SYSTEMATIC REVIEW

The level of electronic health literacy among older adults: a systematic review and metaanalysis

Xin Jiang^{1†}, Lushan Wang^{2†}, Yingjie Leng¹, Ruonan Xie¹, Chengxiang Li¹, Zhuomiao Nie¹, Daiqing Liu³ and Guorong Wang^{4*}

Abstract

Background In the context of deeper integration of the internet and healthcare services, eHealth literacy levels have become an important predictor of public health outcomes and health-promoting behaviors. However, there is a lack of comprehensive understanding of eHealth literacy levels among older adults.

Objective To systematically assess the level of eHealth literacy among older adults.

Methods We conducted searches in MEDLINE, Embase, Web of Science, CINAHL, PsycINFO, China National Knowledge Infrastructure Database (CNKI), Wanfang Database, Weipu Database (VIP), and Chinese Biomedical Database (Sinomed) to collect survey studies on the eHealth literacy levels of the older adults, with a search timeframe from the establishment of the database to May 2024. The quality of the included literature was assessed using the Agency for Healthcare Research and Quality (AHRQ) and the Newcastle-Ottawa Scale (NOS). Additionally, subgroup analysis and meta-regression were conducted to detect sources of heterogeneity. Funnel plots and Egger's test were used to assess publication bias.

Results A total of 48 relevant studies were included, including 45 cross-sectional, 2 cohort studies and 1 longitudinal study, comprising 33,919 older adults. The quality of the studies was all above moderate, with 10 high-quality publications. Meta-integration results showed that the eHealth literacy score of older adults was 21.45 (95% Cl:19.81–23.08). Subgroup analysis showed that among the elderly population, females had lower eHealth literacy at 19.13 (95% Cl:15.83–22.42), those aged 80 years and older had lower eHealth literacy at 16.55 (95% Cl:11.73–21.38), and elderly individuals without a spouse and living alone had even lower eHealth literacy at 18.88 (95% Cl:15.71–22.04) and 16.03 (95% Cl:16.51–21.79). Based on region, eHealth literacy was lower among older adults in developing countries at 20.71 (95% Cl:18.95–22.48). Meta-regression results indicate that sample size and region can significantly impact heterogeneity.

Conclusion Our results found that the average eHealth literacy score of the elderly was 21.45, which was much lower than the passing level (≥ 32), suggesting that more attention should be paid to the eHealth literacy aspect of the

[†]Xin Jiang and Lushan Wang are co-first authors.

*Correspondence: Guorong Wang wangguorong@scu.edu.cn

Full list of author information is available at the end of the article

© The Author(s) 2024. **Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by-nc-nd/4.0/.







elderly. Meanwhile, due to the limitation of the literature sources, the global representativeness of the results of this study still needs to be supported by more research data from other countries.

Keywords EHealth literacy, Older adults, Meta-analysis, Systematic review

Text box 1 Contributions to the literature

EHealth literacy is one of the indispensable abilities in the Internet information age, but the overall eHealth literacy level of the elderly population is still unclear.

The level of eHealth literacy is closely related to healthrelated behaviors, so there is a need to focus on and improve the eHealth level of elderly people who live alone, especially in developing countries.

Policies and interventions need to be tailored to individuals, such as older women, who need more education on the use of electronic information technology.

Introduction

The World Health Organization reports that the global population aged 60 and older has surpassed 1 billion and is projected to reach 2.1 billion by 2050, further intensifying the trend of global aging [1]. It is well-established that as individuals age, their physiological systems decline, leading to an increase in health issues. As a result, the older adult population is the primary user of health services and has greater needs for medical information and services compared to other demographic groups [2, 3]. Prior to the advent of electronic information technology, older patients had limited access to medical protection and few options for medical services, such as health management, information counseling, and medical consultation. However, the internet has emerged as the most convenient and efficient means of obtaining and transmitting health information, thanks to the rapid advancement of information technology [4]. The growing utilization and incorporation of electronic information, communication technology, and mobile devices in healthcare have facilitated elderly individuals' access to health information and medical services through online platforms such as the internet and smart devices [5].

Accessing medical services and information online is undeniably convenient, contingent upon possessing the necessary internet-enabled devices and proficiency in utilizing the internet. However, the vast array of information available online necessitates a discerning approach, as the quality of information can vary significantly. Therefore, individuals must also possess a level of critical thinking skills to navigate and evaluate the information effectively. Nevertheless, previous studies have indicated that older adults are a particularly vulnerable group in the digital age [6], only 5.56–83.46% of older adults utilize the Internet seek healthcare services and medical information [7, 8]. Additionally, more than 50% of the elderly face challenges in accessing reliable, high-quality health information and lack the ability to discern between credible sources [2, 9]. Research indicates that the effectiveness of eHealth technology adoption is constrained by the level of eHealth literacy of the public, the higher the level of eHealth literacy, the better the ability of information acquisition and assessment [10]. EHealth literacy was first proposed by scholars such as Norman, it refers to an individual's ability to obtain, understand, evaluate health information from various online resources, and use it to solve health problems [11], eHealth literacy is considered a key skill that older adults must acquire in the digital age of disease management and healthcare, and is also predicted to be the most cost-effective means of maintaining health for all [4, 6]. Meanwhile, relevant scholars have discovered that the eHealth literacy of older adults is closely linked to their health outcomes. By enhancing the eHealth literacy levels of the elderly, their dietary habits can be improved, and their medication adherence can be strengthened [12, 13].

However, eHealth literacy levels vary based on time, environment, geographic region, and economic status. Some studies have noted significant differences in eHealth literacy between older and younger adults [14]. Currently, there is a lack of global data on the eHealth literacy levels of older adults. Therefore, the aim of our study is to conduct a systematic review of the relevant literature to accurately assess the level of eHealth literacy among older adults and identify potential influencing factors. This review aims to provide an evidence-based foundation for developing eHealth literacy interventions targeted at older adults.

Methods

The systematic review was performed according to the guidelines of the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA). The study protocol has completed registration on International Prospective Register of Systematic Reviews (PROSPERO), CRD42024529520.

