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The Development of E-health Literacy Indicators for Older Thai Adults in Adjusting to Live with the New Normal Lifestyle

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Abstract

The COVID-19 pandemic severely affected people of all ages, particularly affecting how they adapted themselves to the new normal lifestyle. However, these effects were especially observed in the older adults. Subsequently, the purpose of this study was to develop e-health literacy indicators for older Thai adults in adjusting to live with the new normal lifestyle. In addition, this study collected data to empirically test the hypothesized model with e-health literacy indicators model for older Thai adults. Respondents of the study were 410 older Thai adults, living or working in Bangkok and its vicinity. An exploratory factor analysis (EFA) and a confirmatory factor analysis (CFA) were performed to validate the factor structures obtained by EFA. These factor structures were validated through the first order of CFA; and the indicators and components found were: 1) media and information literacy component, with 19 indicators; 2) computer and social media literacy component, with 12 indicators; 3) COVID-19 literacy component, with 9 indicators; 4) healthcare literacy component, with 11 indicators; and 5) health risk literacy component, with 5 indicators. The second order of CFA proved that the e-health literacy indicators model had an acceptable fit with Chi-square/df = 2.41, RMSEA = 0.06, GFI = 0.95, NFI = 0.99, CN = 204.13. These findings potentially contribute towards facilitating the ease of living for older Thai adults, capable of using social media literately on a daily basis while maintaining personal self-care standards in accordance with the recognized new normal guidelines.

The global impact of the COVID-19 pandemic has been seen and felt, with most countries being severely and negatively affected. However, Thailand is one of the few countries recognized and acknowledged by the global community for its ability to effectively contain the outbreak, both in terms of public vaccination corporation and health personnel devotion to their work (Kummetha, 2022). Furthermore, the Ministry of Public Health, Thailand has been praised from World Health Organization for tirelessly working to provide innovation and technology to support self-reliance in medications, vaccinations, and test kits. As a result, the number of severe cases and deaths has notably decreased (Royal Thai Government, 2022a).

However, according to studies conducted by the Centers for Disease Control and Prevention, USA (2022a) it was found that elderly individuals who aged over 60 are most at risk of dying as a result of severe or high COVID-19 infection rates, particularly those with serious underlying health conditions, such as diabetes, high blood pressure, heart disease, and respiratory diseases, such as asthma. Furthermore, the global severity and death rates from COVID-19 in older individuals globally are comparable to those in Thailand. According to a review by the World Health Organization, Thailand (2022) indicated that COVID-

19 infections in the country during the first two months of 2022 attributed 75% of the deaths to be among individuals aged 60 and above, and 60% of the 928 fatalities were found to be unvaccinated.

Since the beginning of the COVID-19 outbreak, the novel term "new normal" was adopted and mentioned again and again in many dimensions (Gunawan et al., 2020), such as economic, social, and daily life, dimensions we once were unfamiliar with or had previously considered abnormal (Wae, 2020). In particular, for the older adults who are at a higher risk, adjusting to the "new normal" lifestyle is unavoidable. For instance, older adults are required to stay at home, and meeting or gathering with friends and family members must be reduced (Centers for Disease Control and Prevention, 2022b). As a result, this was an important factor, urging older Thai adults to learn how to use social media in order to adapt to new situations, through chatting, making phone or video calls with family members and friends through Line, Facebook, and YouTube applications, ordering food and products, and conducting bank transactions. This included exposing, searching for, and sharing information about COVID-19 and the new normal practices. Furthermore, the right to receive financial assistance through remedial and stimulus measures during the COVID-19 pandemic, including the right to be vaccinated and receive benefits from government programs, resulted in older Thai adults learning to use social media more from the pre-Covid-19 epidemic (Electronic Transactions Development Agency, 2020; Foundation of the Thai Gerontology Research and Development Institute, 2021a).

Amidst the flood of information on social media, the capacity of older adults to find, seek, understand, and assess whether health information from social media is reliable or not, thus finally applying their findings to themselves, to manage their disease-related health concerns or be led to appropriate health decisions, is referred to as *e-health literacy*, which is now defined as an indispensable skill (Jung et al., 2022; Sykes et al., 2021). During the COVID-19 outbreak in 2020, Brørs et al. (2020) developed an e-health literacy model, which specified more details that the users would be able to use various digital technologies fluently, particularly older adults with underlying diseases who were at high risk if infected with COVID-19; the essential skills that were required in the ability to assess how the messages were to be received, included searching for reliable and accurate information, comprehending the content, analyzing, and culminating; these could be applied to healthcare prevention or resolution of health problems.

Watkins and Xie (2014), who reviewed 23 articles and 23 report results from independent studies regarding e-health literacy interventions for older adults published between 2003 - 2013 at the University of Texas at Austin found that having e-health literacy skills could help older adults manage their primary chronic illnesses. It allows access to accurate and reliable information on electronic sources, that could be applied to make decisions about one's health or to communicate directly with health personnel, and access to trustworthy health resources on electronic sources. In addition, based on a review of PubMed-indexed papers on e-health literacy of Levin-Zamir and Bertschi (2018) further proposed that the level of e-health literacy is linked to the frequency of digital media use, such as internet, social media, and mobile tools, in order to search for health information, if a user perceived that the digital technology use to find health information was simple, uncomplicated, easy-to-understand, and did not use too much academic text or vocabulary, these would make the users have higher level of e-health literacy, especially those with low level of e-health literacy, such as the older adults' group.

