

A STUDY DEVELOPMENT OF TELEMEDICINE SERVICE AND GUIDELINES FOR PROMOTING IN THAILAND

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ABSTRACT

This study is research and development with the objectives to 1) To examine the significant determinants influencing the adoption and implementation of telemedicine services within the Thai healthcare system. 2) To analyze the extent of the causal relationship among identified factors shaping telemedicine service delivery in Thailand. 3) To development of telemedicine service for enhancing the advancement and utilization of telemedicine services in Thai healthcare.

The researcher employed a mixed-mode data collection strategy utilizing both online and traditional methods to ensure comprehensive coverage of the target population. The quantitative method implements stratified random sampling to ensure proportional representation across key demographic strata within patients using major telemedicine platforms. Sample size determination adheres to established guidelines for Structural Equation Modeling (SEM), which recommend 5-10 participants per observable parameter to ensure robust model estimation. Given the study's 22 observable variables, the target sample size ranges from 220 to 440 patients across the three telemedicine platforms, providing sufficient statistical power for reliable model validation and hypothesis testing.

Keywords: Telemedicine, Technology Acceptance Model, Theory of Planned Behavior, Attitude Toward Using

INTRODUCTION

Telemedicine represents a transformative paradigm in contemporary healthcare delivery, characterized by the systematic integration of digital telecommunications infrastructure to facilitate remote clinical services (WHO, 2020). This innovative approach encompasses a diverse spectrum of modalities, including synchronous video consultations, mobile health applications, and remote patient monitoring systems, enabling healthcare providers to conduct real-time diagnostic assessments, implement treatment protocols, and maintain longitudinal patient care without the constraints of physical proximity. Telemedicine is particularly salient in addressing healthcare disparities within geographically isolated and medically underserved populations where traditional healthcare infrastructure remains insufficient or inaccessible (Dorsey & Topol, 2020). In these contexts, telemedicine functions as a crucial bridge, circumventing conventional barriers to healthcare access, such as geographic isolation, transportation limitations, and the maldistribution of healthcare professionals, thereby democratizing access to primary and specialized medical services. This technological paradigm has demonstrated particular efficacy in rural healthcare settings, where it facilitates immediate access to comprehensive medical services, including urgent care consultations and specialized clinical expertise, through secure digital platforms, effectively reducing the healthcare access disparities that have historically characterized rural-urban healthcare dynamics.

In the Thai context, telemedicine assumes particular significance owing to the nation's heterogeneous geographical composition, encompassing remote rural territories characterized by limited healthcare infrastructure and densely populated urban centers experiencing high healthcare service demands. The Thai Ministry of Public Health has acknowledged telemedicine's transformative potential in addressing healthcare disparities by implementing digital solutions, explicitly targeting rural and underserved populations with substantial impediments to timely medical intervention (Thai Ministry of Public Health, 2022).

Despite its transformative potential, telemedicine implementation encounters multifaceted barriers that significantly influence its operational efficacy and accessibility, with these challenges manifesting distinctively in developing healthcare contexts such as Thailand. A fundamental impediment lies in technological readiness, as the successful deployment of telemedicine systems necessitates robust internet infrastructure and requisite digital literacy competencies—resources that frequently exhibit substantial geographic disparities.

The technological landscape in Thailand also presents unique challenges and opportunities for telemedicine. Despite high mobile penetration rates, the digital literacy required to navigate telehealth applications remains limited among certain demographic groups, particularly older adults and individuals in remote communities. This digital literacy gap poses a barrier to telemedicine adoption and may require targeted strategies to build user competence and confidence in using virtual care tools effectively (Khemapech, Sansrimahachai, & Toahchoodee, 2019).

The current body of telemedicine research in Thailand exhibits methodological limitations stemming from the predominant utilization of singular research paradigms, whereby studies typically employ either quantitative or qualitative methodologies in isolation. While quantitative investigations yield valuable statistical correlations and predictive models, they frequently lack the granular contextual understanding that qualitative inquiry can provide, particularly regarding the nuanced dimensions of user experiences and perceptions.

