

The Development of Digital Elderly Health Book (DEHB) Program for Elderly Using, Thailand

Attaphon Kaewsamrit¹, Nithirat Boontanon^{2*}, Ratchanee Burnrangsri³, Songpol Kamnuengkiattiwong³ and Surachet Hanrob⁴

¹ Department of Health, Ministry of Public Health, Thailand, 11000

² Regional Health Promotion Center 4 Saraburi, Department of Health, Ministry of Public Health, Thailand, 18130

³ Bureau of Elderly Health, Department of Health, Ministry of Public Health, Thailand, 11000

⁴ Health Administration Division, Office of the Permanent Secretary, Ministry of Public Health, Thailand, 11000

Received July 3, 2023
Accepted September 12, 2023
Published December 31, 2023

***Corresponding author:**

Nithirat Boontanon, Regional Health Promotion Center 4 Saraburi, Department of Health, Ministry of Public Health, Thailand, 18130

E-mail:
drnest@hotmail.com

©2023, Kaewsamrit, A et al.

This is an Open Access article published under a Creative Commons (CC BY-NC-ND 0.4) license.



ABSTRACT

Introduction: Thailand is currently experiencing a steady increase in its elderly population, coupled with the societal shift towards digitalization in the modern era. Consequently, the utilization of digital technology to facilitate access to health services among the elderly has become crucial. This study aimed to develop a program for promoting the use of a digital elderly health book (DEHB) and evaluate its effectiveness.

Methods: A research and development approach was employed, consisting of three main steps. Firstly, basic information surveys were conducted, and a program to promote the use of DEHB was developed. The informants included stakeholders from four regions of Thailand, with a sample size of 10 people per region. Secondly, a quasi-experimental research design was implemented to assess the effectiveness of the developed program. The participants were divided into four experimental areas (158 subjects) and four control areas (157 subjects). Thirdly, the program was optimized based on the results of the effectiveness evaluation by qualified experts.

Results: The program for promoting the use of DEHB comprised three essential components: (i) enhancing the capabilities of elderly health workers; (ii) fostering demand and developing skills for utilizing health information among the elderly and their caregivers; and (iii) promoting social influence and participation. The experimental exhibited significantly higher levels of access to and utilization of DEHB compared to the control. There was a substantial level of satisfaction with DEHB.

Conclusion: The successful promotion of digital health adoption among the elderly necessitates proficiency, comprehension, and awareness of its advantages among both practitioners (i.e., public health officials) and users (i.e., elderly individuals and caregivers). It also involves creating social influence to gain more acceptance and support for digital health initiatives.

Keywords: Digital elderly health book; Digital health; Promote to use; Elderly health

Introduction

Thailand is currently experiencing a significant demographic transition, projected to reach a 20% proportion of elderly individuals in the near future, as it moves towards becoming a complete-aged society [1]. This demographic shift is occurring alongside a global digital revolution, characterized by the widespread integration of digital technologies into various aspects of daily life and interpersonal interactions [2].

Recognizing the transformative potential of digital health, the World Health Organization has established a Global Strategy on Digital Health 2020-2025, which emphasizes the importance of strengthening governance and promoting the use of digital health among individuals [3]. In the context of older adults, research has shown that digital technologies have provided them with new avenues for internet-based communication and connection with their families [4]. Additionally,

consistent adoption and use of digital technologies among the elderly have yielded several benefits. These include boosted confidence in technology, heightened self-awareness of capabilities, and reduced hesitations in utilizing digital media, thereby facilitating a broader range of digital activities [5].

