

DIGITAL HEALTH MANAGEMENT: A STUDY OF FACTORS INFLUENCING ITS EFFICIENCY

Prapasri Siri *, Tanpat Kraiwanit **, Supakorn Suradinkura ***,
Rattapol Kasemrat **, Papon Moolngearn ****

* Digital Economy Program, Faculty of Economics, Rangsit University, Pathum Thani, Thailand

** International College, Pathumthani University, Pathum Thani, Thailand

*** Corresponding author, International College, Pathumthani University, Pathum Thani, Thailand

Contact details: International College, Pathumthani University, 140 Moo 4 Tiwanon Road, Ban Klang, Mueang, District,
Pathum Thani, 12000, Thailand

**** Faculty of Liberal Arts, Management Institute for Modern Leader, Krirk University, Bangkok, Thailand



Abstract

How to cite this paper: Siri, P., Kraiwanit, T., Suradinkura, S., Kasemrat, R., & Moolngearn, P. (2025). Digital health management: A study of factors influencing its efficiency. *Journal of Governance & Regulation*, 14(4), 84–94.
<https://doi.org/10.22495/jgrv14i4art8>

Copyright © 2025 The Authors

This work is licensed under a Creative Commons Attribution 4.0 International License (CC BY 4.0).
<https://creativecommons.org/licenses/by/4.0/>

ISSN Print: 2220-9352
ISSN Online: 2306-6784

Received: 22.12.2024
Revised: 06.04.2025; 11.09.2025
Accepted: 03.10.2025

JEL Classification: D83, C83, I18, O33
DOI: 10.22495/jgrv14i4art8

As digital technologies become increasingly embedded in healthcare systems, professionals are showing a stronger interest in the performance of health applications. This study evaluates the effectiveness of these health applications across different demographic backgrounds, driven by the growing need to improve healthcare accessibility and efficiency. A structured survey with 578 participants examined health app usage frequency, user experience, and perceived benefits. The results show that health applications significantly reduce travel time and improve appointment management, especially among younger individuals and urban populations. However, outcomes vary by income and education level, with certain groups benefiting more than others. Challenges such as limited digital literacy and concerns over data privacy remain major barriers to adoption. These findings echo previous research, which highlights how digital health tools contribute to proactive, personalized healthcare delivery while also optimizing system-level efficiency (Li, 2024). The rise of preventive digital medicine also supports a shift toward patient-centered models and continuous care (De la Torre et al., 2025). This study provides useful insights for developers and policymakers seeking to improve the design, adoption, and inclusiveness of digital health technologies.

Keywords: Health Applications, Mobile Health Applications, Digital Health Management, Reduce Time

Authors' individual contribution: Conceptualization — P.S.; Methodology — P.S.; Data Collection — P.S.; Formal Analysis — P.S.; Writing — Original Draft — P.S.; Writing — Review & Editing — T.K. and S.S.; Supervision — T.K.; Project Administration — S.S., R.K., and P.M.

Declaration of conflicting interests: The Authors declare that there is no conflict of interest.

1. INTRODUCTION

The growing integration of health applications into digital health management has transformed healthcare systems over the past decade. By utilizing artificial intelligence (AI) and machine learning, these tools improve access, efficiency, and cost-effectiveness, especially in underserved areas (Al Kuwaiti et al., 2023; Moura et al., 2024). This

shift supports a patient-centered model that emphasizes proactive and equitable care (Abernethy et al., 2022).

Digital health solutions have shown strong potential in reducing costs and improving outcomes. Gentili et al. (2022) and Iribarren et al. (2017) found that mobile health (mHealth) technologies streamline healthcare in resource-limited settings.

AI-driven tools further enhance efficiency by optimizing resource use (Periáñez et al., 2024).

Advancements like telemedicine, remote monitoring, and digital twins have improved diagnosis, real-time care, and system responsiveness (Amjad et al., 2023; Dicuonzo et al., 2023; Sun et al., 2023). At the individual level, mobile applications (apps) support behavioral change and chronic disease management, although user retention remains a challenge without features like gamification and personalization (Jakob et al., 2022; Zhao et al., 2016).

Health technologies also benefit providers by improving workflows and communication. Systems like electronic medication management and mobile data-sharing reduce errors and support decision-making (Kashgary et al., 2017; Sviatenko et al., 2022; Westbrook et al., 2013).

Despite their promise, key barriers persist, including digital literacy gaps, technology access, and data privacy concerns (Dicuonzo et al., 2023; Haleem et al., 2022). Addressing these requires regulatory clarity, user-centered design, and investment in education and infrastructure to build trust and usability.

This study explores how health applications impact time efficiency and care delivery in the Thai context. It contributes to literature on user engagement, digital adoption, and operational impact, using the technology acceptance model (TAM) to guide analysis. The goal is to inform future design and policy for more effective, inclusive digital health systems.

The structure of this paper is as follows: Section 1 provides an overview of digital health applications and their relevance. Section 2 reviews prior studies on technology use in healthcare. Section 3 explains the research methodology and data analysis. Section 4 presents and interprets the survey results. Section 5 discusses the findings and policy implications, and Section 6 concludes with key insights and future research directions.

2. LITERATURE REVIEW

The integration of health applications into digital health management has gained significant attention in recent years due to their transformative potential. Utilizing advancements in AI and machine learning (ML), these tools are reshaping healthcare delivery by addressing critical challenges such as accessibility, efficiency, and cost-effectiveness (Al Kuwaiti et al., 2023; Moura et al., 2024). By enabling scalable, personalized solutions, these technologies provide an opportunity to mitigate healthcare disparities, particularly in underserved regions (Abernethy et al., 2022). This evolution reflects a shift toward patient-centered care, where technology facilitates proactive health management and equitable access to services.

