

Are Health Literacy and eHealth Literacy the Same or Different?

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Abstract

Many researchers assume that there is a relationship between health literacy and eHealth literacy, yet it is not clear whether the literature supports this assumption. The purpose of this study was to determine if there was a relationship between health and eHealth literacy. To this end, participants' ($n = 36$) scores on the Newest Vital Sign (NVS, a health literacy measure) were correlated with the eHealth Literacy Scale (eHEALS, an eHealth literacy measure). This analysis revealed no relationship ($r = -.041$, $p = .81$) between the two variables. This finding suggests that eHealth Literacy and health literacy are dissimilar. Several possible explanations of the pattern of results are proposed. Currently, it does not seem prudent to use the eHEALS as the sole measure of eHealth literacy, but rather researchers should continue to complement it with a validated health literacy screening tool.

Keywords:

Health Literacy; Medical Informatics; Consumer Health Information

Introduction

Consumer health information systems and technology are increasingly popular. Citizens are actively seeking health information (e.g., diagnoses, medications, symptoms, treatment options) on the internet as well as using digital tools to help monitor and manage their health. In fact, nearly 6 in 10 (59%) Americans sought health information on the internet at least once during 2012 [1]. Further, consumers are increasingly accessing electronic personal health information (e.g., lab test results, prescriptions, medical history). For example, 2 in 10 Americans accessed their medical record at least once in 2014 [2]. However, this new medium of digital health communication, as well as increased access to personal health information brings challenges observed in traditional paper-based health information and create new challenges unique to using information technology.

It is concerning that an estimated 6 in 10 Canadians have limited health literacy [3]. Similarly, only one in ten Americans were considered to have proficient health literacy with the remainder having intermediate, basic, or below basic health literacy [4]. Health literacy is considered "the degree to which individuals can obtain, process, and understand the basic health information and services they need to make appropriate health decisions" [5]. Thus, people with limited health literacy may not have the necessary skills to acquire and understand health information as well as make optimal health-related decisions. In a review of the literature, limited health literacy was "consistently associated with increased hospitalizations, greater

emergency care use, lower use of mammography, lower receipt of influenza vaccine, poorer ability to demonstrate taking medications appropriately, poorer ability to interpret labels and health messages, and, among seniors, poorer overall health status and higher mortality" [6].

Given the potential implications of limited health literacy, the concept of health literacy has gained recognition as an important consideration for designing materials and interventions for health consumers.

Several different measures are available for measuring consumers health literacy skills. The scales vary in terms of their evaluation approach, administration time, and national healthcare context appropriateness. However, most health literacy scales generate an objective measure of a consumers' competency by assessing their skills (e.g., comprehension, numeracy, pronunciation of medical terminology). Currently, there is no consensus on the most appropriate health literacy measure [6].

Given the unique challenges associated with navigating healthcare in the digital era, the concept of eHealth literacy has gained traction and research attention. eHealth literacy is "the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem" [7]. Norman and Skinner [7] proposed the Lily Model to depict eHealth literacy. This model is an amalgamation of six component literacies: computer literacy, information literacy, media literacy, traditional literacy and numeracy, scientific literacy, and health literacy [7].

Unlike health literacy, there is a dearth of tools available for assessing consumers' levels of eHealth literacy. Recognizing the value of aligning eHealth programs and the skills of their users and building on their Lily Model of eHealth literacy, Norman and Skinner developed the eHEALS [8]. Currently, this is the most commonly used tool for eHealth Literacy assessment [8]. The instrument "was designed for simple, easy administration and thus can be used on its own or incorporated with other measures of health as part of a standard health assessment battery in primary care or to support health promotion planning." [8]. Since its development, eHEALS has been used for various purposes and translated into other languages [e.g., 9, 10].

Developing measures for any construct can be challenging and health literacy and eHealth literacy are no exceptions. One challenge for measurement development is establishing its validity. Validity is defined as "the extent to which a measure reflects the concept. The measure reflects nothing more or less than that implied by the conceptual definition" [11]. Thus,

whether or not a tool actually measures what it intends to measure can be challenging.