Search strategy

In this study, MEDLINE, Embase, Web of Science, CINAHL, PsycINFO, CNKI, Wanfang, VIP, Sinomed were systematically searched by the researcher (XJ), and the researcher (YJL) supervised and reviewed the searching process and results from the time of database inception to May 2024. A combination of subject terms (e.g., Mesh subject terms were used to search PubMed) and free terms were used for the search. The following terms were used in the search strategy ("aged" OR "aging" OR "elder" OR "elderly" OR "old adult" OR "older adult" OR "old people" OR "older" OR "old" OR "senior" OR "senium") AND ("eHealth literacy" OR "e-Health literacy" OR "ehealth literacy" OR "e-Health literacy" OR "electronic health literacy" OR "digital health literacy" OR "mobile health literacy " OR "mHealth literacy"). Synonyms are connected using OR and non-synonyms are combined using AND. In addition, references to the included literature were tracked as an additional means of obtaining any other eligible studies. Detailed search strategies for each database are provided in Appendix 1, Supplementary Material.

Selection criteria

Inclusion criteria: (1) participants were older adults aged 60 years or above; (2) study type was observational studies including cross-sectional study or cohort study; (3) reports the electronic health literacy scores of the elderly or provides raw data that can be used for calculation; (4) the screening scale is the electronic health literacy scale (eHealth literacy scale, eHEALS). Exclusion criteria: (1) duplicate publication (Select the largest sample size or the newest survey time); (2) low-quality study (AHRQ scores \leq 3 or NOS scores < 4); (3) study with no access to the full text or no raw data provided; (4) conference papers. (5) not published in Chinese or English languages.

Study selection and data extraction

The researchers employed EndNote 20 Literature Manager to import and manage the search results. Following the elimination of duplicates by EndNote 20, the researchers initially screened the literature by reading the titles and abstracts according to the inclusion and exclusion criteria. They then rescreened the articles retained after the initial screening by reading through the full text of the articles to determine the final literature to be included in the research. Two researchers (XJ and LSW) independently conducted the literature screening and data extraction, with the results cross-checked at the end of each step. Any discrepancies were resolved through discussion or consultation with a third researcher (GRW). The data extraction process involved the following elements: first author, year, country, survey setting, study design, age, sample size, and eHealth literacy score. Baseline data were extracted from cohort studies. In the event that multiple papers were published based on the same dataset, only the paper with the most comprehensive information was included in the analysis.

Quality assessment

The cross-sectional study was evaluated using the risk of bias assessment tool recommended by the Agency for Healthcare Research and Quality (AHRQ) [15]. The tool comprises 11 entries, with a total score of 11 points. Each entry is scored as "yes" with one point, "no" or "unclear" with zero points. A score of 0-3 was classified as indicative of low quality, 4-7 as indicative of medium quality, and 8-11 as indicative of high quality. For cohort studies, the methodological quality of each included study was evaluated using the Newcastle-Ottawa scale (NOS) [16]. The Newcastle-Ottawa scale comprises eight items and assesses each study in three domains. Each study was evaluated in three domains, with scores of 0-3, 4-6, and 7-9 indicating low, medium, and high quality, respectively. The assessment of the study was conducted by two researchers independently, with both researchers completing the evaluation and cross-checking the results. In the event of a discrepancy, the two researchers discussed the matter and, if they were unable to reach an agreement, a third party was consulted to make a determination.

Data analysis

The effect sizes of the study results were pooled and analyzed using Stata software (version 16.0). The heterogeneity of the study was determined jointly by Cochrane's Q test and I^2 index. A fixed-effects model was employed for meta-analysis in the presence of $P \ge 0.05$ and $I^2 < 50\%$, while a random-effects model was used for effect size pooling in the event of P < 0.05 and $I^2 \ge 50\%$. Subgroup analyses and meta-regression were also conducted to further analyze the sources of heterogeneity. To ascertain the stability and reliability of the study results, a one-by-one exclusion method was employed in sensitivity analyses. Statistical significance was determined at the 0.05 level. In order to detect the presence of publication bias in the outcome indicators, Egger's test, funnel plot, and trim-and-fill method were combined.

Results

Search results

A comprehensive literature search yielded a total of 3476 studies. After eliminating duplicates, 2343 studies remained. Following an initial reading of titles and abstracts, 129 studies were selected for further analysis. After rescreening full-text,81 studies were excluded. Ultimately, 48 studies were included for meta-analysis. The specific process and results are shown in Fig. 1.

Study characteristics and methodological quality

A total of 48 studies were included in the study, cross sectional (n=45), cohort studies (n=2) and longitudinal study (n=1) [Table 1]. The total sample size of the studies was 33,919, of which studies included a minimum sample size of 52 and a maximum of 6,183, with 22.4% of the studies having a sample size greater than 500.



Fig. 1 Flow diagram of the searching and screening of eHealth literacy for the older adults

Most of the studies were published after 2020, with 2023 being the most common (n=15) at 31.3%, and 77.6% of the studies were from developing countries. Literature quality assessment showed that all included studies were of medium to high quality, with high quality literature (n=10), accounting for 20.8%. [Appendix 3, Supplementary Material]

Results of the meta-analysis of the eHealth literacy

The results of the 48 included studies were tested for heterogeneity, and the results demonstrated significant heterogeneity among studies (I^2 =99.8%, P<0.001). Therefore, the random effects model was employed for the analysis. The meta-analysis results indicated that the composite score of eHealth literacy among the elderly was 21.45 (95% CI: 19.81, 23.08). The forest plot is presented in Fig. 2.

Subgroup analysis and metaregression analysis

The included studies were classified according to gender, age group(i.e.,60–69,70–79,and \geq 80), marital status, residential status, sample size, and region(based on the United Nations criteria for classifying countries, i.e., developed country, or developing country) [Table 2]. The results of the subgroup analysis indicated that men had higher eHealth literacy scores (21.46, 95% CI: 20.04–22.88) than women (19.13, 95% CI: 15.83–22.42). Based on age group, individuals aged \geq 80 years old exhibited the lowest eHealth literacy scores (16.55, 95% CI: 11.73–21.38). The results of subgroup analysis indicated that those with no spouses and elderly living alone exhibited the lowest eHealth literacy levels, with scores of 18.88 (95% CI: 15.71–22.04) and 16.03 (95% CI: 16.51-2) The scores for sample sizes <300, 300–500, and >500 were 22.85 (95% CI: 20.95–24.74), 21.16 (95% CI: 18.75–23.57), 18.80(95% CI: 15.18–22.42). And the eHealth literacy levels of the elderly in developed and developing countries were 23.98 (95% CI: 20.78–27.17) and 20.71 (95% CI: 18.95–22.48), respectively. The meta-regression results are shown in Table 3.