Digital health interventions have shown significant potential in improving cost-effectiveness within healthcare systems. A systematic review by Gentili et al. (2022) highlighted their ability to lower healthcare costs while improving patient outcomes. Iribarren et al. (2017) emphasized the efficiency of mHealth solutions in enhancing healthcare delivery, particularly in resource-constrained environments. Further, Periáñez et al. (2024) discussed how AI-driven resource optimization amplifies cost-saving opportunities in healthcare systems.

Recent studies reinforce these findings. Li (2024) reported that digital health management

systems in chronic disease care led to substantial improvements in patient self-management, early intervention, and reduced healthcare costs, especially through real-time monitoring and personalized treatment strategies. Similarly, Liang et al. (2024) demonstrated the impact of digital health tools on cardiometabolic disease prevention across the Western Pacific, highlighting wearable devices and mobile apps as key technologies in behavior change and early diagnosis.

The paradigm of digital health continues to evolve. Rashid et al. (2025) outlined emerging AI trends that enhance diagnostics, remote monitoring, and personalized care, noting that patient-centered AI integration is shaping the future of medical decision-making and operational efficiency. Moreover, De la Torre et al. (2025) emphasized how digital tools are at the core of a shift toward preventive, personalized, and participatory medicine, with broad implications for chronic disease control and health equity.

AI has emerged as a driving force in healthcare innovation, particularly in telemedicine and patient monitoring. Amjad et al. (2023) explored the application of AI in telehealth, highlighting its potential to improve accessibility and diagnostic accuracy. Similarly, Sun et al. (2023) introduced the concept of digital twins for personalized and predictive care, though they noted that scalability challenges persist. Remote monitoring systems powered by AI facilitate real-time data collection and analysis, enabling early interventions and reducing the burden on healthcare infrastructure (Dicuonzo et al., 2023).

mHealth applications play a critical role in promoting health behavior change and improving adherence to treatment plans. Research by McKay et al. (2016) and Zhao et al. (2016) demonstrated the capacity of these tools to empower users in managing their health, particularly for chronic conditions. However, Jakob et al. (2022) identified challenges related to sustaining user adherence, emphasizing the need for strategies such as gamification, personalized feedback, and AI-driven customization. Beyond individual users, mHealth technologies have contributed to public health campaigns, including vaccination drives and health education initiatives (Grundy, 2022).

Health technologies offer numerous benefits to healthcare providers by streamlining workflows and reducing administrative burdens. Westbrook et al. (2013) demonstrated that electronic medication management systems can lower medical error rates and save time. Sviatenko et al. (2022) highlighted how mobile applications improve time management for healthcare professionals. Real-time data sharing and remote consultations further enhance communication between healthcare teams and patients (Kashgary et al., 2017). Additionally, AI-powered analytics support data-driven decision-making, fostering innovation in healthcare delivery and reducing professional burnout.

Despite their advantages, several barriers hinder the widespread adoption of health applications. Challenges such as limited digital literacy, unequal access to technology, and data privacy concerns remain significant (Dicuonzo et al., 2023). Haleem et al. (2022) noted ethical and infrastructural obstacles associated with implementing medical 4.0 technologies. Regulatory inconsistencies and a lack of standardized guidelines also impede progress. Addressing these

issues requires collaboration among policymakers, developers, and healthcare providers. Transparent data practices and adherence to regulations like the Regulation (EU) 2016/679 (General Data Protection Regulation [GDPR])¹ are essential to building user trust.

Moving forward, the development of interoperable systems and user-centered designs will be critical for improving usability and accessibility. Investments in digital literacy initiatives for both patients and providers will also be vital in overcoming adoption barriers and realizing the full potential of these technologies.

3. MATERIALS AND METHODS

This research employed a quantitative approach to investigate the impact of health applications on reducing time and enhancing efficiency in digital health management. Data collection was conducted using a structured survey administered through Google Forms. The target population included individuals aged 18 years and older with prior experience using health applications, ensuring that the findings were drawn from a sample actively engaged with the technology. Participants were recruited through convenience sampling on online platforms such as social media, health-related forums, and app user communities, which allowed for the inclusion of a diverse participant base. A total of 578 valid responses were collected for analysis.

A structured questionnaire was developed and consisted of four main sections. The demographics section collected information on participants' age, gender, education level, occupation, and income to analyze the demographic factors influencing health application usage. The application usage section explored the types of health applications participants used, their frequency of use, and their specific purposes, such as telemedicine, fitness tracking, medication reminders, and health monitoring. The perceptions and attitudes section, grounded in the TAM, assessed participants' perceived usefulness, ease of use, and behavioral intentions regarding health application usage. The impact assessment section evaluated the direct and indirect benefits of health applications, including their effectiveness in reducing time spent on healthcare activities and improving the efficiency of health management. A pilot survey was conducted with 30 participants to assess the questionnaire's validity and reliability. Feedback from the pilot phase was incorporated to refine the clarity and structure of the survey instrument, ensuring that all questions were relevant to the research objectives and easily comprehensible. Data collection was conducted over a two-month period via Google Forms. The survey responses were exported and analyzed using IBM Statistical Package for the Social Sciences (SPSS) software (version 30.0.0.0), chosen for its intuitive interface and comprehensive statistical tools. Descriptive statistics were used to summarize participant demographics, application usage patterns, and key metrics, including frequencies, means, and standard deviations. Additionally, Chi-square tests were applied to examine relationships between categorical demographic variables (e.g., gender, age group, and education level) and health application usage patterns. To complement these analyses, Bayesian

estimates were employed to assess the impact of demographic variables on reduced travel costs and time savings attributable to health applications. Bayesian analysis provided robust insights into the probability distributions of the effects, capturing uncertainties and credible intervals. These analyses were conducted using SPSS's Bayesian module, which allowed for the exploration of posterior distributions and the estimation of credible intervals for key variables. By integrating both traditional inferential statistics and Bayesian methods, the study provided a comprehensive analysis of the data, offering actionable insights into the demographic and behavioral factors influencing the perceived benefits of health applications. This mixed-method analytical approach ensured a thorough examination of the impact of digital health technologies on time efficiency and health management outcomes.

