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Health Literacy Improvement and Use of Digital Health Services in Aged People: A Systematic Literature Review

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Abstract

The low level of health literacy skills often found in elderly people has been associated with a significant risk of poor access to health services and poor health status and makes it more likely that they will be prevented from obtaining and understanding the basic health information and services needed to make appropriate health decisions. Therefore, empowering the older population with health literacy skills could enable them to benefit from the use of various digital health sources, such as telemedicine, webpages, or other digital platforms, to improve their health quality and enable them to live independently for longer. The purpose of this paper is to perform a systematic review to analyse and evaluate studies that explored the relationship between health literacy skills and the use of digital health platforms in the context of elderly people. To do so, four main databases – Medline, Scopus, Web of Science, and PubMed –were searched based on the following inclusion criteria: (i) no geographical limitation, (ii) written in English, (iii) participants were aged ≥ 65 years, and (iv) studies were published between 2000 and 2020. By applying the inclusion and exclusion criteria for further analysis, the final dataset comprised 32 articles, which were analysed using the Preferred Reporting Items for Systematic Reviews (PRISMA) model. The results show that four different intervention methods could be used to increase elderlies' health literacy skills in the case of using digital health services. Besides, before implementing any training sessions, barriers of learning shall be identified and tackled.

Keywords: Aging, Digital health service, E-health literacy, Elderly people, Health literacy, Intervention, Senior population, Systematic literature review

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1. Introduction

The worldwide population is aging rapidly, and the proportion of individuals aged 65 years and older is predicted to rise from 9% in 2019 to 16% in 2050, so that one in six people in the world will then be aged 65 years or over (Tenani et al., 2019). As people age, they are at higher risk of various health-related issues and become more susceptible to disease, giving a rise to an increasing need for healthcare services (Jaul & Barron, 2017). Therefore, it is of critical importance to improve the health behaviours of the geriatric population and to empower this population to take control of their health status independently. Adopting healthy behaviours may be viewed as being able to seek, obtain, and evaluate health information from various sources – such as healthcare professionals, web pages, or other digital platforms – more efficiently and more effectively, in order to make more appropriate health-related decisions (Uemura et al., 2018). In the digital age, elderly people need to be able to assimilate the health information available on digital platforms, and apply the knowledge gained to address or solve a health problem and make appropriate health decisions (Norman & Skinner, 2006).

However, despite the significant technological development in healthcare service provision through digital platforms, elderly people seldom utilise such platforms appropriately (Nikou et al., 2020). Most of them lack even the basic abilities to use digital health services owing to a lack of familiarity with information and communications technologies (ICTs). As such, they are less equipped to make use of such services or telemedicine systems (Romano et al., 2015). Moreover, Xie et al. (2020) argued that elderly individuals are less likely than younger people to obtain high-quality health-related information or to access and use e-health–based technologies and online platforms. The plausible reason might be the level of their literacy skills, which is usually lower than that of the general population (younger generation), and therefore, they do not benefit from digital health services to the same extent as their counterparts. The literature provides empirical evidence that health literacy skills play a crucial role in accessing and using digital health services to find health-related information and make informed decisions (Xie et al., 2020), since most of the individuals in this cohort lack the basic abilities necessary to use digital health services and the digital divide may make telemedicine systems more challenging for them. As such, it is crucial for elderly people to be empowered with a higher level of health literacy skills (Gálvez, 2020).

The growth of aged people – along with the growth of technological solutions such as mobile applications and digital health services – highlights the importance of higher literacy skills for senior citizens (Gálvez, 2020). Although there has been a noticeable increase in the number of publications concerning e-health or health literacy in recent years, there is a lack of studies investigating the relationship between e-health or health literacy and the use of digital health services in the elderly population (Chen, 2018). Therefore, this study aims to perform a systematic literature review to analyse and evaluate studies with a particular focus on the relationship between literacy skills (e-health or health) and the use of digital health platforms in the context of elderly people (aged $\geq$ 65 years). In addition, in this systematic review paper, we also focus on studies that

examined different methods of e-health or health literacy training programmes (e-health or health literacy interventions) in relation to elderly people and their use of digital health services.

