Factors Associated with High E-Health Literacy Comparing between Seniors and Non-seniors in a Middle-Income Country

Supawadee Sainimnuan, Rinrada Preedachitkun, Ponnapa Petchthai, Yuwadee Paokantarakorn, Arunotai Siriussawakul, Varalak Srinonprasert

Table of Contents

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Abstract

Background: Currently, the rapid aging of the population around the world, especially in low- and middle-income countries (LMICs), is leading to changing demands on healthcare systems. The preparation of the population for adequate e-health literacy and good digital health is one of the challenges of social policy. The willingness to understand e-health literacy and telemedicine use in the different age ranges of the population will help to understand the loopholes and bottlenecks in the implementation and help to develop appropriate solutions. Currently, studies on the status of e-health literacy in the different age ranges remain limited and scarce.

Objective: In this study, we intend to investigate the prevalence and factors associated with low e-health literacy, including attitudes toward e-health literacy, by focusing on the different age ranges in Thailand, a middle-income country.

Methods: We conducted a cross-sectional, observational study in January-July 2021. A total of 400 participants who visited the outpatient department of Siriraj Hospital were recruited and completed questionnaires, which measured demographic information, frequency of internet use, devices used for accessing the internet, and e-health literacy. E-health literacy was assessed using the eHAELS score. We applied univariable logistic regression analysis to elucidate the factors associated with e-health literacy.

Results: Our study revealed that the senior participants had a lower level of e-health literacy compared to non-senior participants. Additionally, other crucial interesting factors in the senior group associated with low e-health literacy included a low level of knowledge about e-health for finding and utilizing health information to take care of themselves, and a lack of confidence in using information from the internet to make health decisions. Moreover, the attitude and interest toward telemedicine use were among the interesting factors that should be considered in the study. The participants in both groups with low e-health literacy expressed fear of not receiving treatment or being unable to complete treatment by a doctor. They were not confident in using technology correctly, feared not understanding how to use medication, and were more concerned about data security compared to participants with high e-health literacy.

Conclusions: Our study provides valuable information on the e-health literacy of seniors and non-seniors in a middle-income country, which may be used to guide further improvements and promote digital health in the aging societies.

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Conclusions: Our study provides valuable information on the e-health literacy of seniors and non-seniors in a middle-income country, which may be used to guide further improvements and promote digital health in the aging societies.

Keywords: eHAELS; e-health literacy; non-seniors; seniors; telemedicine

Introduction

Nowadays, the aging population is one of the most significant global trends. The proportion of the senior population will steadily increase worldwide. In Thailand, the number of senior citizens aged 60 years and above will increase to one-fourth of the population by the year 2030 [1]. Given this worrisome change, improving the quality of life for the senior population has become one of the most crucial issues in public health policy [2]. With the rapid growth of digital technology in health care and related areas, it will inevitably become the core means to deliver various social and health services that can help improve quality of life.

Currently, digital technology has dramatically changed the world and has become easily accessible. The penetration rate of the internet is increasing very rapidly. Around 96% of the world's population aged between 50 and 64 years use the internet [3]. In Thailand, the report from the Electronic Transactions Development Agency (ETDA) indicated that 79.3% of the total Thai population used the internet, and 86.2% used the internet for electronic health (e-health) services related to COVID-19 situation in 2022 [4].

During the COVID-19 pandemic, the importance of digital technology has been emphasized in disseminating critical health information in a non-contact society. Health care services around the world rely more on telehealth and telemedicine to deliver health information and medical care [5].

While older people have higher numbers of chronic health problems requiring continuous management by various medical professionals, the extent of their ability to access that information through digital technology has not been widely studied [6]. It has been shown that older people, who should earn the most benefit from digital health delivery, encountered several difficulties accessing the internet [7]. Moreover, seniors appear to have a high level of anxiety about using smart devices to access health information [8]. These factors may hamper seniors from getting benefits from digital technology, which may negatively affect their health and well-being [8].