The health and well-being of the elderly are crucial for active aging and significantly impact their overall quality of life. Therefore, it is essential to ensure that the elderly have access to a variety of health services, particularly in the realm of digital health, which goes beyond communication and entertainment purposes. This enables them to conveniently and expeditiously receive services from government sectors and relevant organizations, as exemplified by the increased utilization of digital health during the COVID-19 pandemic [6-7]. For example, the Mor Prom application is used by almost every Thai citizen to receive vaccine services and is a huge database for the government. Recognizing the importance of accessible health services for the elderly, the Department of Health, Ministry of Public Health of Thailand has developed the Digital Elderly Health Book (DEHB), also known as the Blue Book Application, which has been implemented in several areas since 2021 [8]. The DEHB caters to two primary user groups: 1) elderly individuals and their primary caregivers, and 2) public health officials and volunteers responsible for elderly care in their respective areas. The system encompasses functionalities for the elderly and caregivers, such as health record keeping, health risk screening, vulnerability assessment, scheduling and receiving health services and acquiring health-related knowledge. It also offers features for public health officials and volunteers, including the provision of health services, data processing of health information, and data management [9].

However, the utilization of the DEHB by users from both groups was found to be limited in 2021-2022 [7]. Studies examining digital technology usage among the elderly have revealed a lack of skills in accessing and utilizing modern communication technologies [10]. While elderly individuals may be proficient in using digital media for information searching and online shopping, they have yet to tap into its potential for self-healthcare purposes [11]. Furthermore, various barriers to digital usage have been identified, including visual impairment, memory difficulties, complexity, and technological challenges [12]. Therefore, promoting the use of digital health platforms among the elderly and relevant individuals should involve detailed and clear training programs that provide guidance and create awareness of the benefits of utilizing digital health in real-life situations. Additionally, the development of user-friendly and convenient digital health platforms is essential [13-14].

Given Thailand's aging society and the development of the DEHB to enhance healthcare accessibility for the elderly, this study aims to address two main objectives. Firstly, it seeks to develop a program specifically tailored for Thai users, including the elderly population and relevant staff, to promote the use of the DEHB. Secondly, the study aims to evaluate the effectiveness of the developed DEHB promotion program. The study's primary focus is on enhancing the elderly users' ability to effectively utilize DEHB, by drawing upon the concept of application skills as shown in Figure 1. These application skills encompass the practical use of DEHB functionalities, including data usage, tool utilization, safety precautions, and computation. [2, 16-17]. The effectiveness of the developed program will be assessed based on the improvement in these application skills among the elderly and staff users. The results of this study can provide implications for promoting the use of digital health among the target group, especially the elderly in the community and health personnel, to improve their access to data, information, and health knowledge.

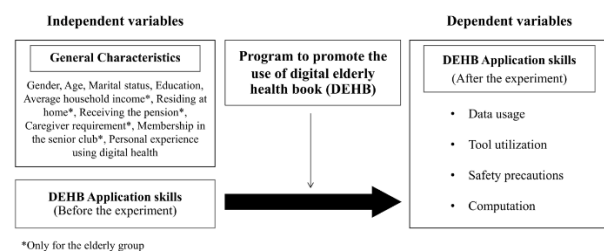


Figure 1 Conceptual framework

Methodology

The study followed a three-phase research and development approach. *Phase 1* focused on investigating and developing a program to promote the use of the DEHB. Data analysis was conducted in four regions: the northern region (Tha Thong Subdistrict, Mueang District, Phitsanulok Province), northeastern region (Tha Tum Subdistrict, Mueang District, Maha Sarakham Province), central region (Samet Tai Subdistrict, Bang Khla District, Chachoengsao Province), and southern region (Thung Takhrui Subdistrict, Thung Tako District, Chumphon Province). Data was collected through semi-structured in-depth interviews with 10 key informants in each region. The key informants comprised 3 elderly individuals, 2 family caregivers, 2 healthcare professionals, 2 village health volunteers or elderly caregivers in the long-term care system, and 1 local government official. Based on the findings, a program was developed, which involved conducting focus group discussions among stakeholders in each region. In this phase, data were analyzed using content analysis.