2. Background
2.1. Health Literacy and Senior Citizens

The concept of health literacy is becoming increasingly important in the field of European public health research (Visscher et al., 2018). Health literacy was initially defined as an individual's ability to find health information, interpret it, and use it to make informed health-related decisions (Williams et al., 1995). The Joint Committee on National Health Education Standards (2005, p. 5) defines health literacy as "the capacity of individuals to obtain, interpret, and understand basic health information and services and the competence to use such information and services in ways which enhance health". However, there are differences in the definitions, but all definitions and standards highlight that an individual must have certain skills and abilities, which are necessary to attain competence in health literacy. In addition, making an informed health decision is an individual responsibility. This implies that individuals are empowered within the healthcare system to develop the competencies needed through self-directed learning and to advocate for personal, family, and community health (Mancuso, 2008).

Obviously, the level of health literacy has an association with age, and older people mostly have a low level of literacy skills (Kobayashi et al., 2014). The ability of people to understand medical information could be affected by age-related disabilities, such as declining physical and mental function. In addition, generally speaking, older people are less able than younger generations to use the internet effectively. Therefore, individuals in this age group (+65 years) are vulnerable in terms of their lower literacy levels (Van Hoa et al., 2020).

Recently, societies placed a premium on health literacy skills among elderly people, on account of (i) an increasing number of geriatric populations worldwide, (ii) a growing incidence of chronic diseases among elderly people (Liu et al., 2015), (iii) an increased need for elderly people to navigate health systems more effectively than other generations, since they have more complex health needs (Vogt et al., 2017), and (iv) a growth in technological solutions for health domains such as m-health or e-health (Nikou et al., 2020). Thus, it is essential that older people are equipped with the appropriate e-health and health literacy skills.

A high level of health literacy offers various benefits for senior citizens. For example, it can empower such individuals to locate trustworthy health online resources and utilise them more effectively and efficiently rather than relying on social media for information (Chen et al., 2018). Additionally, health literacy enables individuals to participate actively in medical decision making by, for example, being able to access legitimate and accurate information. People's improved understanding of their health and well-being is another outcome of being health literate. Health literacy skills empower senior citizens to maintain or enhance their self-management skills (Vogt et al., 2017). In addition, such skills have a positive effect on medication adherence and understanding health information and medication prescriptions (Park et al., 2018). All the mentioned benefits result in better disease management, higher quality of life (Panagioti et al.,

2017), improved health-related behaviours and health outcomes, the ability to take care of themselves independently (Kim and Utz, 2018), and a reduction in risky behaviours (Liu et al., 2015). In other words, health literacy facilitates healthcare delivery and makes access to healthcare services easier by alleviating the barriers. The advantages of a high level of literacy skills for aged people and society are evident based on previous studies focusing on e-health or health literacy and seniors as the target group (Liu et al., 2015; Lin et al., 2019 and Wit et al., 2020).

2.2. Health Literacy Intervention and Senior Citizens

Regarding previous studies, interventions (training programmes) mitigate the effects of low literacy skills (Sheridan et al., 2010), or, in other words, health literacy intervention affects overall health positively by enhancing people's abilities to assimilate and absorb health information. According to previous studies, e-health or health literacy interventions empower senior citizens with higher e-health or health literacy skills and make them more capable of accessing digital health services (Banbury et al., 2019), finding online health information (Goeman et al., 2016), or using digital health tools (Kim et al., 2014). Such training programmes improve the ability of older people to be more accountable for their health responsibilities (Nahm et al., 2015). Additionally, several prior studies have highlighted the importance of improving literacy skills among elderly people in terms of increasing their level of self-efficiency, their awareness regarding healthcare needs, their choices, their ability to use the modern e-health services, and their level of empowerment to play an active role in personal health decision making (Valizadeh-Haghi & Rahmatizadeh, 2018). As pointed out by King (2010), literacy intervention can not only promote healthy behaviour in people but also empower healthcare professionals to offer better health services. So, such training programmes are of benefit to both patients and healthcare professionals. Most studies that have conducted a literature review in the context of health literacy (e.g. Stormacq et al., 2020) have focused on the relationship between an improvement in literacy skills and overall health outcomes, or they have focused on a specific disease (Cheng et al., 2020). The study most closely aligned to our literature review was one conducted by Watkins and Xie (2014); this study explored the relationship between e-health literacy intervention and elderly people but made no reference to the prior studies that have been carried out in relation to literacy intervention and the use of digital health services among elderly people. While all the earlier systematic literature reviews have provided valuable contributions, there is still a paucity of studies focusing on the relationship between empowering elderly people with better e-health or health literacy skills and the effect of this empowerment on elderlies' ability to use digital health services. Therefore, in the current systematic review, we concentrate on the relationship between health literacy development among elderly people and their use of digital health services.