Sensitivity analysis and publication Bias

A sensitivity analysis was conducted using the exclusionby-exclusion method. The results demonstrated that there was no significant change in the scores obtained by excluding each study, suggesting that the results of the studies were more stable. The risk of bias was evaluated using a funnel plot and Egger's test. The funnel plot indicated that the distribution of the included studies was not completely symmetrical (see Fig. 3). The result of Egger's test (t=2.39, P=0.021<0.05) suggested that there was a certain publication bias in this study. Further

Table 1 Characteristics of included studies of eHealth literacy among the older adults

First Author	Year	Country	Setting	Study design	Age	Sample	EHealth Score	Quality assessment
Kim [17]	2024	Korea	Online/Hospital	Cross-sectional	l 72.1±5.3 252		23.44±8.08	7 ^a
Li [18]	2024	China	Community	Cross-sectional	63.8 ± 6.4	248	17.70 ± 5.30	7 ^a
Li [19]	2024	China	Hospital	Cross-sectional	≥60	325	18.73 ± 10.64	8 ^a
Keles [20]	2024	Turkey	Hospital	Cohort	≥60	86	21.81 ± 7.43	6 ^b
Li [21]	2024	China	Community	Cross-sectional	72.0 ± 7.0	2144	17.56 ± 9.61	6 ^a
Dai [11, 22]	2024	China	Community	Cross-sectional	70.82 ± 6.71	413	23.26 ± 6.00	6 ^a
Xu [23]	2024	China	Hospital	Cross-sectional	73.4 ± 7.9	366	19.74 ± 5.13	7 ^a
Zhu [<mark>24</mark>]	2024	China	Hospital	Cross-sectional	≥60	289	17(12,25)	8 ^a
Mamiko [25]	2024	Japan	Rural area	Cross-sectional	76.9 ± 5.9	561	12.40 ± 8.20	8 ^a
Ghazi [<mark>26</mark>]	2023	Sweden	Online	Cross-sectional	78.0 ± 2.4	364	27.5 ± 10.08	8 ^a
Zhang [27]	2023	China	Hospital	Cross-sectional	≥60	333	23.35 ± 9.85	7 ^a
Yuan [28]	2023	China	Community	Cross-sectional	69.4 ± 5.8	335	23.67±7.92	7 ^a
Park [29]	2023	Korea	Community	Cross-sectional	74.2 ± 6.59	398	16.96±8.72	5 ^a
Liu [30]	2023	China	Hospital	Cross-sectional	70.7 ± 6.9	1545	15(12,21)	8 ^a
Pang [31]	2023	China	Hospital	Cohort	67.28±3.42	529	24.77±6.81	5 ^b
Özturk [32]	2023	Turkey	Hospital	Cross-sectional	≥60	100	19.89±9.62	6 ^a
Hu [33]	2023	China	Hospital	Cross-sectional	≥60	235	22.11±8.59	7 ^a
Zhang [34]	2023	China	Community	Cross-sectional	≥60	125	23.30 ± 7.45	7 ^a
Xiong [35]	2023	China	Hospital	Cross-sectional	66.8 ± 4.7	125	24.09 ± 4.17	6 ^a
Xie [36]	2023	China	Online	Cross-sectional	≥60	213	23(13,33)	7 ^a
Xie [37]	2023	China	Hospital	Cross-sectional	≥60	110	27.99 ± 5.37	6 ^a
Zhu [38]	2023	China	Community	Cross-sectional	72.6 ± 5.4	6183	21.17±8.25	8 ^a
Jiang [39]	2023	China	Hospital	Cross-sectional	≥65	230	24.66±6.86	8 ^a
Cao [40]	2023	China	Community	Cross-sectional	71.9 ± 7.2	4218	12.57 ± 10.00	7 ^a
Wu [41]	2022	China	Nursing home	Cross-sectional	68.6 ± 5.4	289	19.15 ± 9.60	8 ^a
Wang [42]	2022	China	Community	Cross-sectional	71.7±1.8	415	16.56±4.08	7 ^a
Duan [43]	2022	China	Hospital	Cross-sectional	69.9 ± 6.5	209	22.68±10.48	7 ^a
Moon [44]	2022	England	Hospital	Cross-sectional	≥60	583	26.10±8.37	5 ^a
Chi [45]	2022	China	Hospital	Cross-sectional	≥60	500	23.97 ± 5.75	7 ^a
Yu [46]	2022	Canada	Online	Cross-sectional	71.5 ± 5.1	2454	25.95 ± 6.98	5 ^a
Li [47]	2022	China	Hospital	Cross-sectional	≥60	355	18.07±10.22	7 ^a
Zhang [48]	2022	China	Community	Cross-sectional	≥60	915	22.81±5.10	7 ^a
Zhou [49]	2022	China	Community	Cross-sectional	71.0 ± 5.6	274	24(14.32)	8 ^a
Wona [50]	2022	China	Community	Cross-sectional	71.7 ± 6.0	68	25.0 ± 8.7	6 ^a
Lee [51]	2022	Korea	Online	Cross-sectional	≥60	67	28.45 ± 5.26	8 ^a
Liu [52]	2022	China	Community	Cross-sectional	69.6 ± 6.7	449	22.88±10.64	7 ^a
Li [53]	2021	China	Hospital	Cross-sectional	68.8 ± 6.1	214	20(14.23)	7 ^a
Liu [54]	2021	China	Community	Cross-sectional	>60	3870	10.20+6.53	7 ^a
Cui [55]	2021	China	Community	Cross-sectional	70.1+6.3	1201	17.24+9.34	7 ^a
Auswin [56]	2021	Thailand	Hospital	Cross-sectional	670+52	110	296+415	6ª
Guo [57]	2021	China	Online	Cross-sectional	> 60	495	196+879	7 a
L in [58]	2020	Iranian	Hospital	Longitudinal	693+73	468	28 16 + 5 46	, 8 ^a
Liu [59]	2020	China	Rural area	Cross-sectional	> 60	472	1376 + 730	7 ^a
Lee [60]	2020	Korea/	Community	Cross-sectional	200 713+67/	104/113	2848+48/	4 ^a
	2020	USA	Community		73.0±11.9	101/113	21.6 ± 12.64	·
Hoogland [<mark>6</mark> 1]	2020	USA	Hospital	Cross-sectional	≥65	101	27.52 ± 7.28	6 ^a
Choi [<mark>62</mark>]	2020	Korea	Community	Cross-sectional	75.6 ± 6.0	186	25.35 ± 7.63	6 ^a
Kang [<mark>63</mark>]	2020	China	Hospital	Cross-sectional	≥60	52	19.90 ± 10.48	7 ^a
Zhou [<mark>64</mark>]	2018	China	Community	Cross-sectional	69.6 ± 6.6	228	12.08 ± 7.68	6 ^a

NR: not report; a: AHRQ score b: NOS score

analysis was conducted using the trim-and-fill method, which revealed that the distribution of the funnel plot was essentially symmetrical after the inclusion of nine additional documents, with a combined result of 20.02 (95% CI: 18.60, 21.44). (see Appendix 4, Supplementary material). And the combined results were statistically significant before and after using the trim-and-fill method (P < 0.001), indicating that the change in the combined effect value was not significant, the publication bias did not have a significant effect on the combined results, and the results were robust.



