Title: Health literacy in the eHealth era: A systematic review of the literature

Authors: Henna Kim a,⁎, Bo Xie b

Affiliations:
a. School of Information, The University of Texas at Austin, 1516 Guadalupe Suite #5.518, Austin, TX, 78701, USA
b. School of Nursing & School of Information, The University of Texas at Austin, Austin, USA

Objective: This study aimed to identify studies on online health service use by people with limited health literacy, as the findings could provide insights into how health literacy has been, and should be, addressed in the eHealth era.

Methods: To identify the relevant literature published since 2010, we performed four rounds of selection—database selection, keyword search, screening of the titles and abstracts, and screening of full texts. This process produced a final of 74 publications.

Results: The themes addressed in the 74 publications fell into five categories: evaluation of health-related content, development and evaluation of eHealth services, development and evaluation of health literacy measurement tools, interventions to improve health literacy, and online health information seeking behavior.

Conclusion: Barriers to access to and use of online health information can result from the readability of content and poor usability of eHealth services. We need new health literacy screening tools to identify skills for adequate use of eHealth services. Mobile apps hold great potential for eHealth and mHealth services tailored to people with low health literacy.

Practice Implications: Efforts should be made to make eHealth services easily accessible to low-literacy individuals and to enhance individual health literacy through educational programs.

© 2017 Elsevier B.V. All rights reserved.
1. Introduction

Information and communication technologies (ICTs) are now used widely to support and deliver health care for patients and the general public. Electronic Health (eHealth) refers to “health services and information delivered or enhanced through the Internet and related technologies” [1]. Internet-based health services include electronic communication between patients and providers, electronic medical records, personal health records, health education programs, patient portals, and Web-based applications for patients [2]. Mobile Health (mHealth) represents a subset of eHealth and can be defined as “the use of mobile computing and communication technologies in health care and public health” [3]. It features a wide variety of services provided through mobile networks, including patient education, remote monitoring, communication and training, disease and outbreak tracking, and diagnostic and treatment decisional support [4–6].

With the increasing adoption of eHealth services, individuals are increasingly expected to engage in appropriate self-care and self-management of their conditions through eHealth [7]. Health consumers must therefore have sufficient health literacy within the context of eHealth. Health literacy can be defined as “people’s knowledge, motivation and competences to access, understand, appraise, and apply health information in order to make judgments and take decisions in everyday life concerning healthcare, disease prevention and health promotion” [8]. eHealth literacy comprises “a set of skills and knowledge that are essential for productive interactions with technology-based health tools” [9].

Unfortunately, over 90 million Americans have low health literacy [10]. Individuals with limited health literacy experience disparities in their health and access to health care resources [11]. Individuals with low health literacy tend to use fewer preventive services and less eHealth, which are associated with poor health outcomes [12]. Low health literacy is related to delayed diagnoses, poor adherence to treatment regimens, increased morbidity and mortality [13], and increased rates of hospitalization and poor health outcomes [14]. Individuals with low health literacy have difficulties in effectively utilizing and interacting with eHealth [15, 16].

Although ICTs are providing new opportunities for accessing health information and self-management of health conditions, no comprehensive reviews have focused on the relationship between patients’ health literacy and their use of Internet-based health services. We conducted a systematic review of the literature to address this gap. The study aim was to examine whether or not existing studies have addressed health literacy within the context of Internet-based services, and if so, how they have done so, including whether or not they have considered both web-based and mobile applications (apps). The findings could provide insights into how health literacy has been, and should be, addressed in the eHealth era.

2. Method

Between February-March of 2014, we performed four rounds of searches to identify relevant publications published since 2010.