3. Methodology

In this paper a systematic literature review was performed using the Preferred Reporting Items for Systematic Reviews (PRISMA) method. The search process involved four main steps: identification, screening, eligibility, and inclusion (Steinmetz et al., 2021). The review process

started with searches of the main sources and repositories of the following electronic databases (the first step: identification): Web of Science, PubMed, MEDLINE, and Scopus. These databases were selected because they are the most well-known databases, and they can lead to comprehensive outputs. The search was restricted to articles published in the English language. The specific filter for the time frame was set at 2000–2020.

Our search terms were a combination of the main keywords used to search articles in the electronic databases. With regards to the overall objectives of the paper and research question stated earlier, the following search keywords were deemed to be the most appropriate terms for screening the most relevant studies:

("health literac" OR "health information literac*" OR "ehealth literac*" OR "e-health literac*" OR "digital health literac*") AND (?lder* OR "senior citizen*" OR "senior population" OR "old people" OR elderly OR "aged adult") AND ("health service*" OR "digital health service*" OR "ehealth service" OR "e-health service*" OR "health information service*" OR "ehealth information service*" OR "e-health information service").*
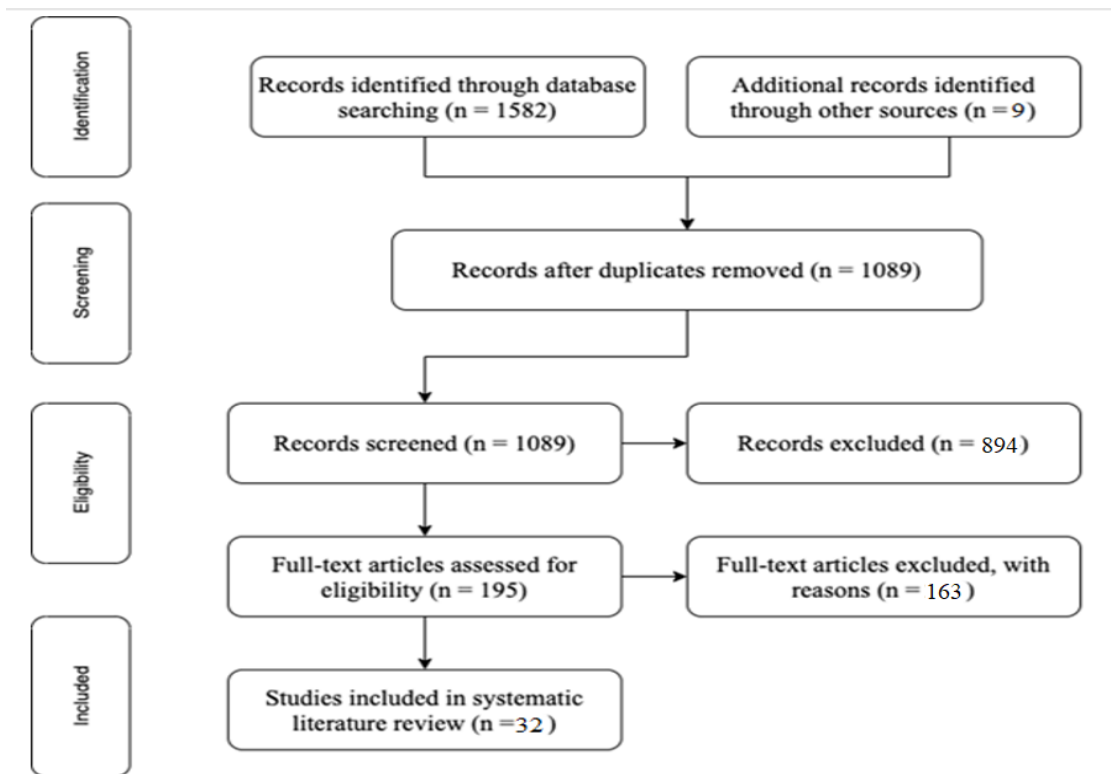

Figure 1: RRISMA flowchart of selection procedures

The exclusion criteria were as follows: (1) the study population did not include adults aged ≥ 65 years, (2) the study population entirely comprised individuals with diagnosed cognitive or mental health impairments, and (3) studies that focused solely on improvement in mental health literacy.