Phase 2 involved the evaluation of the effectiveness of the developed program through quasi-experimental research. Four areas were identified in Phase 1, four (4) were designated as experimental groups, while the remaining four areas in the same provinces served as control groups. The sample size was determined using a formula for testing the mean difference between two groups based on previous research findings [18], with a 20% increase to account for potential attrition, resulting in a minimum sample size of 75 individuals per group. The participants were divided into two groups: the elderly and the officers (healthcare workers, local government officials, or volunteers), as illustrated in Figure 2. Inclusion criteria for the elderly participants were as follows: age between 60 and 80 years, ability to perform normal activities of daily living, residence in the research area for at least one year, and possession of a personal digital device. The inclusion criteria for the officers were as follows: age of 18 years or older, a minimum of one year of experience in the field of aged care within the research area, and ownership of a personal digital device. The experimental group underwent a 3-month intervention using the developed program, while the control group did not receive the program. To assess the participants' application skills, a 3-part questionnaire was administered before and after the experiment. The questionnaire consisted of two sections: i) general characteristics; ii) self-assessment of four elements of application skills, namely data usage (e.g., platform access and knowledge), tool utilization (e.g., basic access to tools and learning), safety precautions (e.g., registering and recording personal information), and computation (e.g., viewing health reports and understanding one's health status); and iii) a satisfaction assessment used exclusively in the experimental group. Additionally, the research team evaluated the application skills across these four components using behavioral records collected from both groups. Data were gathered from the questionnaires and behavioral records and analyzed using descriptive statistical methods (mean, standard deviation) and analytical statistical methods (chi-square, independent t-test).

Phase 3 focused on refining the developed program based on the results of the effectiveness evaluation. This phase involved conducting focus group discussions with 12 key stakeholders, including elderly health professionals, community development experts, and digital health specialists. Feedback and insights gathered from these discussions were carefully considered and incorporated to enhance the program's appropriateness and effectiveness in promoting the use of DEHB.

The content validity of the semi-structured interview, questionnaire, and behavioral record form was assessed by three experts. The index of item-objective congruency for all items ranged from 0.70 to

1.00, indicating a high level of validity. Additionally, the reliability of the instruments was tested on groups similar to the sample population, and Cronbach's Alpha coefficient was found to be between 0.84 and 0.91, demonstrating good internal consistency. This study obtained ethical approval from the Department of Health on September 26, 2022 (No. 547/2565), ensuring compliance with human research ethics. Before starting the research in each area, the objectives, research process, and data collection were explained to the sample. The sample was also allowed to ask questions and to independently consider participating in the study.

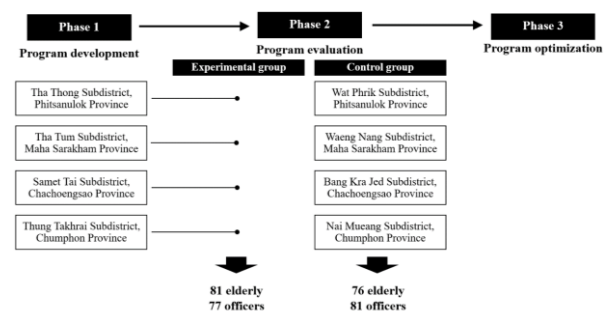


Figure 2 Research area and sample group

Results

The program to promote the use of digital elderly health books

The findings from the in-depth interviews conducted in four regions across Thailand shed light on the challenges faced by elderly individuals, volunteers, public health officials, and local government officials regarding the utilization of DEHB. The interviews revealed that elderly individuals encounter barriers related to comprehension, application skills, limited infrastructure, and awareness of DEHB. Similarly, volunteers and some officials exhibited a lack of awareness and proficiency in using DEHB, particularly in recording and processing health data. Furthermore, the impact of DEHB on elderly healthcare remains uncertain. These findings underscore the importance of targeted interventions to address these challenges, enhance awareness and skills among the elderly, and provide support to stakeholders involved in the program (Table 1).

Table 1 Findings from the in-depth interview

Informants	Findings
Elderly individuals	Lack of understanding and still not having the skills to use DEHB, including recording data, acquiring health knowledge, and

Informants	Findings
	viewing their own health reports.
	• No smart phone to access DEHB. • The personal benefits of DEHB use are not known.
Family caregivers	• It is unknown whether DEHB can serve as a substitute for elderly individuals who are unable to use it independently. • They have not yet used DEHB. • They do not know the benefits of using it and are not confident in the safety of personal information.
Healthcare professionals	• They do not know how to use DEHB as a data manager. • Lack of skills in using DEHB, especially in entering data and viewing data reports. • They have not yet received benefits from its use, such as access to health information of the elderly in the area and reduced workloads.
Village health volunteers and elderly caregivers	• Lack of a smartphone and access to free internet to use DEHB. • Lack of skills in using DEHB, particularly in entering data and viewing data reports. • Preference for recording data on paper and sending reports to healthcare professionals.

