

# Online Research @ Cardiff

This is an Open Access document downloaded from ORCA, Cardiff University's institutional repository: <https://orca.cardiff.ac.uk/id/eprint/146205/>

This is the author's version of a work that was submitted to / accepted for publication.

Citation for final published version:

Verma, Ridhi, Saldanha, Conchita, Ellis, Ursula, Sattar, Schroder and Haase, Kristen R. 2022. eHealth literacy among older adults living with cancer and their caregivers: A scoping review. *Journal of Geriatric Oncology* 13 (5) , pp. 555-562. 10.1016/j.jgo.2021.11.008 file

Publishers page: <http://dx.doi.org/10.1016/j.jgo.2021.11.008>  
<<http://dx.doi.org/10.1016/j.jgo.2021.11.008>>

Please note:

Changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version. For the definitive version of this publication, please refer to the published source. You are advised to consult the publisher's version if you wish to cite this paper.

This version is being made available in accordance with publisher policies.

See

<http://orca.cf.ac.uk/policies.html> for usage policies. Copyright and moral rights for publications made available in ORCA are retained by the copyright holders.



**eHealth literacy among older adults living with cancer and their caregivers: a scoping review.**

**Verma R<sup>1</sup>, Saldanha C<sup>2</sup>, Ellis U<sup>3</sup>, Sattar S<sup>\*4</sup>, Haase KR<sup>\*5</sup>.**

**\*Joint senior authors**

<sup>1</sup> School of Healthcare Sciences, Cardiff University, 19 Brent Avenue, Didcot, Oxfordshire, United Kingdom.

<sup>2</sup> School of Physical and Occupational Therapy, McGill University, 5385 rue de Bernieres, Saint Leonard, H1R 1M9, Canada

<sup>3</sup> Woodward Library, University of British Columbia, Vancouver, Canada

<sup>4</sup> College of Nursing, University of Saskatchewan, 4400, 4th Avenue, Rm 108. Regina, Saskatchewan, S4T 0H8, Canada

<sup>5</sup> School of Nursing, Faculty of Applied Science, University of British Columbia, Vancouver, Canada

**Corresponding author**

Kristen R Haase  
School of Nursing  
Faculty of Applied Science  
University of British Columbia  
Vancouver, Canada

**Present/permanent address**

**Twitter handle.**

Ridhi Verma- @RidhiVerma\_

Conchita Saldanha- @ConchitaS19

Ursula Ellis- @uellis

Kristen Haase- @Kristenhaase

Schroder Sattar- @SattarSchroder

## **Abstract**

**Introduction:** Over 90% of people living with cancer access information online to inform healthcare decisions. Older adults with cancer are also increasingly adopting electronic healthcare services, or eHealth, particularly with the rapid transition to virtual care amidst the pandemic. Therefore, the purpose of this review is to understand the level of eHealth literacy among older adults with cancer and their caregivers, as well as any barriers and facilitators in terms of accessing, comprehending, and implementing eHealth information.

**Methods:** This scoping review was guided by Arksey and O'Malley methodology and PRISMA ScR guidelines. Comprehensive searches for the concepts of "eHealth Literacy" and "cancer" were performed in MEDLINE, Scopus, CINAHL, PsycINFO, AMED and EMBASE, from 2000-2021. We used descriptive quantitative and thematic analysis to analyze the literature.

**Results:** Of the 6076 articles screened by two reviewers, eleven articles were included. Quantitative findings suggest older adults with cancer and their caregivers have low self-perceived eHealth literacy and less confidence evaluating online health information for cancer decision-making. Low socioeconomic status, lower education levels, rapid expansion of digital applications, broadband access, reduced familiarity, and frequency of use were cited as prominent barriers. eHealth literacy appears to be positively correlated with caregivers seeking a second opinion, awareness of treatment options, shared decision making, and trust in the health care system.

**Conclusion:** With the growing reliance on eHealth tools, developing credible digital health applications that require minimal internet navigation skills, patient education, and collaborative efforts to address access and affordability are urgently warranted.

247 words

**Keywords-** eHealth Literacy, mHealth literacy, Geriatric Oncology, Internet, Digital Health Literacy, Caregivers.

**Abbreviations-** HNC- Head and neck cancer, HRAs- Health related activities, eHEALS- eHealth Literacy Scale, READY- Readiness and Enablement index for Health technology.

## **Introduction**

Electronic health (eHealth) and mobile health (mHealth) have emerged as convenient modes of healthcare delivery. Information and communication technologies (ICT) and mobile technologies are being utilized for health [1, 2], providing opportunities to enhance management of medical conditions [3]. In the World Health Organization's global strategy for promotion, incorporation, and dissemination of digital health [4], they describe the need for evaluation of the skills needed to seek, find, appraise, and evaluate electronic health information- or what is formally known as e-Health Literacy [5]. eHealth literacy (including mHealth) relates to the knowledge to use technologies with Internet access such as smartphones, wearables, tablets, and computers for health information [6]. Prior studies across disciplines demonstrate that eHealth interventions have the potential to improve health outcomes [7-10]. eHealth interventions can promote health information seeking behaviors [11,12], knowledge of illness [13,14], adoption of preventative strategies [15], and mediate positive health behaviors [16].

Cancer is most common among older adults [17,18], who are more vulnerable to comorbid conditions [19] and polypharmacy which further complicates their cancer

experience [20,21]. Amongst all people living with cancer, 90% access cancer information online [22], with older adults often citing a preference for their caregivers to acquire online information for them [23,24] to inform their healthcare decisions [25,26]. eHealth literacy is important amongst older adults with cancer as it can have an impact on their ability to find and understand good quality cancer information resources and recommendations [27]. eHealth literacy also encompasses the confidence to filter relevant and trustworthy online health information and apply said information to solve health problems [28]. Both the inability to acquire health information online and the inability to critically appraise the acquired information have been cited as barriers by people living with cancer and their caregivers [29,30]. Inability to locate and comprehend online health information may negatively influence the perceived trust in the information amongst people living with cancer and their caregivers [31,32]. With the growing move to online information for all health conditions [33,34], coupled with the rapid transition to virtual care imposed by the pandemic [35] there is a need to understand the literature related to eHealth literacy amongst older adults with cancer and their caregivers.

Previous systematic and scoping reviews of eHealth literacy research have been limited to patients with Human Immunodeficiency Virus (HIV) [36], college students [37], medically underserved population [38] and eHealth literacy interventions for older adults [39]. Despite a growing number of internet-enabled interventions for older adults living with cancer [40,41], there has been no review to assess the nature and extent of the literature related to eHealth literacy amongst this population.

This review aims to address this gap in knowledge by summarizing and critically evaluating the evidence from existing research on eHealth or mHealth

literacy among older adults living with cancer and their caregivers. Herein, we present a scoping review to document the nature and extent of literature related to eHealth literacy amongst older adults with cancer and their caregivers, including the levels, correlates, and attitudes, to guide future development of tailored eHealth interventions.

## **Methods**

We conducted a scoping review based on the six-step methodology first described by Arksey and O'Malley [42] and furthered by Levac et al [43]. This is a suitable methodology for this review, given our purpose is to identify the extent of the evidence, knowledge gaps, and key characteristics pertaining to eHealth and mHealth literacy among older adults living with cancer and their caregivers. We followed five of the six-step iterative process, including: identifying the research question; identifying relevant studies; selecting studies; data charting the data and collating and reporting results. The optional consultation with potential stakeholder was excluded as that did not fall within the purview of the aims of this review. Each of the other five steps are described below.

### Step 1: Identifying the research question

This scoping review was undertaken to answer the question: What is the nature and extent of the literature related to eHealth and mHealth literacy among older adults living with cancer and their caregivers?

Specifically, with the aims to:

1. Summarize and critically evaluate the evidence from existing research on eHealth and mHealth literacy among older adults living with cancer and their caregivers.