Database searches yielded 1582 articles. PubMed was searched according to the previously described procedure. The combination of key terms generated 909 articles. With Scopus, the combination of keywords yielded 339 results, while Medline yielded 227 articles and Web of Science 122 articles. After eliminating duplicate articles (n = 502), 1089 relevant articles remained.

In the second step (i.e. screening), we examined the titles and abstracts of the 1089 articles and excluded all unsuitable studies. We began the initial screening phase by checking the relevant studies by title, abstract, and keywords. In this step, 894 papers were excluded. In the third step (i.e. eligibility), we checked the full text of all the remaining 195 articles. All the articles from the four databases were read in-depth. In the fourth step (i.e. inclusion), after the inclusion and exclusion criteria had been applied by the researchers, articles that met the primary selection criteria were then critically appraised based on the relevance to the research questions.

We finally selected 32 articles for the systematic literature review, 23 studies were found from database search and 9 studies were found from other sources by crosschecking of the citations. All the selected articles were read thoroughly again, and useful information extracted. The summary of the search process is shown in the PRISMA flow chart (Figure 1), which illustrates the four main stages of identification, screening, eligibility, and inclusion.

It is important to mention that the first author began the initial search, screening, and data extraction. In addition to the lead author, another senior researcher double checked the entire work, ensuring that all published articles matching the inclusion and exclusion criteria had been considered. In the following section, the results of the literature reviewed are presented.

4. Results

The 32 articles are categorised based on different aspects. (i) research setting and location, (ii) research design, (iii) use of theory, (iv) sample characteristics, (v) barriers to improving literacy skills among elderly people, and (vi) intervention method.

4.1. Research Setting and Location

The 32 selected articles were conducted in 9 different countries, and interestingly, 19 of the 32 studies (59.37%) were conducted in the USA, followed by five studies (15.62%) in Australia and two studies (6.25%) in the UK. Additionally, five studies were conducted in each of the following five different countries: Canada, New Zealand: France, Taiwan, and China. Just one study was conducted in multiple countries and as an international study (see Table 1).

Table1. Country of origin

Country of origin	List of studies
USA	Masi et al. (2003), Campbell & Nolfi (2005), Gross et al. (2007), Bertera et al (2007), Neafsey et al. (2008), Chu et al (2009), Bosworth et al. (2009), Xie and Bugg (2009), Xie (2011a, 2011b, 2011c and 2012), Aspinall et al. (2012), Strong et al. (2012), Czaja et al. (2013), Kim et al. (2014), Nahm et al. (2015), fink & Beck (2015), and Nahm et al. (2018)

Australia	Goeman et al. (2016), Parker et al. (2018), Heckel et al. (2018), Banbury et al. (2019), and Redfern et al. (2020)
The UK	Long & Gambling (2012) and Edwards et al. (2013)
Canada	Manafò & Wong (2013)
New Zealand	Sarfati et al. (2018)
France	Susic (2009)
Taiwan	Chiu et al. (2016)
China	Tse et al. (2008)
International study	Perestelo-Perez et al. (2020)

The selected studies were performed in different settings. Among the 32 selected articles, 16 studies (50%) were conducted in informal learning settings (e.g. public libraries or senior centres). Moreover, 11 studies (34.37%) were administered remotely via ICTs systems, including online tutoring through the use of video conferencing or by phone. In addition, four studies (12. 5%) were conducted in clinical settings. In addition, only one study (3.125%) was carried out in a university setting. The study setting findings clarify that the commonest way to enhance the literacy skills of elderly people is via face-to-face education in an informal learning setting (see Table 2).

Table 2. Study setting

Study setting	List of studies
Informal learning settings	Campbell & Nolfi (2005), Bertera et al (2007), Gross et al. (2007), Neafsey et al. (2008), Tse et al. (2008), Chu et al (2009), Susic (2009), Xie and Bug (2009), Xie (2011a, 2011b, 2011c and 2012), Strong et al. (2012), Aspinall et al. (2012), Goeman et al. (2016) and Chiu et al. (2016)
Remotely via ICTs	Masi et al. (2003), Long & Gambling (2012), Manafò & Wong (2013), Nahm et al (2015), fink & Beck (2015), Sarfati et al. (2018), Parker et al. (2018), Nahm et al. (2018), Banbury et al. (2019) Redfern et al. (2020), and Perestelo-Perez et al. (2020)
Clinical settings	Bosworth et al. (2009), Edwards et al. (2013), Kim et al. (2014) and Heckel et al. (2018)
University	Czaja et al. (2013)