2.1. Round 1: database selection

Electronic databases available through the libraries at the authors’ institution were used to perform the search queries. We selected 13 subjects that were closely related to our topic; they were as follows: Communication, Communication Sciences and Disorders, Communication Studies, Computer Sciences, Consumer Health, Education, Educational Psychology, Library and Information Science, Medicine, Nursing, Psychology, Social Work, and Sociology. Of the databases listed under these 13 subjects, we selected 25 most relevant to our investigation. These included the ACM Digital Library; Annual Reviews Online; CINAHL; Cochrane Library; Communication & Mass Media Complete; Edulib; Emerald Insight; ERIC; Health Source: Consumer Edition; Health Source: Nursing/Academic Edition; IEEE Xplor; Information Science & Technology Abstracts; Internet & Personal Computing Abstracts; INSPEC; Library Literature & Information Science Full Text; Library, Information Science & Technology Abstracts; MEDLINE; Psychology & Behavioral Sciences Collection; PsycINFO; PubMed; SAGE Premier; Sociological Abstracts; Social Services Abstracts; Web of Science; and Wiley Online Library.

2.2. Round 2: keyword search

The following combinations of search keywords were used: (“health literacy” OR “ehealth literacy” OR “e-health literacy” OR “health disparity” OR “health disparities”) AND (technology OR technologies OR technology OR computer” OR Internet OR web OR “mobile app” OR “mobile application” OR “mobile device” OR smartphone OR “social media” OR “social computing” OR “social networking” OR facebook OR twitter OR youtube OR myspace OR patientslikeme OR webmd).

Academic publications, including peer-reviewed journal articles and conference proceedings papers, were searched in the 25 databases. This yielded 1106 publications. All search results were imported into EndNote, a reference software program designed for easily extracting search results and managing references (http://endnote.com). After duplicates were removed, 644 remained.

2.3. Round 3: screening the titles and abstracts

The titles and abstracts of the 644 publications were reviewed and screened based on the following inclusion criteria: (1) studies focusing on health literacy or eHealth literacy; (2) studies addressing health services through ICTs on the Internet and/or mobile apps for health-related purposes; (3) studies targeting patients or the general public; (4) studies with the full text written in English; and (5) original empirical studies. A total of 570 studies that did not meet all five of these criteria were excluded. For example, 403 studies were excluded because they either failed to address health literacy or the use of ICTs, and another 88 failed to address both of the first two criteria. Studies that targeted healthcare professionals, were not written in English, or do not have full text were also excluded. Non-empirical studies such as letters, opinion papers, editorials, poster abstracts, and review
articles were also excluded, as shown in Fig. 1. In total, 532 articles were excluded in this round of screening, leaving 112 publications.

2.4. Round 4: screening the full text

The full texts of the 112 publications were further examined to determine if each study indeed met our five inclusion criteria. As a result, 38 publications were excluded, leaving a total of 74 publications in the final sample. Fig. 1 illustrates the search and review process.

3. Results

Forty five (61%) studies investigated a variety of special populations (e.g., older adults with heart failure, low-literacy patients with diabetes, and low-income parents whose children have special health care needs). Target groups with low health literacy varied according to demographics (age, race, and economic status) and health conditions. Individuals with limited health literacy were prevalent among those of age 65 years or older, African Americans or Hispanics, non-English speakers, and people of low income and less education. A wide range of target health conditions were addressed including diabetes, asthma, otolaryngology, cancer, HIV, heart failure, menopause, osteosarcoma, sinus, stress, physical activity, reproductive health care, neonates, and urology (Table 1).

In terms of the measurement of individual health literacy level, 33 of the 74 studies assessed individual health literacy using various screening tools. The eHealth Literacy Scale (eHEALS) (8/33, 24%) [17] and the Short Test of Functional Health Literacy in Adults (S-TOFHLA) (5/33, 15%) [18] were the most frequently used instruments. New health literacy instruments were developed and used by their research teams [47,64,65,67] (Table 2).

The 74 studies fell into five broad areas or themes: (1) evaluation of health-related content, (2) development and evaluation of eHealth services, (3) development and evaluation of health literacy measurement tools, (4) interventions to improve health literacy, and (5) online health information seeking behavior (Table 3).