OBJECTIVE

1. To examine the significant determinants influencing the adoption and implementation of telemedicine services within the Thai healthcare system.
2. To analyze the extent of the causal relationship among identified factors shaping telemedicine service delivery in Thailand.
3. To development of telemedicine service for enhancing the advancement and utilization of telemedicine services in Thai healthcare.

Literature Reviews

1. Telemedicine The concept of telemedicine has transformed from a simple idea into a sophisticated healthcare delivery system that harnesses the power of modern telecommunications. At its core, telemedicine represents the intersection of healthcare and technology, enabling medical professionals to provide care across distances through virtual means (WHO, 2010). The digital divide between urban and rural Thailand has starkly contrasted telemedicine adoption across the country (NHSO, 2022). With their robust digital infrastructure and concentration of private healthcare providers, urban centers have become fertile ground for telemedicine implementation. Telemedicine has been defined by several academicians. According to Smiley (2022), telemedicine is using computers and automated data to deliver healthcare services to patients far away from medical professionals. On the other hand, according to Bém (2022), telemedicine is defined as “medicine practiced at a distance,” utilizing virtual platforms and technologies to provide various aspects of health information, disease monitoring, and medical care, primarily for patients with chronic diseases, enhancing care quality and accessibility. Finally, Dey et al. (2023) state that telemedicine is the provision of medical treatment from a certified doctor online, allowing patients

to receive healthcare remotely. It is particularly beneficial in rural areas with limited access to specialized doctors, especially during the COVID-19 pandemic.

2. **Technology Acceptance Model** The technology Acceptance Model (TAM) emerged as a groundbreaking framework in 1989 when Fred Davis sought to unravel the complex psychology behind technology adoption. The empirical validation of TAM has been extensive and compelling. Numerous studies have confirmed the robust relationship between PEOU, PU, and technology adoption intentions (Venkatesh & Davis, 2000). TAM provides a clear roadmap for increasing technology acceptance (Venkatesh & Davis, 2000). This practical utility and solid theoretical foundation explain why TAM influences how we think about and implement new technologies in an increasingly digital world. Furthermore, TAM's influence extends beyond its original scope, inspiring numerous researchers to explore additional factors that might affect technology adoption. These investigations have led to a deeper understanding of how individual differences, cultural factors, and organizational contexts can impact technology acceptance (Venkatesh et al., 2003).

3. **The Theory of Planned Behavior (TPB)** incorporation of social influence processes and cognitive instrumental determinants expands our understanding of how users evaluate and form intentions toward new technologies. Similarly, UTAUT's emphasis on facilitating conditions, as highlighted by Venkatesh et al. (2003), In the context of telemedicine adoption, Behavioral Intention emerges as a critical determinant shaped by an intricate web of technological, psychological, and social factors. The foundational work of Mettler and Raptis (2012) The significance of system design and user experience in shaping behavioral intention cannot be overstated, as evidenced by Sun et al.'s (2020). The research conducted by Zhang et al. (2021) provides compelling evidence that addressing digital trust and risk perception can substantially enhance behavioral intentions toward telemedicine adoption.

4. **Attitude Toward Using (ATT)** construct represents a critical psychological determinant that shapes individuals' behavioral intentions and engagement with technological innovations in healthcare delivery systems. ATT manifests as a multifaceted evaluative disposition in telemedicine that encompasses both affective and cognitive components of stakeholders' orientations toward remote healthcare services. Their findings revealed that the three proposed external factors: system quality, perceived self-efficacy, and facilitating conditions were significant predictors of attitude toward LMS. Additionally, Wichadee (2015) investigated the factors about the faculty members' attitudes toward LMS and the adoption of LMS in their courses. The findings revealed that the respondents of the study had a positive overall attitude toward LMS as well as PU and PEOU were the constructs with the highest positive correlations with the attitude toward LMS. contribute to the formation of a positive attitude toward the use of the said system (Fathema et al., 2015; Lavidas et al., 2019; Teo, 2010).