Telehealth and telemedicine play a crucial role in healthcare, and many studies have reported that they can improve healthcare access, reduce the cost of care, and enhance the quality of care [9]. However, there are many barriers to its use, such as geographical access, availability, affordability, and acceptability [10]. Moreover, the healthcare systems in many low- and middle-income countries (LMICs) face considerable challenges in providing high-quality, affordable, and universally accessible care through online services.

Electronic health (e-Health) literacy refers to the ability to access, understand, and use health information obtained through electronic sources to solve health problems [2,11,12]. E-health literacy reflects skills in using digital technology to make decisions regarding health [5]. People with lower e-health literacy had less access to technology devices and to using the internet for health [13,14]. Therefore, they might miss out on opportunities to benefit from several public health interventions delivered through digital tools compared to people with higher e-health literacy [15]. The study of e-health literacy and factors associated with low e-health literacy in people living in LMICs, especially across different age ranges, is essential for developing effective interventions to improve health outcomes and reduce inequalities in the digital world.

In Thailand, the Ministry of Public Health (MOPH) had strategic plans to promote digital health and implement the use of telemedicine in all hospitals by 2023 [16,17]. However, studies on the status of e-health literacy and willingness to use telemedicine in Thailand remain limited, especially among older people. Information regarding the level of e-health literacy among Thai people and factors affecting the acceptance of digital technology, especially across different age ranges, will help understand the loopholes and bottlenecks in policy implementation. Therefore, we aim to study the factors associated with attitudes toward e-health literacy among people of different age ranges, to inform health policy guidelines.

Methods

2.1. Study design and participants

This cross-sectional study was conducted at the outpatient department of Siriraj Hospital, a large medical school that serves as a tertiary referral center in Bangkok, from January to July 2021. The inclusion criteria included senior patients and their relatives visiting the outpatient department. Subjects with communication difficulties, such as language or hearing problems, and those who were unable to communicate fluently in Thai, were excluded. The study protocol received approval from the Siriraj Institutional Review Board, Faculty of Medicine Siriraj Hospital, Mahidol University, Thailand (approval number Si 802/2020).

2.2. Measurement instruments

The questionnaire was divided into three main sections. Part 1 focused on gathering general information about the participants, including their age, sex, medical benefit occupation, monthly income, number of doctor visits per year, internet usage, duration of daily internet use, devices used for internet access, and experience in telemedicine usage. Part 2 assessed the participants' e-health literacy level using the e-Health Literacy Scale (eHEALs). The scale consists of 8 questions designed to measure self-perceived ability in using technology to gather health information combined with the

knowledge, perceived comfort, and ability to find, evaluate, and implement electronic health information [18,19]. The scores are obtained by assessing the degree of agreement using a five-point Likert scale ranging from 1 "strongly disagree" to 5 "strongly agree" for each of 8 items. Therefore, the scores could range from 8 to 40, with higher scores indicating higher levels of e-health literacy [20]. The eHEALS has been categorized as indicating adequate e-health literacy with a cut-off score ≥ 26 [21]. Therefore, a score of ≥ 26 points indicates adequate e-health literacy in this study. Moreover, the responses of each item could be categorized into three groups: "disagree" (score of 1–2), "undecided" (score of 3), and "agree" (score of 4–5) [22]. Therefore, eHEALS could also be divided into low levels of e-health literacy (agreeing with <5 out of 8 eHEALS items) and high e-health literacy (agreeing with ≥5 out of 8 eHEALS items) [22]. In this study, participants were divided into groups with low and high e-health literacy to analyze factors associated with low levels of e-health literacy. Part 3 focused on the participants' attitudes toward accessing telemedicine and included multiple-choice questions and opinion-based questions.

2.3. Data collection

Research assistants explained the study to the participants, utilizing an information sheet. Sufficient time was given to the participants to read the information sheet and ask any questions they had before offering written consent. Once consent was obtained, participants were requested to respond to the questionnaire. If any explanations were required, the research assistants would provide additional information to help participants complete the questionnaire.