3.1. Evaluation of health-related content

Nineteen studies assessed the readability of health information available on websites [27–37,39–46]. The majority of these studies used multiple tools or measures to assess the readability levels of online health information. Common among the tools were the Simplified Measure of Gobbledy-gook [99], Flesch-Kincaid Grade Level [100], and Flesch Reading Ease [101].

All results across the 19 studies showed that most of the online health-related content was written above the recommended 6th-grade reading level. The readability levels of consumer medication information on MedlinePlus, Yahoo Health, and WebMD were also higher than the 6th-grade reading level [33]. Health information on Wikipedia was the hardest to read, even though the website was the most frequently searched result from search engines [44].

In addition to the readability of health information, several studies highlighted additional issues of websites in relation to a language selection option, reliability and trustworthiness of health information, and target group-specific content. Few websites provided health information about menopause in languages other than English [28]. Commercial websites were not reliable sources of health information [34,38]. Only 12.5% of osteosarcoma websites included adolescent-specific content [35], even though osteosarcoma is the third most common malignancy in adolescents and young adults [102].

3.2. Development and evaluation of eHealth services

3.2.1. Websites

Four studies focused on the development and evaluation of websites. These studies suggested strategies to improve interface design and functions for low-literacy users. The strategies included simplicity in design (e.g., limited use of colors, a single font type and font size), display of understandable textual information (e.g., avoidance of lengthy text and medical jargon), and simplified technical features (e.g., limited use of pop-ups). Concrete and realistic images with clear captions may be more effective than text alone in improving user understanding of educational materials [48–51].

3.2.2. Web-based apps

Five studies suggested features to help low-literacy users to utilize web-based apps. These include: navigational cues for scroll bar use and drop-down menus [52]; a consistent interface allowing users to easily understand the structure of apps, and information presented in short sentences and plain language and with multimedia formats including graphics, pictures, video and audio [52,53]. Functions such as a dictionary, alternative text language

---

**Fig. 1.** Data selection process.
Table 1
Characteristics of the 74 studies.

<table>
<thead>
<tr>
<th>Categories</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of study publication</td>
<td></td>
</tr>
<tr>
<td>- 2010</td>
<td>17 (23%)</td>
</tr>
<tr>
<td>- 2011</td>
<td>14 (19%)</td>
</tr>
<tr>
<td>- 2012</td>
<td>17 (23%)</td>
</tr>
<tr>
<td>- 2013</td>
<td>19 (26%)</td>
</tr>
<tr>
<td>- 2014</td>
<td>7 (9%)</td>
</tr>
<tr>
<td>Region where the studies were conducted</td>
<td></td>
</tr>
<tr>
<td>- Asia</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>- Europe</td>
<td>10 (14%)</td>
</tr>
<tr>
<td>- Oceania</td>
<td>2 (3%)</td>
</tr>
<tr>
<td>- North America</td>
<td>61 (82%)</td>
</tr>
<tr>
<td>Authors’ fields</td>
<td></td>
</tr>
<tr>
<td>- Health-related fields</td>
<td>49 (66%)</td>
</tr>
<tr>
<td>- Collaborations between health- and technology-related fields</td>
<td>12 (16%)</td>
</tr>
<tr>
<td>- Other fields</td>
<td>11 (15%)</td>
</tr>
<tr>
<td>- Not reported</td>
<td>2 (3%)</td>
</tr>
<tr>
<td>Service platforms</td>
<td></td>
</tr>
<tr>
<td>- Websites</td>
<td>54 (72%)</td>
</tr>
<tr>
<td>- Web-based apps</td>
<td>10 (14%)</td>
</tr>
<tr>
<td>- Mobile apps</td>
<td>10 (14%)</td>
</tr>
<tr>
<td>Target populations</td>
<td></td>
</tr>
<tr>
<td>- Specific groups in terms of demographics, health conditions, care groups (patients or caregivers), and health literacy level</td>
<td>45 (61%)</td>
</tr>
<tr>
<td>- No</td>
<td>29 (39%)</td>
</tr>
<tr>
<td>Target health conditions</td>
<td></td>
</tr>
<tr>
<td>- Specific health conditions</td>
<td>36 (49%)</td>
</tr>
<tr>
<td>- No</td>
<td>38 (51%)</td>
</tr>
<tr>
<td>Individual’s health literacy measurement</td>
<td></td>
</tr>
<tr>
<td>- Yes</td>
<td>33 (45%)</td>
</tr>
<tr>
<td>- No</td>
<td>41 (55%)</td>
</tr>
</tbody>
</table>

