

**DIGITAL HEALTH KNOWLEDGE AND ITS ASSOCIATED FACTORS AMONG PRE-ELDERLY
PERSONNEL AT A UNIVERSITY IN NORTHEASTERN THAILAND:
A CROSS-SECTIONAL STUDY**

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Abstract

The rapid growth of the aging population has increased the importance of digital health knowledge in supporting effective health management, particularly among pre-elderly individuals. This study aimed to assess the level of digital health knowledge and examine its associations with personal factors and digital health-related technology use behaviors among pre-elderly personnel at a university in northeastern Thailand.

A cross-sectional survey was conducted among 50 personnel aged 45–59 years, selected using a stratified random sampling method. Data were collected using a self-administered structured questionnaire covering personal characteristics, digital health-related technology use behaviors, and digital health knowledge. Descriptive statistics were used to summarize the data, and Chi-square test or Fisher's exact test was applied to examine associations.

The results showed that most participants had a moderate level of digital health knowledge (46.0%), followed by low (34.0%) and high levels (20.0%). Age and job category were significantly associated with digital health knowledge ($p < 0.05$), with younger participants and academic staff demonstrating higher levels of knowledge. In contrast, digital health-related technology use behaviors were not significantly associated with knowledge level.

The findings suggest a need for targeted educational interventions focusing on digital health information evaluation, telemedicine, and digital health privacy to strengthen digital health knowledge among pre-elderly adults and support their preparedness for ageing in an increasingly digital healthcare environment.

Keywords: Digital health knowledge, Pre-elderly, Technology use behavior, Health information

Introduction

Population ageing has become a major global demographic trend, with the United Nations projecting that older adults will account for a substantial proportion of the world's population by 2050. This shift is particularly evident in Thailand, where national reports indicate that the country became a complete aged society in 2023 and is expected to transition into a super-aged society within the next decade (by 2033), with individuals aged 60 years and over accounting for approximately 28% of the total population (Department of Older Persons, Ministry of Social Development and Human Security, 2023).

This demographic transformation places increasing pressure on healthcare systems, as older adults often require continuous and complex care, particularly for chronic conditions, as well as long-term monitoring and support. In this context, digital health has emerged as an important tool to enhance access to health information and support self-management, as highlighted by the World Health Organization (World Health Organization, 2019). Evidence suggests that digital technologies can improve health behaviors, quality of life, and disease management among older adults (Cui et al., 2024). However, access to digital information alone is insufficient. Despite increasing use of the internet for health-related purposes among older populations, the presence of inaccurate or misleading information remains a significant concern (Sun et al., 2020). Without adequate digital health knowledge, individuals—particularly older adults—may be vulnerable to misinformation, which can negatively affect health decisions, increase exposure to health-related fraud, and pose risks to public health (Zhou, Xiang, and Xie, 2023; Suarez-Lledo and Alvarez-Galvez, 2021).

Despite the growing importance of digital health in ageing societies, evidence regarding digital health knowledge among pre-elderly adults remains limited. In this study, digital health knowledge refers to basic understanding of digital health information, services, and data privacy necessary for safe and appropriate use. Existing research has predominantly focused on digital health literacy, eHealth literacy, or the adoption of digital technologies among older adults (Choi & DiNitto, 2013; Norman & Skinner, 2006; Vaart & Drossaert, 2017), while relatively few studies have specifically examined foundational digital health knowledge and its associated factors among individuals approaching older age. In Thailand, available evidence has mainly addressed digital readiness and technology use among older populations, with limited empirical evidence given to digital health knowledge among pre-elderly adults (Department of Older Persons, Ministry of Social Development and Human Security, 2023; Naseeda & Thanyaratporn H., 2025). Furthermore, little is known about how personal characteristics and digital health-related technology use behaviors are associated with digital health knowledge in this population. Addressing this gap is important for informing context-specific interventions to improve digital health knowledge among pre-elderly adults and promote effective engagement with digital health information and technologies before individuals transition into older adulthood.

Objectives

1. To assess the level of digital health knowledge among pre-elderly personnel at a university in northeastern Thailand.
2. To examine the association between personal factors, digital health-related technology use behaviors, and the level of digital health knowledge among pre-elderly personnel at a university in northeastern Thailand.

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Methods

1. Ethic committees

This study was reviewed and granted exemption approval by the Institutional Review Board (IRB) of the university (Reference No. HE693039). Participation was voluntary, and informed consent was obtained from all participants. Participant confidentiality was strictly maintained throughout the study.