4.2. Research Design

In this systematic literature review, selected articles were assessed based on their focus on the improvement in literacy skills of the target groups. The improvement could be related to finding online health-related information or using digital health tools (digital health services). The selected articles employed four different kinds of research design. As many as 19 of the studies (59.37%) used only one group with a pre- and post-test to compare the changes in the literacy skills of the sample group before and after intervention in relation to using digital health services. Also, the review results showed that 10 studies (31.25%) used different groups: an intervention group and a control group. In this case, participants in the intervention group took part in training programmes which helped them to enhance their literacy skills, while those in the control group did not participate in any training programmes. Next, we compared the results of both groups in terms of improved literacy skills in relation to using digital health services. In three studies, more than two groups were included. Additionally, we found that two studies (6.25%) included three different groups. Moreover, four different groups were used in one of the studies (3.125%). In the

aforementioned three studies, one of the groups was the control group and the other two groups received different types of trainings. As shown in Table 3, most researchers prefer to work on one single group, and compare their progress before and after intervention.

Table 3. Research design

Research design	List of studies
One group	Campbell & Nolfi (2005), Bertera et al. (2007), Gross et al. (2007), Tse et al. (2008), Neafsey et al. (2008), Chu et al (2009), Susic (2009), Xie and Bugg (2009), Xie (2011a), Xie (2011b), Xie (2011c), Xie (2012), Strong et al. (2012), Long & Gambling (2012), Aspinall et al. (2012), Manafò & Wong (2013), Goeman et al. (2016), Chiu et al. (2016) and Perestelo-Perez et al. (2020)
Two groups	Masi et al. (2003), Kim et al. (2014), fink & Beck (2015), Nahm et al. (2015), Nahm et al. (2018), Parker et al. (2018), Heckel et al. (2018), Sarfati et al. (2018), Banbury et al. (2019) and Redfern et al (2020)
Three groups	Edwards et al. (2013) and Czaja et al. (2013)
Four groups	Bosworth et al. (2009)

4.3. Use of Theory

Different studies used different theories and frameworks. Twelve studies (36.36 %) applied no theoretical framework and 6 (18.75%) used social theories. We also found that two studies (6.25%) used social interdependence theory, and four (12.5%) used social cognitive theory. Learning theory and self-efficacy theory were applied in each of three studies (9.37%). Behavioural theory and the health belief model (HBM) were applied in each of two (6.25%) studies. The NASSS framework (non-adoption, abandonment, scale-up, spread and sustainability), transtheoretical model, technology acceptance model (TAM) theory, diffusion of innovation (DOI) theory, and thematic framework were all used in one study (3.125%) (see Table 4).

Table 4. Use of theory

Use of theory	List of studies
Social Interdependence theory	Xie (2011a and 2011c)
Social Cognitive theory	Xie (2012), Neafsey et al. (2008), Kim et al. (2014) and Nahm et al. (2015)
Learning theory	Campbell & Nolfi (2005), Bertera et al. (2007) and Xie & Bugg (2009)
Self-efficacy theory	Chu et al. (2009), Manafò & Wong (2013) and Nahm et al. (2018).
Behavioural theory	Sarfati et al. (2018) and Parker et al. (2018)
Health Belief Model (HBM)	Bosworth et al. (2009) and fink & Beck (2015)
NASS framework	Redfern et al. (2020)
Transtheoretical Model	Long & Gambling (2012)
Diffusion of innovation (DOI) and TAM	Chiu et al. (2016)
Thematic framework.	Edwards et al. (2013)

4.4. Sample Characteristics

Sample size varied between six participants and 909 participants. All the studies, apart from one Gross et al. (2007), had reported the sample size. More than half of the studies – 18 (56.25%) – had over 100 participants. Moreover, four studies (12.5%) had a sample size of 50–99 participants.

In addition, nine studies (28.125%) had a sample size of less than 50 participants, and all the selected studies (100%) involved people aged 65 years or older (see Table 5).