2. Evaluate the levels of eHealth and mHealth literacy among older adults living with cancer and their caregivers.
3. Assess the barriers of eHealth and mHealth Literacy among older adults living with cancer and their caregivers.
4. Assess the attitudes affecting eHealth and mHealth literacy among older adults living with cancer and their caregivers.
5. Analyse the correlates of eHealth and mHealth Literacy among older adults living with cancer and their caregivers.

### Step 2: Identifying relevant studies.

Initial search strategies were piloted in an iterative process to select the highest yielding and most appropriate keywords. Following consultation with an academic librarian (UE), a comprehensive and refined final search strategy was developed.

Literature searches were conducted in MEDLINE (Ovid), Scopus, CINAHL (Cumulative Index to Nursing and Allied Health Literature), PsycINFO (Ovid), AMED (Allied and Complementary medicine) (Ovid) and EMBASE (Ovid) on 27<sup>th</sup> of January 2021, using search terms for the following concepts: (1) “eHealth Literacy” or “mHealth literacy” and, (2) “Cancer” or “Neoplasm” using database specific controlled vocabulary, keywords, and appropriate Boolean operators. The search was limited to English language articles published in the last 21 years (2000-2021) corresponding to the advent and rise of electronic health information [44,45]. A detailed search strategy for all the databases is presented in appendix 1.

### Step 3: Selecting studies.

We used Covidence systematic review software [46] to screen and select the studies based on the following criteria:

#### Inclusion criteria

- Peer-reviewed published original research of any design.
- Studies addressing eHealth or mHealth literacy.
- Includes a population of older adults living with cancer or cancer survivors aged  $\geq 65$  or have a subgroup analysis of those of the aforementioned age.
- Pertaining to caregivers of older adults living with cancer.

#### Exclusion criteria

- Editorials, conference proceedings, abstracts, and grey literature including research reports, working papers, theses, preprints, and reports produced by government departments and industry.
- Non- English articles.

The predetermined inclusion and exclusion criteria were piloted on 30% of retrieved articles by two reviewers (RV and CS) at the title and abstract screening phase until a 90% agreement was reached. The remaining articles were divided and individually screened for inclusion; two reviewers (KH and SS) resolved conflicts. Forward and backward citation chasing was performed on included studies to further identify relevant literature. The selection of articles is detailed below, based on the PRISMA guidelines (Figure 1) [47].

#### Step 4: Data Charting

We developed data extraction forms in excel which included the following information: author, year of publication, place of study, study design, participant



characteristics - sample size, age, diagnosis, outcome measure, level of eHealth/mHealth literacy, and resultant themes from the qualitative studies. The form was piloted by two authors on randomly selected included articles. Modifications were made following discussion with the team in an iterative process. The finalised extraction form was used by two reviewers (RV and CS), once agreement was reached, data from the remaining articles were extracted individually.

#### Step 5: Collating and reporting results.

The analytical framework outlined by Arksey and O'Malley (2005) [42] and furthered by Levac (2010) [43] was used to examine the study findings. The three steps (1) quantitative and thematic analysis, (2) reporting results and, (3) defining broader implications guided this step. Descriptive quantitative analysis was performed to estimate the levels of eHealth and mHealth literacy in the study population and the nature & distribution of the studies included in the review. We used a thematic analysis method [48] to generate themes and sub-themes of attitudes and perceived barriers to eHealth and mHealth literacy among older adults living with cancer and their caregivers.

### **Results**

The analysis of eleven articles meeting the inclusion criteria are included herein. Of the eleven articles, all but one [59] were quantitative studies [49-58]. Where cross sectional surveys were conducted using both validated eHealth literacy tools, i.e., eHEALS (eHealth Literacy Scale) [49, 51-55, 57,58] and READHY (Readiness and Enablement index for Health technology) [56], with one study using a non- validated computer literacy questionnaire [50]. Some studies limited the administration of eHEALS [52,54,57] to a few of its components while others

administered it in its entirety [49,51,53,57,58]. The demographic details and results are outlined in Table 1. The number of articles at each stage are illustrated in the PRISMA flow chart (Figure 1).

### Quantitative Findings

Within the included studies, seven focused solely on people living with cancer [49,50,54,55-58], one exclusively on caregivers of patients with prostate cancer [51], while three included a combined sample of both patients and caregivers [52,53,59]. Nine of the eleven articles measured overall eHealth literacy levels or a single component measuring the confidence in using eHealth information to make care decisions [49-55, 56-58]. Six of the studies measuring overall eHealth literacy levels suggested low levels of eHealth literacy among older adults living with cancer and their caregivers [49-52, 56, 58]. Among the nine, three measured only the confidence of older adults living with cancer and their caregivers in using online health technology and information to inform their cancer care decision [50,55,57]. Across all studies, confidence in using technology for healthcare decisions varied considerably (31%- 47%). All nine of the included studies measuring eHealth literacy suggested low levels among older adults living with cancer and their caregivers, irrespective of the diagnosis [49,50,54,55-58]. Statistical significance of the same varied, two studies failed to establish a statistically significant association ( $p = 0.09$ ) between age and eHealth literacy, although older adults within their study population had lower eHEALS scores [49,57].

Inferring from the available data, the overall eHealth literacy of older adults with cancer and their caregivers was characterized as low. Confidence in making

health care decisions based on online information was the most studied and affected dimension of eHealth literacy.

### Qualitative Findings

The eleven studies were analyzed and coded for attitudes and barriers towards eHealth among the study population. Barriers included themes of 'Intrinsic Barriers' (capacities of the individual) and 'Extrinsic Barriers' (contextual factors surrounding the individual). The subthemes are illustrated in Figure 2. The secondary aim of analyzing the attitudes influencing eHealth literacy resulted in both positive and negative attitudes towards eHealth, outlined below in Figure 3 along with their respective subthemes.

### Barriers to eHealth literacy

The barriers to eHealth literacy described in the literature were both intrinsic and extrinsic in nature (Figure 2). The intrinsic barriers arose from older adults and their caregivers' abilities and knowledge. The following barriers were identified: (a) lack of confidence in their ability to find relevant information to answer their health-related question [54,57,58]; (b) inability to gauge whether the available information is of adequate quality [49,52,53,54]; (c) lack of familiarity with the tools available to them [51,58]; and (d) lack of understanding of applicability of the online information due to awareness of the potential or actual utility [52,58].

Extrinsic barriers were categorized as those arising from an individual's environment which impacted their literacy. They included (a) rapid development of the digital landscape [59], including the invention and implementation of various electronic gadgets and applications for example domotics, wearable devices, social media, virtual reality, personal health records and web-based applications or

interventions; (b) availability of resources necessary to access electronic health facilities like broadband, computers, tablets, phones etc. [49,59]; (c) educational level and geographical location of the population: the more rural the population the lower their eHealth literacy [49,56,57]; and (d) frequency with which the population used the eHealth resources: authors suggested that it played an integral part in the comprehension of available information [52,53].

Based on the resultant themes pertaining to intrinsic and extrinsic barriers, a pattern of interdependence was observed. The intrinsic and the extrinsic barriers were further explored through the lens of the possible influence they may have over one another (see figure 3). This was done in an effort to isolate the facets of eHealth literacy that can be modified in tandem.

#### Attitudes affecting eHealth literacy

Both positive and negative attitudes were identified. The negative attitudes were, (a) the lack of confidence in their ability to search for the information [54,57,58]; (b) the inability to distinguish the quality of the acquired information [49,52,53,54]; and (c) the feeling of unfamiliarity with both the utility and the usability of eHealth tools [51,52,58].

The positive attitudes included: (a) a desire to actively engage in eHealth interventions as long as their logistical needs were addressed; and [59] (b) a sense of autonomy resulting from a more active role in utilizing the resources at their disposal [58,59]. The negative attitudes were further considered as intrinsic barriers towards eHealth literacy.