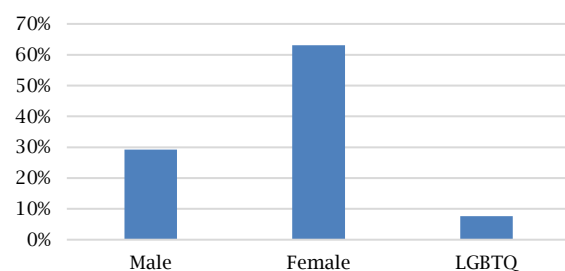
Alternatively, while this study employed a quantitative survey for its scalability and ability to capture broad usage patterns, other methods could have been considered. Qualitative approaches, like interviews or focus groups, might reveal deeper user insights, while longitudinal or experimental designs could track changes over time or assess causality. However, these require more time, resources, and ethical oversight. The survey method was ultimately chosen for its suitability in exploring diverse demographics and ensuring generalizable findings.

4. RESULTS

The survey results provide a comprehensive demographic overview of the 578 respondents who participated in the study.

Figure 1 shows the percentage of respondents by gender. The chart indicates that female participants represent the largest proportion at 63.1%, followed by male respondents at 29.2%, and lesbian, gay, bisexual, transgender, and queer (LGBTQ) respondents at 7.6%. This distribution suggests that females were more likely to participate in the study, which may reflect greater engagement with or accessibility to digital health applications within this group.

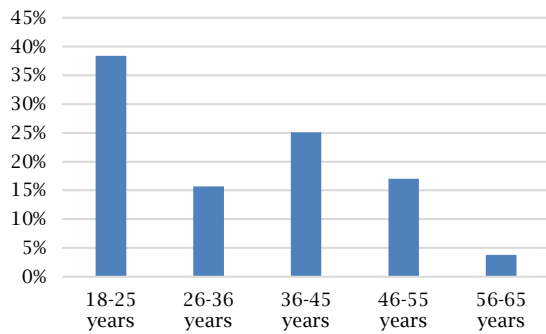
Figure 1. Gender distribution



Source: Authors' elaboration.

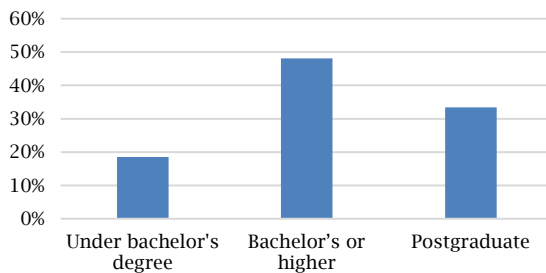
Figure 2 shows the percentage of respondents across different age groups. The largest group is 18-25 years, accounting for 38.4%, followed by 36-45 years at 25.1%, and 46-55 years at 17.0%. The 26-36 years group represents 15.7%, while the 56-65 years group makes up only 3.8%. This distribution suggests that the study primarily attracted younger participants, especially those in their late teens and early twenties, reflecting a tech-savvy demographic more engaged with digital health applications.

¹ <https://eur-lex.europa.eu/eli/reg/2016/679/oj/eng>

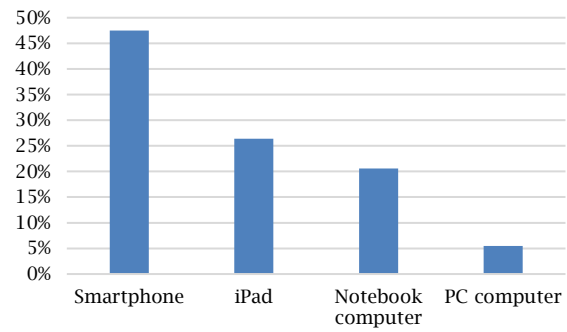
Figure 2. Age distribution

Source: Authors' elaboration.

Figure 3 shows the educational background of the respondents. The majority, 48.1%, hold a bachelor's degree or higher, followed by 33.4% with postgraduate education, and 18.5% who have not completed a bachelor's degree. This suggests that most participants are well-educated, which may influence their familiarity with and willingness to use digital health applications.

Figure 3. Education level

Source: Authors' elaboration.

Figure 4. Devices used for health apps

Source: Authors' elaboration.

Figure 4 shows the types of devices respondents used to access health applications. Smartphones were the most commonly used device at 47.5%, followed by iPads (26.4%), notebook computers (20.6%), and personal computers (5.5%). This indicates a strong preference for mobile and portable devices, suggesting that health app development should prioritize mobile-friendly and responsive design for optimal user engagement.

Table 1 summarizes the key demographic characteristics. As can be seen, most respondents were students (41.5%), followed by company employees (24.0%) and government workers (15.4%). A smaller group (4.5%) were homemakers or laborers. In terms of income, 30.8% earned below THB (Thai baht) 15,000, while 22.7% earned over THB 45,001. The majority were single (73.0%) and lived in Bangkok (52.8%). Most lived with family (74.0%), while 25.6% lived alone.

Table 1. General data characteristics of the respondents

Data	Number	Percent
Occupation		
Company employees	139	24.00%
Students	240	41.50%
Business owners	84	14.50%
Government officials or state enterprise employees	89	15.40%
Other occupations: homemakers (married) and laborers	26	4.50%
Monthly income		
Less than THB 15,000	178	30.80%
THB 15,001-25,000	108	18.70%
THB 25,001-35,000	65	11.20%
THB 35,001-45,000	96	16.60%
More than THB 45,001	131	22.70%
Marital Status		
Single	422	73.00%
Married	156	27.00%
Residence		
Bangkok	305	52.80%
Perimeter	142	24.60%
Upcountry	131	22.70%
Living status		
Alone	148	25.60%
Living with family/relatives	428	74.00%
Stay with friends	2	0.30%

Source: Authors' elaboration.