Nonetheless, the results of the aforementioned research found that the higher use of social media have positive effects on having higher levels of e-health literacy and a better quality of life in terms of being aware of information, getting in touch with friends and family, including learning to use communication technology from self-experiment or help from friends and family to make older adults live more comfortably (Vicerra, 2021; Yodmai et al., 2021). Conversely, there is still the problem of "digital divide" among the older Thai adults. This has resulted in disparities in access to health services, such as not being vaccinated against COVID-19 because they are not registered through the application or Line Official or not registered via the mobile phone network or some older adults do not have smartphones (Saisombut &

Suwankiri, 2022). Not to mention, during lockdown period, it was also found that older Thai adults were often victims of scammers who deceived them for financial gain by sending fraudulent SMS messages claiming to be from banks to trick them into making financial transactions for example (Foundation of the Thai Gerontology Research and Development Institute, 2021b).

Thus, according to the e-health literacy model (Brørs et al., 2020), which has been developed during COVID-19 outbreak defined that literacy in all dimensions would provide older adults with the skills or abilities to search, seek, understand, and be able to analyze, distinguish, have access to trustworthy health information from electronic sources, and can be applied for them to manage, or solve problems, or lead them to make appropriate health decisions.

In this regard, international experts undertook most of the research on applying the concept of e-health literacy to the population of older adults' group during the COVID-19 pandemic were conducted by foreign scholars (e.g., Jung et al., 2022; Pourrazavi et al., 2020; Sykes et al., 2021; Watkins & Xie, 2014). However, there has been no research on this topic in Thailand. Only a few Thai researchers (e.g., Kleechaya, 2020; Saisombut & Suwankiri, 2022) focused on older Thai adults' use of social media and electronic devices during the COVID-19 pandemic.

Therefore, the objectives of this study were to develop e-health literacy indicators for older Thai adults in adjusting to live with the new normal lifestyle and to examine the consistency between the empirical data and the e-health literacy indicators model of them with the new normal lifestyle. The outcome of this study would contribute to behavioral science by preparing older Thai adults to enter the aging society with the ability to use social media, such as interactive websites, search engines, and applications on a daily basis and maintain self-care in accordance with the new normal practices. Such practices include, for example, using social media to search for information regarding COVID-19 from trustworthy sources, not believing or spreading fake news regarding COVID-19 to friends or family member, being able to use social media in daily life, and always taking care of personal health, thus lowering the risks of COVID-19 infection.

Literature Review

The COVID-19 crisis has been affecting the entire globe. Meanwhile, most governments have come to adjust their measures to the new normal standard based on their specific conditions, cultures, and daily lives of population (Gunawan et al., 2020). This particularly affects vulnerable groups, such as the older adult population who are encouraged the most to adjust to the new normal practices (Center for Disease Control and Prevention, 2022b). As a result, in order to better understand social media use behavior among older Thai adults, the concept of new normal lifestyle and older adults must be discussed first.

New Normal Lifestyle and the Older Adults

Based on the findings of Yodmai et al. (2021), who studied on COVID-19 preventive behaviors among older Thai adults, it was found that most of older Thai adults regularly washed their hands with soap and alcohol gel, wore masks when going out, ate freshy cooked meals, and used a serving spoon every time they shared meals with other people. Furthermore, they reduced the risk of severe illness and death through vaccination against COVID-19 (Thanapluetiwong et al., 2021). This survey was consistent with what Vicerra (2021) noted that more than 80% of older Thai adults performed hand washing and mask wearing. In addition, 77% followed physical distance restrictions and 62% avoided sharing meals in order to prevent the virus from spreading.

Furthermore, the full lockdown during the COVID-19 pandemic was a significant factor affecting older Thai adults' increased use of social media. The uses included for chatting, sharing information about COVID-19 selves-defense, and adjusting to new normal behavior, as well as for ordering goods and food and conducting financial transactions (Electronic Transactions Development Agency, 2020; Foundation of

the Thai Gerontology Research and Development Institute, 2021a). As a result, in the following section, the researcher reviewed the concept of social media and the older adults to examine what internal and external factors influence them to learn how to utilize social media in everyday life.

Social Media and the Older Adults

According to the findings of a study of internet users in Thailand conducted during the COVID-19 pandemic in 2020-2021, it revealed that Thai's baby boomers (aged 58-76 in 2022) used the most top three social media applications, such as Line, Facebook, and YouTube, and took time to surf the internet and social media around nine hours a day. The using purposes were for chatting, calling, ordering products or food, bank transactions, including information searching and sharing through those applications (Electronic Transactions Development Agency, 2020; National Statistical Office, 2021). In terms of the study on knowledge and practices regarding COVID-19 prevention of older Thai adults, it was revealed that digital media play a critical role because older Thai adults who possess a mobile phone, computer, and gain COVID-19 information via SMS or the internet have a greater impact on COVID-19 knowledge and preventative behavior than older Thai adults who receive COVID-19 information through mass media, such as by radio or television (Vicerra, 2021).