2. Population and Sample

The study population consisted of permanent personnel at a university in northeastern Thailand, including both academic and support staff aged 45–59 years in 2025. According to human resources records as of January 5, 2026, 410 personnel met the inclusion criteria (232 academic staff and 178 support staff). Eligible participants were permanent academic or support personnel aged 45–59 years who were able to complete the questionnaire and willing to participate. Personnel on extended leave during data collection or those who returned incomplete questionnaires were excluded.

A sample size of 44 was estimated using the finite population proportion (Lwanga & Lemeshow, 1991), assuming a 95% confidence level, 5% margin of error, and an anticipated high level of digital health knowledge of 96.7% (Chinwatsopol et al., 2024). To account for a potential 10% drop-out rate, the final sample size was set at 50 participants.

Participants were selected using stratified random sampling. The population was first stratified into two main groups: academic staff and support staff. Within each stratum, personnel were further categorized into three disciplinary groups: health sciences, science and technology, and social sciences and humanities. This multistage sampling approach was applied due to the organizational structure of the university. Two faculties were randomly selected from each disciplinary group to support representation across academic units. Sample sizes within each faculty were allocated proportionally based on stratum size, and simple random sampling was used to select participants within each faculty.

3. Instruments

Data were collected using a self-administered questionnaire developed based on a review of relevant literature and conceptual frameworks related to digital health and eHealth literacy, particularly the eHealth Literacy Framework proposed by Norman and Skinner (Norman & Skinner, 2006), as well as literature on digital health technologies, ageing populations, and digital health behaviors to guide item development for the knowledge and behavior sections of the questionnaire. The questionnaire comprised three sections: 1) Demographic information, 2) Digital health–related technology use behaviors, and 3) Digital health knowledge.

Digital health–related technology use behaviors were assessed using eight items covering four domains: (1) online health information seeking and credibility evaluation, (2) use of health applications and self-monitoring technologies, (3) utilization of digital health services and telemedicine, and (4) privacy and security management in digital health contexts. Participants reported the frequency of these behaviors using five-point rating scales, with higher scores indicating more frequent engagement in digital health–related technology use behaviors.

Digital health knowledge was defined as an individual's foundational understanding of digital health information, technologies, services, and data privacy principles necessary for their safe and appropriate use. The 10-item knowledge instrument was developed to assess factual knowledge across four domains: (1) evaluation of the credibility of online health information, (2) understanding of digital health technologies and telemedicine

services, (3) appropriate use of health applications and self-monitoring devices, and (4) awareness of privacy and data security issues. Responses were scored as correct or incorrect, with higher scores indicating greater digital health knowledge.

Content validity was evaluated by experts using the item-objective congruence (IOC) index, with all items achieving IOC values ≥ 0.50 , indicating satisfactory content validity. Reliability for the digital health-related technology use behaviors section was assessed using Cronbach's alpha, which yielded a coefficient of 0.659, considered acceptable for research purposes (Gliem and Gliem, 2003). The digital health knowledge section, consisting of 10 dichotomous items, had a mean item difficulty of 0.75, indicating most items were moderately easy. In classical test theory, items difficulty values between 0.30 and 0.80 are generally considered acceptable for distinguishing participants' knowledge levels, while avoiding items that are excessively easy or difficult (Boateng et al., 2018; Quaigrain and Arhin, 2017).

4. Data collection

Data were collected following the sampling procedure. The researchers coordinated with the relevant administrative offices to obtain permission for participant contact and data collection. Participants were informed of the study objectives, confidentiality measures, and voluntary participation; consent was obtained on the first page of the questionnaire. Paper-based questionnaires were distributed to selected participants through faculty staff. Respondents were given a specified timeframe to complete the questionnaires, and reminders were provided to ensure a high response rate. Upon collection, questionnaires were reviewed for completeness and consistency prior to analysis.