Overall, the sample was largely young, urban, and single, with varied income levels, factors likely influencing their use of health applications.

As presented in Table 2, most respondents (53.5%) reported visiting a doctor every 6 months to 1 year, followed by 35.5% who visited every 2-3 months, and 11.1% who visited monthly. Females had the highest number of visits overall, particularly in the 2-3 month and 6-12 month

categories, while the LGBTQ group had the fewest respondents and the lowest monthly visit rate. Males showed lower visit frequency across all categories. These results suggest notable gender differences in healthcare-seeking behavior, with females more likely to engage in regular medical visits. This insight supports the need for gender-responsive healthcare strategies and service planning.

Table 2. Relationship between gender and frequency of medical visits

<i>Gender</i>	<i>Frequency of medical visits</i>			<i>Total</i>
	<i>Monthly</i>	<i>Every 2-3 months</i>	<i>Once in 6 months-1 year</i>	
Male	33	42	94	169
	5.7%	7.3%	16.3%	29.2%
Female	29	140	196	365
	5.0%	24.2%	33.9%	63.1%
LGBTQ	2	23	19	44
	0.3%	4.0%	3.3%	7.6%
Total	64	205	309	578
	11.1%	35.5%	53.5%	100.0%

Source: Authors' elaboration.

As shown in Table 3, the 18-25 years group made up the largest portion of respondents (38.4%) and reported the highest number of visits across all categories, especially visits every 6 months to 1 year (24.4%). The 36-45 years group had the highest proportion visiting every 2-3 months (15.4%). In contrast, the oldest group (56-65 years) had

the fewest respondents and the lowest visit frequency. Overall, younger participants tended to space out their medical visits, while older groups, particularly those aged 46-55, showed a tendency toward more regular check-ups. These patterns highlight age-related differences in healthcare behavior and monitoring needs.

Table 3. Relationship between age and frequency of medical visits

<i>Age</i>	<i>Frequency of medical visits</i>			<i>Total</i>
	<i>Monthly</i>	<i>Every 2-3 months</i>	<i>Once in 6 months-1 year</i>	
18-25 years	38	43	141	222
	6.6%	7.4%	24.4%	38.4%
26-35 years	25	18	48	91
	4.3%	3.1%	8.3%	15.7%
36-45 years	1	89	55	145
	0.2%	15.4%	9.5%	25.1%
46-55 years	0	50	48	98
	0.0%	8.7%	8.3%	17.0%
56-65 years	0	5	17	22
	0.0%	0.9%	2.9%	3.8%
Total	64	205	309	578
	11.1%	35.5%	53.5%	100.0%

Source: Authors' elaboration.

As shown in Table 4, respondents with a bachelor's degree made up the largest group (48.1%) and reported the highest frequency of visits across all categories, especially every 6 months to 1 year (25.3%). Those with education above a bachelor's degree had the highest proportion visiting every 2-3 months (15.9%), while respondents

with lower education levels showed the least frequent visits overall. These findings suggest that higher education levels are associated with more regular medical visits, reflecting greater health awareness and access. This insight can guide more targeted health service planning across educational groups.

Table 4. Relationship between education level and frequency of medical visits

<i>Education</i>	<i>Frequency of medical visits</i>			<i>Total</i>
	<i>Monthly</i>	<i>Every 2-3 months</i>	<i>Once in 6 months-1 year</i>	
Under bachelor's degree	2	35	70	107
	0.3%	6.1%	12.1%	18.5%
Bachelor's or higher	54	78	146	278
	9.3%	13.5%	25.3%	48.1%
Postgraduate	8	92	93	193
	1.4%	15.9%	16.1%	33.4%
Total	64	205	309	578
	11.1%	35.5%	53.5%	100.0%

Source: Authors' elaboration.

As shown in Table 5, students represented the largest group (41.5%) and reported the highest frequency of visits, especially every 6 months to 1 year (26.3%). Company employees followed, with notable visits every 2-3 months (12.8%). Business owners and government officials also showed moderate visit rates, particularly in longer intervals.

Meanwhile, those in other occupations had the lowest visit frequency. Overall, students tended to visit less frequently but regularly, while employees and business owners showed shorter visit intervals. These patterns suggest that occupation influences healthcare behaviors and can help shape more targeted health service strategies.

Table 5. Relationship between occupation and frequency of medical visits

Occupation	Frequency of medical visits			Total
	Monthly	Every 2-3 months	Once in 6 months-1 year	
Company employees	10	74	55	139
	1.7%	12.8%	9.5%	24.0%
Students	43	45	152	240
	7.4%	7.8%	26.3%	41.5%
Business owners	11	33	40	84
	1.9%	5.7%	6.9%	14.5%
Government officials or state enterprise employees	0	39	50	89
	0.0%	6.7%	8.7%	15.4%
Other occupations: homemakers (married) and laborers	0	14	12	26
	0.0%	2.4%	2.1%	4.5%
Total	64	205	309	578
	11.1%	35.5%	53.5%	100.0%

Source: Authors' elaboration.

Table 6. Relationship between average monthly income and frequency of medical visits

Monthly income	Frequency of medical visits			Total
	Monthly	Every 2-3 months	Once in 6 months-1 year	
Less than THB 15,000	30	41	107	178
	5.2%	7.1%	18.5%	30.8%
THB 15,001-25,000	7	37	64	108
	1.2%	6.4%	11.1%	18.7%
THB 25,001-35,000	10	13	42	65
	1.7%	2.2%	7.3%	11.2%
THB 35,001-45,000	8	58	30	96
	1.4%	10.0%	5.2%	16.6%
More than THB 45,001	9	56	66	131
	1.6%	9.7%	11.4%	22.7%
Total	64	205	309	578
	11.1%	35.5%	53.5%	100.0%

Source: Authors' elaboration.