Variables	Number of Studies	Sample Size	Heterogeneity		Meta-analysis Results		P Value for Difference
			l ² (%)	P Value	Mean Score(95%CI)	P Value	-
Gender							0.202
Male	11	2233	97.0	< 0.001	21.46(20.04, 22.88)	< 0.001	
Female	11	2141	99.2	< 0.001	19.13(15.83, 22.42)	< 0.001	
Age							0.131
60–69	11	1676	97.8	< 0.001	21.93(19.34, 24.52)	< 0.001	
70–79	11	1010	99.1	< 0.001	19.31(15.35, 23.28)	< 0.001	
≥80	7	270	95.2	< 0.001	16.55(11.73, 21.38)	< 0.001	
Marital status							0.746
Spousal	10	3037	99.0	< 0.001	19.55(16.99, 22.11)	< 0.001	
Non-spousal	10	776	98.2	< 0.001	18.88(15.71, 22.04)	< 0.001	
Living status							0.069
Live alone	7	326	84.6	< 0.001	16.03(13.96, 18.1)	< 0.001	
Non alone	7	1966	98.6	< 0.001	19.15(16.51, 21.79)	< 0.001	
Sample size							0.131
<300	24	4028	98.6	< 0.001	22.85(20.95, 24.74)	< 0.001	
300-500	14	5688	99.4	< 0.001	21.16(18.75, 23.57)	< 0.001	
>500	11	24,203	99.9	< 0.001	18.80(15.18, 22.42)	< 0.001	
Country							0.08
Developed	11	5183	99.4	< 0.001	23.98(20.78, 27.17)	< 0.001	
Developing	38	28,736	99.7	<0.001	20.71(18.95, 22.48)	< 0.001	

 Table 2
 Subgroup analysis of eHealth literacy scores among older adults

Table 3 Meta-regression analysis results of eHealth literacyscores among older adults

Covariate	β	SE	95%CI	t value	P value
Sample size	-1.97	0.80	-3.60~-0.37	-2.48	0.017
Publication year	-0.81	1.86	-4.55~2.93	-0.44	0.665
Country	3.27	1.57	0.10~6.43	2.08	0.043

Discussion

In the face of the intensifying global aging trend and the increase in the elderly population, paying attention to and safeguarding the physical health of the elderly population and maintaining their normal physiological functions are important measures to alleviate the medical



Fig. 3 Funnel plot of publication bias in eHealth literacy scores for older adults

pressure and economic burden, and to promote the sustainable development of the society. EHealth literacy, as an important predictor of health outcomes and health behaviors in the older adult, is one of the indispensable personal competencies for the older adult in the Internet information age. In this study, the eHealth literacy score of older adults was 21.45 (95% CI: 19.81,23.08), which was much lower than the pass level [33, 65]. EHealth literacy, as an important means of evaluating the public's use of internet information technology, is considered to be a set of basic competencies that individuals possess to improve their self-health in the digital age [66]. The results of several systematic reviews have shown that [12, 13], there is a positive relationship between eHealth literacy and health-related behaviors, and that older adults with high e-health literacy perform better in self-care and medication use adherence. And interventions on eHealth literacy can help the physical condition and health management of the older adults [67].

Subgroup analysis by gender demonstrated that eHealth literacy was lower among older women than among older men, which is contrary to the findings of Meier et al [68] on health literacy among older adults. This may be attributed to the fact that eHealth literacy encompasses not only health literacy but also the ability to access and utilize electronic information using media, computers, etc [11, 22]. Kim et al. found [69] that females are indeed weaker than males in the utilization of electronic information technology, the probability of using the internet for men is 1.5% higher than that for women [70]. Yoon et al. pointed out [71] that socioeconomic status may directly affect older adults' ability to use the internet. Most of the women in this study were from developing countries, and in the context of previous realities (economic situation of the country, distribution of educational resources, historical and cultural backgrounds, etc.), the lower socio-economic status of older women undoubtedly hindered their utilization of the internet [72]. Therefore, for elderly women, we should reduce their difficulty in accessing information and improve their ability to utilize electronic information technology, and promote the enhancement of elderly women's eHealth literacy by increasing the convenience of accessing electronic information resources. Nevertheless, some scholars [73] have found that there is no difference in eHealth literacy by gender. This may be related to the fact that the study's analyzed population also included adults under 60 years of age. This indicates that the disparity in women's access to information resources is gradually diminishing.

A gradual decrease in eHealth literacy scores with increasing age was found in the age subgroups, which is consistent with the findings of previous studies [73, 74]. Although eHealth literacy has great potential for health promotion among older adults [66], older adults have difficulties in learning, accepting, and utilizing electronic information technology and online healthcare services due to various physiological, psychological, and others, including technology anxiety, declining cognitive abilities, and lack of training or support [75, 76], and the problem becomes more pronounced the older they get [77].But some studies [67] have indicated that positive training interventions have a positive effect on the eHealth literacy of older adults. In particular, face-to-face digital health literacy training has been shown to significantly improve the eHealth literacy level of older adults. Therefore, how to apply scientific and effective interventions to the real world is a key step in improving eHealth literacy among the elderly. Primary healthcare institutions, as the cornerstone of the medical service system, have characteristics such as convenient access to services and a wide coverage area. Therefore, we can rely on primary healthcare institutions, combined with the strength of community workers, to carry out training and guidance in electronic information technology (such as health information search methods, operational guidance for common applications, methods for identifying false information, etc.) gradually improve the electronic health literacy of the elderly to meet their practical needs in the digital age.

