy among adults with chronic pain: A descriptive, cross-sectional survey. *International Health Trends and Perspectives*, *1*(3), 390-403.  
<https://doi.org/10.32920/ihtp.v1i3.1469>
- Rabenbauer, L. M., & Mevenkamp, N. (2021, Feb). Factors in the Effectiveness of e-Health Interventions for Chronic Back Pain: How Self-Efficacy Mediates e-Health Literacy and Healthy Habits. *Telemedicine and E-Health*, *27*(2), 184-192. <https://doi.org/10.1089/tmj.2019.0301>
- Richtering, S. S., Hyun, K., Neubeck, L., Coorey, G., Chalmers, J., Usherwood, T., Peiris, D., Chow, C. K., & Redfern, J. (2017, Jan 27). eHealth Literacy: Predictors in a Population with Moderate-to-High Cardiovascular Risk. *JMIR Human Factors*, *4*(1), e4.  
<https://doi.org/10.2196/humanfactors.6217>
- Santana, S., Brach, C., Harris, L., Ochiai, E., Blakey, C., Bevington, F., Kleinman, D., & Pronk, N. (2021, Nov-Dec 01). Updating Health Literacy for Healthy People 2030: Defining Its Importance for a New Decade in Public Health. *Journal of Public Health Management and Practice*, *27*(Suppl 6), S258-S264.  
<https://doi.org/10.1097/PHH.0000000000001324>





- Shiferaw, K. B., Tilahun, B. C., Endehabtu, B. F., Gullslett, M. K., & Mengiste, S. A. (2020, Aug 6). E-health literacy and associated factors among chronic patients in a low-income country: a cross-sectional survey. *BMC Medical Informatics and Decision Making*, 20(1), 181. <https://doi.org/10.1186/s12911-020-01202-1>
- Stellefson, M., Hanik, B., Chaney, B., Chaney, D., Tennant, B., & Chavarria, E. A. (2011, Dec 01). eHealth literacy among college students: a systematic review with implications for eHealth education. *Journal of Medical Internet Research*, 13(4), e102. <https://doi.org/10.2196/jmir.1703>
- Stellefson, M., Paige, S. R., Alber, J. M., Chaney, B. H., Chaney, D., Apperson, A., & Mohan, A. (2019, Jun 6). Association Between Health Literacy, Electronic Health Literacy, Disease-Specific Knowledge, and Health-Related Quality of Life Among Adults with Chronic Obstructive Pulmonary Disease: Cross-Sectional Study. *Journal of Medical Internet Research*, 21(6), e12165. <https://doi.org/10.2196/12165>
- Tennant, B., Stellefson, M., Dodd, V., Chaney, B., Chaney, D., Paige, S., & Alber, J. (2015, Mar 17). eHealth literacy and Web 2.0 health information seeking behaviors among baby boomers and older adults. *Journal of Medical Internet Research*, 17(3), e70. <https://doi.org/10.2196/jmir.3992>
- Watkins, I., & Xie, B. (2014, Nov 10). eHealth literacy interventions for older adults: a systematic review of the literature. *Journal of Medical Internet Research*, 16(11), e225. <https://doi.org/10.2196/jmir.3318>
- Xesfingi, S., & Vozikis, A. (2016, May 25). eHealth Literacy: In the Quest of the Contributing Factors. *Interactive Journal of Medical Research*, 5(2), e16. <https://doi.org/10.2196/ijmr.4749>
- Xie, L., Zhang, S., Xin, M., Zhu, M., Lu, W., & Mo, P. K. (2022, Apr). Electronic health literacy and health-related outcomes among older adults: A systematic review. *Preventive Medicine*, 157, 106997. <https://doi.org/10.1016/j.ypmed.2022.106997>
- Zelaya, C. E., Dahlhamer, J. M., Lucas, J. W., & Connor, E. M. (2020, Nov). Chronic Pain and High-impact Chronic Pain Among U.S. Adults, 2019. *NCHS Data Brief* (390), 1-8. <https://www.ncbi.nlm.nih.gov/pubmed/3315114>
- 5



**Table 1. Participant demographics according to levels of eHealth literacy**

Variable/Level	Low eHealth Literacy		High eHealth Literacy		p-value
	n	%	n	%	
Gender					.873
Male	5	41.7	81	44.0	
Female	7	58.3	103	56.0	
Ethnicity					.395
White	11	91.7	151	82.1	
Not White	1	8.3	33	17.9	
Marital Status					.068
Married	9	75.0	88	47.8	
Not Married	3	25.0	96	52.2	
Work Status					.391
Full-Time	7	58.3	129	70.1	
Not Working Full-Time	5	41.3	55	29.9	
Education Level					.116
2 Year Degree or less	9	75.0	95	51.6	
4 Year Degree or more	3	25.0	89	48.4	
Duration of Chronic Pain					.264
< 5Years	5	41.7	107	58.2	
>= 5 Years	7	58.3	77	41.8	
Location of Chronic Pain					.884
Back	6	50.0	88	47.8	
Other	6	50.0	96	52.2	
	n	Mean (SD)	n	Mean (SD)	
Age	12	46 (15.5)	184	39.7 (11.8)	.079



**Table 2.** Summary statistics for each measure

Measure	p-value	Low eHealth Literacy			High eHealth Literacy			Total Sample		
		n	Mean	SD	n	Mean	SD	n	Mean	SD
HLQ – Having sufficient information	.011	12	2.50	0.46	184	2.91	0.55	196	2.89	0.55
HLQ – Critical appraisal	.011	12	2.98	0.36	184	3.29	0.40	196	3.27	0.41
HLQ – Finding good health information	.018	12	3.38	0.45	156	3.70	0.44	168	3.68	0.45
HLQ – Understanding health information	.784	11	3.62	0.55	131	3.66	0.48	142	3.66	0.48
BPI – Intensity (average)	.812	12	5.58	1.62	184	5.46	1.79	196	4.71	2.13
BPI – Interference	.229	12	6.08	2.31	184	5.29	2.20	196	5.46	1.78
CPCI – Guarding	.751	12	3.83	2.48	184	3.60	2.49	196	7.47	1.61
CPCI – Resting	.949	12	3.33	2.61	184	3.29	2.35	196	5.34	2.21
CPCI – Asking for Assistance	.293	12	3.08	2.68	184	2.39	2.19	196	3.61	2.48
CPCI – Muscle relaxation	.147	12	2.42	1.83	184	3.45	2.41	196	3.29	2.36
CPCI – Task Persistence	.400	12	3.42	1.73	184	3.91	1.97	196	2.43	2.22
CPCI – Exercise	.515	12	4.08	2.19	184	3.61	2.45	196	3.39	2.39
CPCI – Seeking support	.850	12	1.83	2.55	184	1.96	2.27	196	3.88	1.95
CPCI – Coping	.868	12	2.83	2.62	184	3.81	2.42	196	3.64	2.44
SOPA – Pain Control	.007	12	2.08	0.67	184	2.73	1.13	196	1.95	2.28
SOPA – Disability	.196	12	3.33	1.44	184	2.83	1.29	196	3.75	2.44
SOPA – Harm	.300	12	3.67	0.89	184	3.38	1.19	196	2.69	1.12
SOPA – Emotion	.452	12	3.67	0.89	184	3.46	1.21	196	2.86	1.30
SOPA – Medication	.312	12	3.58	1.08	184	3.20	1.28	196	3.39	1.17
SOPA – Solicitude	.572	12	4.08	0.79	184	3.91	1.05	196	3.47	1.19
SOPA – Medical Cure	.010	12	1.92	0.79	184	2.64	1.21	196	3.22	1.27