As shown in Table 6, respondents earning below THB 15,000 made up the largest group (30.8%), with most visiting doctors every 6 months to 1 year (18.5%). In contrast, those earning THB 35,001-45,000 had the highest proportion visiting every 2-3 months (10.0%). Respondents with income above THB 45,001 showed

balanced visit patterns across all frequencies. Overall, lower-income individuals tended to visit less frequently and at longer intervals, while higher-income groups showed more regular and consistent healthcare visits. These patterns underscore the influence of income on healthcare behavior and support income-sensitive health service planning.

Table 7. Relationship between marital status and frequency of medical visits

Marital status	Frequency of medical visits			Total
	Monthly	Every 2-3 months	Once in 6 months-1 year	
Single	56	140	226	422
	9.7%	24.2%	39.1%	73.0%
Married	8	65	83	156
	1.4%	11.2%	14.4%	27.0%
Total	64	205	309	578
	11.1%	35.5%	53.5%	100.0%

Source: Authors' elaboration.

As shown in Table 7, single respondents made up the majority (73.0%) and reported the highest frequency of medical visits, especially every 6 months to 1 year (39.1%). Married respondents (27.0%) had lower visit rates across all categories but a relatively higher proportion in the 2-3 month

group. These results suggest that single individuals tend to visit doctors more consistently at longer intervals, while married individuals may seek care more frequently. Such differences reflect varying healthcare needs and can support more tailored service planning by marital status.

Table 8. Relationship between residence and frequency of medical visits

Residence	Frequency of medical visits			Total
	Monthly	Every 2-3 months	Once in 6 months-1 year	
Bangkok	33	130	142	305
	5.7%	22.5%	24.6%	52.8%
Perimeter	9	50	83	142
	1.6%	8.7%	14.4%	24.6%
Upcountry	22	25	84	131
	3.8%	4.3%	14.5%	22.7%
Total	64	205	309	578
	11.1%	35.5%	53.5%	100.0%

Source: Authors' elaboration.

As shown in Table 8, Bangkok residents accounted for the largest group (52.8%) and reported the highest frequency of visits every 6 months to 1 year (24.6%). Respondents in metropolitan areas (24.6%) and rural areas (22.7%) showed similar patterns, with around 14.4–14.5% visiting at

the same interval. Overall, urban and rural respondents tended to visit doctors less frequently but on a regular, long-term basis. These insights highlight how location influences healthcare behavior and support the need for region-specific health service planning.

Table 9. Relationship between living status and frequency of medical visits

Living status	Frequency of medical visits			Total
	Monthly	Every 2–3 months	Once in 6 months–1 year	
Alone	32	54	62	148
	5.5%	9.3%	10.7%	25.6%
Living with family/relatives	32	151	245	428
	5.5%	26.1%	42.4%	74.0%
Stay with friends	0	0	2	2
	0.0%	0.0%	0.3%	0.3%
Total	64	205	309	578
	11.1%	35.5%	53.5%	100.0%

Source: Authors' elaboration.

As shown in Table 9, most respondents lived with family or relatives (74.0%) and reported the highest frequency of medical visits, especially every 6 months to 1 year (42.4%). Those living alone (25.6%) showed lower visit rates across all categories, while respondents living with friends made up

only 0.3% of the sample. Overall, individuals living with family tend to seek medical care more consistently than those living alone. These findings highlight the influence of living arrangements on healthcare behavior and support the need for tailored service approaches.

Table 10. Relationship between gender and increased productivity through reduced absenteeism due to health applications

Gender	The average number of days per month of absenteeism or missed work			Total
	Once per month	2–3 times per month	More than 3 times per month	
Male	62	38	69	169
	10.70%	6.60%	11.90%	29.20%
Female	211	87	67	365
	36.50%	15.11%	11.60%	63.10%
LGBTQ	34	9	1	44
	5.90%	1.60%	0.20%	7.60%
Total	307	134	137	578
	53.10%	23.20%	23.70%	100.00%

Source: Authors' elaboration.

As shown in Table 10, most respondents (53.1%) reported reduced absenteeism once per month, with females representing the largest share (36.5%). Females also led across all categories of reduced absenteeism, followed by males. The LGBTQ group reported the lowest frequency of productivity gains from reduced absenteeism. Overall,

the findings suggest that females benefit most from health applications in reducing missed workdays, while the lower impact among LGBTQ respondents points to potential gaps in accessibility or app effectiveness for this group. These insights can help guide more inclusive digital health strategies.

Table 11. Relationship between age and increased productivity through reduced absenteeism due to health applications

Age	The average number of days per month of absenteeism or missed work			Total
	Once per month	2–3 times per month	More than 3 times per month	
18–25 years	127	54	41	222
	22.0%	9.3%	7.1%	38.4%
26–36 years	58	13	20	91
	10.0%	2.2%	3.5%	15.7%
36–45 years	71	45	29	145
	12.3%	7.8%	5.0%	25.1%
46–55 years	46	22	30	98
	8.0%	3.8%	5.2%	17.0%
56–65 years	5	0	17	22
	0.9%	0.0%	2.9%	3.8%
Total	307	134	137	578
	53.1%	23.2%	23.7%	100.0%

Source: Authors' elaboration.

As shown in Table 11, the 18–25 years group reported the highest overall impact from health apps, especially in reducing absenteeism once per month (22.0%). Respondents aged 36–55 also showed notable effects, particularly at higher frequencies of absenteeism reduction. Although the 56–65 years group had the fewest respondents, a relatively high share reported reduced absenteeism

more than 3 times per month. These results suggest that younger users experience broader but less intensive productivity gains, while older users, though fewer, may benefit more significantly per use. This highlights how age influences the effectiveness of digital health tools on productivity.