5. Data analysis

Prior to analysis, data were entered and cleaned to ensure accuracy and completeness. Data screening included checking for missing values, outliers, and out-of-range values. Any inconsistencies were verified and corrected where necessary. New variables were constructed for analysis. Digital health-related technology use behaviors (Part 2) were measured across four domains: (1) online health information seeking and credibility evaluation, (2) use of health applications and wearable devices, (3) use of digital health services and telemedicine, and (4) privacy and data security management, with two items in each domain. Mean scores for each domain were calculated and categorized into three levels—low, moderate, and high—based on class interval criteria (Best & Kahn, 2006): 1.00–2.33 (low), 2.34–3.67 (moderate), and 3.68–5.00 (high). Digital health knowledge (Part 3) was assessed using 10 dichotomous items, with one point assigned for each correct answer and zero for incorrect answers. The total score was categorized into three levels based on Bloom's cut-off points (Bloom et al., 1971): low (0–5 points), moderate (6–7 points), and high (8–10 points).

For data analysis, descriptive statistics were used to summarize the data. Participants' characteristics were described using frequencies and percentages for categorical variables, and means and standard deviations (SD) for continuous variables. The level of digital health knowledge was presented using frequencies and percentages. To examine the association between personal factors, digital health-related technology use behaviors, and the level of digital health knowledge, the Chi-square test or Fisher's exact test was applied as appropriate. For this analysis, the level of digital health knowledge and digital health-related technology use behaviors were recategorized into two groups to ensure adequate cell counts and to meet the assumptions of the statistical tests. Digital health knowledge was recategorized into low–moderate (0–7 points) and high (8–10 points). For digital

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health-related technology use behaviors, the low and moderate categories (mean score 1.00–3.67) were combined into a single group, while the high category (mean score 3.68–5.00) remained unchanged. A p-value of less than 0.05 was considered statistically significant. All analyses were performed using IBM SPSS Statistics version 29.0.

Results

Participants' characteristics are presented in Table 1. Of the 50 participants, the majority were female (82.0%), while males accounted for 18.0%. The largest age group was 45–49 years (46.0%), followed by 50–54 years (38.0%) and 55–59 years (16.0%). Regarding job classification, participants were equally distributed between academic and support staff (50.0% each). In terms of educational attainment, half of the participants held a doctoral degree (50.0%), followed by bachelor's (22.0%) and master's degrees (20.0%), while a small proportion had lower than a bachelor's degree (8.0%).

Table 1 Characteristics of the Participants

Characteristics	Number (%)
Sex	
Male	9 (18.00)
Female	41 (82.00)
Age (years)	
45 – 49 years	23 (46.00)
50 – 54 years	19 (38.00)
55 – 59 years	8 (16.00)
Job Category	
Academic staff	25 (50.00)
Support staff	25 (50.00)
Highest Education Level	
Below bachelor's degree	4 (8.00)
Bachelor's degree	11 (22.00)
Master's degree	10 (20.00)
Doctoral degree	25 (50.00)

The level of digital health knowledge among participants is presented in Table 2. Most participants demonstrated a moderate level of digital health knowledge (46.0%), followed by a low level (34.0%) and a high level (20.0%). The mean knowledge score was 6.64 (SD = 2.10).

Table 2 Level of Digital Health Knowledge among Participants

Level of Digital Health Knowledge	Number (%)
Low	10 (20.00)
Moderate	23 (46.00)
High	17 (34.00)
Mean (SD)	6.64 (2.10)

The levels of digital health–related technology use behaviors across four domains are presented in Table 3. Participants demonstrated varying levels across behavioral domains. Online health information seeking and credibility evaluation showed relatively higher mean scores (mean = 2.58, SD = 0.97), with participants equally distributed between low and moderate levels (44.0% each). The use of health applications and wearable devices was predominantly at a low level (52.0%), although a notable proportion reported high levels (28.0%) (mean = 2.52, SD = 1.45). In contrast, the use of digital health services and telemedicine was largely low (82.0%), with the lowest mean score among all domains (mean = 1.90, SD = 0.94). Similarly, privacy and data security management were mainly reported at a low level (60.0%) (mean = 2.13, SD = 1.17).

Table 3 Level of Digital Health–Related Technology Use Behaviors by Domain

Domain	Level of Digital Health–Related Technology Use Behaviors			Mean (SD)
	Low, n (%)	Moderate, n (%)	High, n (%)	
Online health information seeking and credibility evaluation	22 (44.00)	22 (44.00)	6 (12.00)	2.58 (0.97)
Use of health applications and wearable devices	26 (52.00)	10 (20.00)	14 (28.00)	2.52 (1.45)
Use of digital health services and telemedicine	41 (82.00)	6 (12.00)	3 (6.00)	1.90 (0.94)
Privacy and data security management	30 (60.00)	14 (28.00)	6 (12.00)	2.13 (1.17)

Association between Factors and Digital Health Knowledge

The associations between personal factors, digital health–related technology use behaviors, and the level of digital health knowledge are presented in Table 4. Among personal factors, age and job category were

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significantly associated with the level of digital health knowledge ($p < 0.05$). Participants aged 45–49 years were more likely to have a high level of knowledge compared to older age groups. Similarly, academic staff demonstrated a higher proportion of high-level digital health knowledge than support staff. In contrast, sex and educational level were not significantly associated with digital health knowledge ($p > 0.05$).