Table 5. sample size

Sample characteristic	List of studies
Over 100 participants	Bosworth et al. (2009), Xie & Bugg (2009), Chu et al. (2009), Susic (2009), Xie (2011a, b and c), Xie (2012), Gambling (2012), Kim et al. (2014), Nahm et al. (2015), Sarfati et al. (2018), Heckel et al. (2018), Parker et al. (2018), Nahm et al. (2018), Banbury et al. (2019), Perestelo-Perez et al. (2020), and Long & Redfern et al. (2020)
between 50-99 participants	Aspinall et al. (2012), Czaja et al. (2013), Manafò & Wong (2013), and fink & Beck (2015)
less than 50 participants	Masi et al. (2003), Campbell & Nolfi (2005), Bertera et al. (2007), Neafsey et al. (2008), Tse et al. (2008), Edwards et al. (2013), Strong et al. (2012), Chiu et al. (2016), and Goeman et al. (2016)

In terms of gender distribution, the percentage of female participants in 24 of the selected articles was more than 50%. In two other studies, the percentage of female participants was less than 50%. Additionally, six studies did not provide information about the gender of the participants. Moreover, information regarding race and ethnicity were not provided in all the studies; thus, it was not possible to make a comparison based on these elements.

4.5. Barriers of Improving Literacy Skills Among Elderly People

In the process of improving literacy skills through different methods of interventions there are some barriers. These barriers can be divided into internal and external barriers.

- External barriers

According to the findings of the literature review, we found:

(i) that elderly people require more time to learn than younger people, and in the case of using digital health services this required time is expected to be much more (Chu et al., 2009; Chiu et al., 2016; Xie, 2011a),

(ii) a lack of suitably trained staff to provide training, and a lack of support to design and implement an intervention programme for elderly individuals (Nahm et al., 2018; Xie & Bugg, 2009),

(iii) that elderly people had limited access to computers, relatively few resources to obtain reliable information on many subjects, and a lack of ability to find and evaluate reliable information on the internet (Chu et al., 2009; Gross et al., 2007; Susic, 2009; Tse et al., 2008).

Moreover, the results showed that some of the teaching methods used are not suitable for elderly people, or alternatively, methods are too complex to be used for the elderly population. In addition, it was found that inappropriate methods did not lead to the expected outcomes (Heckel et al., 2018; Parker et al., 2018; Xie, 2011a & Xie, 2011c). In terms of improving the ability of elderly people to use digital health services, it was found that lack of experience prolongs the learning period. In

addition, most of the aged adults studied lacked experience in using technology (Banbury, 2019; Chiu et al., 2016; Manafò & Wong, 2013; Perestelo-Perez et al., 2020; Strong et al., 2012; Xie, 2011c & Xie, 2012).

- Internal barriers

Aside from external barriers, elderly people face some internal challenges in terms of improving their health literacy skills. People in this age group tend to have limited capacity to find and appraise health information across the service. Additionally, some other internal barriers exist, such as computer anxiety, lack of self-esteem, lack of self-efficacy, lack of personal motivation, lack of computer interest and efficacy, and attitudes towards the aging experience regarding psychosocial loss and psychological growth (Campbell & Nolfi, 2005; Chiu et al., 2016; Goeman et al., 2016; Manafò & Wong, 2013; Xie, 2011b). Edwards et al. (2102) referred to other internal factors too, such as poor acceptance and compliance, reliance on health professionals for information, emotional barriers (shock, fear, anxiety), and avoidance of information. People in this age group tend to experience more stress and anxiety regarding the learning process than the younger generation (Chu et al., 2009). Physical barriers, such as vision or hearing problems, were identified as other challenges faced by elderly people. This age group also tend to have limited dexterity (Bertera et al., 2007). Moreover, a low level of education among the geriatric population represents another important limitation in their efforts to deal with e-health, m-health, or other digital health services (Chiu et al., 2016 & Poduval et al, 2018). Additionally, elderly people often find it difficult to use digital health applications and are reluctant to use digital health platforms. For example, web pages are complex for elderly people to navigate (Banbury, 2019; Czaja et al., 2013; Manafò & Wong, 2013).

4.6. Intervention Method

In this study, all the 32 selected articles can be categorized into the five groups described below. Some articles were placed in more than one group, such as the study conducted by Xie (2011c). However, this study could not be placed in the multi-method group, since two methods were implemented and compared separately. We will elaborate further in the sections below.

- *Tailored intervention*

Tailored intervention is a method which is designed to address the individual characteristics of persons within a sample, such as personality factors, goals, needs, preferences, and resources (Beck et al., 2011). However, other authors, such as Ryan and Lauver (2002), consider the tailored intervention as a method focusing on individuals' experiences or individuals' goals. Tailoring interventions offers one approach to ensuring instructional content matches each participant's specific characteristics. This method was used in 11 of the selected studies (34.37%).