Table 12. Relationship between occupation and increased productivity through reduced absenteeism due to health applications

Occupation	The average number of days per month of absenteeism or missed work			Total
	Once per month	2-3 times per month	More than 3 times per month	
Company employees	69	44	26	139
	11.9%	7.6%	4.5%	24.0%
Students	145	54	41	240
	25.1%	9.3%	7.1%	41.5%
Business owners	32	21	31	84
	5.5%	3.6%	5.4%	14.5%
Government officials or state enterprise employees	47	15	27	89
	8.1%	2.6%	4.7%	15.4%
Other occupations: homemakers (married) and laborers	14	0	12	26
	2.4%	0.0%	2.1%	4.5%
Total	307	134	137	578
	53.1%	23.2%	23.7%	100.0%

Source: Authors' elaboration.

As shown in Table 12, students reported the highest overall productivity gains from health app use, particularly in reducing absenteeism once per month (25.1%). Company employees and government officials followed in total impact, while business owners showed the highest proportion, reducing absenteeism more than 3 times per month.

Respondents in other occupations, such as homemakers and laborers, reported the lowest impact. These results highlight how occupation influences the benefits of health applications, supporting the need for tailored solutions that address the specific work patterns of each group.

Table 13. Relationship between average monthly income and increased productivity through reduced absenteeism due to health applications

Monthly income	The average number of days per month of absenteeism or missed work			Total
	Once per month	2-3 times per month	More than 3 times per month	
Less than THB 15,000	100	44	34	178
	17.3%	7.6%	5.9%	30.8%
THB 15,001-25,000	53	28	27	108
	9.2%	4.8%	4.7%	18.7%
THB 25,001-35,000	54	4	7	65
	9.3%	0.7%	1.2%	11.2%
THB 35,001-45,000	46	28	22	96
	8.0%	4.8%	3.8%	16.6%
More than THB 45,001	54	30	47	131
	9.3%	5.2%	8.1%	22.7%
Total	307	134	137	578
	53.1%	23.2%	23.7%	100.0%

Source: Authors' elaboration.

As shown in Table 13, respondents earning below THB 15,000 reported the highest overall reduction in absenteeism across all frequencies, making up 30.8% of the total sample. Those earning over THB 45,001 followed, with the highest proportion reducing absenteeism more than 3 times

per month (8.1%). Meanwhile, the THB 25,001-35,000 group showed the least impact. These findings suggest that both low- and high-income earners benefit most from health applications, while middle-income groups may require more targeted features to boost effectiveness.

Table 14. Relationship between marital status and increased productivity through reduced absenteeism due to health applications

Marital status	The average number of days per month of absenteeism or missed work			Total
	Once per month	2-3 times per month	More than 3 times per month	
Single	221	116	85	422
	38.2%	20.1%	14.7%	73.0%
Married	86	18	52	156
	14.9%	3.1%	9.0%	27.0%
Total	307	134	137	578
	53.1%	23.2%	23.7%	100.0%

Source: Authors' elaboration.

As shown in Table 14, single respondents made up the majority (73.0%) and reported greater overall benefits from health applications in reducing absenteeism, especially once or 2-3 times per month. While fewer in number, married respondents showed a higher proportion experiencing reduced

absenteeism more than 3 times per month. These findings suggest that marital status influences how users benefit from health apps, with singles seeing broader impacts and married individuals showing more frequent reductions. This highlights the need for tailored features based on users' life situations.

Table 15. Bayesian estimates of reduced travel costs by residential area

<i>Residence</i>	<i>Posterior mean</i>	<i>Variance</i>	<i>95% credible interval (lower bound — upper bound)</i>
Bangkok	314.066	1048.741	250.570 → 377.561
Perimeter	369.718	2252.578	276.662 → 462.775
Upcountry	411.046	2441.726	314.161 → 507.930

Source: Authors' elaboration.

As presented in Table 15, Bayesian estimates indicate that the average reduction in travel costs to hospitals or clinics when using health applications varies across residential areas. Residents in the upcountry had the highest average cost reduction at THB 411.046 per trip, followed by residents in the perimeter with an average reduction of THB 369.718 per trip. Residents in Bangkok had the lowest average cost reduction at THB 314.066 per trip. The 95% credible intervals for each group indicate the stability of the estimates. Upcountry residents had the widest credible interval (314.161 to 507.930), followed by perimeter residents (276.662 to 462.775), and Bangkok residents (250.570 to 377.561). These differences reflect variations in travel patterns and access to medical services across different areas, which may influence the effectiveness of health applications in reducing travel costs.

5. DISCUSSION

The findings of this study demonstrate the tangible benefits of health applications in improving healthcare efficiency, particularly by reducing absenteeism, cutting travel costs, and optimizing appointment scheduling. These benefits were most prominent among younger users, urban populations, students, and low- and high-income groups. However, the adoption and impact of digital health tools were found to vary based on demographic factors such as gender, income, education, and residential location, signaling important policy and design implications.

Given that most participants reported improved healthcare access and efficiency through health apps, particularly in urban areas, policymakers should consider formally integrating these tools into national health strategies. Digital health platforms can support universal healthcare goals, especially in reducing the burden on physical healthcare infrastructure and enhancing accessibility in densely populated or underserved areas (Gentili et al., 2022; Li, 2024).

Evidence from Tables 2 to 14 suggests that gender, age, occupation, and income play significant roles in health app effectiveness. For instance, females showed higher engagement, and students reported the greatest reduction in absenteeism. This implies the need for user-centered app designs that consider varied lifestyle patterns and healthcare behaviors (Grundy, 2022; De la Torre et al., 2025). Health applications should be adapted to support both proactive care for younger users and chronic disease management for older or higher-need populations.

Despite the benefits observed, barriers such as digital literacy gaps and limited access to mobile technologies remain challenges for widespread adoption, particularly among the elderly, rural populations, and those with lower education (Haleem et al., 2022; Dicuonzo et al., 2023). Policymakers should promote digital literacy programs and provide subsidies or incentives for smartphone access in vulnerable communities. This

aligns with the principle of equitable healthcare delivery.