We developed a framework of association based on the results of this review. Based on the literature, three factors, including: rapid digital development [59],

frequency of use [52,53], and educational level [49,56,57] seemed to influence older adults' ability to comprehend eHealth information [52,58]. Frequency of digital technology use and level of education were also direct contributors to comprehension, while rapid technological advancements made the digital landscape unfamiliar to the user thereby indirectly influencing the regularity with which they used technology [51,58]. Lack of familiarity with the tools and technology and the frequency with which they are used, could also have an impact on the comprehensibility or understanding of applicability of the online information. This negatively effected older adults living with cancer and their caregiver's ability to distinguish between reliable and unreliable online information [49,52,53,54]. This negative perception can be detrimental to the confidence of using this information to make health decisions and reduce older adults' autonomy over their health [54,57,58]. Increasing access to eHealth resources can have a positive impact on two levels; firstly, at the frequency with which the resources are employed and secondly, on the independence and autonomy over the usage and implementation of the amassed information [49,59].

### Correlates of eHealth literacy

This review also aimed to establish the correlates of eHealth literacy. The literature included in this review suggests a positive correlation between eHealth literacy among cancer caregivers and their involvement in getting a second opinion, their awareness of treatment options, the size of the social network they relied on for additional information, and their support for treatment decision making. The caregiver's level of eHealth literacy was positively related to their access to eHealth resources similar to that of patients living with cancer [51]. eHealth literacy was also

positively associated with older adults' trust in the health care system and their communication patterns [55].

## **Discussion**

The aim of this review was to determine the nature and extent of the literature related to levels of eHealth literacy among older adults living with cancer and their caregivers. We also sought to determine their attitudes, barriers, and possible correlates to eHealth literacy. Through the findings of this review, it is evident that despite the growing dissemination of online resources by older adults living with cancer, relatively few studies have focused on this population. Based on the existing literature, we found that the overall eHealth literacy of older adults living with cancer and their caregivers is low. This is consistent with large scale studies conducted to examine eHealth literacy in other chronic conditions [60] and across the lifespan [61], which indicate older adults and those with chronic conditions fare poorer on eHealth literacy scales. The present review is the first of its kind to compile the data pertaining to older adults with cancer and their caregivers.

The interconnected barriers related to eHealth literacy amongst older adults with cancer are an important finding as they may provide a direction to improving eHealth literacy (Figure 3). The reviewed literature elucidates a positive correlation between education level and the ability to comprehend online information [49,56,57]. Online cancer health information is written above the recommended level of readability for the average patient population, which poses a challenge to comprehension for those with limited education [62,63]. As older adults may be less likely to have higher levels of education compared to their younger counterparts, it may adversely affect their ability to distinguish between reliable and unreliable online

information [49,52,53,55]. Rapid development in the eHealth service sector has also been cited as a challenge by older adults living with cancer as it breeds unfamiliarity with the digital landscape [59]. Familiarity with technology has been shown to positively impact the judgment of trustworthiness, credibility, and comprehension of online health information [62,64]. Frequent web-users have been described as being more equipped to discern the quality of the content of online health information [65] which may create a sense of confidence [52,58,66].

The lack of confidence in using online information in making healthcare decisions seems to be both a by-product and the cause of the inability to differentiate between reliable and unreliable information. The lack of confidence in using online information in making healthcare decisions seems to be both a by-product and the cause of the inability to differentiate between reliable and unreliable information. Older adults are more susceptible to discerning quality information, thereby limiting their 'sense of control' and possibly preventing their ability to use online information [59]. This is a problem because limited access to eHealth resources due to intersecting social inequities presents a two-fold limitation: one is the logistical barrier that limits the frequency with which they can access online resources, the second is dependence on others to use or access such resources [58,59]. Older adults have expressed a desire to manage their own health as a way to maintain their autonomy [58,59] provided they have adequate access to eHealth resources [49]. The influence of the 'Informational Age' on determinants of health have been discussed elsewhere [67], and they seem to play a role with this population as well.

The qualitative findings of this review suggest an equal contribution of both intrinsic and extrinsic barriers towards eHealth literacy. The need to equally address both is crucial to positively impact eHealth literacy amongst older adults with cancer.

Therefore, screening for eHealth literacy throughout the cancer care continuum may reduce the risk of alienating a population that would ultimately benefit from eHealth interventions. This is increasingly important as we see many cancer care services moving to virtual delivery methods during the pandemic [68]. Without appropriate considerations of the needs and abilities of older adults and their caregivers, there is a potential risk of widening disparities [68]. Healthcare professionals caring for older adults with cancer can provide high quality online resources to combat potential uncertainties regarding reliable information. Age- appropriate counselling and awareness programmes are warranted to help older adults evaluate the trustworthiness and applicability of available online information [39]. Skill training can help address the barriers of lack of familiarity and increase the frequency of use [69]. Simplifying online education for older adults with cancer can contribute to the patients' comprehension of the same. Considering offering telephone support for this population as they familiarize themselves with more advanced eHealth tools, is also recommended [69].

The most frequently used eHealth literacy tool used was the eHEALS, it is a validated 8-item tool designed to measure eHealth literacy. However, three studies [52,54,57] only used one item; “I feel confident in using information from the Internet to help make health decisions”, to evaluate the perceived confidence of individuals in their skill to gather online information to inform health decisions. READHY (Readiness and Enablement index for Health technology) [56] was the second most commonly used questionnaire, and is a combination of three validated questionnaires, i.e., eHealth literacy questionnaire; the Health Education Impact Questionnaire; and the Health literacy Questionnaire, used to assess eHealth literacy. While the computer literacy questionnaire [50] was a non- validated tool



used to measure technology use, experience, and confidence in using computers or related technology for health-related activities on a five-point Likert scale ranging from “Very confident” to “Not at all confident” was used by one study. These findings indicate a need for more rigorous deployment when measuring eHealth literacy in this population.

Regarding the limitations of the included studies, all but one was cross-sectional surveys presenting a potential for sampling bias. Potential recruitment bias could also affect the result as it is less likely that non-internet users participated. The tools used for measuring eHealth literacy, i.e., eHEALS, READHY and the computer literacy questionnaire are self-administered questionnaires measuring the self-perceived eHealth literacy, limiting the inference to association not causation. Although eHEALS and READHY are validated tools, the validity of the computer literacy questionnaire and that of a single item to measure eHealth confidence, as employed by a few of the included studies is yet to be established.

The present review limited the inclusion to only English language papers which limits our ability to exclude the possibility that not all relevant articles have been captured in this review. The sixth step of consultation with potential stakeholder as outlined by Arksey and O’Malley [40] was excluded as it was not the primary object of this review, but it presents an opportunity for stakeholder involvement in future reviews. In some of the included studies [50,51,55,59], the number of older adults in the sample was unspecified, although the information extracted from those studies was limited to what could be inferred about the population of interest; mentioning the possibility of bias while extrapolating the results is a necessity.

Given the homogeneity of the included studies, further studies are required with larger more representative ethnically, culturally, and socioeconomically diverse sample of older adults with cancer and their caregivers. A gap in the literature that needs to be addressed is both quantitative and qualitative assessment of eHealth literacy solely focussing on older adults living with cancer and their caregivers. Future research would benefit from exploring attitudes towards eHealth literacy rather than attitudes towards factors influencing it. Understanding older adults' perspectives on improving digital health literacy through focus groups or semi-structured interviews may aid in facilitating their involvement in the growing trend towards eHealth in cancer care.

## **Conclusion**

eHealth literacy is a prerequisite for the successful engagement with eHealth interventions [5]. Findings from our review suggests low eHealth literacy among older adults living with cancer and their caregivers. Without adequate levels of eHealth literacy, we risk excluding older adults from the benefits of digital interventions, resources, and social support available online [49]. Improving access to eHealth resources, simplifying eHealth information, targeted skill development, tailoring eHealth interventions to meet older adult needs, and offering initial telephone support as older adults familiarize themselves with these tools may help curb disparities. Enhancing eHealth literacy may have a positive impact on patient communication patterns, trust in the healthcare system, and facilitate informed shared decision making in cancer care [55,56].