2.4. Statistical Analysis

The e-health literacy score could be categorized into two groups including inadequate e-health literacy (eHEALS<26) and adequate e-health literacy (eHEALS≥26). Age was one of the factors related to level of eHEALS. Sample size calculation was estimated based on a previous study [21], where participants classified as inadequate e-health literacy comprised of 72.8% seniors and the group with adequate e-health literacy had 57.9 % of seniors. When considering a two-sided type I error of 0.05 with 80% power, it was determined that 160 participants would be needed for each group. Anticipation around 20% of incomplete data, a total of 400 participants were planned for the study.

Demographic information and characteristic variables were summarized using descriptive statistics. Continuous variables were represented by the mean (± SD) for normal distributions or median (minimum, maximum) for non-normal distributions. Categorical variables were described using frequency and percentage. For continuous variables, comparisons between the senior and non-senior groups; 2-sample t-test and Mann-Whitney U test were applied after testing for normality of the data. Pearson's chi-square test or Fisher's exact test were used to test categorical variables as appropriate. The analyses were performed using PASW Statistics for Windows), version 29.0, SPSS Inc., Chicago, IL, USA.

Results

A total of 400 participants were recruited for the study, including 131 (32.8%) seniors. Participant demographic information and baseline characteristics are presented in Table 1. Among 131 seniors, 35.1% were males, and 61.1% had an education level higher than high school. Most were unemployed (67.9%), with an average income of around 10,000 THB (285.86 USD) per month, and had an average expenditure of 300 THB (8.58 USD) per visit to see a doctor. More than half (53.4%) of seniors never use the internet. Among internet users, the frequency of internet use was

around 2 hours per day, with smartphones (63.1%) being the most frequently used devices for accessing the internet.

Among 269 subjects who were non-seniors, 80 (29.7%) were males, and 228 (84.8%) had an education level higher than high school. Most were employed (79.9%), with an average income of 20,000 THB (571.72 USD) per month, and had an average expenditure of 400 THB (11.43 USD) per visit to see a doctor. The majority of non-seniors (89.2%) regularly use the internet, spending an average of 5 hours per day on it. Two-hundred fifty-four (94.8%) of non-seniors use smartphones to access the internet.

When comparing the two age groups, the senior group was more likely to have a lower educational level (p <0.001), be unemployed (p <0.001), and have lower income (p <0.001). The senior group was also less likely to have experience using the internet (p <0.001) and spent less time online among those who did use it (p <0.001).

Table1. Demographic information and baseline characteristics of the included population compared between non-senior and senior groups.

Variables	Non-senior Group (<60 years) [n=269]	Senior Group (≥60 years) [n=131]	p-value
Gender			
Male	80 (29.7%)	46 (35.1%)	0.303
Educational level			
≥ High school	228 (84.8%)	80 (61.1%)	<0.001*
Occupation			
Employed	215 (79.9%)	43 (32.8%)	<0.001*
Average income (THB/month)	20,000 (500, 300,000)	10,000 (500, 300,000)	<0.001*
Average cost to see a doctor (THB/time)	400 (0, 8,000)	300 (0, 11,000)	0.063
Experience in using internet			<0.001*
Yes	240 (89.2%)	61 (46.6%)	
[a]**Frequency of internet use (hr./day)**	5 (1, 20)	2 (30 mins, 18)	<0.001*
[b]**Digital devices for using the internet**			
Computer	45 (16.8%)	7 (5.4%)	<0.001*
Notebook	45 (16.8%)	8 (6.2%)	0.004
Tablet	38 (14.2%)	9 (6.9%)	0.046*
Smartphone	254 (94.8%)	82 (63.1%)	<0.001*

Abbreviation: THB, Thai baht.

[a] Specified only patient who has access the internet.

[b] One person may use more than one device.

Table 2 presents detailed comparisons of competency in each area of e-health literacy between the senior and non-senior groups. The results indicate that seniors exhibited significantly lower levels of knowledge in all dimensions of e-health literacy. Most seniors do not know how to use the internet to find health information for self-care. The results revealed that less than one-fifth of seniors knew how to use the internet to find health information and how to utilize health information on the internet for taking care of themselves. Moreover, less than one-fifth of seniors were confident in identifying the quality of retrieved information and using it to make health

decisions.