As seen in prior studies, long-term user engagement remains a challenge. This study confirms that gamified features and AI-driven personalization are key factors identified by Jakob et al. (2022) and Zhao et al. (2016) that can significantly boost consistent app usage. Developers should prioritize features that enhance user motivation, such as real-time health insights, goal tracking, and feedback mechanisms, especially for chronic care and preventive health programs.

One of the major concerns expressed by users across all demographics was data security. This finding is consistent with prior literature stressing the importance of clear regulatory frameworks and ethical standards (Dicuonzo et al., 2023; Haleem et al., 2022). Health apps must comply with established data privacy laws (e.g., GDPR), implement transparent data-use policies, and offer users control over personal data to build trust and promote adoption.

Table 15 shows that travel cost savings were most significant in upcountry and perimeter areas, where healthcare access is more geographically challenging. This indicates that digital health tools can act as a cost-saving solution for decentralized healthcare delivery, especially in rural settings. Local governments should leverage this insight by supporting mobile-first health services and infrastructure in these regions.

The study also found that reduced absenteeism due to health app usage was notably high among students, company employees, and government officials. Employers and public agencies could benefit from incentivizing health app use through wellness programs, leading to improved workforce productivity and reduced sick leave, aligning with evidence from Sviatenko et al. (2022) and Westbrook et al. (2013).

6. CONCLUSION

This study provides empirical evidence supporting the critical role of health applications in enhancing digital health management. Through data collected from 578 respondents across diverse demographic groups, the findings demonstrate that health applications contribute significantly to time efficiency, reduction in travel costs, fewer missed workdays, and streamlined healthcare processes. These benefits were most pronounced among younger users, students, and urban residents groups typically more familiar with digital technologies.

The results are consistent with previous literature highlighting the cost-effectiveness, accessibility, and behavioral impact of mHealth technologies (Gentili et al., 2022; McKay et al., 2016; Sviatenko et al., 2022). Beyond operational benefits, the study reveals important insights into user behavior and engagement, suggesting that demographic factors such as age, income, gender, and education strongly influence the perceived value and actual usage of health applications.

In particular, the study highlights that female users and lower-income groups reported higher productivity gains, while older adults and less-educated individuals showed relatively lower engagement, suggesting digital inclusion gaps that need to be addressed through design improvements and supportive policy. Furthermore, findings related to reduced absenteeism and travel cost savings especially in rural and perimeter areas, point to the potential of digital tools to alleviate systemic barriers to healthcare access.

The importance of user-centered design is strongly reinforced. Applications must be adaptable, intuitive, and personalized, with features like gamification, real-time feedback, and AI-driven customization playing a crucial role in ensuring long-term engagement (Jakob et al., 2022; Grundy, 2022). Developers should also consider integrating features tailored to chronic disease management, preventive care, and mental health support to maximize the holistic impact of these tools.

Despite its valuable contributions, the study has several limitations. The use of convenience sampling and self-reported data introduces potential bias, limiting the generalizability of results. Participants may have overestimated or underestimated the impact of health app usage due

to recall bias. Moreover, the cross-sectional nature of the study does not capture longitudinal effects or behavior change over time.

To build upon these findings, future research should consider adopting longitudinal or experimental designs to assess the sustained impact of digital health apps. Comparative studies across regions, cultures, and healthcare systems could help identify context-specific success factors or barriers. Additionally, the integration of emerging technologies such as digital twins, predictive analytics, and wearable IoT devices holds promising potential for advancing personalized and preventive care models (Sun et al., 2023; Rashid et al., 2025).

In conclusion, health applications are more than convenience tools; they are strategic enablers of healthcare transformation. For these technologies to reach their full potential, a collaborative effort is needed among policymakers, developers, healthcare providers, and users. Investing in inclusive design, robust data governance, digital literacy programs, and equitable infrastructure will be essential in realizing the dual goals of efficiency and equity in healthcare systems. Done effectively, digital health tools can shift the paradigm toward patient-centered, proactive, and sustainable healthcare delivery.