## **Appendix 1**

### **Database Search**

<https://d.docs.live.net/181a17d2d50b0697/Desktop/Ehealth%20Literacy/final%20mauscript/Databa se%20Search%20.docx>

## **PRISMA ScR Checklist**

<https://d.docs.live.net/181a17d2d50b0697/Desktop/Ehealth%20Literacy/final%20ma uscript/PRISMA%20ScR%20Checklist.pdf>

## **Conflicts of Interest**

The authors have no conflicts of interest to declare.

## **Author Contribution**

Study concepts - Ridhi Verma, Kristen Haase, Schroder Sattar

Study design- Ridhi Verma, Kristen Haase, Schroder Sattar

Data acquisition- Ursula Ellis, Ridhi Verma, Kristen Haase, Schroder Sattar,  
Conchita Saldanha

Quality control of data and algorithms- Ridhi Verma, Kristen Haase, Schroder Sattar

Data analysis and interpretation- Ridhi Verma, Conchita Saldanha, Kristen Haase,  
Schroder Sattar

Manuscript preparation- Ridhi Verma, Kristen Haase, Schroder Sattar

Manuscript editing- Ridhi Verma, Ursula Ellis, Kristen Haase, Schroder Sattar

Manuscript review- Ridhi Verma, Ursula Ellis, Kristen Haase, Schroder Sattar

## **References**

1. Cherid C, Baghdadli A, Wall M, Mayo NE, Berry G, Harvey EJ, et al. Current level of technology use, health and eHealth literacy in older Canadians with a recent fracture—a survey in orthopedic clinics. *Osteoporosis International*. 2020 Jul;31(7):1333-40. <https://doi.org/10.1007/s00198-020-05359-3>

2. Steinhubl SR, Muse ED, Topol EJ. The emerging field of mobile health. *Sci Transl Med*. 2015; 7(283):283rv283.  
<https://doi.org/10.1126/scitranslmed.aaa3487>
3. O'shea CJ, McGavigan AD, Clark RA, Chew DP, Ganesan A. Mobile health: an emerging technology with implications for global internal medicine. *Internal medicine journal*. 2017 Jun 1;47(6):616-9. <https://doi.org/10.1111/imj.13440>
4. Global strategy on Digital Health. World Health Organization. 2020-2025.  
URL:  
<https://www.who.int/docs/defaultsource/documents/gd4dhdaa2a9f352b0445bafbc79ca799dce4d.pdf>
5. Norman CD, Skinner HA. eHEALS: the eHealth literacy scale. *Journal of medical Internet research*. 2006;8(4):e27. <https://doi.org/10.2196/jmir.8.4.e27>
6. Semple JL, Armstrong KA. Mobile applications for postoperative monitoring after discharge. *Cmaj*. 2017 Jan 9;189(1):E22-4. <https://doi.org/10.1503/cmaj.160195>
7. Elbert NJ, van Os-Medendorp H, van Renselaar W, Ekeland AG, Hakkaart-van Roijen L, et al. Effectiveness and cost-effectiveness of ehealth interventions in somatic diseases: a systematic review of systematic reviews and meta-analyses. *Journal of medical Internet research*. 2014;16(4):e110.  
<https://doi.org/10.2196/jmir.2790>
8. Ryan K, Dockray S, Linehan C. A systematic review of tailored eHealth interventions for weight loss. *Digital health*. 2019 Feb;5:2055207619826685.  
<https://doi.org/10.1177/2055207619826685>
9. Badawy SM, Cronin RM, Hankins J, Crosby L, DeBaun M, Thompson AA, et al. Patient-centered eHealth interventions for children, adolescents, and

- adults with sickle cell disease: systematic review. *Journal of medical Internet research*. 2018;20(7):e10940. <https://doi.org/10.2196/10940>
10. Schnall R, Travers J, Rojas M, Carballo-Diéguez A. eHealth interventions for HIV prevention in high-risk men who have sex with men: a systematic review. *Journal of medical Internet research*. 2014;16(5):e134. <https://doi.org/10.2196/jmir.3393>
  11. Cheng C, Beauchamp A, Elsworth GR, Osborne RH. Applying the electronic health literacy lens: systematic review of electronic health interventions targeted at socially disadvantaged groups. *Journal of medical Internet research*. 2020 Aug 13;22(8):e18476. <https://doi.org/10.2196/18476>
  12. Bodie GD, Dutta MJ. Understanding health literacy for strategic health marketing: eHealth literacy, health disparities, and the digital divide. *Health marketing quarterly*. 2008 Jul 2;25(1-2):175-203. <https://doi.org/10.1080/07359680802126301>
  13. Sin J, Henderson C, Spain D, Cornelius V, Chen T, Gillard S. eHealth interventions for family carers of people with long term illness: A promising approach?. *Clinical psychology review*. 2018 Mar 1;60:109-25. <https://doi.org/10.1016/j.cpr.2018.01.008>
  14. Rohde JA, Barker JO, Noar SM. Impact of eHealth technologies on patient outcomes: a meta-analysis of chronic gastrointestinal illness interventions. *Translational behavioral medicine*. 2021 Jan;11(1):1-0. <https://doi.org/10.1093/tbm/ibz166>
  15. Chang FC, Chiu CH, Chen PH, Miao NF, Lee CM, Chiang JT, et al. Relationship between parental and adolescent eHealth literacy and online health information seeking in Taiwan. *Cyberpsychology, Behavior, and Social*

Networking. 2015 Oct 1;18(10):618-24.

<https://doi.org/10.1089/cyber.2015.0110>

16. Mitsutake S, Shibata A, Ishii K, Oka K. Association of eHealth literacy with colorectal cancer knowledge and screening practice among internet users in Japan. *Journal of medical Internet research*. 2012;14(6):e153.  
<https://doi.org/10.2196/jmir.1927>
17. Cancer incidence by age. *Cancer Research*,  
<https://www.cancerresearchuk.org/healthprofessional/cancerstatistics/incidence/age#heading-Zero>. [accessed 13 March 2021].
18. Siegel RL, Miller KD, Goding Sauer A, Fedewa SA, Butterly LF, Anderson JC, et al. Colorectal cancer statistics, 2020. *CA: a cancer journal for clinicians*. 2020 May;70(3):145-64. <https://doi.org/10.3322/caac.21601>
19. Williams GR, Deal AM, Lund JL, Chang Y, Muss HB, Pergolotti M, et al. Patient-reported comorbidity and survival in older adults with cancer. *The oncologist*. 2018 Apr;23(4):433. <https://doi.org/10.1634/theoncologist.2017-0404>
20. Magnuson A, Sattar S, Nightingale G, Saracino R, Skonecki E, Trevino KM. A practical guide to geriatric syndromes in older adults with cancer: a focus on falls, cognition, polypharmacy, and depression. *American Society of Clinical Oncology Educational Book*. 2019 May 17;39:e96-109.  
[https://doi.org/10.1200/EDBK\\_237641](https://doi.org/10.1200/EDBK_237641)
21. Lu-Yao G, Nightingale G, Nikita N, Keith S, Gandhi K, Swartz K, et al. Relationship between polypharmacy and inpatient hospitalization among older adults with cancer treated with intravenous chemotherapy. *Journal of geriatric oncology*. 2020 May 1;11(4):579-85. <https://doi.org/10.1016/j.jgo.2020.03.001>