Regarding digital health–related technology use behaviors, no significant associations were found between any behavioral domains and the level of digital health knowledge ($p > 0.05$), including online health information seeking, use of health applications and wearable devices, use of digital health services and telemedicine, and privacy and data security management.

Table 4 Association between Personal Factors, Digital Health–Related Technology Use Behaviors, and Digital Health Knowledge

Characteristics	Level of Digital Health Knowledge		p-value
	Low-Moderate, n (%)	High, n (%)	
Sex			0.467
Male	5 (55.60)	4 (44.40)	
Female	28 (68.30)	13 (31.70)	
Age (years)			0.039
45 – 49 years	11 (47.80)	12 (52.20)	
50 – 54 years	16 (84.20)	3 (15.80)	
55 – 59 years	6 (75.00)	2 (25.00)	
Job Category			0.037
Academic staff	13 (52.00)	12 (48.00)	
Support staff	20 (80.00)	5 (20.00)	
Highest Education Level			0.113
Below bachelor's degree to bachelor's degree	12 (80.00)	3 (20.00)	
Master's degree	8 (80.00)	2 (20.00)	
Doctoral degree	13 (52.00)	12 (48.00)	

Characteristics	Level of Digital Health Knowledge		p-value
	Low-Moderate, n (%)	High, n (%)	
			0.650
Online health information seeking and credibility evaluation			
Low-Moderate	28 (63.60)	16 (36.40)	
High	5 (83.30)	1 (16.70)	
Use of health applications and wearable devices			0.746
Low-Moderate	23 (63.90)	13 (36.10)	
High	10 (71.40)	4 (28.60)	
Use of digital health services and telemedicine			>0.999
Low-Moderate	31 (66.00)	16 (34.00)	
High	2 (66.70)	1 (33.30)	
Privacy and data security management			0.650
Low-Moderate	28 (63.60)	16 (36.40)	
High	5 (83.30)	1 (16.70)	

Note: For the association analysis, digital health knowledge was recategorized into low–moderate (0–7 points) and high (8–10 points). Digital health–related technology use behaviors were recategorized into low–moderate (mean score 1.00–3.67) and high (mean score 3.68–5.00). Educational level was also collapsed into two categories (Bachelor’s degree or lower and higher than Bachelor’s degree) to ensure adequate cell counts and meet the assumptions of the statistical tests.

Discussion

The findings of this study indicate that most pre-elderly personnel demonstrated a moderate level of digital health knowledge (46.0%), while a considerable proportion remained at a low level (34.0%). This suggests that adequate understanding of digital health concepts is not yet fully established in this population, despite increasing exposure to digital health technologies and online health information. Similar patterns have been reported in Thailand, where pre-elderly adults were found to demonstrate moderate readiness for digital health use (Naseeda & Thanyaratporn H., 2025). These findings indicate potential gaps in foundational digital health knowledge among individuals approaching older adulthood, although interpretation should consider the specific occupational context and sample size of this study.

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The present study assessed digital health knowledge rather than digital health literacy. Digital health knowledge in this study refers to foundational understanding of digital health information, technologies, services, and data security. This construct is conceptually related to but distinct from eHealth literacy, which represents a broader set of competencies involving access, understanding, evaluation, and application of digital health information (Norman & Skinner, 2006; Paige et al., 2018). Accordingly, the findings should be interpreted as reflecting cognitive-level understanding rather than broader functional or applied digital health literacy skills.

The moderate level of digital health knowledge observed in this study suggests that exposure to digital health technologies may not be sufficient to ensure adequate understanding of digital health information. This may reflect challenges in evaluating the credibility of online health information and distinguishing reliable sources. Similar concerns have been reported in previous studies on digital health literacy, particularly regarding difficulties in evaluating online health information (Vaart & Drossaert, 2017). In the Thai context, similar limitations in assessing the reliability of digital health information have also been reported among pre-elderly individuals (Naseeda & Thanyaratporn H., 2025). However, given the cross-sectional design of the study, causal relationships cannot be inferred.