Norman and Skinner identified the potential limitation of it as a self-report rather than empirical observation measure and the implication that it was an index of perceived rather than observed skills [8]. Given this potential shortcoming, the extent of the relationship between eHEALS scores and consumers' observed eHealth literacy skills has been investigated. One study found no evidence of a relationship between participants' ($n = 88$) objective performance eHealth tasks and their eHEALS scores [10]. That is, participants were presented explicit tasks and practical scenarios and then asked to solve a health problem such as "Why is the Swine flu not correct?" [10]. Given the dearth of eHealth literacy instruments and that the validity of eHEALS has been challenged, many researchers continue to rely on traditional health literacy tools for consumer health informatics research. Further, many researchers infer, either directly or indirectly, that eHealth literacy is grounded in health literacy, which in turn encompasses literacy. However, a discrepancy between literacy and health literacy was reported, whereby fewer people were identified as having low literacy than low health literacy, suggesting health literacy requires additional skills [3]. Thus, it is unwise to assume that health literacy is equivalent to eHealth literacy. Yet, one of the most popular health literacy assessments is based on whether participants are able to pronounce (i.e. a basic literacy skill) medical terms accurately [12] rather than on their comprehension (i.e. a health literacy skill). It is logical for researchers to assume there is a relationship between health literacy and eHealth literacy, given that (a) the primary difference in the definition of these two constructs is how health information is attained (i.e. paper-based vs. electronic resources) and (b) health literacy is a component of the Lily Model [7].

An assumed relationship between health literacy and eHealth literacy is also apparent in methodological approaches. Many researchers administer health literacy measures as a proxy for eHealth literacy rather than using measures developed to assess eHealth literacy itself. Often, this is unlikely to be problematic as these assessments are typically conducted in an applied consumer health information technology context. Thus, using health literacy as a proxy for eHealth literacy may be suboptimal, but other aspects of the study will still reveal whether or not participants have difficulty using electronic health information. Health literacy screening instruments have been reviewed for eHealth applications which is evidence of the popularity of this approach and supports this line of reasoning [13]. Therefore, the purpose of this study was to determine if there was a relationship between health literacy and eHealth literacy. It was hypothesized that there would be at least a moderate, positive correlation (i.e. $r > 0.4$) between participants' performance on the NVS (a health literacy measure) and eHEALS (an eHealth literacy measure).

Methods

Participants

This study recruited participants using faculty listserves and posters at the University of Victoria, British Columbia Canada. The participants ($n = 36$) ranged in age from 18 to 35 years old ($M = 23.6$ years $SD = 3.8$) and volunteered to participate. All participants completed both the NVS [14] and eHEALS [8] scales as part of a battery of tests in a larger study.

Apparatus and Materials

The NVS [14] is a 6-question scale used to measure health literacy through comprehension and numeracy skills. Participants must interpret information on a nutrition label to answer the questions correctly [14]. The range of possible scores on the NVS is zero to six and it requires approximately three minutes to administer [14]. Participants' scores are used to infer the likelihood of whether or not they are likely to have limited health literacy.

The eHEALS [8] is an 8-item self-report scale assessing consumers' impressions of their ability to seek, appraise, and apply health information gained from electronic resources [8]. The eHEALS asks participants how well they know health resources on the internet in terms of what is available, where and how to find helpful one, how to use them, how to evaluate them, how to differentiate between high and low quality ones, and how to use them to inform their health decision-making. Participants rate each question on a five point likert scale from Strongly Disagree (1 point) to Strongly Agree (5 points) and therefore the range of scores on the eHEALS is 8 to 40. However, Norman and Skinner [8] did not provide explicit instructions for differentiating between eHealth Literacy levels, merely that higher scores (i.e. more Agree or Strongly agree responses) indicate higher levels of eHealth literacy.

The demographic questionnaire and the scales were displayed on a 13 inch MacBook Air. Scales were entered into and administered using survey software.

Procedure

This study was a within-groups design and therefore all participants completed both scales. Participants were told to answer the questions to the best of their ability. If participants had questions, they were encouraged to ask the experimenter who remained nearby in the room. All participants completed the demographic questionnaire first, followed by the NVS [14], and finally the eHEALS [8]. All of the measures were administered online.

Descriptive statistics were computed for participants' demographics, NVS scores, and eHEALS scores. Additionally, a Pearson product-moment correlation coefficient was computed to assess the relationship between participants' NVS and eHEALS scores.

Results

Participants

Participants were predominantly female (72.2%, Table 1). As expected, all participants were students, (83.3%) most were enrolled full-time, and half (50%) of the participants reported high school as their highest level of education completed. Five participants (13.9%) spoke a first language other than English.