Informants	Findings
Local government official	• Unaware that reports can be viewed in the areas under the responsibility of local governments. • Lack knowledge and skills to use DEHB.

The developed program aimed to promote the use of DEHB through three key components: (i) enhancing application skills for elderly health workers, public health officials, local government officials, and volunteers, focusing on usage, data management, problem-solving, and information utilization; (ii) improving the skills of elderly individuals and caregivers in recording health data, conducting health screenings, and raising awareness of DEHB's benefits, including convenient access to health services and improved health literacy; and (iii) creating social influence and participation by fostering communication, increasing awareness among the elderly, and facilitating discussions and experience sharing related to DEHB usage.

However, upon assessing the effectiveness of the program, it was observed that there were no significant differences in the computational application skills among the elderly participants. Therefore, in Phase 3 of the research, there was a focus on enhancing the skill development of the elderly and caregivers, as outlined in Figure 3. This involved increasing their understanding of how to interpret the health status information provided in the DEHB and applying it to practical scenarios. For instance, if a health screening indicates the presence of urinary incontinence, the elderly individual or their caregiver can request an assessment and be eligible to receive support in the form of adult diapers. Additionally, during this phase, the duration of each program activity was carefully determined to ensure more efficient implementation. This allowed for better utilization of the developed program and maximized its impact on the target population.

Program components	Program activities	Duration of program activities*
1 Enhancing application skill for the officers	Teaching and practicing the use of DEHB	Initial with 2 hours, then repeat for 1 hour/month
	Learning to manage elderly and practitioner data	Initial with half an hour, then repeat for 15 minutes/month
	Utilizing available information to its fullest potential	Initial with half an hour, then repeat for 15 minutes/month
	Acquiring skills to solve basic usage problems	Initial with an hour, then repeat for half an hour/month
2 Enhancing application skill and raising awareness for the elderly	Practicing data recording and health screening with DEHB	Initial with half an hour, then repeat for 15 minutes/month
	Building awareness and leveraging DEHB	Initial with half an hour, then repeat for 15 minutes/month
	Practicing self-learning health literacy using DEHB	Initial with half an hour, then repeat for 15 minutes/month
	Processing and interpreting the health status of the elderly*	Initial with half an hour, then repeat for 15 minutes/month
3 Social influence and participation	Continuously communicating to create awareness among users in the community	Continue every 1-2 weeks
	Engaging in discussions and exchanging experiences with DEHB	Every month, 1-2 hours at a time

*Revised details from Phase 3 of the research

The effectiveness of the program to promote the use of digital elderly health books

When comparing the general characteristics of the elderly and the staff between the experimental group and the control group, no significant differences were observed. Furthermore, the mean application skills for using the DEHB were compared before the experiment, revealing no significant difference between the elderly and the staff in both the experimental and control groups (Table 2).

Figure 3 Revised program to promote the use of digital elderly health books in Thailand.

Table 2 General characteristics of the sample

General characteristics	The elderly			The officers		
	Experiment (n=81)	Control (n=76)	p-value	Experiment (n = 77)	Control (n = 81)	p-value
Gender						
Male	19	14	0.439	7	9	0.674
Female	62	62		70	72	
Age	$\bar{X}$ 66.55 SD 5.28	$\bar{X}$ 67.30 SD 6.15	0.121	$\bar{X}$ 49.29 SD 8.62	$\bar{X}$ 50.86 SD 10.23	0.343
Marital status						
Married/ living together	52	50	0.834	47	51	0.803
Unmarried/ widowed/ divorced	29	26		30	30	
Education						
No/ primary school	52	59	0.065	27	26	0.693
Secondary education and above	29	17		50	55	
Average household income	$\bar{X}$ 11071.56 SD 10626.69	$\bar{X}$ 10342.11 SD 13759.42	0.506	-	-	-
Residing at home				-	-	-
Living with oneself	7	13	0.157			
Living with family or someone	74	63				
Receiving the pension				-	-	-
Received	73	68	0.893			
Not received						