Table2. E-Health Literacy comparison between the non-senior and senior groups.

E-Health Literacy	Agree (Score4-5)	
	Non-senior Group (<60 years) [n=269]	Senior Group (≥60 years) [n=131]
1. I know what health resources are available on the internet.	183 (68.0%)	32 (24.4%)
2. I know where to find helpful health resources on the internet.	187 (69.5%)	33 (25.2%)
3. I know how to find helpful health resources on the internet.	197 (73.2%)	32 (24.4%)
4. I know how to utilize the internet to answer my questions about health.	193 (71.7%)	25 (19.1%)
5. I know how to utilize the internet information I find to help me.	185 (68.8%)	26 (19.8%)
6. I have the necessary skills to evaluate the health resources I find on the internet.	151 (56.1%)	26 (19.8%)
7. I can identify high-quality health resources from low-quality health resources.	135 (50.2%)	22 (16.8%)
8. I feel confident in using information from the internet to make my health decisions.	131 (48.7%)	22 (16.8%)
The high score (4-5) of e-health literacy in 5 questions and higher.	175 (65.1%)	26 (19.8%)

Regarding the adequacy of e-health literacy, Table 3 displays factors associated with e-health literacy adequacy and attitudes toward telemedicine compared between senior and non-senior groups. Around one-fourth of seniors and three-fourths of non-seniors had adequate e-health literacy. In both the senior and non-senior groups, level of education was significantly associated with a level of e-health literacy. Participants with adequate e-health literacy are more likely to be interested in telemedicine, leading to a positive attitude and greater confidence in using telemedicine. Nevertheless, a substantial proportion of both the senior group (32.4%) and the non-senior group (24.0%) with adequate e-health literacy remained not confident in using the new technology and declined to use telemedicine. Concerns not directly related to technological competency, such as the adequacy of treatment received through telemedicine and willingness to have physical examinations by doctors, did not significantly differ between groups with adequate and inadequate e-health literacy in both age groups. Concerns regarding data security and the adequacy of information received were not significantly different between seniors with adequate and inadequate e-health literacy.

Table3. Factors associated with adequacy of e-health literacy and the willingness to use telemedicine, compared between non-senior and senior groups.

Variables	Non-senior Group (<60 years) [n=269]			Senior Group (≥60 years) [n=131]		
	Inadequate e-health	Adequate e-health	*p*-value	Inadequate e-health	Adequate e-health	*p*-value

	literacy (n=61)	literacy (n=208)		literacy (n=97)	literacy (n=34)	
Living Status						
Living with family	48 (78.7%)	119 (57.2%)	0.003	69 (71.1%)	25 (73.5%)	0.789
Living alone	13 (21.3%)	89 (42.8%)		28 (28.9%)	9 (26.5%)	
Educational level						
≥ High school	38 (62.3%)	190 (91.3%)	<0.001*	50 (51.5%)	30 (88.2%)	<0.001*
Occupation						
Employed	50 (82.0%)	165 (79.3%)	0.651	30 (30.9%)	13 (38.2%)	0.435
[a]**Frequency of internet use (hr./day)**	2 (1, 18)	6 (1, 20)	<0.001*	2 (30 min, 12)	3 (1, 18)	0.025*
[b]**Digital devices for using the internet**						
Computer	4 (6.6%)	41 (19.8%)	0.018*	1 (1.0%)	6 (17.6%)	0.001*
Notebook	3 (4.9%)	42 (20.3%)	0.003*	3 (3.1%)	5 (14.7%)	0.029*
Tablet	3 (4.9%)	35 (16.9%)	0.020*	4 (4.2%)	5 (14.7%)	0.052
Smartphone	48 (78.7%)	206 (99.5%)	<0.001*	49 (51.0%)	33 (97.1%)	<0.001*
Attitude of telemedicine						
Know or have experience in telemedicine	8 (13.1%)	92 (44.2%)	<0.001*	6 (6.2%)	17 (50.0%)	<0.001*
Interested in using telemedicine	40 (65.6%)	188 (90.4%)	<0.001*	66 (68.0%)	30 (88.2%)	0.022*
What would be the reason for declining the use of telemedicine?						
Wish to have a physical examination by a doctor	42 (68.9%)	120 (57.7%)	0.117	70 (72.2%)	22 (64.7%)	0.413
Not confident in using new technology	38 (62.3%)	50 (24.0%)	<0.001*	64 (66.0%)	11 (32.4%)	0.001*
Concerns about data security	20 (32.8%)	38 (18.3%)	0.015*	20 (20.6%)	5 (14.7%)	0.450
Concerns of not receiving adequate treatment	32 (52.5%)	104 (50.0%)	0.736	60 (61.9%)	15 (44.1%)	0.072
Concerns of not receiving	18 (29.5%)	25 (12.0%)	0.001*	17 (17.5%)	4 (11.8%)	0.431