Furthermore, the following psychological and physical factors influence older adults' use of digital technology: 1) perceived self-efficacy: how older adults found its enjoyable to use digital technology. This may be the time when they were working and may boost their confidence in utilizing digital technology by learning from experts and obtaining positive social feedback; 2) digital competence: having knowledge, skills, and a positive attitude towards using digital technology. They develop confidence by resolving technological challenges; and 3) personal learning environments: this refers to the community of people who are engaged in digital technology, such as peers of the same age, family members, and also grandchildren who assist them in learning how to use it (Tyler et al., 2018). Moreover, these findings were in line with Heo et al. (2015), who studied on internet use and well-being in older adults, and further looked into social support, such as receiving encouragement, talking and sharing both good or bad experiences with family, members, grandchildren, and trusted friends.

On the other hand, Kleechaya (2020) proposed that enhancing older Thai adult's skills and abilities in using digital technology will assist them in maintaining their health, take part in daily activities, participate in activities with family members and communities, and use digital technology safely in daily life, while being able to generate productivity through income stability for livelihood.

However, being active on social media remains insufficient for older adults because of the prevalence of fake news during the COVID-19 outbreak, they resulted in negative health consequences, if followed. As a result, in order to access health information, older persons must be able to assess, identify, and recognize trustworthy sources. (Jung et al., 2022; Sykes et al., 2021). Therefore, the researcher revisited the concept of e-health literacy which focuses on being well-literate in online health information derived from social media sources, such as interactive websites, search engines, and applications in order to determine whether health information derived from social media is credible, and to preserve their health in order to live productively throughout the variety of COVID-19 situations.

The E-health Literacy

Norman and Skinner (2006) described the e-health literacy model or the lily model of e-health literacy as a person's ability to identify, seek, interpret, and judge whether health information from electronic sources is credible or not. Brørs et al. (2020) contributed details, such as users' ability to use various technologies fluently and apply them to themselves to manage, solve disease-related health issues, or make appropriate health decisions during the COVID-19 pandemic. The six fundamental components of the e-health literacy model are as follows: 1) traditional literacy component: audiences must be able to decipher symbols in still photos, video clips, animation, sound effects, and numerous infographics utilized in

communication, including non-literal interpretations of messages; 2) information literacy component: understanding how knowledge is organized and how to locate and use information such that others can learn from them; a literate person knows where to find information on a specific topic; 3) media literacy component evaluating how media formats affect the content. Cognitive and critical thinking skills are applied to media and its message; 4) health literacy component: knowledge of health-care system and self-care skills. Health-literate persons understand and act on healthcare information; 5) computer literacy component: The capacity to use computers or other electronic devices to solve health problems; and 6) scientific literacy component: comprehending science-based online health information without prior knowledge of science.

Furthermore, Levin-Zamir and Bertschi (2018) further suggested that e-health literacy concept should be considered in conjunction with other factors related to an individual context, be it through personal factors, including different demographic characteristics, such as gender, age, education, occupation, income, ethnicity, as well as levels of familiarity with digital media, such as internet, social media, and mobile tools. These factors would shape individuals to have different ways of finding, understanding, appraising online health information, and applying it to take care of their personal health care.

According to research on theory-based e-health literacy treatments in older persons, the frequently mentioned element influencing the development of e-health literacy abilities among older adults was perceived self-efficacy. The health belief model (HBM) was also employed in the study and had a significant role in the development of e-health literacy (Pourrazavi et al., 2020; Watkins & Xie, 2014). Secondly, behavioral science theory must be discussed. Consequently, the researcher revisited the health belief model, which focuses on psychological and physical factors that influence appropriate health behavior.

The Health Belief Model (HBM)

The health belief model (HBM) has a fundamental belief that a person will protect him/herself from health hazards only if s/he has a certain level of knowledge, motivation for health care, and belief that s/he is at risk for their illness, and the recommended treatments can help reduce his/her symptoms (Champion & Skinner, 2008). The HBM is made up of the six basic components listed below: 1) perceived susceptibility towards disease; 2) perceived severity towards disease; 3) modifying factors- such as gender, age, employment, income, and educational level of each individual contributes to varying perceptions of illness risk and severity, as well as knowledge, attitude, and experience towards disease; 4) perceived benefits of treatment and healthcare; 5) perceived barriers: if a person believes that seeking treatment or healthcare is not worth their resources, such as squandering money and time or having risks or side effects, that person may decide not to seek treatment or care for their health any longer; and 6) cues to action: events that motivate people to adopt healthy behaviors based on both direct and indirect experiences, such as information gained through personal media, mass media, or social media (Rosenstock et al., 1988). In 1988, the perceived self-efficacy component was introduced by Bandura (1997) as a personal internal factor that influences proper healthcare practices.

Perceived self-efficacy means belief or confidence of individuals that have the ability to perform their desired behavior until the desired results are achieved when they have the appropriate health beliefs. To present disease prevention and take care of their own health, individuals must also rely on their own self-efficacy (Martin et al., 2010). Recent research on e-health literacy, it was found that the concept of "perceived self-efficacy" was utilized to describe the promotion of e-health literacy in older adults' group in accordance with the findings of Pourrazavi et al. (2020) and Watkins and Xie (2014), they revealed that older adults who perceive high self-efficacy in using digital media and motivation for healthcare will allow themselves to explore and analyze health information they received from digital sources to use for their healthcare advantages and make alternative health decisions. However, in order to accomplish optimal health practices during COVID-19 pandemic depends on a combination of psychological and physical

elements of the health belief model. For instance, these elements include proactive information searching, interactive two-way communication, positive attitudes towards internet, as well as prior experience with internet use, level of education, technology accessibility, social support, and health status perception are required (Jung et al., 2022; Pourrazavi et al., 2020).