General characteristics	The elderly			The officers		
	Experiment (n=81)	Control (n=76)	p-value	Experiment (n = 77)	Control (n = 81)	p-value
	8	8				
Caregiver requirement				-	-	-
Require	5	11	0.086			
Do not require	76	65				
Membership in the senior club				-	-	-
Be a member	62	55	0.549			
Not be a member	19	21				
Personal experience using digital health						
Have used	38	32	0.545	71	78	0.268
Have not use	43	44		6	3	
Mean application skills for using the DEHB before the experiment	$\bar{X}$ 21.32 SD 9.56	$\bar{X}$ 19.35 SD 9.19	0.190	$\bar{X}$ 23.14 SD 9.10	$\bar{X}$ 24.26 SD 8.90	0.438

*Significant level at $\alpha=0.05$

A comparative analysis of the mean application skills for using the Digital Elderly Health Book (DEHB) was conducted between the elderly participants in the experimental group and the control group, after their engagement in the developed program activity. This analysis utilized an independent t-test. The findings revealed a noteworthy disparity in the mean application skills for using DEHB between the elderly participants in the experimental and control groups. Specifically, the elderly participants in the experimental group demonstrated significantly higher mean application skills for using DEHB in comparison to those in the control group. This significant difference was evident across all application skills, including data usage, tool utilization, and adherence to safety precautions. It is important to note, however, that the experimental group only exhibited a non-significant difference in the computation element. Conversely, among the officers, the average application skills for using DEHB were significantly higher in the experimental group than in the control group, encompassing all variables examined (Table 3). Furthermore, when evaluating the satisfaction with the developed program and the use of DEHB, it was found that the elderly participants in the experimental group expressed a satisfaction rate of 91.36%, while the officers in the experimental group reported a satisfaction rate of 89.61%.

Table 3 Comparing the mean application skills for using the digital elderly health book among the elderly and the officers in the experimental and control groups

Application skills	Mean application skills for using the digital elderly health book							
	The elderly				The officers			
	Experiment	Control	t	p-value	Experiment	Control	t	p-value
All application skills	$\bar{X}$ 24.65 SD 7.32	$\bar{X}$ 18.03 SD 9.55	4.896	<0.001*	$\bar{X}$ 35.35 SD 3.81	$\bar{X}$ 28.64 SD 7.42	7.099	<0.001*
Data usage	$\bar{X}$ 5.13 SD 2.39	$\bar{X}$ 3.01 SD 2.97	4.942	<0.001*	$\bar{X}$ 8.85 SD 0.96	$\bar{X}$ 7.37 SD 1.87	6.219	<0.001*
Tool utilization	$\bar{X}$ 6.22 SD 1.91	$\bar{X}$ 4.32 SD 2.54	5.318	<0.001*	$\bar{X}$ 8.86 SD 1.00	$\bar{X}$ 6.94 SD 1.89	7.887	<0.001*

Application skills	Mean application skills for using the digital elderly health book							
	The elderly				The officers			
	Experi ment	Control	t	p-value	Experi ment	Control	t	p-value
Safety precautions	$\bar{X}$ 6.02 SD 2.11	$\bar{X}$ 3.75 SD 2.63	5.975	<0.001*	$\bar{X}$ 8.78 SD 1.03	$\bar{X}$ 6.67 SD 2.30	7.370	<0.001*
Computation	$\bar{X}$ 7.28 SD 2.10	$\bar{X}$ 6.94 SD 3.06	0.792	0.429	$\bar{X}$ 8.86 SD 1.06	$\bar{X}$ 7.65 SD 1.78	5.192	<0.001*

*Significant level at $\alpha=0.05$

Discussion

The program designed to promote the use of DEHB in Thailand comprises three primary components that contribute to its effectiveness and reliability. The first component focuses on enhancing the application skills of elderly health workers. Previous studies have consistently highlighted the significance of regular training for health personnel to effectively utilize digital technologies, as it enhances their digital literacy [19-20]. The positive outcomes observed in this study, with health personnel demonstrating higher levels of application skills, support these findings. The development of application skills among health personnel through the program aligns with previous studies that have implemented human resource development programs aimed at cultivating competencies for more effective utilization of digital health technologies [21-22].