Table 2
Instruments used to measure individual health literacy levels.

<table>
<thead>
<tr>
<th>Tools for the measurement of health literacy</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>- eHealth Literacy Scale (eHEALS) [17]</td>
<td>8</td>
</tr>
<tr>
<td>- Short Test of Functional Health Literacy in Adults (5-TOFHLA) [18]</td>
<td>5</td>
</tr>
<tr>
<td>- Rapid Estimate of Adult Literacy in Medicine (REALM) [19]</td>
<td>4</td>
</tr>
<tr>
<td>- Newest Vital Sign (NVS) [20]</td>
<td>3</td>
</tr>
<tr>
<td>- Web performance tests [69,95]</td>
<td>2</td>
</tr>
<tr>
<td>- Active Australia Questionnaire [21]</td>
<td>1</td>
</tr>
<tr>
<td>- Functional, Communicative, and Critical health literacy scale [22]</td>
<td>1</td>
</tr>
<tr>
<td>- Four types of Internet skills [68]</td>
<td>1</td>
</tr>
<tr>
<td>- Medical Term Recognition Test (METER) [23]</td>
<td>1</td>
</tr>
<tr>
<td>- Single Item Literacy Screener (SILS) [24]</td>
<td>1</td>
</tr>
<tr>
<td>- The National Assessment of Adult Literacy [25]</td>
<td>1</td>
</tr>
<tr>
<td>- Three-item health literacy screening questionnaire [26]</td>
<td>1</td>
</tr>
<tr>
<td>- New tools developed for the study (e.g., a set of 90 items based on item response theory [64,65], HIV-Related Health Literacy Scale [67], and a questionnaire about reading comprehension and time [47])</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
</tr>
</tbody>
</table>

(presented when moving the mouse over texts or images), and links to more information can help users understand medical and scientific terms, reducing reading time and improving comprehension [47,52,54]. Apps using text-to-speech engines may provide audio-based health information to individuals with low literacy, although existing apps need improvement for handling complex and long sentences [55].

3.2.3. Mobile apps
Eight studies focused on the development and evaluation of touchscreen-based apps on mobile devices such as kiosks, tablet computers, and mobile phones. Two of these assessed health apps based on design guidelines [56,57]. One study reported a number of recommendations to improve the usability of the app in terms of content, display, navigation, and interactivity. For example, the app had usability issues such as long sentences, no bulleted lists, small font size, low color contrast, and irrelevant icons. These features should be optimized for services specific to mobile devices. Another study suggested that the features of a diet-monitoring app, including automated calculation tools of dietary intake, pictorial icons, and feedback displayed in graphical and textual
forms, could be useful for low-literacy patients’ self-monitoring [57].

The other six studies demonstrated that touchscreen apps could serve individuals with limited health literacy. One study assessed an app for an asthma-screening questionnaire among caregivers with limited health literacy and English proficiency [58]; five studies evaluated the effect of mobile apps on patient education in clinical trials, interventions, and user participation in community or clinical settings [59–63]. Apps programmed with computer-animated characters, text, and graphics were acceptable and easy to use, providing health communication and education to populations with low health literacy [59,60,62]. Patients preferred the screening questionnaire and educational materials on tablet computers over printed formats of content [58,59]. A kiosk developed for interactive MedlinePlus tutorials increased patients’ health literacy by providing reliable information [63].