Method

Participants

The final sample size of 410 participants was drawn from a population of 2,086,376 older Thai adults living in Bangkok and its vicinity, including Nonthaburi, Pathum Thani, Samut Prakan, Nakhon Pathom, and Samut Sakhon Provinces (Department of Older Persons, 2021). The inclusion criteria for targeted participants were that they were 60 years and over, who were fully conscious, and capable of answering questionnaires on their own. Some of them had already retired, while others were still working. Furthermore, in the previous year, they had searched for COVID-19 and new normal lifestyle information using social media, such as interactive websites or search engines, such as Google.com, as well as social media applications, such as Line, Facebook, YouTube, or Twitter. The sample size was calculated, using Kline's (2016) suggestion, which stated that for exploratory factor analysis (EFA), the sample size should be at least 5-10 times greater than the number of observed variables.

Procedure

In the first step, the researcher improved and constructed the questionnaire items that would be utilized as indicators for data collection by adapting previous research on social media and older adults (Heo et al., 2015; Kleechaya, 2020; Sykes et al., 2021; Tyler et al., 2018), e-health literacy (Brørs et al., 2020; Norman & Skinner, 2006; Pourrazavi et al., 2020; Sykes et al., 2021; Watkins & Xie, 2014), and health belief model (Champion & Skinner, 2008; Martin et al., 2010). This was in addition to the compilation of in-depth interview data regarding factors affecting e-health literacy skills for older Thai adults in adjusting to live with the new normal lifestyle from 31 specialists, 15 of whom were older Thai adults, 9 academics in health communication and communication sciences, and 7 public health professionals.

The following measures were taken by the researchers to assess the content validity and reliability of this study: 1) The content validity of the study questionnaire was verified by five scholars in health communication, communication sciences, and public health professionals to investigate a closed-ended questionnaire in order to verify the content validity using the item objective congruence index (IOC). Thus, every question met the criteria since the IOC values ranged from 0.60 to 1.00 (the cut-off value was .50) (Rovinelli & Hambleton, 1977). 2) The researcher ran a trial run by distributing research questionnaires to 40 participants who shared comparable features but were not samples in this study in order to determine the reliability value of the questionnaire, which was .95. A general accepted value suggested by Cronbach and Shavelson (2004) is that reliability value of 0.7 or higher. It indicated that every research question can be applied to the actual samples. Lastly, 3) Prior to distributing to the chosen samples, the researcher modified it based on the expert recommendations.

Instrument

The questionnaire consisted of 4 parts. Part one included five questions regarding demographic characteristics, such as gender, age, educational level, occupation, and monthly average income. Part two contained two screening questions for the use of social media of older Thai adults. An example question was *"Do you use computers or mobile electronic devices?"* Part three included two questions regarding how older Thai adults use social media to learn about COVID-19 and the new normal lifestyle. An example question was *"Which social media platforms are you using to obtain COVID-19 information?"* Part four included 58 questions in the form of 5-point Likert scales regarding e-health literacy of older Thai adults in adjusting to live with the new normal lifestyle. The questions of this part covered six components of e-health literacy model which had been refined and developed after expert recommendations, e.g., "You are

able to distinguish between messages about COVID-19 which one should be trusted and followed". "You are able to download, sign up, and be able to use applications launched by government on smartphones or applications related to products or food delivery by yourself". "You get tested for COVID-19 with Antigen Test Kit or ATK testing when you are at risk or get risk symptoms", and "Getting vaccinated against COVID-19 enable to reduce serious illness and death?"

Data Collection and Analysis

The questionnaires were distributed to 500 selected participants by means of stratified random sampling and quota sampling techniques between January 15 to April 15, 2022. The 410 participants completed research questionnaires. Firstly, descriptive analysis was performed. Secondly, exploratory and confirmatory factor analyses were utilized in order to extract the components and validate the consistency between indicators and components.

Ethical Considerations

The research was approved by the Ethics Committee in Human Research of Ramkhamhaeng University with the protocol ID NO. RU-HRE 64/0122 on September 6, 2021. The committee followed the guidelines proposed by the Declaration of Helsinki and ICH-GCP, which were implemented in order to require researcher concealed the confidential information regarding the volunteers and ensure that they were well protected.

Results

Descriptive Statistics

The 410 participants were older Thai adults who lived or worked in Bangkok and its vicinity areas, and who were fully conscious, and could answer the questionnaire on their own. The majority of them were females (56.8%), with a median age of 60-69 years old (71.7%), followed by 70-79 years old (27.1%). Almost half of participants (41.2%) had an average monthly income of less than 10,000 Thai Baht (less than $285), followed by those with an average monthly income of 10,000 - 20,000 Thai Baht ($285-570) (16.6%). The majority of them (45.4%) had education below a bachelor's degree, followed by respondents with a bachelor's degree (30.7%). Nearly one-third of participants (29.3%) were pensioners, with the remainder working in private business or trading (26.8%).