EHealth literacy scores were found to be lower among the older adults without spouses and living alone, a finding that is consistent with the results reported by Liu et al [74]. This may be attributed to the level of social support received. Prior research has indicated that social support is a significant predictor of older adults' utilization of electronic information resources for the purpose of searching for health behaviors [78]. And it has also been found that adopting a collaborative peer learning approach has a long-term positive effect on eHealth literacy among older adults [79]. This suggests that eHealth literacy can be improved by increasing the social support of elderly people [73, 80]. Among the sources of social support, support from family and friends is an effective way to improve eHealth literacy [81, 82]. Consequently, an increasing number of scholars have put forth the proposition of bridging the digital divide among the elderly through the implementation of "technology feedback, intergenerational support, and peer education," with the objective of enhancing their proficiency in internet usage.

Despite the results of the Meta regression analysis indicating that region and sample size may be significant factors influencing the heterogeneity of the study, heterogeneity still exists after conducting subgroup analyses based on region and sample size, suggesting that the sources of heterogeneity in the research still need further exploration. The results of the subgroup analysis by region show. that there are differences in the level of electronic health literacy between elderly people in developed countries and those in developing countries. The division of countries according to their level of development revealed that the older adults in developing countries exhibited lower levels of eHealth literacy. The reason for this may be related to differences in Internet information construction, the number of elderly population, and welfare protection for the older adults. As indicated by the World Health Organization (WHO), developing countries are experiencing the most rapid growth in the number of individuals aged 60 and above [1]. It is projected that by 2050, nearly 80% of the world's older population will be residing in less developed countries. In light of the rapidly growing number of older adults, developing countries must take an active role in addressing the social, economic, and medical challenges posed by this demographic shift. It is imperative that they prioritize the health and well-being of their older populations and promote active aging. Meanwhile, in this study, it was observed that the results of studies divided into different sample sizes exhibited some discrepancies. The sample size has a direct impact on the accuracy and reliability of the results. Therefore, it is recommended that further large-sample, multicenter studies be conducted in the future to further validate the robustness of the results.

Strength and limitations

In general, our study conducted a comprehensive search of the relevant study on the eHealth literacy of the older adult and employed a systematic evaluation of the level of eHealth literacy among this population. Furthermore, studies with low quality literature were excluded in order to ensure the veracity and dependability of the data. Ultimately, our research also yielded insights into the key population for eHealth literacy intervention, offering a novel perspective for future research. Nevertheless, this study is not without limitations. First, this study included only Chinese and English literature, as well as a lack of searching the gray literature, which may have led to some bias in the data results; Secondly, significant heterogeneity was observed among the included studies, which may be due to differences in study design, sample inclusion, and data processing among the studies. Of course, the considerable heterogeneity between studies somewhat limits the generalizability of the results, and further validation of the results is still needed in the future; Next, the uneven distribution of samples and regions is another limitation of this study. Most of the studies included in the analysis come from developing countries, which may limit the representativeness of the electronic health knowledge levels of older adults in developed areas. Therefore, future studies should include more data from developed regions, which would be useful for further investigation and follow-up studies on the level of eHealth literacy among older adults.

Conclusions

In summary, our study found that the overall eHealth literacy level of the older adult is relatively low, which hinders the popularization and utilization of electronic information resources and internet medical services for the older adult. We also found that there are differences in the level of eHealth literacy among older adults by gender and age, and the reasons that hinder their use vary. Therefore, it is recommended that follow-up and management of eHealth literacy be added to the health management of the older adults to promote the formation and improvement of their health-related behaviors. For example, training classes can be organized in the community based on the different needs of the older adults (such as teaching mobile applications, popularizing electronic health literacy inquiry methods, methods for identifying online information, and solutions for when problems arise) to enhance their ability to apply, judge, and make decisions regarding electronic information; Secondly, knowledge competitions on electronic information technology, etc. can also be organized to understand and promote the elderly's mastery of knowledge in the form of games; In addition, an eHealth literacy profile management booklet for the older adults can be established to conveniently record their usage of electronic information technology and any existing issues, facilitating the updating and setting of teaching content for future training classes.

Supplementary Information

The online version contains supplementary material available at https://doi.or g/10.1186/s13690-024-01428-9.

Supplementary Material 1	
Supplementary Material 2	
Supplementary Material 3	
Supplementary Material 4	
Supplementary Material 5	

Author contributions

Study design: JX, WLS. Data extraction and collection: JX, LYJ, and XRN. Data analysis and interpretation: JX, LCX, and NZM. Manuscript writing: JX, LDQ. and WGR. All authors read and approved the final manuscript.

Funding

No funding was received for this study.

Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethical approval

None.

Informed consent No applicable.

Competing interests

The authors declare no competing interests.

Author details

¹Department of Nursing, Chengdu University of Traditional Chinese Medicine, Chengdu 610072, China ²The Traditional Chinese Medicine Hospital of Longquanyi, Chengdu 610100, China ³Medical College of University of Electronic Science and Technology of China, Chengdu 611731, China ⁴West China School of Public Health and West China Fourth Hospital, West China Nursing School, Sichuan University, Chengdu 610041, China

Received: 30 July 2024 / Accepted: 17 October 2024 Published online: 07 November 2024