adequate
information

[a] Specified only patient who has access the internet.

[b] One person may use more than one device.

Factors associated with interest in using telemedicine are demonstrated in Table 4. Lower age, higher education level, higher income, high e-health literacy, experience in using telemedicine, and belief in the safety and convenience of the service were all significantly associated with willingness to use telemedicine.

Confidence in the safety and convenience of the service, along with adequate e-health literacy, were the three strongest factors associated with interest in telemedicine, with odds ratios (OR) of 5.90 (95% CI 3.43-10.15, p=0.001), 5.43 (95% CI 3.12-9.43, p=0.001), and 4.45 (95% CI 2.60-7.62, p=0.001), respectively. The non-senior group was more likely than the senior group to accept using telemedicine, with an OR of 2.02 (95% CI 1.21-3.37, p=0.007).

Table4. The factors associated with interest in using telemedicine.

Variables	Interested in telemedicine use		Univariate analysis OR (95% CI)	*p*-value
	Not Interested (n=76)	Interested (n=324)		
Gender				
Male	17 (22.4%)	109 (33.6%)	1.76 (0.97-3.16)	0.059
Age				
<60 Years	41 (53.9%)	228 (70.4%)	2.02 (1.21-3.37)	0.007*
Education Level				
≥ High school	49 (64.5%)	259 (79.9%)	2.19 (1.27-3.77)	0.005*
Occupation				
Employed	42 (55.3%)	216 (66.7%)	1.62 (0.97-2.69)	0.063
Average income (THB)				
≥10,000 (≥ 285.86 USD)	38 (65.5%)	214 (80.8%)	2.20 (1.18-4.11)	0.012*
Average Internet use (hour/day)				
≥5	10 (25.0%)	135 (51.3%)	3.16 (1.48-6.73)	0.003*
E-Health literacy				
Adequate E-Health literacy (eHEALS≥26)	24 (31.6%)	218 (67.3%)	4.45 (2.60-7.62)	<0.001*
Knowledge of telemedicine	15 (19.7%)	108 (33.3%)	2.03 (1.10-3.74)	0.023*
Confident in security issue				
Vary safe	24 (31.6%)	237 (73.1%)	5.90 (3.43-10.15)	<0.001*
Convenient of telemedicine				

compared to face-to-face service				
More convenient	41 (53.9%)	280 (86.4%)	5.43 (3.12-9.43)	<0.001*
Having digital devices for assessing the internet	52 (70.3%)	287 (88.9%)	3.37 (1.83-6.19)	<0.001*

Abbreviation: THB, Thai baht; USD, US dollars.

Discussion

Our study highlights the very low level of e-health literacy among seniors compared to non-seniors in a middle-income country. Moreover, competency in several aspects of e-health literacy in both senior and non-senior groups was also unsatisfactory. Several factors associated with a low level of e-health literacy in this study, such as age, income level, and education level, were non-modifiable. However, e-health literacy itself is modifiable through several interventions. The level of e-health literacy further influences the acceptance and ability to undertake digital healthcare services. Factors affecting e-health literacy and attitudes toward accepting telemedicine are key factors to explore and intervene in when planning to implement novel digital technologies at the population level.