In terms of possessing computer or mobile electronic devices, or social media use, all of the selected respondents were required to constantly use computers or mobile electronic devices and social media. Almost all respondents (91.2%) used the *Line* application to receive COVID-19 and new normal lifestyle information, followed by *Facebook* application (63.7%), and *YouTube* application (59.0), consecutively. The majority of time spent was searching for related information which was around 1-2 hours per day (35.4%), followed by less than 1 hour per day (33.7%).

According to Table 1, overall, the majority of participants agreed and followed regarding e-health literacy with the new normal lifestyle.

When the specifics of each item were examined, it was noted that the participants strongly followed regarding wearing a fabric mask or surgical mask when leaving home ($M = 4.67$, $SD = 0.67$), followed by receiving full doses of vaccination ($M = 4.58$, $SD = 0.85$), and finally eating cooked food ($M = 4.48$, $SD = 0.75$). Wearing a surgical mask or fabric mask when talking to people in the same house ($M = 2.40$, $SD = 1.51$) was the issue that the participants unfollowed when it came to e-health literacy under the new normal lifestyle.

Regarding the issues related to e-health literacy with the new normal lifestyle that the participants neither followed nor unfollowed: the ability to download, sign up, and use applications launched by

government or applications related products or food delivery by themselves ($M = 2.85$, $SD = 1.39$), followed by scanning *Thai Chana* or *Mor Chana* app- a scanning app for tourist arrivals that records the user's travel information with GPS and Bluetooth technology when traveling to public areas ($M = 2.90$, $SD = 1.36$), sequentially.

In order to interpret descriptive results, the criteria by Watson and Preedy (2010) were used: 1 = strongly disagree or strongly unfollow; 2 = disagree or unfollow; 3 = neither agree nor disagree or neither follow nor unfollow; 4 = agree or follow; and 5 = strongly agree or strongly follow. In terms of interpreting mean value, the following criteria were used: 1.00-1.80 = strongly disagree or strongly unfollow; 1.81-2.60 = disagree or unfollow; 2.61-3.40 = neither agree nor disagree or neither follow nor unfollow; 3.41-4.20 = agree or follow; and 4.21-5.00 = strongly agree or strongly follow.

Table 1

Mean, Standard Deviation, and Interpretation of the Items Regarding Opinions, Knowledge, and Practices Towards E-health Literacy with the New Normal Lifestyle (n = 410)

E-health Literacy with New Normal Lifestyle	M	SD	Interpretation
1. Wearing a fabric mask or surgical mask when leaving home*	4.67	0.67	Strongly followed
2. Receiving full doses of vaccination*	4.58	0.85	Strongly followed
3. Eating cooked food*	4.48	0.75	Strongly followed
1. Scanning app for tourist arrivals called Thai Chana or Mor Chana when traveling to public areas**	2.90	1.36	Neither followed nor unfollowed
2. The ability to download, sign up, and use applications launched by government or applications related products or food delivery by themselves**	2.85	1.39	Neither followed nor unfollowed
3. Wearing a surgical mask or fabric mask when talking to people in the same house**	2.40	1.51	Unfollowed
The overall mean score from 58 items	3.52	1.18	Agreed and followed

Note. *The first-three averages of the items with highest mean score. **The first-three averages of the items with lowest mean score.

The Exploratory Factor Analysis

Table 2 shows four statistical techniques that were used to assess preliminary agreement and analytical feasibility of the exploratory factor analysis (Hair et al., 2019).

Table 2

Statistical Techniques to Assess Preliminary Agreement and Analytical Feasibility of the Exploratory Factor Analysis

Statistical Techniques	Cut-Off Value	Result	Interpretation
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	> .50	.96	Most suitable
Bartlett's Test of Sphericity	*p*-value < .01	.001	Statistically significant
Anti-image Correlation Value (h^2)	> .50	.75 - .98	Suitable
Communality Value	> .30	.30 - .87	Suitable
Cumulative Eigenvalues of Extracted Five Components	> 60%	67.75%	Suitable

The results noted that 57 out of 58 indicators met the initial criteria with the exception of the 32nd indicator *"You get adequate sleep"*, which had a communality value of .28; the researcher therefore excluded such variable. In order to extract the components for exploratory factor analysis, oblique rotation and direct oblimin rotation techniques were utilized. Finally, five components were extracted. The researcher then assigned these five components their respective names based on their associated indicators of each component. The details of each component are further explained.

Media and Information Literacy Component.

This consisted of 19 indicators, with factor loading values ranging from .36 to .98. The eigenvalues were 27.92, and the component explained 48.98% of the variance. It comprised of factors that thoroughly described both older people' capacity to recognize accurate and misleading information regarding COVID-19 on social media, as well as their ability to differentiate which materials were of high quality and which should be trusted and followed. Media and information literacy were also used to examined how older adults recognize that social media employed numerous tactics and presentations in both static and animated formats to construct COVID-19 presentations. Furthermore, media and information literacy covered how older adults use social media information to take care of and protect themselves from contracting COVID-19, understanding the meaning of English technical terms related to daily reporting on the COVID-19 situation, using information to make treatment decisions if they became infected with COVID-19, and bringing quality and reliable sources to share with friends. However, in order to determine the credibility of information, it was necessary to consider the credibility of the sources, which included both individuals and entities sharing the information. This included not being overly concerned with the overloaded information received and being aware of social media scams, such as not clicking or forwarding links sent via SMS or email.