22. Braun LA, Zomorodbakhsch B, Keinki C, Huebner J. Information needs, communication and usage of social media by cancer patients and their relatives. *Journal of cancer research and clinical oncology*. 2019 Jul;145(7):1865-75. <https://doi.org/10.1007/s00432-019-02929-9>
23. Girault A, Ferrua M, Lalloué B, Sicotte C, Fourcade A, Yatim F, et al. Internet-based technologies to improve cancer care coordination: current use and attitudes among cancer patients. *European Journal of Cancer*. 2015 Mar 1;51(4):551-7. <https://doi.org/10.1016/j.ejca.2014.12.001>
24. Nölke L, Mensing M, Krämer A, Hornberg C. Sociodemographic and health- (care-) related characteristics of online health information seekers: a cross-sectional German study. *BMC public health*. 2015 Dec;15(1):1-2. <https://doi.org/10.1186/s12889-015-1423-0>
25. Symes Y, Song L, Heineman RG, Barbosa BD, Tatum K, Greene G, et al. Involvement in decision making and satisfaction with treatment among partners of patients with newly diagnosed localized prostate cancer. *Oncology nursing forum*, 42(6), 672–679. <https://doi.org/10.1188/15.ONF.672-679>
26. Song L, Kimberly T, Greene G, Chen RC. eHealth literacy and partner involvement in treatment decision making for men with newly diagnosed localized prostate cancer. *Oncology nursing forum*, 44(2), 225–233. <https://doi.org/10.1011/17.ONF.225-233>
27. Benotsch EG, Kalichman S, Weinhardt LS. HIV-AIDS patients' evaluation of health information on the internet: the digital divide and vulnerability to fraudulent claims. *Journal of consulting and clinical psychology*. 2004 Dec;72(6):1004. <https://doi.org/10.1037/0022-006X.72.6.1004>

28. Norman C. eHealth literacy 2.0: problems and opportunities with an evolving concept. *Journal of medical Internet research*. 2011;13(4):e125.  
<https://doi.org/10.2196/jmir.2035>
29. Kinnane NA, Milne DJ. The role of the Internet in supporting and informing carers of people with cancer: a literature review. *Supportive Care in Cancer*. 2010 Sep;18(9):1123-36. <https://doi.org/10.1007/s00520-010-0863-4>
30. Dolce MC. The Internet as a source of health information: experiences of cancer survivors and caregivers with healthcare providers. *Oncology nursing forum*, 38(3), 353–359. <https://doi.org/10.1188/11.ONF.353-359>
31. Lange L, Peikert ML, Bleich C, Schulz H. The extent to which cancer patients trust in cancer-related online information: a systematic review. *PeerJ*. 2019 Sep 30;7:e7634. <https://doi.org/10.7717/peerj.7634>
32. Chua GP, Ng QS, Tan HK, Ong WS. Caregivers of cancer patients: what are their information-seeking behaviours and resource preferences?. *Ecancermedicalscience*, 14, 1068. <https://doi.org/10.3332/ecancer.2020.1068>
33. Tan SS, Goonawardene N. Internet health information seeking and the patient-physician relationship: a systematic review. *Journal of medical Internet research*. 2017;19(1):e9. <https://doi.org/10.2196/jmir.5729>
34. Madrigal L, Escoffery C. Electronic health behaviors among US adults with chronic disease: cross-sectional survey. *Journal of medical Internet research*. 2019;21(3):e11240. <https://doi.org/10.2196/11240>
35. Wosik J, Fudim M, Cameron B, Gellad ZF, Cho A, Phinney D, et al. Telehealth transformation: COVID-19 and the rise of virtual care. *Journal of the American Medical Informatics Association*. 2020 Jun;27(6):957-62.  
<https://doi.org/10.1093/jamia/ocaa067>



36. Han HR, Hong H, Starbird LE, Ge S, Ford AD, Renda S, et al. eHealth literacy in people living with HIV: systematic review. *JMIR public health and surveillance*. 2018;4(3):e64. <https://doi.org/10.2196/publichealth.9687>
37. Stellefson M, Hanik B, Chaney B, Chaney D, Tennant B, Chavarria EA. eHealth literacy among college students: a systematic review with implications for eHealth education. *Journal of medical Internet research*. 2011;13(4):e102. <https://doi.org/10.2196/jmir.1703>
38. Chesser A, Burke A, Reyes J, Rohrberg T. Navigating the digital divide: a systematic review of eHealth literacy in underserved populations in the United States. *Informatics for Health and Social Care*. 2016 Jan 2;41(1):1-9. <https://doi.org/10.3109/17538157.2014.948171>
39. Watkins I, Xie B. eHealth literacy interventions for older adults: a systematic review of the literature. *Journal of medical Internet research*. 2014;16(11):e225. <https://doi.org/10.2196/jmir.3318>
40. Seiler A, Klaas V, Tröster G, Fagundes CP. eHealth and mHealth interventions in the treatment of fatigued cancer survivors: A systematic review and meta-analysis. *Psycho-oncology*. 2017 Sep;26(9):1239-53. <https://doi.org/10.1002/pon.4489>
41. Dorri S, Asadi F, Olfatbakhsh A, Kazemi A. A Systematic Review of Electronic Health (eHealth) interventions to improve physical activity in patients with breast cancer. *Breast Cancer*. 2020 Jan;27(1):25-46. <https://doi.org/10.1007/s12282-019-00982-3>
42. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *International journal of social research methodology*. 2005 Feb 1;8(1):19-32. <https://doi.org/10.1080/1364557032000119616>

43. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. *Implementation science*. 2010 Dec;5(1):1-9.  
<https://doi.org/10.1186/1748-5908-5-69>
44. Eng TR. *The eHealth landscape: a terrain map of emerging information and communication technologies in health and health care*. Robert Wood Johnson Foundation, Princeton NJ. 2001
45. Eysenbach G. What is e-health?. *Journal of medical Internet research*. 2001;3(2):e20. <https://doi.org/10.2196/jmir.3.2.e20>
46. Covidence systematic review S, Veritas Health Innovation. Available at [www.covidence.org](http://www.covidence.org). [accessed 13 March 2021].
47. Moher D, Liberati A, Tetzlaff J, Altman DG, Prisma Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS medicine*. 2009 Jul 21;6(7):e1000097.  
<https://doi.org/10.1016/j.jclinepi.2009.06.005>
48. Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative research in psychology*. 2006 Jan 1;3(2):77-101.  
<https://doi.org/10.1191/1478088706qp063oa>
49. Milne RA, Puts MT, Papadakos J, Le LW, Milne VC, Hope AJ, et al. Predictors of high eHealth literacy in primary lung cancer survivors. *Journal of Cancer Education*. 2015 Dec;30(4):685-92. <https://doi.org/10.1007/s13187-014-0744-5>
50. Cartmill B, Wall LR, Ward EC, Hill AJ, Porceddu SV. Computer literacy and health locus of control as determinants for readiness and acceptability of telepractice in a head and neck cancer population. *International journal of telerehabilitation*. 2016;8(2):49. <https://doi.org/10.5195/ijt.2016.6203>

51. Song L, Kimberly T, Greene G, Chen RC. eHealth literacy and partner involvement in treatment decision making for men with newly diagnosed localized prostate cancer. In *Oncology nursing forum* 2017 Mar 1; 44(2), 225–233. <https://doi.org/10.1011/17.ONF.225-233>
52. Halwas N, Griebel L, Huebner J. eHealth literacy, Internet and eHealth service usage: a survey among cancer patients and their relatives. *Journal of cancer research and clinical oncology*. 2017 Nov;143(11):2291-9. <https://doi.org/10.1007/s00432-017-2475-6>
53. Heiman H, Keinki C, Huebner J. EHealth literacy in patients with cancer and their usage of web-based information. *Journal of cancer research and clinical oncology*. 2018 Sep;144(9):1843-50. <https://doi.org/10.1007/s00432-018-2703-8>
54. Bender JL, Feldman-Stewart D, Tong C, Lee K, Brundage M, Pai H, et al. Health-related internet use among men with prostate cancer in Canada: Cancer Registry Survey Study. *Journal of medical Internet research*. 2019;21(11):e14241. <https://doi.org/10.2196/14241>
55. Nejati B, Lin CC, Aaronson NK, Cheng AS, Browall M, Lin CY, et al. Determinants of satisfactory patient communication and shared decision making in patients with multiple myeloma. *Psycho-oncology*. 2019 Jul;28(7):1490-7. <https://doi.org/10.1002/pon.5105>
56. Rossen S, Kayser L, Vibe-Petersen J, Ried-Larsen M, Christensen JF. Technology in exercise-based cancer rehabilitation: a cross-sectional study of receptiveness and readiness for e-Health utilization in Danish cancer rehabilitation. *Acta Oncologica*. 2019 May 4;58(5):610-8. <https://doi.org/10.1080/0284186X.2018.1562213>