REFERENCES

- Abernethy, A., Adams, L., Barrett, M., Bechtel, C., Brennan, P., Butte, A., Faulkner, J., Fontaine, E., Friedhoff, S., Halamka, J., Howell, M., Johnson, K., Long, P., McGraw, D., Miller, R., Lee, P., Perlin, J., Rucker, D., Sandy, L., ... Valdes, K. (2022). The promise of digital health: Then, now, and the future. *NAM Perspectives*, 2022. <https://doi.org/10.31478/202206>
- Abolfotouh, M. A., BaniMustafa, A., Salam, M., Al-Assiri, M., Aldebasi, B., & Bushnak, I. (2019). Use of smartphone and perception towards the usefulness and practicality of its medical applications among healthcare workers in Saudi Arabia. *BMC Health Services Research*, 19(1), Article 826. <https://doi.org/10.1186/s12913-019-4523-1>
- Al Kuwaiti, A., Nazer, K., Al-Reedy, A., Al-Shehri, S., Al-Muhanna, A., Subbarayalu, A. V., Al Muhanna, D., & Al-Muhanna, F. A. (2023). A review of the role of artificial intelligence in healthcare. *Journal of Personalized Medicine*, 13(6), Article 951. <https://doi.org/10.3390/jpm13060951>
- Al-Ghamdi, S. (2018). Popularity and impact of using smart devices in medicine: Experiences in Saudi Arabia. *BMC Public Health*, 18(1), Article 531. <https://doi.org/10.1186/s12889-018-5465-y>
- Amjad, A., Kordel, P., & Fernandes, G. (2023). A review on innovation in healthcare sector (telehealth) through artificial intelligence. *Sustainability*, 15(8), Article 6655. <https://doi.org/10.3390/su15086655>
- De la Torre, K., Min, S., Lee, H., & Kang, D. (2025). The Application of preventive medicine in the future digital health era. *Journal of Medical Internet Research*, 27, Article 59165. <https://doi.org/10.2196/59165>
- Dicuonzo, G., Donofrio, F., Fusco, A., & Shini, M. (2023). Healthcare system: Moving forward with artificial intelligence. *Technovation*, 120, Article 102510. <https://doi.org/10.1016/j.technovation.2022.102510>
- El-Tallawy, S. N., Pergolizzi, J. V., Vasiliu-Feltes, I., Ahmed, R. S., LeQuang, J. K., Alzahrani, T., Varrassi, G., Awaleh, F. I., Alsubaie, A. T., & Naguib, M. S. (2024). Innovative applications of telemedicine and other digital health solutions in pain management: A literature review. *Pain and Therapy*, 13(4), 791–812. <https://doi.org/10.1007/s40122-024-00620-7>
- Gentili, A., Failla, G., Melnyk, A., Puleo, V., Tanna, G. L. D., Ricciardi, W., & Cascini, F. (2022). The cost-effectiveness of digital health interventions: A systematic review of the literature. *Frontiers in Public Health*, 10, Article 787135. <https://doi.org/10.3389/fpubh.2022.787135>
- Grundy, Q. (2022). A review of the quality and impact of mobile health apps. *Annual Review of Public Health*, 43(1), 117–134. <https://doi.org/10.1146/annurev-publhealth-052020-103738>
- Haleem, A., Javaid, M., Singh, R. P., & Suman, R. (2022). Medical 4.0 technologies for healthcare: Features, capabilities, and applications. *Internet of Things and Cyber-Physical Systems*, 2, 12–30. <https://doi.org/10.1016/j.iotcps.2022.04.001>
- Iribarren, S. J., Cato, K., Falzon, L., & Stone, P. W. (2017). What is the economic evidence for mHealth? A systematic review of economic evaluations of mHealth solutions. *PLoS One*, 12(2), Article 0170581. <https://doi.org/10.1371/journal.pone.0170581>
- Jakob, R., Harperink, S., Rudolf, A. M., Fleisch, E., Haug, S., Mair, J. L., Salamanca-Sanabria, A., & Kowatsch, T. (2022). Factors influencing adherence to mHealth apps for prevention or management of noncommunicable diseases: Systematic review. *Journal of Medical Internet Research*, 24(5), Article 35371. <https://doi.org/10.2196/35371>
- Kashgary, A., Alsolaimani, R., Mosli, M., & Faraj, S. (2017). The role of mobile devices in doctor-patient communication: A systematic review and meta-analysis. *Journal of Telemedicine and Telecare*, 23(8), 693–700. <https://doi.org/10.1177/1357633X16661604>
- Liang, F., Yang, X., Peng, W., Zhen, S., Cao, W., Li, Q., Xiaoa, Z., Gongf, M., Wang, Y., & Gu, D. (2024). Applications of digital health approaches for cardiometabolic diseases prevention and management in the Western Pacific region. *The Lancet Regional Health — Western Pacific*, 43, Article 100817. <https://doi.org/10.1016/j.lanwpc.2023.100817>

- Li, Z. (2024). The impact and benefits of digital health management systems on chronic disease management. *BIO Web of Conferences* (vol. 111, p. 03005). EDP Sciences. <https://doi.org/10.1051/bioconf/202411103005>
- McKay, F. H., Cheng, C., Wright, A., Shill, J., Stephens, H., & Uccellini, M. (2016). Evaluating mobile phone applications for health behaviour change: A systematic review. *Journal of Telemedicine and Telecare*, 24(1), 22-30. <https://doi.org/10.1177/1357633X16673538>
- Moura, L., Sousa, B. B., & Veloso, C. M. (2024). The role of health marketing in the dissemination of AI and ML application in preventive health. In R. Correia & D. Venciute (Eds.), *AI Innovation in services marketing* (pp. 81-109). IGI Global Scientific Publishing. <https://doi.org/10.4018/979-8-3693-2153-9.ch004>
- Periáñez, A., Fernández Del Río, A., Nazarov, I., Jané, E., Hassan, M., Rastogi, A., & Tang, D. (2024). The digital transformation in health: How AI can improve the performance of health systems. *Health Systems & Reform*, 10(2), Article 2387138. <https://doi.org/10.1080/23288604.2024.2387138>
- Rashid, Z., Ahmed, H., Nadeem, N., Zafar, S. B., & Yousaf, M. Z. (2025). The paradigm of digital health: AI applications and transformative trends. *Neural Computing and Applications*, 37, 11039-11070. <https://doi.org/10.1007/s00521-025-11081-0>
- Stoumpos, A. I., Kitsios, F., & Talias, M. A. (2023). Digital transformation in healthcare: Technology acceptance and its applications. *International Journal of Environmental Research and Public Health*, 20(4), Article 3407. <https://doi.org/10.3390/ijerph20043407>
- Sun, T., He, X., & Li, Z. (2023). Digital twin in healthcare: Recent updates and challenges. *Digital Health*, 9, Article 20552076221149651. <https://doi.org/10.1177/20552076221149651>
- Sviatenko, T., Gogunska, I., Semigina, T., Kasianenko, L., Salei, O., & Prokopenko, M. (2022). The role of mobile applications in the doctor's working time management system. *International Journal of Statistics in Medical Research*, 11, 66-76. <https://doi.org/10.6000/1929-6029.2022.11.08>
- Westbrook, J. I., Li, L., Georgiou, A., Paoloni, R., & Cullen, J. (2013). Impact of an electronic medication management system on hospital doctors' and nurses' work: A controlled pre-post, time and motion study. *Journal of the American Medical Informatics Association*, 20(6), 1150-1158. <https://doi.org/10.1136/amiajnl-2012-001414>
- Zhao, J., Freeman, B., & Li, M. (2016). Can mobile phone apps influence people's health behavior change? An evidence review. *Journal of Medical Internet Research*, 18(11), Article 287. <https://doi.org/10.2196/jmir.5692>