Computer and Social Media Literacy Component.

This consisted of 12 indicators, with factor loading values ranging from .50 to .86. The eigenvalues were 3.89, and the component explained 6.82% of the variance. It included indicators that comprehensively described older adults' ability to adapt to constantly learning new things on social media, to use social media applications, such as Line, Facebook, YouTube, or Twitter to communicate, download, sign up for, and use smartphone applications, such as applications launched by government or applications related to products or food delivery. Computer and social media literacy included older adults' capacity to access accurate information about COVID-19 from social media, such as a Google search (Google.com), Facebook Fanpage, or YouTube. In addition, computer and social media literacy also implied that older adults could handle basic social media difficulties on their own and understand when family members or grandchildren explained how to acquire and utilize such applications.

Healthcare Literacy Component.

This consisted of 11 indicators, with factor loading values ranging from .34 to .82. The eigenvalues were 2.61, and the component explained 4.59% of the variance. It covered indicators of how older adults were taking good care of themselves in accordance with the new normal lifestyle in order to prevent the spread of COVID-19. Such practices included using a serving spoon and washing hands before eating, eating foods that boost immunity, social distancing, washing hands with soap, alcohol gel, or alcohol spray, having regular exercises, and refraining from gathering with family and friends, It included scanning app for tourist arrivals, measuring body temperature when entering public areas, avoiding gathering and traveling in busy places, and wearing a surgical mask or fabric mask when talking to others in the same house.

Health Risk Literacy Component.

This consisted of 5 indicators, with factor loading values ranging from .67 to .81. The eigenvalues were 2.29, and the component explained 4.02% of the variance. It included indicators that comprehensively explained how older adults used self-protective behaviors in accordance with their new normal lifestyle to

reduce the risk of contracting COVID-19, such as eating cooked food, getting a full dose of COVID-19 vaccination, wearing a surgical mask or fabric mask when going out, and reducing the spread of COVID-19 to others by getting tested for COVID-19, especially when they knew they were at high risk or in an epidemic area.

COVID-19 Literacy Component.

This consisted of 9 indicators, with factor loading values ranging from .39 to .59. The eigenvalues were 1.91, and the component explained 3.36% of the variance. It included indicators that covered how older people were aware of how COVID-19 was spread, as well as being aware of any congenital diseases and how they might be at risk if they got infected with COVID-19, knowledge of species, conventional medicines, and herbal medicines that had been approved for use in treatment, and preventing severe symptoms through full-dose immunization and continued protection long after vaccination. It was also revealed that older persons trusted information regarding COVID-19 obtained from family. Due to one indicator, *"COVID-19 information passed on from friends impacts the beliefs of older adults"* had a factor loading value of .29 (the cut-off value was .30), the researcher therefore excluded it.

The First and Second Orders of Confirmatory Factor Analysis

According to Table 3, 5 components and 56 indicators were discovered through exploratory factor analysis and were validated through the first order of confirmatory factor analysis, and the same indicators and components were found. The following were the cut-off criteria for determining the consistency of components and indicators: *p*-value > .05, Chi-square/*df* ≤ 3.00, RMSEA ≤ .08, RMR ≤ .05, SRMR ≤ .05, GFI ≥ .90, AGFI ≥ .90, NFI > .95, NNFI > .95, CFI ≥ .95, IFI ≥ .95, RFI ≥ .95, and CN ≥ 200 (Hair et al., 2019; Kline, 2016).

Table 3

The First Order of Confirmatory Factor Analysis of the E-health Literacy Indicators Model of Older Thai Adults with New Normal Lifestyle

Components and Number of Indicators	Factor Loading Ranges	Qualified Criteria
Media and Information Literacy (19 Indicators)	.53** - .92**	Chi-square/df = 1.87, RMSEA = .05, RMR = .03, SRMR = .02, GFI = .95, AGFI = .91, NFI = .99, NNFI = 1.00, CFI = 1.00, IFI = 1.00, RFI = .99, and CN = 296.66
Computer and Social Media Literacy (12 Indicators)	.39** - .95**	*p*-value = .16, Chi-square/df = 1.29, RMSEA = .03, RMR = .02, SRMR = .01, GFI = .99, AGFI = .96, NFI = 1.00, NNFI = 1.00, CFI = 1.00, IFI = 1.00, RFI = .99, and CN = 580.64
Healthcare Literacy (11 Indicators)	.50** - .85**	*p*-value = .15, Chi-square/df = 1.36, RMSEA = .03, RMR = .02, SRMR = .02, GFI = .99, AGFI = .96, NFI = 1.00, NNFI = 1.00, CFI = 1.00, IFI = 1.00, RFI = .99, and CN = 593.41
Health Risk Literacy (5 Indicators)	.37** - .72**	*p*-value = .15, Chi-square/df = 2.12, RMSEA = .05, RMR = .02, SRMR = .02, GFI = 1.00, AGFI = .97, NFI = 1.00, NNFI = .98, CFI = 1.00, IFI = 1.00, RFI = .95, and CN = 1,279.03
COVID-19 Literacy (9 Indicators)	.42** - .86**	Chi-square/df = 2.51, RMSEA = .06, RMR = .02, SRMR = .02, GFI = .98, AGFI = .94, NFI = .99, NNFI = .99, CFI = .99, IFI = .98, RFI = .98, and CN = 335.42