57. Eng L, Bender J, Hueniken K, Kassirian S, Mitchell L, Aggarwal R, et al. Age differences in patterns and confidence of using internet and social media for cancer-care among cancer survivors. *Journal of geriatric oncology*. 2020 Jul 1;11(6):1011-9. <https://doi.org/10.1016/j.jgo.2020.02.011>
58. Hoogland AI, Mansfield J, Lafranchise EA, Bulls HW, Johnstone PA, Jim HS. eHealth literacy in older adults with cancer. *Journal of geriatric oncology*. 2020 Jul 1;11(6):1020-2. <https://doi.org/10.1016/j.jgo.2019.12.015>
59. Kemp E, Trigg J, Beatty L, Christensen C, Dhillon HM, Maeder A, et al. Health literacy, digital health literacy and the implementation of digital health technologies in cancer care: the need for a strategic approach. *Health Promotion Journal of Australia*. 2020 Jul 18; 32 Suppl 1:104-114  
<https://doi.org/10.1002/hpja.387>
60. Paige SR, Krieger JL, Stellefson M, Alber JM. eHealth literacy in chronic disease patients: an item response theory analysis of the eHealth literacy scale (eHEALS). *Patient education and counseling*. 2017 Feb 1;100(2):320-6.  
<https://doi.org/10.1016/j.pec.2016.09.008>
61. Paige SR, Miller MD, Krieger JL, Stellefson M, Cheong J. Electronic health literacy across the lifespan: measurement invariance study. *Journal of medical Internet research*. 2018;20(7):e10434 <https://doi.org/10.2196/10434>
62. Prabhu AV, Hansberry DR, Agarwal N, Clump DA, Heron DE. Radiation oncology and online patient education materials: deviating from NIH and AMA recommendations. *International Journal of Radiation Oncology\* Biology\* Physics*. 2016 Nov 1;96(3):521-8.  
<https://doi.org/10.1016/j.ijrobp.2016.06.2449>

63. Bui TL, Silva-Hirschberg C, Torres J, Armstrong AW. Are patients comprehending? A critical assessment of online patient educational materials. *Journal of Dermatological Treatment*. 2018 Apr 3;29(3):295-9. <https://doi.org/10.1080/09546634.2017.1372558>
64. Sun Y, Zhang Y, Gwizdka J, Trace CB. Consumer evaluation of the quality of online health information: systematic literature review of relevant criteria and indicators. *Journal of medical Internet research*. 2019;21(5):e12522. <https://doi.org/10.2196/12522>
65. Sbaffi L, Rowley J. Trust and credibility in web-based health information: a review and agenda for future research. *Journal of medical Internet research*. 2017;19(6):e218. <https://doi.org/10.2196/jmir.7579>
66. Feufel MA, Stahl SF. What do web-use skill differences imply for online health information searches?. *Journal of medical Internet research*. 2012;14(3):e87. <https://doi.org/10.2196/jmir.2051>
67. Rice L, Sara R. Updating the determinants of health model in the Information Age. *Health promotion international*. 2019 Dec 1;34(6):1241-9. <https://doi.org/10.1093/heapro/day064>
68. Haase KR, Kain D, Merchant S, Booth C, Koven R, Brundage M, et al. Older survivors of cancer in the COVID-19 pandemic: Reflections and recommendations for future care. *Journal of geriatric oncology*. 2020 Dec 3;12(3), 461–466. <https://doi.org/10.1016/j.jgo.2020.11.009>
69. O'Connell, M. E., Haase, K. R., Grewal, K. S., Panyavin, P., Kortzman, K., Flath, M. E., et al. (2020). Overcoming Barriers to Technology Adoption for Older Adults to Maintain Virtual Community and Social Connections During the COVID-19 Pandemic. Submitted Dec 15th to *Clinical Gerontologist*



**Table**

**Table 1: Study Characteristics and levels of eHealth literacy amongst older adults living with cancer and their caregivers.**

Studies assessing levels of eHealth literacy amongst older adults living with cancer									
Author and Year	Location	Study Design	Older adults/ Caregiver	Aim of the study	Cancer Site	Age (Mean/ median/ range)	Sample size ≥ 65/ mean age above 65 (n=total sample size)	Outcome measure/Key themes	Results
Milne et al 2015 [47]	Canada	Quant	Older adults	To determine self-perceived eHealth literacy levels in lung cancer survivors and to explore predictors of higher eHealth literacy	Lung cancer	71(44-89)	83	eHEALS*	66.3% have low perceived eHealth Literacy (24.0)
Cartmill et al 2016 [48]	Australia	Quant	Older adults	To explore computer literacy and health locus of control in head/neck cancer (HNC) patients	HNC§	57.78 (20-73)	Unspecified (n=60)	Computer literacy questionnaire	47% were at least somewhat confident with using technology for HRAs¶
Song et al 2017 [49]	USA	Quant	Caregivers	To examine how the eHealth literacy of partners of patients with newly diagnosed prostate cancer affects their involvement in decision making, and the influencing partner.	Caregivers of patients with prostate cancer	61.4	Unspecified (n=142)	eHEALS*	Low eHealth literacy score (28.5)
Halwas et al 2017 [50]	Demark	Quant	Older adults and caregivers	The investigate eHealth usage and literacy by patients with cancer and their relatives.	Various cancers	62	50 (n=142)	Six components from eHEALS*	Low health literacy among older adults
Heiman et al 2018 [51]	Germany	Quant	Older adults and caregivers	To assess the sources of cancer information patients with cancer and eHealth literacy among people living with cancer and caregivers	Various cancers	50.7	57 (n=182)	eHEALS*	41.5% had a low score for eHealth literacy.
Bender et al 2019 [52]	Canada	Quant	Older adults	To determine the patterns and factors associated with the use of the internet as a source of health information	Prostate cancer	69	903	One component of eHEALS*	40.2% were confident with using technology for

				among Canadian men with prostate cancer					cancer care decisions
Nejati et al 2019 [53]	Iran	Quant	Older adults	To identify determinants of shared decision making in patients with multiple myeloma	Multiple myeloma	62.86 (47.41-78.31)	Unspecified (n=276)	eHEALS*	Trust in the health care system is significantly associated with eHealth literacy ( $\beta = 0.397$ )
Rossen et al 2019 [54]	Denmark	Quant	Older adults	To stratify cancer survivors based on their self-reported receptiveness and readiness for the utilization of health technology in physical activity rehabilitation	Various cancers	60.0 (50.5-69) Older adult Subgroup = 69.0 (58.5-77.5)	38 (n=305)	READHY†	Low health literacy among older adults
Eng et al 2020 [55]	Canada	Quant	Older adults	To evaluate the impact of age on cancer-related internet and social media use and confidence in evaluating online information for cancer-care decision making.	Various cancers	49 (15–83) Older adult Subgroup = 70 (65–83)	58 (n=371)	One component of eHEALS*	31% confident with using technology for cancer care decisions.
Hoogland et al 2020 [56]	USA	Quant	Older adults	To examine age differences in eHealth literacy and use of technology devices in patients with cancer	Various cancers	18-85+	101 (n=198)	eHEALS*	Low health literacy among older adults (Mean=3.44)
Kemp et al 2021 [57]	Australia	Qual	Older adults and caregivers	To examine issues for digital health technology implementation in cancer care regarding digital health literacy, via stakeholder consultation.	Unspecified	33-82	Unspecified (n=14)	Framework thematic analysis	Resultant themes-traditional health literacy, age, geography and socioeconomic circumstances.