### 3.3. Development and evaluation of health literacy measurement tools

Five studies developed new health literacy measurement tools based on several different guidelines such as the Medical Outcomes Trust [104] and the 2004 Institute of Medicine report [105]. A health literacy measurement tool utilized a broad range of content and multimedia response formats (e.g., video simulation) to assess conceptual knowledge, listening and speaking, writing, reading, and numeracy. A research team developed HIV-related health literacy scale and assessed the validity of the scale in relation to measures of health literacy, HIV-related knowledge, and medication adherence [67]. These new tools were available in both English and Spanish [64–67]. One study developed assessments for a set of Internet skills (operational, formal, information, and strategic skills) in relation to the use of online health information [68]. These studies suggest that computer-administered measurement tools may reduce staff burden and costs, interview bias, and feelings of embarrassment among individuals with low health literacy [65,66]. In particular, underserved patients had no difficulty using touchscreens at primary care clinics [65].

### 3.4. Interventions to improve health literacy

Nine intervention studies investigated the effects of the use of websites or online apps on health literacy. Six educational interventions targeted low-literacy adults and older adults, and reported positive effects on knowledge about health conditions, use of computers and the Web, search skills, confidence in finding and using eHealth resources, and use of health information for own health care [70–75]. Four of these six interventions offered education explaining the use of both computers and websites [71,73–75]. However, three of the nine interventions reported that the use of websites and avatars were not effective in improving health literacy skills [69,76,77], even when the websites offered content tailored to people with low health literacy [69].

### 3.5. Online health information-seeking behavior

Twenty three studies explored online information-seeking behavior related to health literacy. Key findings across these studies were identified in terms of self-efficacy, the use of Internet/ computer and multiple sources (e.g., the Internet and healthcare professionals) for health information, and the adoption of online services in online health information seeking related to health literacy. Even when they had high levels of health literacy, people often had low self-efficacy in their own abilities to find online health information or were unsure about the quality of online information [83–85].
There were inconsistent reports about online information seeking and the level of health literacy across target user groups. Most studies found that individuals with low health literacy were less likely to use computers and Internet technology (e.g., email, search engines, and patient portals) [78,80,82,84,87–89,93,94], obtain information from multiple sources [79,79], or use the Internet as their primary information source [78,91]. People with limited health literacy spent more time on irrelevant information than did those with adequate literacy [86]. However, one study reported that adolescent with asthma or diabetes often searched online for health information regardless of their health literacy levels [79]. Furthermore, health literacy was not significantly related to the intention to use various online support services [96]. Although college students lacked health literacy skills in seeking and evaluating health information on the Internet [92], they were found in other studies to have adequate levels of health literacy [15,85,90].

4. Discussion and conclusion

4.1. Discussion

Based on the review of 74 empirical studies, we have identified five key themes and suggest future directions for research and practice related to health literacy in the eHealth era.

4.1.1. Online health-related content

Our findings show that the readability of online health information exceeded the recommended 6th-grade reading level. This comes as no surprise. Indeed, many studies have pointed out this issue as it pertains to patient educational materials and websites [106,107]. Health organizations should implement changes to offer online health information at the recommended reading level [103].

The readability level of information is an important factor for health education and support. Nonetheless, there is a scarcity of research on other important characteristics of online information resources related to health literacy [114]. Resource-related factors such as accessibility, usefulness, effectiveness, comprehensiveness, credibility, relevancy, unbiasedness, and interactivity can affect individuals’ choice and use of health information [108–111]. Further research is necessary to understand how these other resource-related factors might also impact eHealth service use and healthcare for people with low health literacy.