Table 1 – Sample Characteristics

Descriptor	Categories	N (%)
Gender	Female	26 (72.2)
	Male	10 (27.8)
Highest Completed	High School	18 (50.0)
Education Level	Undergraduate	13 (36.1)
	Graduate	4 (11.1)
	Other	1 (2.8)
First Language	English	31 (86.1)
	Other	5 (13.9)

Newest Vital Sign (NVS) Scores

Participants scored an average of 5.1 (Range 2 to 6, SD = 1.2) on the NVS [14]. The NVS had poor internal consistency ($\alpha = 0.57$). However, this is likely the result of the limited number of items in the scale as well as the dichotomous (i.e. correct or incorrect) nature of the questions.

The majority of the participants ($n = 30$, 83%) scored five or six on the NVS, indicating a very low likelihood of having limited health literacy (see Figure 1) and further suggesting that there was a ceiling effect. Six (17%) of the participants had NVS scores of 3 or fewer, indicating the possibility they had limited health literacy. However, there was no indication any participants had a high likelihood of limited health literacy, as no participants scored 0 or 1.

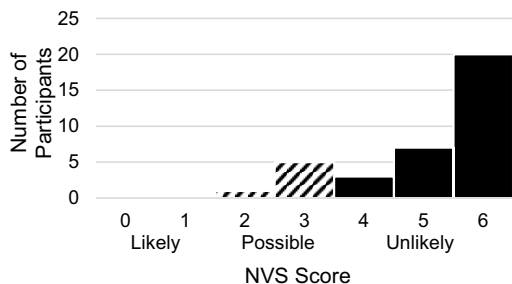


Figure 1 – Participants' NVS Scores and the Implied Likelihood of Limited Health Literacy

eHEALS Scores

Participants scored an average of 27.9 (Range 17 to 38, SD = 5.5) on the eHEALS, which demonstrated good internal consistency ($\alpha = 0.86$).

Table 2 – eHEALS Responses (Scores)

Question / Statement	Mean	SD
* How useful do you feel the Internet is in helping you in making decisions about your health?	3.8	0.93
* How important is it for you to be able to access health resources on the Internet?	3.9	0.89
1. I know what health resources are available on the Internet	3.5	0.94
2. I know where to find helpful health resources on the Internet	3.3	0.93
3. I know how to find helpful health resources on the Internet	3.7	0.79
4. I know how to use the Internet to answer my questions about health	3.7	0.98
5. I know how to use the health information I find on the Internet to help me	3.3	0.97
6. I have the skills I need to evaluate the health resources I find on the Internet	3.4	1.08
7. I can tell high quality health resources from low quality health resources on the Internet	3.7	0.78
8. I feel confident in using information from the Internet to make health decisions	3.3	0.95

* supplementary questions, not formally part of the eHEALS

A framework was developed to make inferences about participants' scores on the eHEALS. The neutral score was deemed to be the value a participant would earn by answering all eight eHEALS questions with a neutral response (i.e. 24). Two categories were created on either side of this neutral value to postulate the confidence participants had in their eHealth skills based on their eHEALS scores (see Table 2). A histogram was constructed to assess the distribution of participants' eHEALS scores based on the categories generated (see Figure 2).

Table 3 – eHEALS Score Categories

Level of Perceived eHealth Literacy Skills	Responses	Score Range
Lack	Predominantly Disagree	8 – 15.99
Low	Mostly Disagree	16 – 23.99
Moderate	Mostly Agree	24 – 31.99
High	Predominantly Agree	32 – 40

Interestingly, 7 participants (see striped column in Figure 2) predominantly disagreed with eHEALS statements, which suggests they were doubtful of their eHealth literacy skills. The majority of the sample (21, 58.3%) perceived themselves as moderately capable of performing eHealth tasks (Table 3). Only 8 participants scored between 32 and 40 indicating high confidence in their eHealth capabilities.