Note. **.01 level of significance (*t*-value ≥ 2.58)

Table 4

The Second Order of Confirmatory Factor Analysis of the E-health Literacy Indicators Model of Older Thai Adults with New Normal Lifestyle

Components	Factor Loadings	R^2
Media and Information Literacy	.99**	.98
Computer and Social Media Literacy	.98**	.95
Healthcare Literacy	.77**	.59
Health Risk Literacy	.35**	.12
COVID-19 Literacy	.86**	.74

Note. **.01 level of significance (*t*-value $\geq$ 2.576)

From Table 4, it could be concluded that the second order of confirmatory factor analysis confirmed that e-health literacy indicators model of older Thai adults in adjusting to live with new normal lifestyle had a reasonable fit with Chi-square/*df* = 2.41, RMSEA = .06, RMR = .03, SRMR = .04, GFI = .95, NFI = .99, NNFI = .99, CFI = .99, IFI = .99, RFI = .98, and CN = 204.13. Furthermore, these five components were linked and could be used to explain the variability of the indicators model of e-health literacy indicators model of older Thai adults in adjusting to live with new normal lifestyle. Media and information literacy component was the most important in this regard. The metric model's variance was explained by 98%, second, the computer and social media literacy component explaining 95% of the variance. Following that was the COVID-19 literacy component, which explained 74% of the variance in the metric model.

Discussion and Conclusion

This study focused on developing e-health literacy indicators of older Thai adults who were aged over 60 years and adjusting to live with the new normal lifestyle in order to assess the consistency between the empirical data and e-health literacy indicators model. Five factor structures were validated through the first order of CFA and the same indicators and components were found. Consequently, the researcher discussed each component in descending order of the coefficient of determination value or R^2 value as shown below.

Firstly, media and information literacy component included indicators that comprehensively explained the ability of older Thai adults to detect true and false information about COVID-19 on social media, as well as how older Thai adults could recognize that social media used various techniques and presentations in both static and animated formats to make COVID-19 presentations. Furthermore, media and information literacy explained how older Thai adults could use social media information to protect themselves from contracting COVID-19, understanding the meaning of English technical terms related to daily reporting on the COVID-19 situation, and using information to make treatment decisions if they became infected with COVID-19, as well as bringing quality and reliable sources to share with friends. To establish the reliability of the information, however, the trustworthiness of the sources, both persons and entities providing the information, must be considered. The component's indicators were also comparable to the lily model of e-health literacy developed by Brørs et al. (2020) and Norman and Skinner (2006) in terms of traditional literacy and media literacy components, which included the ability for the audiences to interpret the meaning from the symbols that come in the form of still images, video clips, animation, sound effects, and various infographics used in communication; a well-literate individual would be able to draw on his or her knowledge and apply it to himself or herself. In this regard, individuals are to expose, search, understand, analyze, and assess the credibility of online health information and dissemination channels before believing or following such advice due to a large number of fake news about protecting oneself from COVID-19 appearing on social media (Sykes et al., 2021).

Secondly, computer and social media literacy component consisted of indicators that comprehensively described the ability of older Thai adults to adapt to constantly learn new things on social media. They also had the ability to use applications in social media to communicate, as well as having the

ability to download, sign up, and use applications on smartphones. Computer and social media literacy also included the ability of the older Thai adults to know where to find reliable information about COVID-19 from social media. In addition, computer and social media literacy also included the capability to solve basic problems in using social media by themselves, while understanding when family members or grandchildren explained how to use them. The component's indicators were also comparable to the computer literacy component developed by Brørs et al. (2020) and Norman and Skinner (2006), which explained the concept of computer literacy as requiring users to have knowledge and skill in using digital technology, such as computers and electronic devices in addition to basic reading and writing skills. Computer literacy also involved the capacity to adapt to new functionalities and get health information from reliable sources. The indicators discovered that this component also supports the findings of Tyler et al. (2018), who concluded that older adults who had pleasurable experiences with digital technology while working would feel more confident in using it, along with learning to use it from experts, obtaining positive social feedback, and having a positive attitude towards using digital technology. Furthermore, older persons who are able to handle simple challenges with the use of digital technology increased self-confidence. The findings of Jung et al. (2022) and Heo et al. (2015) further recommended that the environmental context of the older adults, such as people around them who are interested in digital technology, or friends of the same age, and grandchildren might assist them in learning how to use digital technology. In addition, the above findings were also consistent with what Pourrazavi et al. (2020) and Watkins and Xie (2014) proposed that the older adults who perceive high self-efficacy in using digital media and motivation for healthcare will allow themselves to search and analyze health information they receive from digital sources to use for their healthcare benefits and make alternative health decisions.