4.1.2. Features of eHealth services

Our review revealed three types of health service platforms: websites, web-based apps, and mobile apps. Our findings support the promotion of specific eHealth features for serving people with low health literacy across different types of service platforms. These include: interface design for easy navigation and user tests to enhance content presentation of eHealth services. Many interventions have shown that interactive multimedia formats of patient educational materials (e.g., videos, animated characters) are effective in improving health outcomes in adolescents, older adults, and people with low socio-economic status (SES) [115–117]. It follows that multimedia-based content might be an effective way to present information to individuals with limited health literacy. Most health-related websites provide content only in English, although some health-related websites (e.g., Aids.gov, MedlinePlus, and Mayo Clinic) offer content in other languages. Health-related organizations should provide content in different languages for non-native English speakers.

Smartphones and tablets have become important tools for accessing the Internet among low SES populations [118,119]. Our findings suggest that mobile apps may offer great potential for reducing the barrier in accessing and using online health information and services. People with low health literacy found mobile apps to be acceptable and easy to use for educational materials, screening questionnaire, and literacy measurement [58,59,64–66]. Mobile platforms include mobile devices, networks, services, and apps [120]. Mobile platforms enable a growing number of eHealth functionalities (e.g., patient–provider communication, medication and treatment compliance) [121,122]. Websites are accessible through web browser apps (e.g., Safari and Chrome) on mobile devices. People are increasingly shifting to using apps rather than traditional web browsers as gateways to access Internet services. Thus, eHealth functionalities need to be optimized for mobile devices [56,118]. This will require continual efforts on the part of researchers, educators, and designers to make eHealth services accessible to individuals with low health literacy.

4.1.3. Health literacy measurement tools

While many health literacy measurement tools exist, no standardized measurement captures the full spectrum of skills and knowledge associated with health literacy and technology use. eHEALS, which measures an individual’s perceived skills at finding and using online health information [17], is a useful tool to assess eHealth literacy. Since S-TOFHLA, REALM, and NVS are commonly used screening tools in research and clinical settings, they have also been used to assess individual health literacy levels in relation to the use of eHealth services [55,58,76]. Some studies have evaluated individual eHealth literacy through web performance tests [69,95]. Existing studies have used these diverse screening tools because no comprehensive screening tools exist that measure the full range of skills involved in defining health or eHealth literacy. Many health literacy measurement tools focus on a single skill or conceptual domain (e.g., nutritional literacy, reading level, etc) [20,24,26]. In addition, screening tools have different advantages for use in different contexts [112,123]. A particular measurement of health literacy might be selected when considering different target populations (e.g., race and health conditions) and the purpose of the study (e.g., evaluation of information, development of eHealth tools, or interventions) [113]. For these reasons, some studies tend to adopt health literacy instruments customized for a particular study or targeted at a specific disease population [67,87,88,91,95].

New health literacy measurement tools [64,65] can be easily and quickly administered on touchscreen-based tablet computers, which is a major advantage particularly in clinical settings where short administration time is critical. In addition, new health literacy screening tools developed in the U.S. context offer both English and Spanish languages. Further testing is needed to determine if these new tools are clinically applicable, valid, reliable, and feasible in a variety of settings and populations [113].

It is important to also note that some researchers argue that there is insufficient evidence to support routine screening of health literacy and that such screening may stigmatize patients, which may subsequently negatively impact patient care [124,125]. Moreover, eHealth levels will constantly evolve as technology changes [126]. It would therefore be necessary to incorporate new types of literacy skills into the eHealth concept and develop and validate the new instruments accordingly.

4.1.4. Interventions to improve health literacy

Consistent with prior studies [127,128], our findings suggest that individuals with limited health literacy are prevalent among those age 65 or older, African Americans or Hispanics, non-English speakers, and people who have low incomes and less formal education. Low health literacy may also be widespread among all age groups: although older adults often lack the skills and knowledge necessary to use eHealth resources [80,129],
adolescents and young adults may not have the ability to access, analyze, and evaluate such resources [35,38,50,92].