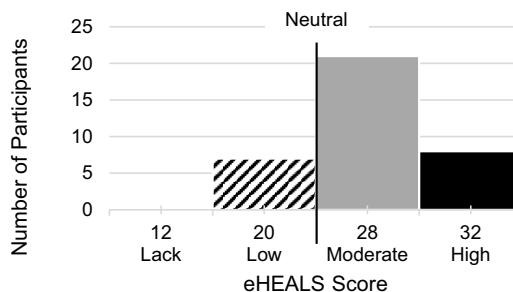


Figure 2 – Participants' eHEALS Scores

Relationship Between NVS and eHEALS Scores

A Pearson product-moment correlation coefficient was computed to assess the relationship between participants' NVS and eHEALS scores. No significant relationship ($r = -0.041$, $p = 0.81$) was observed between the two variables (see Figure 3). This suggests that the relationship between eHEALS and NVS is limited or non-existent.

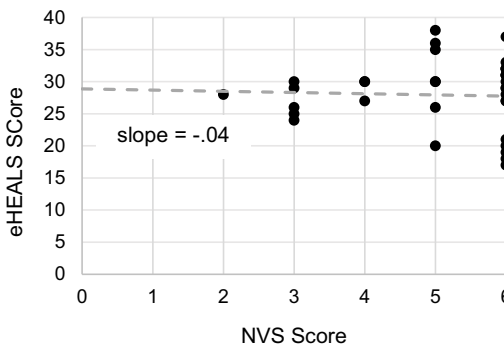


Figure 3 – Scatterplot of Participants' eHEALS and NVS Scores

Interestingly, six out of seven participants identified as having low confidence in their eHealth Literacy skills scored high (5 or 6) on the NVS. This pattern suggests that despite having strong observed health literacy scores, these participants were doubtful of their ability to accomplish eHealth tasks.

Discussion

Contrary to the hypothesis, no relationship between participants' scores on the NVS and eHEALS was observed.

Moreover, participants had generally high levels health literacy scores, but their eHealth literacy scores were much more variable. There are several different explanations for this pattern of results.

This finding could be the result of health literacy and eHealth literacy being very distinct concepts. That is, contrary to the hypothesis that health literacy is the foundation of eHealth literacy, the skills required for engaging with electronic health resources are so unique from those required for interacting with paper materials, there is no relationship between an individual's health literacy and eHealth literacy.

Another possible explanation is that the eHEALS assesses health information seeking and appraisal, whereas the NVS only requires comprehension and application of health information. That is, the NVS provides participants with the health information necessary to answer the questions posed, rather than having to find it and determine its trustworthiness. However, the eHEALS asks participants about all three aspects with respect to health resources on the internet.

These results may have been observed because the eHEALS is a self-report measure, which is a suboptimal measure of actual skills. This argument is supported by evidence that participants' scores on the eHEALS were not positively related to their performance on actual eHealth tasks [10]. In most circumstances, the weaknesses of self-report measures are that there is a tendency for respondents rate themselves in a more socially desirable (or favourable) manner than what is true in reality. However, the pattern of results from this study suggest that participants are actually more critical of their eHealth literacy skills than one would expect them to perform. That is, despite being able to apply health information successfully (i.e. high NVS scores), participants may be overly doubtful of their eHealth skills. Participants in this study were all university students and as such they may approach information on the internet more cautiously.

The final explanation is that eHEALS is not a valid measure of eHealth literacy. The validity of this tool was previously challenged by the lack of relationship between eHEALS and performance on eHealth tasks [10]. Logically, eHealth task performance and eHEALS scores would have a strong positive correlation if eHEALS actually measured eHealth literacy. In contrast, because health literacy is merely one of eHealth literacy's multiple facets, a moderate correlation would be expected. However, neither of these expected patterns of results was observed. The weakness of eHEALS may simply be that it is a self-report measure. That is, people may be substantially more or less confident (suggested by this data) in their ability to seek and appraise eHealth resources as well as apply the information contained therein. However, even if eHEALS measures consumers' confidence using eHealth tools rather than their actual competency, it still has value. For example, people who are less confident may require more support with electronic health interventions even though they are capable of using them successfully.

Norman addressed some of the identified shortcomings and inconsistencies in research published since his work with Skinner (i.e. Lily model, eHEALS). Specifically, he argued that the concept of eHealth literacy warranted reconsideration in the emerging context of Web 2.0 and popularity of social media and that this dynamic eHealth landscape explains why eHEALS scores were not correlated with eHealth tasks [15]. Further, Norman asserted that eHealth literacy should be considered a "form of meta-literacy, combining many different literacy skills beyond just health literacy or numeracy". Norman cautioned against extrapolating results from one or two component literacies to make claims about eHealth literacy (as done in this study), because eHealth literacy should be considered a set of

integrated rather than independent skills [15]. Despite this warning, scores on health literacy measures are often used as a proxy for eHealth literacy skills in studies of consumer health informatics. It is unfair to blame the researchers, because if the eHEALS is not a valid measure of the integrated eHealth skills, they are forced to adopt an alternative. Further, as previously argued, given the similarity of the definitions for health and eHealth literacy, it is sensible to assume that there should be substantial overlap between these two constructs.