\*- eHEALS- eHealth Literacy Scale

§- HNC- Head and neck cancer

¶- HRAs- Health related activities,

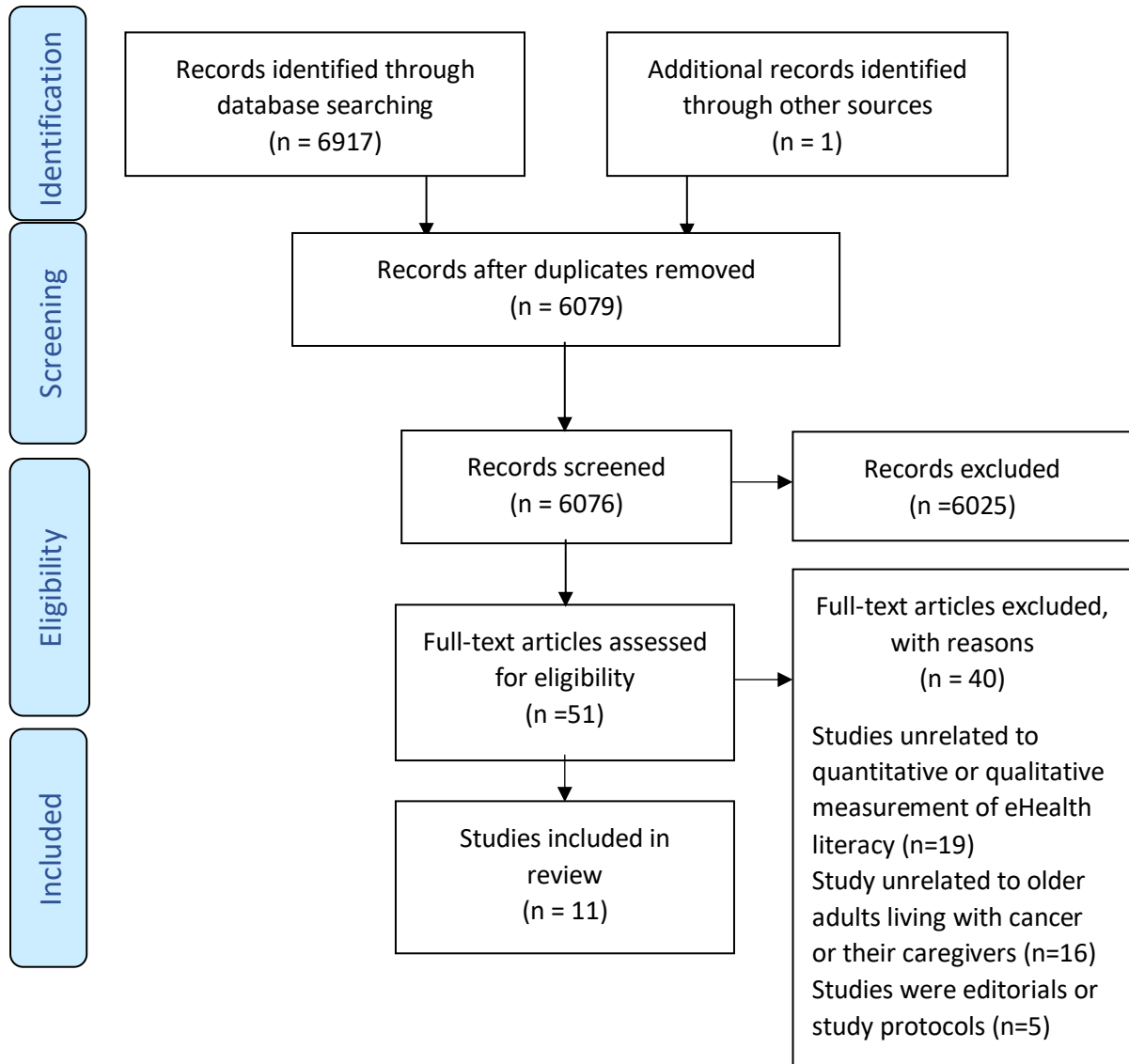
†- READHY- Readiness and Enablement index for Health technology



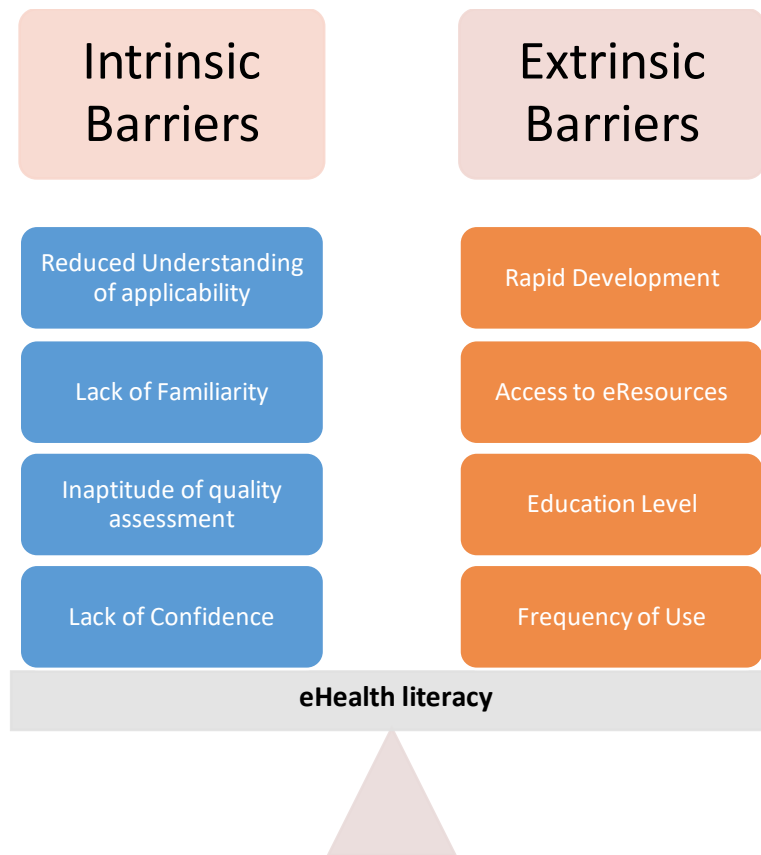
## Figures

Color for web only

Figure 1 PRISMA flow chart



**Figure 2 Intrinsic and Extrinsic Barriers to eHealth literacy among older adults living with cancer and their caregivers.**