The second component focuses on developing the application skills of the elderly and caregivers while fostering acceptance of digital health among this group. The results of this study revealed that continuous engagement in the program for 3 months led to higher application skills among the target group. This finding is consistent with prior research that has identified higher levels of perceived usefulness and perceived ease of use as contributing factors to greater acceptance of digital health among the elderly [16, 23-25]. Moreover, the development of application skills among the elderly and their caregivers emphasizes the importance of digital competency, enabling them to use digital technologies safely [10, 16]. Significantly, the development of these application skills helps bridge the gap in digital health utilization among the elderly [26] and enhances their access to health services [16, 27-28].

The final component of the program focuses on creating social influence and fostering participation within the community. This aspect plays a crucial role in encouraging the acceptance and utilization of digital health among the elderly, caregivers, and stakeholders [24, 29]. The study findings highlight those continuous interpersonal interactions regarding digital health topics

contribute to sustained usage [30]. These results align with the digital health governance proposal, which underscores the importance of involving multiple sectors in driving the implementation of digital health initiatives [28]. The inclusion of this component further enhances the reliability and effectiveness of the program in promoting the use of DEHB among the target population.

When considering program effectiveness, recipients exhibited superior application skills compared to non-recipients. This coincides with research advocating promotion strategies, including mass media utilization and digital literacy promotion on social platforms, to enhance accessibility, especially for elderly users [31]. Similarly, an instructional strategy study [32] reported that these methods bolstered older individuals' confidence, awareness, and motivation to embrace digital technologies, aligning with this study's program effectiveness.

Conclusions

The program aimed to promote the use of DEHB in Thailand by addressing challenges related to comprehension, application skills, and awareness. Three key components were developed: enhancing the application skills of stakeholders, improving the skills of elderly individuals and caregivers, and fostering social influence and participation. The first component focused on training health workers, officials, and volunteers in DEHB usage, data management, problem-solving, and information utilization. This aimed to improve their proficiency and familiarity with DEHB for effective utilization. The second component aimed to improve the skills of elderly individuals and caregivers in recording health data, conducting screenings, and raising awareness of DEHB's benefits. This empowered them to actively participate in healthcare management, enhancing access to services and health literacy. The third component emphasized creating social influence through communication, awareness campaigns, and experience sharing. It fostered acceptance and utilization of DEHB among the elderly and stakeholders, promoting sustained usage.

Efficient implementation was ensured by optimizing activity durations and maximizing program impact. Skill development and practical application were prioritized, enabling interpretation of health status information and informed decision-making. The program's effectiveness was evaluated through a comparative analysis of mean application skills and satisfaction rates. The experimental group showed significantly higher skills and expressed high satisfaction, indicating the program's positive impact.

Overall, the program addressed challenges, enhanced application skills, and fostered social influence. It empowered stakeholders and promoted healthcare access, active participation, and overall well-being of the elderly. The findings highlight the importance of targeted interventions, awareness enhancement, and skill development for effective DEHB utilization among the elderly population. The results of the research can be applied to promote the use of digital health for the elderly in the community, as well as to increase awareness and skills of public health personnel. However, it is still necessary to develop strategies to promote such use at the local level to seriously use these digital platforms in the future.

Acknowledgments

The authors would like to express their sincere gratitude to the elderly participants, caregivers, volunteers, and staff involved in the research area, whose contributions have made the research project successful. We would also like to extend our heartfelt thanks to the executive personnel in the Department of Health for recognizing the importance of digital health development for the elderly and for promoting research in this area.