Several socioeconomic disadvantages are associated with lower levels of e-health literacy. The present study showed results concordance with previous studies [9,23,24,25], indicating that participants with lower levels of e-health literacy were more likely to be older and have lower levels of educational attainment. Additionally, low e-health literacy appears to be related to inadequate financial resources, resulting in less exposure to digital devices and technologies. This trend was evidenced more prominently among the senior group, similar to findings in previous studies [23,26].

The concept of e-health literacy among older people has been explored separately [9] from the younger population, as the need for support and barriers to implementation would be substantially different. It has been emphasized that e-health literacy increases with age among young adults, but decreases among older adults [9,23,25,26,27,28]. Among senior participants in the present study, the reported difficulties in e-health literacy were related to having a low level of knowledge and skills in using the internet. This might also lead to the finding that they were unconfident in using information from the internet to make health decisions. Additionally, older people had fewer opportunities to access the internet and spent less time using it compared to younger adults. Increasing exposure to and providing training in digital technologies, particularly for older people who might naturally be left behind, would be beneficial for the initiation of e-health programs.

During the COVID-19 pandemic, the importance of digital technologies has skyrocketed for disseminating health information and providing necessary services [22]. Telemedicine was one of the popular technologies that was widely expanded to cover a boarder range of health conditions, including preventive, curative, and rehabilitative aspects. The services also expanded to include several chronic medical conditions, including older people with frailty and dementia [29]. Nevertheless, there were some barriers to the uptake of technology among seniors. The top barriers to using telemedicine among seniors were related to a low level of e-health literacy, such as lack of knowledge, difficulty learning, and using the technology [8,21,22,30]. Moreover, concerns related to the privacy and security of the technology, as well as the health outcomes of using online services, were also raised [22]. Our studies discovered similar findings regarding those barriers, which appear to be modifiable through several interventions. Other barriers might be related to aging changes, such as difficulty with hearing, visual deficits, functional disabilities, and ergonomic barriers [22]. These issues were not explored in our study but should also be considered when contemplating plans to implement digital technologies for older people.

Previous studies have shown the benefits of arranging various styles of interventions to improve e-health literacy in older people, conducted in high-income countries [31]. It has been

shown that older people can become proficient in using technology, just like younger adults, with adequate support, understandable explanations of its benefits, and a suitable learning pace [32]. Therefore, encouragement to gain knowledge and skills in digital technologies and having a positive attitude toward the use of telemedicine could enhance uptake in digital health for seniors. LMICs will soon have the highest proportion of older people, along with an expected shortage in several resources for delivering on-site health care services. Using digital health in appropriate service areas would be a promising solution for those settings. Being well prepared by including a training program for senior users would increase the chances of successful implementation. Older people have the potential to learn and uptake novel technologies, not less than the younger population, but at different paces. Having volunteers in their communities to provide training through public health centers or activities clubs might be one of the interesting ways to reach more senior groups. The process requires considerable work, such as developing local content, coordinating governments and private organizations to provide funding for e-health literacy projects, and empowering community members to take the initiative to improve their health. However, this will be a sustainable option for the long term.

Conclusions

Our study provides insight into the low level of e-health literacy among seniors compared to non-senior participants in a middle-income country. We also address the barriers to uptake innovative modes of healthcare delivery that could be modifiable by providing suitable interventions. Providing information and service through digital technology for seniors would be more successful if adequate support were also prepared.

Acknowledgements

Data Availability

All data analyzed during this study are included in this published article and available from the corresponding author upon reasonable request.

Authors' Contributions

SS collected the data, drafted, and edited and reviewed the manuscript. YP collected the data, conceptualized the study. PP designed the methodology, collected and curated the data. RP analyzed the data. AS conceptualized the study. VS conceptualized the study, acquired funding, designed the methodology, supervised the study, and edited and reviewed the manuscript.

Conflicts of Interest

None declared.

Abbreviations

eHEALS: e-Health Literacy Scale
eHealth: Electronic health
ETDA: Electronic Transactions Development Agency
MOPH: Ministry of Public Health

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