References

- World Health Organization. (2019).Decade of Healthy Ageing (2021– 2030).https://www.who.int/initiatives/decade-of-healthy-ageing
- Liu YF, Liu CJ. Study on the realistic dilemma of the Elderly's Access to Internet Medical resources. Health Econ Res. 2024;41(06):49–53. https://doi.org/10.140 55/j.cnki.33-1056/f.2024.06.007.
- Wang K, Dong Y, Li ZJ, et al. Current Situation and related factors of Internet Medical Service utilization among older adults in China. Med Soc. 2024;37(05):1–9. https://doi.org/10.13723/j.yxysh.2024.05.001.
- Cai W, Liang W, Liu H, et al. Electronic health literacy Scale-Web3.0 for older adults with noncommunicable diseases: Validation Study. J Med Internet Res. 2024;26:e52457. https://doi.org/10.2196/52457.
- Hu CD, Liu YL, Liu XF, et al. Advances in e-health literacy research among older adults in the context of active aging. Chin J Health Educ. 2024;40(05):446–50. https://doi.org/10.16168/j.cnki.issn.1002-9982.2024.05.01
 2.
- Yang SY, Liu Y, Yu MF, et al. Research progress on the status and intervention of e-health literacy in elderly patients with cancer. J Nurses Train. 2024;39(08):812–6. https://doi.org/10.16821/j.cnki.hsjx.2024.08.006.
- Li P, Zhang C, Gao S, et al. Association between Daily Internet Use and Incidence of Chronic diseases among older adults: prospective cohort study. J Med Internet Res. 2023;25:e46298. https://doi.org/10.2196/46298.
- Li L. Internet use and frailty in middle-aged and older adults: findings from developed and developing countries. Global Health. 2024;20(1):53. https://do i.org/10.1186/s12992-024-01056-6.
- Yang B, Jin DC. (2021) The Manifestation, Motivation and Solution of Elderly Digital divide. Acad J Zhongzhou (12):74–80.
- Shiferaw KB, Tilahun BC, Endehabtu BF, et al. E-health literacy and associated factors among chronic patients in a low-income country: a cross-sectional survey. BMC Med Inf Decis Mak. 2020;20(1). https://doi.org/10.1186/s12911-0 20-01202-1.
- 11. Norman CD, Skinner HA. eHEALS: the eHealth literacy scale. J Med Internet Res. 2006;8(4). https://doi.org/10.2196/jmir.8.4.e27.
- 12. Xie L, Zhang S, Xin M, et al. Electronic health literacy and health-related outcomes among older adults: a systematic review. Prev Med. 2022;157:106997. https://doi.org/10.1016/j.ypmed.2022.106997.
- Kim K, Shin S, Kim S, et al. The relation between eHealth literacy and healthrelated behaviors: systematic review and Meta-analysis. J Med Internet Res. 2023;25:e40778. https://doi.org/10.2196/40778.
- Li MH, Qin WZ, Xu LZ, et al. E-health literacy and its influencing factors among middle-aged and elderly community residents in different regions of Tai'an city. Chin J Public Health. 2021;37(9):1328–32. https://doi.org/10.11847/zggg ws1135052.
- 15. Zeng X, Zhang Y, Kwong JS, et al. The methodological quality assessment tools for preclinical and clinical studies, systematic review and meta-analysis,

and clinical practice guideline: a systematic review. J Evid Based Med. 2015;8(1):2–10. https://doi.org/10.1111/jebm.12141.

- Stang A. Critical evaluation of the Newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. Eur J Epidemiol. 2010;25(9):603–5. https://doi.org/10.1007/s10654-010-9491-z.
- Kim M, Kim B, Park S. Social support, eHealth literacy, and mHealth Use in older adults with diabetes. CIN-COMPUTERS Inf Nurs. 2024;42(2):136–43. https://doi.org/10.1097/CIN.00000000001081.
- Li HY, Zhang JM, Wen ZQ, et al. Relationship between potential profile analysis of e-health literacy and physical activity level in elderly diabetic patients in community. Chin J Practical Nurs. 2024;07:540–7. https://doi.org/10.3760/cm a.j.cn211501-20231011-00720.
- Li C, Yu DJ, Bu L. Associations of E-health literacy with health promotion behavior and quality of life among the elderly patients with chronic diseases. J Baotou Med Coll. 2024;40(05):65–71. https://doi.org/10.16833/j.cnki.jbmc.20 24.05.013.
- Keles A, Kose M, Somun UF, et al. Impact of health and digital health literacy on quality of life following radical prostatectomy for prostate cancer: prospective single-center cohort study. World J Urol. 2024;42(1). https://doi.org/ 10.1007/s00345-024-04960-z.
- Li SJ, Hu MZ, An R, et al. Relationship between eHealth literacy and healthy aging in older Chinese people: the mediating effect of Health behaviors. JOURNAL OF THE AMERICAN; 2024. https://doi.org/10.1016/j.jamda.2023.06.0
 26. MEDICAL DIRECTORS ASSOCIATION 25(2).
- Xia HZ, Gu LB, Wang QL, et al. Review of the concepts and measurement tools of digital health literacy. Chin J Health Educ. 2023;39(07):642–6. https:// doi.org/10.16168/j.cnki.issn.1002-9982.2023.07.013.
- Xu Q, Liu CB, Chen C, et al. Analysis of e-health literacy level of elderly COPD patients and its influencing factors. Zhejiang Clin Med J. 2024;26(04):547–9.
- 24. Yiran Z, Yan Z, Lijun X, et al. Current status and influencing factors of activation of older patients with chronic disease. Front Public Health. 2023;11:1308196. https://doi.org/10.3389/fpubh.2023.1308196.
- Eto M, Yamatsu K. Associations of eHealth literacy with Social Activity among Community-Dwelling older adults: a cross-sectional study. Eur J Investig Health Psychol Educ. 2024;14(5):1279–94. https://doi.org/10.3390/ejihpe1405 0084.
- Ghazi SN, Berner J, Anderberg P, et al. The prevalence of eHealth literacy and its relationship with perceived health status and psychological distress during Covid-19: a cross-sectional study of older adults in Blekinge, Sweden. BMC Geriatr. 2023;23(1). https://doi.org/10.1186/s12877-022-03723-y.
- Zhang X, Lin Y, Xia BY, et al. Relationship between technology acceptance and eHealth literacy in old patients with coronary arteery disease. Chin Nurs Res. 2023;37(24):4403–7. https://doi.org/10.12102/j.issn.1009-6493.2023.24.00 7.
- Yuan C, Wei XM, Wu XY, et al. Effects of eHealth literacy on health seeking behavior in elderly patients with chronic diseases:the mediating role of social support and self-efficacy. Mod Prev Med. 2023;50(24):4475–9. https://doi.org/ 10.20043/j.cnki.MPM.202308097.
- Park SY, Chung S. E-health literacy and associated factors among Korean adults during the COVID-19 pandemic: age-group differences. Health Promot Int. 2023;38(5). https://doi.org/10.1093/heapro/daad099.
- Liu ZP, Wang LR, Lou CY, et al. The mediating role of electronic health literacy and social support between depression and health-related quality of life in elderly patients with chronic diseases. J Nurs Sci. 2023;38(22):93–6. https://do i.org/10.3870/j.issn.1001-4152.2023.22.093.
- Pang R, Sun DD, Zhang YM. Correlation between e-health literacy scale score and MACE in aged AMI patients in northwest China. Chin J Cardiovasc Rehabilitation Med. 2023;32(05):441–6. https://doi.org/10.3969/j.issn.1008-00 74.2023.
- Özturk ES, Canbolat O, Polat U. Internet use, eHealth literacy, and influencing factors in Turkish Cancer patients: a descriptive and correlational study. Semin Oncol Nurs. 2023;39(4). https://doi.org/10.1016/j.soncn.2023.151469.
- Hu YF, Chen L, Deng Y, et al. Status quo and influencing factors of eHealth literacy in elderly patients with chronic diseases. Chin Nurs Res. 2023;37(19):3442–7. https://doi.org/10.12102/j.issn.1009-6493.2023.19.005.
- Zhang N, Gao CX, Wang AY, et al. Effects of e-health literacy and health promoting lifestyle on quality of life for community disabled elderly. J Nurs Adm. 2023;23(10):854–8. https://doi.org/10.3969/j.issn.1671-315x.2023.10.015.
- Xiong WW, Guo J, Li FQ. Current status and influencing factors of safe medication behavior in elderly patients with chronic diseases. Chin J Public Health Eng. 2023;22(06):794–6. https://doi.org/10.19937/j.issn.1671-4199.2023.06.02