The sample for this study was predominantly female, early adult, full-time university students, who spoke English as their first language. Given their age and education level, it is fair to assume this sample is technologically skillful. Further, with this fairly homogeneous sample, one would expect high levels of both health and eHealth literacy. This group demonstrated health literacy proficiency with the majority earning high scores on the NVS (i.e. a positively skewed distribution) and evidence of a ceiling effects. In contrast, participants' eHEALS scores yielded an interesting pattern of results. Specifically, it was expected that the majority of eHealth Literacy scores would indicate the sample had high confidence in their skills. Higher eHEALS scores (i.e., more agree and strongly agree responses) suggest high confidence in participants' ability to find, evaluate, and use health resources on the Internet. However, eHEALS scores from this sample of participants were much more variable than expected and more closely resembled a normal distribution as opposed to being positively skewed.

Responses to the supplementary questions suggest that participants feel that the Internet is a useful resource for making health decisions and it was important for them to be able to access health information resources on the Internet. However, the three lowest rated formal eHEALS questions (see Table 2) suggest participants were not as confident in:

- Where to find helpful health resources on the Internet?
- How to use health information on the Internet to help them?
- Using information from the Internet to make health decisions.

Based on their total eHEALS scores, most participants had moderate confidence in their eHealth skills. Almost equal parts of the remaining participants had either high or low confidence in their eHealth skills.

One limitation is that only the paper-based NVS has been validated. However, it was administered digitally in this study. Additionally, the Chronbach's alpha was low indicating poor internal consistency of the NVS. Another limitation was the relatively small size.

Conclusion

Results from this study indicate that people one would expect to be very confident in their eHealth literacy skills (i.e. young, well educated), many people are only moderately confident and some even doubtful. One of the motivations for assessing eHealth literacy is to assess how suitable an eHealth interventions might be for a health consumer. If eHealth literacy skills are low in this demographic, it is likely much worse in populations who more likely to have limited health literacy (e.g., seniors, immigrants). This finding also prompts us to question whether the concepts of health literacy and eHealth literacy need to be revisited, new measures needs to be developed, or both.

If the eHEALS is not a valid measure of eHealth literacy skills, it should not be used as the sole index for eHealth literacy. However, it could still be valuable to use an assessment of

consumers' confidence with eHealth tasks. As a precautionary measure, it would be wise for researchers to continue to administering health literacy screening tools paired with eHEALS in consumer health informatics research. Typically, administering a health literacy measure and eHEALS is not time prohibitive. However, this approach does not serve as a solution.

Despite development of a new eHealth literacy measure [16], and another in development based on a more robust eHealth literacy framework [17], these measures likely have the same weakness as the eHEALS: consumers' may underestimate or overestimate their eHealth skills, limiting the validity of self-report measures. Researchers are in need of a valid, objective (rather than self-report), rapid measure of eHealth literacy. Perhaps this could be done in by standardizing tasks similar to those in Van der Vaart's [10] study. However, this type of measure would have been developed with careful consideration to control or standardize the test (i.e. participants experience the same events with every administration). The Internet is dynamic and thus, participants attempting tasks in a live environment would introduce variability (e.g., different search results). However, it is important that the tasks used as indices of eHealth literacy are realistic. A simulated internet environment could be used as experimental control over the experience of each participant. Given that health inquiries on the internet predominantly begin with a search engine [1], this is an important eHealth literacy task. Including a search task and requiring participants to assess the quality of search results would be a useful and realistic eHealth task. The skill set required for health consumers to navigate and benefit from an increasingly digital landscape is undoubtedly unique from a paper based world. However, establishing a valid measure for eHealth literacy remains an outstanding challenge.

Currently, due to the different measurement approach of the tools (i.e. objectively vs. self-report), it is difficult to discern whether there truly is or is not a relationship between health literacy and eHealth literacy. Future research is required to investigate whether health literacy skills are fundamental to, have some overlap with, or are entirely different from eHealth literacy skills.

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