References

- [1] The Bureau of Registration Administration, Department of Provincial Administration. Civil registration demographic statistics (monthly). 2023. Available: <https://stat.bora.dopa.go.th/stat/statnew/statMONTH/statmonth/#/mainpage>
- [2] Ministry of Digital Economy and Society. Thailand digital economy and society development plan. 2016. Available: <https://onde.go.th/assets/portals/files/Digital%20Economy%20Plan-%E0%B8%89%E0%B8%9A%E0%B8%B1%E0%B8%9A%E0%B9%80%E0%B8%95%E0%B9%87%E0%B8%A1.pdf>
- [3] World Health Organization. Global strategy on digital health 2020-2025. 2021. Available: <https://www.who.int/docs/default-source/documents/gsd4dhdaa2a9f352b0445bafbc79ca799dce4d.pdf>
- [4] Beckenhauer JIL, Armstrong J. Exploring relationships between normative aging, technology, and communication. *Journal Marriage & Family Review*. 2009; 45(6-8): 825-44. DOI:10.1080/01494920903224418
- [5] Lam J, Lee MKO. Investigating the role of internet self-efficacy in the elderly's learning of ICT in Hong Kong, China: a two-part study. *Journal of Technology in Human Services*. 2007; 25(1-2): 159-76. DOI:10.1300/J017v25n01_11
- [6] Alwashmi MF. The use of digital health in the detection and management of COVID-19. *International Journal of Environmental Research and Public Health*. 2020. 20; 1-7. DOI: 10.3390/ijerph17082906
- [7] Suranartvatchavong SS, Sudnongbau S. Applications of digital technology for elderly health care during the spread of COVID-19 pandemic. *Journal of Southern Technology*. 2022; 15(12): 129-138.
- [8] Bureau of Elderly Health, Department of Health. Blue nook application manual. Nonthaburi: GD Production; 2021.
- [9] Bureau of Elderly Health, Department of Health. Blue book application. 2023. Available: <https://bluebook.anamai.moph.go.th>
- [10] Thisaphak P, Oranop Na Ayuthaya C, Pathumcharoenwattana W. Media, information, and digital literacy indicators for advocating democratic citizenship of Thai elderly. *Journal of Mass Communication*. 2019; 7(1): 147-90.
- [11] Marston HR, Kroll M, Rosario HD, Gschwind YJ. Technology use, adoption and behavior in older adults: results from the iStoppFalls project. *Educational Gerontology*. 2016; 42(6), 371-87. DOI:10.1080/03601277.2015.1125178
- [12] Kleechaya P. Digital technology utilization of elderly and framework for promoting Thai active and productive aging. *Journal of Community Arts*. 2021; 39(2): 56-78.
- [13] Blažič AJ, Blažič BJ. Digital Skills for Elderly People: A learning experiment in four European Countries. *Review of European Studies*. 2018; 10(4): 74-86. DOI: 10.5539/res.v10n4p74
- [14] Castilla D, Botella C, Miralles I, Bretón-López J, Dragomir-Davis AM, Zaragoza I, et al. Teaching digital literacy skills to the elderly using a social network with linear navigation: a case study in a rural area. *International Journal of Human-Computer Studies*. 2018; 118, 24-37. DOI:10.1016/j.ijhcs.2018.05.009