- Xie YQ, Zhang XG, Cao B, et al. Correlation analysis between technology anxiety and eHealth literacy among urban elderly people. J Mod Clin Med. 2023;49(04):279–81. https://doi.org/10.11851/j.issn.1673-1557.2023.04.011.
- Xie L, Mo PKH. Comparison of eHealth literacy scale (eHEALS) and Digital Health Literacy Instrument (DHLI) in Assessing Electronic Health Literacy in Chinese older adults: a mixed-methods Approach. Int J Environ Res Public Health. 2023;20(4). https://doi.org/10.3390/ijerph20043293.
- Zhu X, Yang F. The association among eHealth literacy, depressive symptoms and health-related quality of life among older people: a cross-section study. Int J Older People Nurs. 2023;18(1):e12497. https://doi.org/10.1111/opn.1249 7.
- Jiang Y, Gao J, Sun P, et al. Factors Associated with the e-Health literacy among older adults with chronic obstructive Pulmonary Disease: a cross-sectional study. Telemed J E Health. 2023. https://doi.org/10.1089/tmj.2023.0394.
- Cao C, Cao W, Zheng X, et al. Association of social capital with self-perceived eHealth literacy among community-dwelling older people: age and gender differences. Front Public Health. 2023;11:1088863. https://doi.org/10.3389/fp ubh.2023.1088863.
- Wu Y, Wen J, Wang X, et al. Associations between e-health literacy and chronic disease self-management in older Chinese patients with chronic non-communicable diseases: a mediation analysis. BMC Public Health. 2022;22(1):2226. https://doi.org/10.1186/s12889-022-14695-4.
- Wang YN, Wang AM, Zhu YR, et al. Current state of eHealth literacy and its relationship with health promoting behaviors among community-dwelling older adults. J Nurs Sci. 2022;37(10):100–2. https://doi.org/10.3870/issn.100I-4 152.2022.10.100.
- Duan YW, Chen MY, Lu MM. A study on E-health literacy and its influencing factors in the Elderly with Coronary Heart Disease. Shanghai Nurs. 2022;22(11):37–40. https://doi.org/10.3969/j.issn.1009-8399.2022.11.008.
- Moon Z, Zuchowski M, Moss-Morris R, et al. Disparities in access to mobile devices and e-health literacy among breast cancer survivors. Support Care Cancer. 2022;30(1):117–26. https://doi.org/10.1007/s00520-021-06407-2.
- Chi CH, Zhou ZQ, Liu H, et al. Current Situation and influencing factors of Safe Drug Use Behavior in Elderly patients with Chronic diseases. J Changzhi Med Coll. 2022;36(06):414–7. https://doi.org/10.3969/j.issn.1006-0588.2022.06.004.
- Yu E, Hagens S. Socioeconomic disparities in the demand for and use of virtual visits among senior adults during the COVID-19 Pandemic: crosssectional study. JMIR Aging. 2022;5(1):e35221. https://doi.org/10.2196/35221.
- Li JY, Zhang HJ. Mediating effect of disease self-efficacy on e-health literacy and self-management behavior of elderly hypertensive patients. Chin Gen Pract Nurs. 2022;20(25):3457–61. https://doi.org/10.12104/j.issn.1674-4748.20 22.25.001.
- Zhang W, Zhao YN, Liu Y. Current situation and influencing factors of electronic health literacy of the elderly. Mod Prev Med. 2022;49(09):1642–6.
- Zhou CQ. Study on the correlation among E-health Literacy, Health Promotion Behavior and cognitive function of the Elderly in Community. 2023. https: //https://doi.org/10.27134/d.cnki.ghbzc.2022.000358
- Wong AKC, Bayuo J, Wong FKY. Investigating predictors of self-care behavior among homebound older adults: the role of self-efficacy, eHealth literacy, and perceived social support. J Nurs Scholarsh. 2022;54(3):278–85. https://doi .org/10.1111/jnu.12730.
- Lee J, Tak SH. Factors associated with eHealth literacy focusing on digital literacy components: a cross-sectional study of middle-aged adults in South Korea. Digit Health. 2022;8:20552076221102765. https://doi.org/10.1177/205 52076221102765.
- Liu JB. A study on the correlation between personality, social support and electronic health literacy of the elderly in YanJi city.2022.https://https://doi.or g/10.27439/d.cnki.gybdu.2022.000778
- Li PY, Chen X, Zhang HM. Status of eHealth literacy and influencing factors in elderly diabetic patients. Mod Clin Nurs. 2021;20(11):8–14. https://doi.org/10. 3969/j.issn.1671-8283.2021.11.002.
- Liu WJ, Qin WZ, Xu LZ, et al. Associations of e-health literacy with life satisaction and quality of life among the elderly in Tai'an city Chinese. J Public Health. 2021;37(09):1333–6. https://doi.org/10.11847/zgggws1135051.
- Cui GH, Li SJ, Yin YT, et al. The relationship among social capital, eHealth literacy and health behaviours in Chinese elderly people: a cross-sectional study. BMC Public Health. 2021;21(1):45. https://doi.org/10.1186/s12889-02 0-10037-4.
- Rojanasumapong A, Jiraporncharoen W, Nantsupawat N, et al. Internet use, Electronic Health Literacy, and Hypertension Control among the Elderly at an Urban Primary Care Center in Thailand: a cross-sectional study. Int J Environ Res Public Health. 2021;18(18). https://doi.org/10.3390/ijerph18189574.