Digital disparities in the health context should be addressed to promote sufficient skills in using ICTs. Offering online health services tailored to individuals’ health literacy levels is not sufficient on its own. Interventions are needed to enhance individuals’ e-health literacy. Effective educational strategies can help individuals with limited health literacy learn how to use ICTs and eHealth services [75,116]. Interventions should include education about how to access online resources for health information and disease management, how to search for information effectively, and how to evaluate the quality of online health information. Furthermore, just like Mein et al. [71] integrated digital literacy and health literacy components within a community-based ESL curriculum, interventions combined with educational programs at the community level could encourage target groups to use online health resources.

4.1.5. Online health information seeking behavior

Websites have become important resources for health information and services. Consequently, many studies have focused on websites in order to investigate health literacy in relation to self-care and health information-seeking behavior. Our findings show that there are digital disparities in using the Internet to find health information among individuals with varying degrees of health literacy. Disparities in using computers and the Internet are related to individual abilities that one must have to find and use eHealth resources [130–132]. The lack of access to and use of the Internet could lead to unequal opportunities to benefit from available health resources, thereby increasing health disparities for under-served and vulnerable groups. Disadvantages in using eHealth services can result in difficulties in communicating with healthcare providers, decision making, and self-care [133–136].

Few studies have explored the relationship between health literacy and social media. Social media can help make important health-related decisions and obtain emotional support [137–139]. Individuals with high health literacy are more likely to use social media platforms to obtain health-related information than those with low health literacy [136,140,141]. More research is needed to further explore the use of social media that target individuals with limited health literacy for their health care.

This systematic literature review has limitations. First, the keyword search did not use a controlled vocabulary (e.g., Medical Subject Headings; Cumulative Index to Nursing and Allied Health); and it was restricted to the title; keywords; and abstract of each publication. Second; studies that did not contain the exact keywords in our search queries were excluded. Third; only studies written in English were included in the sample. Fourth; the timeframe for this review limits the number of studies to those between 2010 and March of 2014. Future reviews should include more recent studies worldwide in both mHealth and eHealth.

4.2. Conclusion

Almost half of the population in the U.S. have limited health literacy. Given the growing trend toward patient-centered care, the growing dependence on technology for self-care and self-management requires more research and programmatic efforts. Limited health literacy is associated with personal factors such as demographics and health conditions as well as difficulty in the use of eHealth services. Our systematic review has important implications for addressing the challenges in using eHealth services for individuals with varying degrees of health literacy. Barriers to access online health information can come from the eHealth services, including the availability and readability of content and usability of eHealth services. To lower the barrier to the use of eHealth services, it is critical that low-literacy individuals are provided with sufficient technological and practical support. Future studies will need new health literacy screening tools to identify skills for adequate use of the Internet and eHealth services. Mobile apps have an advantage of delivering interactive health services tailored to individuals with low health literacy. Efforts should be made to make eHealth services easily accessible to low-literacy individuals and to enhance individual health literacy through educational programs.

Conflict of interest

The authors have no potential conflicts of interests to declare, including relevant financial interests, activities, relationships, and affiliations.

Acknowledgements

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References


K.Y. Kim, A. Metzger, P.R. Wigg, P.J. Choe, Evaluation of online consumer medication information, Res. Social Adm. Pharm. 7 (2011) 202—207.


T. Hove, H. Paek, T. Isaacson, Using adolescent ehealth literacy to weigh trust in commercial web sites: the more children know the tougher they are to persuade, J. Advert. Res. 51 (2011) 524—537.


Cancer

G.H.

R.

M.

J.P.

L.S.

C.

S.F.

D.J.

among

threatening

realities is

for

web:

a

systematic

review:

J.

Med.

Internet

Res.

15

(2013)

e29.


C.C. Cutilli, I.M. Bennett, Understanding the health literacy of Americans results of the National Assessment of Adult Literacy, Orthop. Nurs. 28 (2009) 27–34.