The findings indicate that age was significantly associated with digital health knowledge, with participants aged 45–49 years demonstrating higher levels of knowledge compared to older age groups. This suggests variation in digital health knowledge across age groups within the study population. Previous research has reported lower levels of eHealth literacy among older adults and greater difficulties in engaging with online health information (Choi & DiNitto, 2013). Although that study focused on digital health literacy rather than digital health knowledge, it provides a relevant comparison as both constructs involve engagement with digital health information. This may reflect greater exposure to digital technologies among younger individuals to digital technologies and greater familiarity with evolving digital platforms, while age-related differences in adapting to new information environments may influence knowledge acquisition (Jiang et al., 2024; Shi et al., 2024). However, these interpretations should be considered cautiously given the study design and sample size.

Job category was significantly associated with digital health knowledge, with academic staff demonstrating higher levels of knowledge compared to support staff. This difference may be related to variations in occupational roles, particularly in terms of engagement with information-seeking, critical appraisal, and academic-related activities between groups. These competencies may be relevant to understanding digital health information in this context. This finding is broadly consistent with previous evidence indicating that higher eHealth literacy is associated with greater educational attainment and stronger skills in evaluating online information (Neter & Brainin, 2012). However, educational level was not significantly associated with digital health knowledge in this study. This finding may reflect overlapping effects between job category and educational level, as well as potential unmeasured confounding factors. This discrepancy may also reflect sample-specific characteristics. This discrepancy may also reflect unmeasured factors or sample-specific characteristics and should be interpreted cautiously.

The findings indicate that none of the four domains of digital health–related technology use behaviors were significantly associated with digital health knowledge. This suggests that frequency of digital health technology use may not directly reflect knowledge level in this population. One possible explanation is that access to digital health resources does not necessarily ensure correct interpretation of health information. Consistent with previous findings, van der Vaart and Drossaert (Vaart & Drossaert, 2017) reported that even regular internet users may experience

difficulties in evaluating the credibility of online health information. In addition, effective engagement with digital health information requires cognitive and evaluative competencies beyond access alone, as emphasized in the eHealth literacy framework (Norman & Skinner, 2006). However, these explanations remain exploratory and should be interpreted in light of the small sample size and measurement limitations of the behavioral scale.

Conclusions

The findings indicate that pre-elderly personnel demonstrated a moderate level of digital health knowledge, with significant differences observed by age and job category, while no significant association was found with digital health-related technology use behaviors.

However, the interpretation of these findings should be considered in light of the study's cross-sectional design and relatively small sample size, which limit causal inference and generalizability. Therefore, the findings should be viewed as preliminary and can inform future research and the development of targeted strategies to support digital health knowledge among pre-elderly adults.

Suggestions

Based on the study findings, several recommendations can be considered. First, capacity-building initiatives targeting digital health knowledge, particularly among support staff and older personnel, may be beneficial, with particular attention to differences in age and occupational groups observed in this study. In particular, support staff and older personnel may benefit from tailored learning approaches that reflect varying levels of digital familiarity and learning needs.

In addition, digital health promotion efforts should not focus solely on increasing access to digital technologies, particularly given the finding that technology use behaviors were not significantly associated with knowledge levels. Instead, emphasis should be placed on developing skills related to evaluating and interpreting online health information. Accordingly, interventions that integrate critical appraisal skills and data literacy components may be more appropriate for strengthening foundational digital health knowledge in this population.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, although the sample size was calculated using a standard formula and participants were selected through stratified random sampling, the relatively small sample size, together with the lower-than-expected proportion of participants with high digital health knowledge, may have limited the statistical power to detect associations between variables. As a result, the findings should be considered exploratory and interpreted with caution. Second, several variables, including digital health knowledge and digital health-related technology use behaviors, were recategorized prior to analysis to meet the assumptions of chi-square tests. This procedure may have reduced variability in the data and limited the ability of the analysis to detect differences between groups. Third, the internal consistency of the digital health-related technology use behavior scale was slightly below the commonly accepted threshold (Cronbach's $\alpha = 0.659$), which may be related to the limited number of items and the multidimensional nature of the construct. Future research may benefit from refining and expanding items within each domain to improve reliability and measurement precision.

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