- [15] Schirmer W, Geerts N, Vercruyssen A, Glorieux I. Digital skills training for older people: The importance of the 'lifeworld'. *Archives of Gerontology and Geriatrics*. 2022; 101: 104695. DOI:10.1016/j.archger.2022.104695
- [16] Bothipan S, Supannakul P. Health caring of elders by digital technology. *Buddhachinaraj Medical Journal*. 2019; 36(1): 128-36.
- [17] Chanyawudhiwan G, Mingsiritham K. An analysis of elderly use of digital technology in Thailand. *International Journal: Interactive Mobile Technologies*. 2022; 16(7): 173-80. DOI: 10.3991/ijim.v16i07.28755
- [18] Manmee C, Niramitmahapanya S, Sickamann O, Srithong H. Development of nutrition knowledge-based learning program by information technology for blood sugar control among diabetic patients. *Journal of the Department of Medical Services*. 2021; 46(1): 52-63.
- [19] Pfof, A, Sidey-Gibbons C, Schuessler M, Lu SC, Xu C, Dubsky P, et al. Contrast of digital and health literacy between IT and health care specialists highlights the importance of multidisciplinary teams for digital health- a pilot study. *JCO Clinical Cancer Informatics*. 2021; 5: 734-45. DOI:10.1200/CCI.21.00032
- [20] Petrakaki D, Chamakiotis P, Curto-Millet D. From 'making up' professionals to epistemic colonialism: digital health platforms in the global south. *Social Science & Medicine*. 2023; 321: 115787. DOI:10.1016/j.socscimed.2023.115787
- [21] Seemann RJ, Mielke AM, Glauert DL, Gehlen T, Poncette AS, Mosch LK, et al. Implementation of a digital health module for undergraduate medical students: a comparative study on knowledge and attitudes. *Technology and Health Care*. 2023; 31: 157-65. DOI: 10.3233/THC-220138
- [22] Vasilou V, Philia I, Drosatou C, Mitsi E, Tsakonas I. LeadinCare: A Qualitative informed digital training platform development to increase physicians' soft communication skills after COVID-19. *Psychology, Health & Medicine*. 2023; 1-16. DOI: 10.1080/13548506.2023.2206144
- [23] Ayanlade OS, Oyebisi TO, Kolawole BA. Health information technology acceptance framework for diabetes management. *Heliyon*. 2019; 5: e01735. DOI:10.1016/j.heliyon.2019.e01735
- [24] Ahmad A, Rasul T, Yousaf A, Zaman U. Understanding factors influencing elderly diabetic patients' continuance intention to use digital health wearables: extending the technology acceptance model (TAM). *Journal of Open Innovation: Technology, Market, and Complexity*. 2020; 6(81). 1-15. DOI: 10.3390/joitmc6030081
- [25] Manyazewa T, Woldeamanuel Y, Blumberg HM, Fekadu A, Marconi VC. The potential use of digital health technologies in the African context: a systematic review of evidence from Ethiopia. *Digital Medicine*. 2021; 4: 125. DOI:10.1038/s41746-021-00487-4
- [26] Vainieri M, Vandelli A, Benvenuti SC, Bertarelli G. Tracking the digital health gap in elderly: a study in Italian remote areas. *Health Policy*. 2023; 133: 104842. DOI:10.1016/j.healthpol.2023.104842
- [27] Sertler N, Semiz T. The use of digital health systems in the elderly: a literature study. *Journal of Innovation Healthcare Practices*. 2022; 3(1): 26-35.
- [28] Kijisanayotin B, Suwanthaweeemesuk K, Ratchatorn A, Ungsachon T. Digital health governance model: recommendation for Thailand health systems. *Journal of Health Systems Research*. 2023; 17(2): 203-27.
- [29] Sun X, Yan W, Zhou H, Wang Z, Zhang X, Huang S, et al. Internet use and need for digital health technology among the elderly: a cross-sectional survey in China. *BMC Public Health*. 2020; 20: 1386. DOI:10.1186/s12889-020-09448-0
- [30] Landgren S, Cajander Å. Non-use of digital health consultations among Swedish elderly living in the countryside. *Frontiers in Public Health*. 2021; 9: 588583. DOI:10.3389/fpubh.2021.588583
- [31] Xu X, Mei Y, Sun Y, Zhu X. Analysis of the effectiveness of promotion strategies of social platforms for the elderly with different levels of digital literacy. *Applied Sciences*. 2021; 11(9): 4312. DOI:10.3390/app11094312
- [32] Ahmad NA, Abd Rauf MF, Mohd Zaid NN, Zainal A, Tengku Shahdan, TS, Abdul Razak FH. Effectiveness of instructional strategies designed for older adults in learning digital technologies: a systematic literature review. *SN Computer Science*. 2022; 3: 130. DOI:10.1007/s42979-022-01016-0