- *Collaborative intervention*

As Laal (2013) argues, collaborative learning is an educational approach to teaching and learning that involves groups of learners working together to solve a problem, complete a task, or create a product. While this intervention method makes learners more dependent on each other, it offers some benefits as well, such as making the learning process more interesting and meaningful for the learners, helping the learners feel less lonely and more supported by each other as a part of community, increasing the learners' knowledge by enabling them to share knowledge, and helping the learners take more responsibility for their actions (Ibrahim et al., 2015). In this study, group learnings are placed in this category. This method was used in seven of the selected studies (21.87%).

- *Teach-back intervention*

The teach-back method is a kind of intervention in which health information providers such as nurses take entire responsibility for the training process (Morony et al., 2018). To educate and assess learning, the teach-back method has been shown to be an effective approach (White et al., 2013). With this method, learners can improve their knowledge about different diseases, such as diabetes (Negarandeh et al., 2012). This method was used in only one of the selected studies (3.125%).

- *Hands on intervention*

Hands-on training (also described as on-the-job training) is another technique used to establish different skills and has been demonstrated effective in several studies (e.g. Iwata et al., 2000). Hands-on training involves direct feedback on teaching performances and is like role-playing except for the fact that the trainers work directly with the clients (Hatlenes & Eikeseth, 2016). Training programmes that were conducted via workshops and experimental design were placed in this category. This method was used in eight of the selected studies (25%).

- *Multi-method intervention*

Multi-method intervention is not defined as a specific way of coaching. In this study, method is considered as a mixed intervention method. For example, some studies consider the effect of mixed methods – such as online, tailored, and collaborative intervention – in one step without specifying the result of each method. In such cases, the study would be categorised as a multi-method intervention. This method was used in six of the selected studies (18.75%) (see Table 6).

Table 6. Intervention method

Intervention method	List of studies
Tailored intervention	Tse et al (2008); Xie and Bugg (2009), Chu et al. (2009), Bosworth et al. (2009), Xie (2011c); Aspinall et al. (2012); Long & Gambling (2012), Heckel et al. (2018), Parker et al. (2018), Sarfati et al. (2018) and Redfern et al. (2020)
Collaborative intervention	Masi et al. (2003), Xie (2011b) and Xie (2011c), Nahm et al. (2015), Nahm et al. (2018), Banbury et al. (2019) and Perestelo-Perez et al. (2020)
Teach-back intervention	Goeman et al. (2016)

Hands on intervention	Campbell & Nolfi (2005), Bertera et al. (2007), Susic (2009), Aspinall et al. (2012), Strong et al. (2012), Xie (2012), Manafò & Wong (2013) and Fink & Beck (2015)
Multi-method intervention	Gross et al. (2007), Xie (2011a), Czaja et al. (2013), Edwards et al. (2013), Kim et al. (2014) and Chiu et al. (2016)

5. Discussion

The main objectives of this systematic literature review were to summarise the best available evidence on the effectiveness of literacy interventions (e-health or health) in relation to the use of digital health platforms. In this systematic review, we identified a broad variety of intervention methods that focused on promoting the e-health or health literacy skills of elderly people and empowering them to use available e-health services. We also focused on the development of medical technology and transformation of digitalisation to all aspects of healthcare services globally and found that the ability of elderly people to deal with digital health platforms seems to be increasingly crucial. Obviously, literacy interventions (e-health or health) can provide senior citizens with the skills and knowledge necessary to benefit from digital health platforms (Watkins & Xie, 2014). As pointed out by Xie (2011a), e-health or health literacy training programmes can provide senior citizens with the skills and knowledge necessary to benefit from e-health resources and digital health services. We contribute to the literature by showing that the obtained results of any training session depend on different factors, including the demographic characteristics of the sample, the basic literacy level of the participants, and even the environment in which the training programme is delivered.