Thirdly, COVID-19 literacy component included indicators that covered how older people were aware of how the COVID-19 was spread, as well as being aware of any congenital diseases and how they may be at risk if they became infected with COVID-19, with knowledge of species, conventional medicines, and herbal medicines had been approved for use in treatment. This was in addition to preventing severe symptoms with full-dose immunization and always safeguarding oneself even after vaccination. Furthermore, it was also shown that older persons trusted information regarding COVID-19 acquired from family members. These findings were also comparable to scientific literacy component developed by Brørs et al. (2020) and Norman and Skinner (2006), which implied the necessity for everyone to have a set of knowledge about scientific material relevant to their daily lives, without requiring them to be a science learner in order to comprehend the term's meaning. Consequently, individuals will be able to use this information to take care of themselves in order to stay healthy. In addition, these findings were consistent with the findings of Jung et al. (2022) and Tyler et al. (2018), who coherently noted that social surroundings, such as family members, grandchildren, and peers play critical roles in older individuals' self-confidence to use social media and electronic devices. Furthermore, the aforementioned indicators were explained by the health belief model (HBM) (Champion & Skinner, 2008), which aims to change people's thoughts, beliefs, and attitudes in order to achieve proper health practices by relying on both psychological and physical factors, such as risk and barrier perceptions, as well as supportive environment.

Fourthly, healthcare literacy component included the indicators regarding how the older Thai adults were taking good care of themselves in accordance with the new normal lifestyle in order to prevent the spread of COVID-19, by doing like using a serving spoon, washing hands before eating, eating immunity-boosting food, doing social distancing, washing hands with soap, alcohol gel, or alcohol spray, having regular exercises, abstaining from gathering with family and friends, including avoiding gatherings and commuting in congested areas, and wearing a surgical mask or fabric mask when talking to people in the same house. The component's indicators were also comparable to health literacy component developed by Brørs et al. (2020) and Norman and Skinner (2006), which explained that individuals need to understand their health conditions in order to make practical decisions about their healthcare. This includes the requirement for people to be able to assess their health state and have a rudimentary understanding of what they are experiencing. Furthermore, the findings of the indicators were also compatible with the findings

of Yodmai et al. (2021), who revealed that the majority of older Thai adults typically practice hand washing and mask wearing. Furthermore, they follow the official health measures, such as physical distancing recommendations and avoid sharing meals to prevent the spread of the virus. In addition, the findings of Vicerra (2021) confirmed that older Thai adults who possess a mobile phone, computer, and gain COVID-19 information via SMS or the internet have a higher level of preventative action compared to older Thai adults who receive COVID-19 information through mass media.

Lastly, health risk literacy component included indicators that comprehensively explained how older Thai adults engaged in self-protective behaviors in accordance with their new normal lifestyle to reduce the risk of contracting COVID-19. They did so by eating cooked food, completing doses of COVID-19 vaccination, and wearing a surgical mask or fabric mask when going out. These activities serve to reduce the transmission of COVID-19 to others by getting tested for COVID-19 if they were at high risk or were in an epidemic location, as well as self-examination using the Antigen Test Kit or ATK if they experienced symptoms or hazards. The component's indicators were also comparable to health literacy component developed by Brørs et al. (2020) and Norman and Skinner (2006), which described the importance of individuals understanding their health conditions and selecting health datasets that are relevant to their physical condition in order to make practical healthcare decisions. This includes the necessity for individuals to be able to assess their health and have a rudimentary understanding of their illness at an early stage (Jung et al., 2022). In addition, the findings were also compatible with the findings of a study of Thai elderly people on how to maintain their health in order to reduce their chances of contracting COVID-19 (Thanapluetiwong et al., 2021; Vicerra, 2021), the majority of the them are observed to wear masks while going out, routinely wash their hands with soap and alcohol gel, eat freshly prepared meals, and use a serving spoon whenever they share meals with others. Furthermore, they lower the chance of serious disease and death through vaccination against COVID-19.

In summary, based on the results of the second order of confirmatory factor analysis, it was confirmed that the indicator model of e-health literacy of older Thai adults in adjusting to live with the new normal lifestyle had an acceptable fit with Chi-square/df = 2.41, RMSEA = .06, GFI = .95, NFI = .99, CN = 204.13. As a result, increasing e-health literacy skills for older Thai adults would help them reduce their exposure to social media scams, share and forward fewer fake news, photos, and video clips, and have a greater ability to use social media on their own in daily life, as well as be able to maintain self-care according to new and next normal guidelines.

Limitation

Due to the COVID-19 situation, which is constantly changing, both types of variants and symptoms of disease, as well as the Thailand government measures have moved forward with Thai economy in declassification COVID-19 from a dangerous communicable disease to a communicable disease that must be monitored (Royal Thai Government, 2022b). Since this study collected data during a severe COVID-19 pandemic, it would be possible that e-health literacy indicators for older Thai adults might change. Therefore, continual research initiatives are necessary.

Implication for the Behavioral Science

The results of this study could potentially contribute to behavioral science by providing e-health literacy components and indicators for older Thai adults and those who are entering the aging society. They need to be well-literate in social media use in order to determine whether health information derived from them is reliable or not, have a stronger capacity to use social media independently in everyday life, as well as preserve their health in accordance with new and next normal guidelines during the COVID-19 pandemic. Furthermore, because COVID-19 may remain with us for a long time, the indications acquired can be utilized to develop government policies or practical advice for the elderly. The result of this study

can also be utilized to elaborate on the concepts of e-health literacy and health belief model (HBM) that are specific to the older adults' group.

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