**Figure 3 Correlation between the intrinsic and extrinsic barriers to eHealth literacy.**

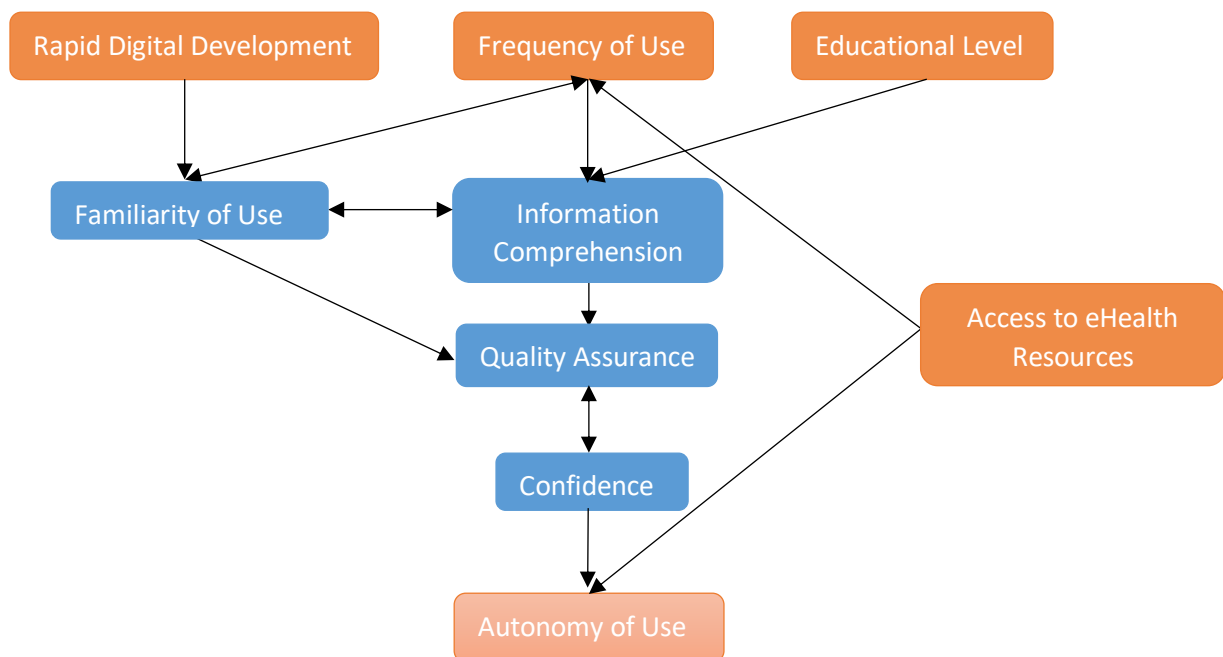
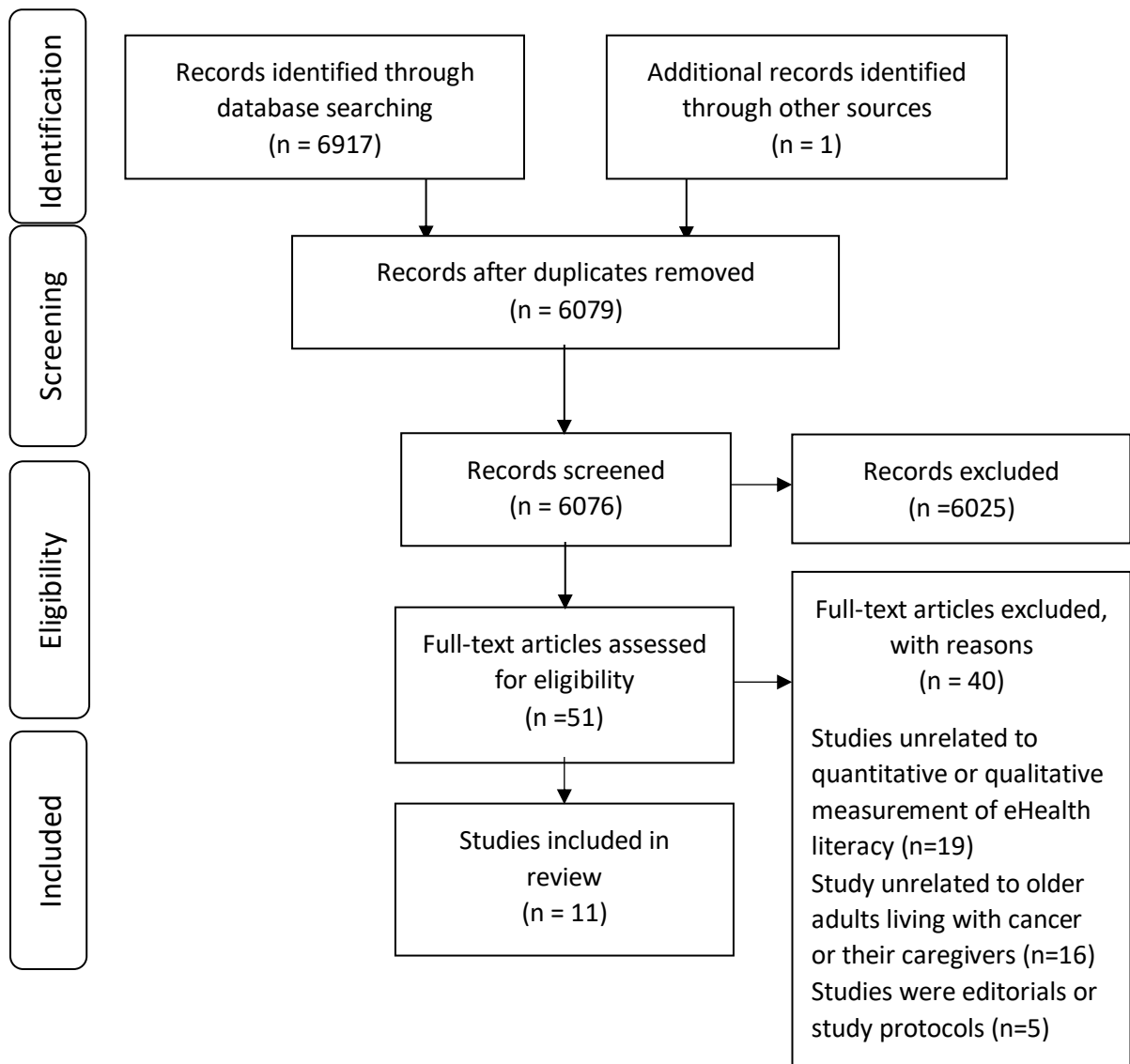
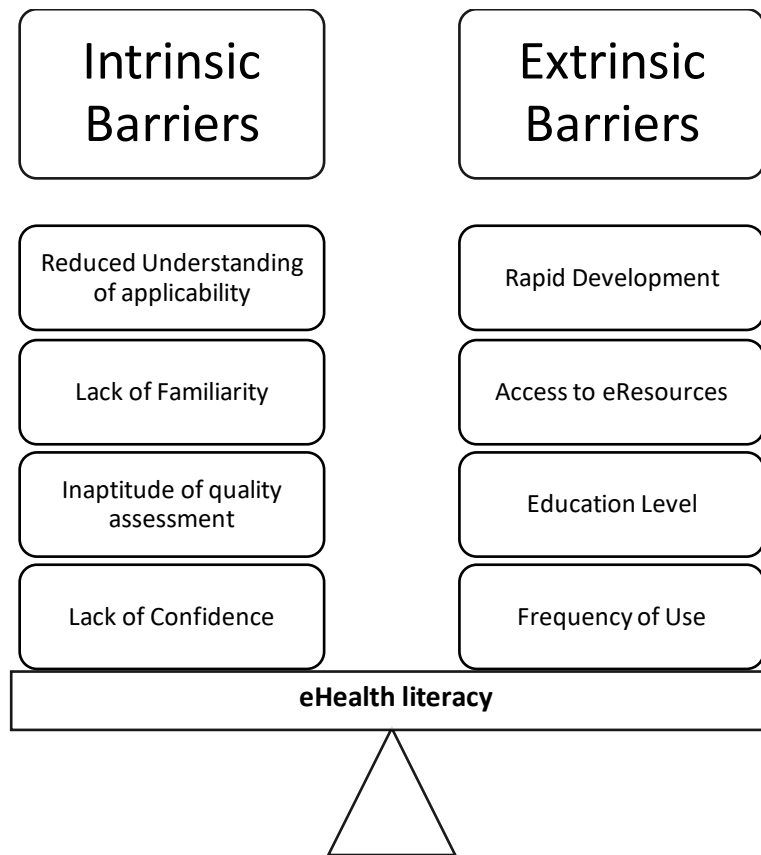


Figure 1 PRISMA flow chart



**Figure 2 Intrinsic and Extrinsic Barriers to eHealth literacy among older adults living with cancer and their caregivers.**



**Figure 3 Correlation between the intrinsic and extrinsic barriers to eHealth literacy.**