Moreover, there are various ways to increase the literacy ability among elderly people, and scholars should be able to find the most appropriate method for any sample group (Xie, 2011a & Xie, 2011c). Since each of the identified methods has its own advantages and disadvantages, it is the responsibility of the trainer to decide which method is most suitable for a specific sample. For example, the tailored intervention seems to be appropriate when a single characteristic dominates the variables on which individuals may be subdivided into groups with similar responsiveness to interventions (Beck et al., 2011). In the collaborative learning method, trainees work together and help each other in small groups to reach a common goal, and group members reap the benefit of interdependency. It means that any change in the state of a group member changes that of other group members (Xie, 2016). However, Xie (2011a, c) argued that there is no significant difference for learning outcomes between collaborative and tailored interventions. In the teach-back method, trainers are responsible for ensuring that everything is fully explained. Therefore, all the responsibility is on the health information providers (Morony et al., 2018). The hands-on method provides an opportunity for elderly people to learn by doing, so they can learn very rapidly and easily. Therefore, this method could be very useful for samples involving very old participants. If trainers cannot decide which method would best meet the educational needs of their sample, they could apply a combination of different methods. Different methods of intervention were used in the selected studies. Since 11 of the studies used the tailored intervention method, this method

seems to be the commonest way to improve older adults' literacy skills and empower them to use digital health services. Moreover, the tailored intervention method could offer a solution that addresses the effect of personal features and characteristics on the ability of senior people to use digital health platforms effectively. With a tailored literacy intervention, the intervention content considers factors like participants' computer experience, health literacy, income, educational attainment, age, race, ethnicity, language, or health issues (Watkins & Xie, 2014). Before any training method is applied, barriers should be identified and tackled. For senior citizens, intervention to improve literacy skills will likely be most effective when potential barriers have been overcome (Jacobs & Kane, 2016).

The studies examined in this systematic review included participants that varied considerably in age, but all the selected studies involved people aged 65 years and over. Moreover, more than 50% of the participants in most of the studies were female. In most studies, participants' income, education, race, or ethnicity were not reported, so it was not possible to compare these factors. However, different theories were applied in different studies, and two such theories – "social cognitive theory" and "learning theory" were used more frequently than others. Therefore, it might be presumed that in the context of elderly people, these two theories are the most practical.

Two different channels have been used to provide elderly people with training materials: face-to-face and online channels. Online channels provide various benefits such as integration into existing interventions, adaptability to the larger population, simplicity of data retrieval, and cost-effectiveness. These advantages are over face-to-face methods (Su et al., 2014). The online approach makes it possible to reach patients from a distance, exchange information across the world, and collect large datasets in order to monitor and improve healthcare services, thereby educating people or influencing their health behaviours (Andersson, 2018). However, most of the selected studies relied on face-to-face learning channels to transfer educational materials to elderly people, and recent studies show that this is mostly achieved by the use of ICTs, indicating that the use of technology is increasing in educational settings for elderly people.

6. Conclusion

This review paper investigated 32 academic articles on health literacy in the context of senior citizens aged 65 years and over. The systematic review results show that a higher level of e-health or health literacy skills among elderly people enables them to use digital health platforms and e-health services more frequently. We also found that healthy, literate aged people can navigate through digital health services, comprehend health-related information, and make health-related decisions. Besides this, health-literate elderly people are better able to use digital health tools. The review results and article analysis show that empowering elderly people with health literacy skills to motivate them to use digital health services can be achieved by applying different intervention methods. In this systematic literature review paper, all reviewed articles were selected from four electronic databases (Medline, PubMed, Scopus, and Web of Science). The results show that in all 32 articles, at least one intervention method has been utilised. The main five intervention methods

are tailored (individualistic) intervention, collaborative learning, the teach-back method, hands-on learning, and multi-method intervention. Since the positive role of health literacy training programmes on elderly people was demonstrated in all the selected studies, we argue that such intervention is an effective way to empower elderly people to effectively deal with online health information, digital health tools, e-health services, and digital health platforms. Moreover, it is important to note that such interventions should be supported by the family, friends, and society, as many of the reviewed articles indicated. These emotional supports encourage elderly people to continue the learning process, since people in this age group often experience more stress and anxiety than younger people when learning new skills.

6.1. Future Work and Limitations

In the next stage of development, this systematic literature review paper will be extended. Through a content analysis, a number of themes (e.g. health literacy, digital literacy, self-efficacy) were identified from the 32 selected articles. In addition, some of the reviewed articles provided some sort of statistical information, which makes them suitable for analysis through the use of comprehensive meta-analyses, which we plan to perform in the future.

This systematic literature review has several limitations. For example, only studies with full text written in English were included in the sample, so the findings of studies published in other languages were not considered and could be of relevance. In addition, this review paper only considers independent studies and identified five different methods of interventions in terms of using digital health services but does not specify which methods could be most suitable for improving the health literacy skills among senior citizens.

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