- Guo ZQ, Zhao SZ, Guo NY, et al. Socioeconomic disparities in eHealth literacy and preventive behaviors during the COVID-19 pandemic in Hong Kong: cross-sectional study. J Med Internet Res. 2021;23(4). https://doi.org/10.2196/ 24577.
- Lin CY, Ganji M, Griffiths MD, et al. Mediated effects of insomnia, psychological distress and medication adherence in the association of eHealth literacy and cardiac events among Iranian older patients with heart failure: a longitudinal study. Eur J Cardiovasc Nurs. 2020;19(2):155–64. https://doi.org/10.1177 /1474515119873648.
- Liu Z, Zhang H, Zhang Y, et al. Current situation and influencing factors of e-health literacy among rural older adults in Zhengzhou. Mod Prev Med. 2020;47(02):283–6.
- Lee OEK, Kim DH, Beum KA. Factors affecting information and communication technology use and eHealth literacy among older adults in the US and South Korea. Educ Gerontol. 2020;46(9):575–86. https://doi.org/10.1080/0360 1277.2020.1790162.
- Hoogland AI, Mansfield J, Lafranchise EA, et al. eHealth literacy in older adults with cancer. J Geriatr Oncol. 2020;11(6):1020–2. https://doi.org/10.1016/j.jgo. 2019.12.015.
- 62. Choi M. Association of eHealth Use, literacy, informational Social Support, and Health-promoting behaviors: mediation of Health Self-Efficacy. Int J Environ Res Public Health. 2020;17(21). https://doi.org/10.3390/ijerph17217890.
- Kang DQ, Lu YH, Wang Y. Current situation and influencing factors of eHealth literacy in tumor patients. Chin J Mod Nurs. 2020;26(22):2998–3004. https://d oi.org/10.3760/cma.j.cn115682-20200407-02535.
- Zhou HH, Zheng AM. Current situation and influencing factors of e-health literacy among community older adults. J Nanjing Med University(Social Sciences). 2018;18(06):455–8. https://doi.org/10.7655/NYDXBSS20180610.
- Lanxin W, Yan Z, Yutong T, et al. Potential profiling of self-management skills in older co-morbid patients. BMC Geriatr. 2024;24(1):555. https://doi.org/10.1 186/s12877-024-05137-4.
- Jin SX, Li XH. Research progress of eHealth literacy among older adults. Chin Nurs Res. 2024;38(04):620–3. https://doi.org/10.12102/j.issn.1009-6493.2024.0 4.010.
- 67. Dong Q, Liu T, Liu R, et al. Effectiveness of Digital Health Literacy Interventions in older adults: single-arm Meta-analysis. J Med Internet Res. 2023;25:e48166. https://doi.org/10.2196/48166.
- Meier C, Vilpert S, Borrat-Besson C, et al. Health literacy among older adults in Switzerland: cross-sectional evidence from a nationally representative population-based observational study. Swiss Med Wkly. 2022;152:w30158. https://doi.org/10.4414/smw.2022.w30158.
- Kim J, Lee HY, Christensen MC, et al. Technology Access and Use, and their associations with Social Engagement among older adults: do women and men Differ? J Gerontol B Psychol Sci Soc Sci. 2017;72(5):836–45. https://doi.or g/10.1093/geronb/gbw123.
- Guo H, Feng S, Liu Z. The temperature of internet: internet use and depression of the elderly in China. Front Public Health. 2022;10:1076007. https://doi. org/10.3389/fpubh.2022.1076007.
- Yoon H, Jang Y, Vaughan PW, et al. Older adults' internet use for Health Information: Digital divide by Race/Ethnicity and socioeconomic status. J Appl Gerontol. 2020;39(1):105–10. https://doi.org/10.1177/0733464818770772.
- Jones MS, Worthen MGF, Sharp SF, et al. Life as she knows it: the effects of adverse childhood experiences on intimate partner violence among women prisoners. Child Abuse Negl. 2018;85:68–79. https://doi.org/10.1016/j.chiabu. 2018.08.005.
- Estrela M, Semedo G, Roque F, et al. Sociodemographic determinants of digital health literacy: a systematic review and meta-analysis. Int J Med Inf. 2023;177:105124. https://doi.org/10.1016/j.ijmedinf.2023.105124.
- Liu S, Zhao H, Fu J, et al. Current status and influencing factors of digital health literacy among community-dwelling older adults in Southwest China: a cross-sectional study. BMC Public Health. 2022;22(1):996. https://doi.org/10. 1186/s12889-022-13378-4.
- Paige SR, Miller MD, Krieger JL, et al. Electronic Health Literacy across the Lifespan: Measurement Invariance Study. J Med Internet Res. 2018;20(7):e10434. https://doi.org/10.2196/10434.
- Zhao YC, Zhao M, Song S. Online Health Information seeking behaviors among older adults: systematic scoping review. J Med Internet Res. 2022;24(2):e34790. https://doi.org/10.2196/34790.
- 77. Yao R, Zhang W, Evans R, et al. Inequities in Health Care services caused by the Adoption of Digital Health Technologies: scoping review. J Med Internet Res. 2022;24(3):e34144. https://doi.org/10.2196/34144.

- Wang XL, Yang QJ, Wang SY, et al. A review of competency of online health information acquisition and influencing factors in the older population. J Nurs Sci. 2024;39(11):20–3. https://doi.org/10.3870/j.issn.1001-4152.2024.11.0 20.
- Vazquez CE, Xie B, Shiroma K, et al. Individualistic Versus Collaborative Learning in an eHealth literacy intervention for older Adults: quasi-experimental study. JMIR Aging. 2023;6:e41809. https://doi.org/10.2196/41809.
- Xu RH, Shi LS, Xia Y, et al. Associations among eHealth literacy, social support, individual resilience, and emotional status in primary care providers during the outbreak of the SARS-CoV-2 Delta variant. Digit Health. 2022;8:20552076221089789. https://doi.org/10.1177/20552076221089789.
- Zhang Y, Xu P, Sun Q, et al. Factors influencing the e-health literacy in cancer patients: a systematic review. J Cancer Surviv. 2023;17(2):425–40. https://doi.o rg/10.1007/s11764-022-01260-6.
- 82. Hao CL, Hu M. Research progress on eHealth literacy in elderly patients with chronic diseases. Chin Nurs Res. 2023;37(03):506–10. https://doi.org/10.12102/j.issn.1009-6493.2023.03.023.

Publisher's note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.