Conceptual Framework

The conceptual framework depicted in Figure1 presents an integrated theoretical model that synthesizes key constructs from the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB). This integration addresses the complementary nature of cognitive-technological factors and social-psychological determinants in shaping technology adoption behaviors by incorporating TAM's core constructs of Perceived Ease of Use (PEOU) and Perceived Usefulness (PU), alongside TPB's dimensions of Subjective Norms (SN) and Perceived Behavioral Control (PBC).

The framework posits a network of relationships wherein PEOU influences both PU and Attitude, while PU affects both Attitude and Behavioral Intention. This cognitive pathway is complemented by the social-psychological pathway represented by SN and PBC, both directly influencing Behavioral Intention. Attitude serves as a crucial mediating construct, channeling the effects of both PEOU and PU toward Behavioral Intention. This theoretical integration advances understanding beyond single-theory approaches by acknowledging that technology adoption decisions are shaped by multiple forces: technological characteristics, social influences, and individual capability perceptions.

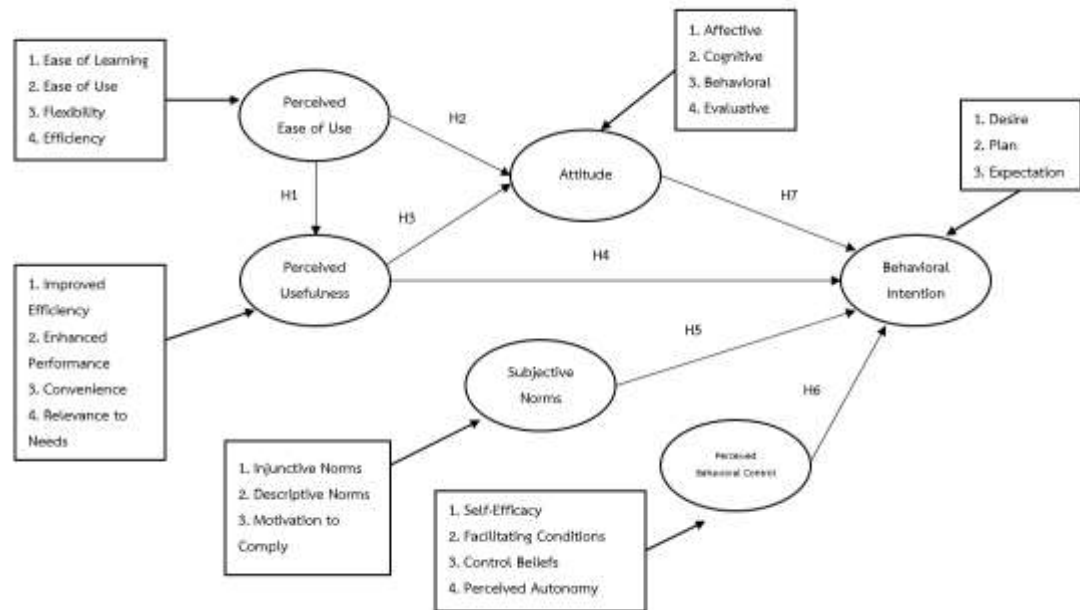


Figure 1: illustrates the conceptual model based on the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB), depicting the relationships between key constructs influencing behavioral intention to use a technology.

METHODOLOGY

The quantitative method implements stratified random sampling to ensure proportional representation across key demographic strata within patients using major telemedicine platforms, such as Mordee, DoctorAnywhere, and Clicknic, including geographical distribution (urban, suburban, and rural zones), types of virtual care services utilized (primary care, specialist consultations, and mental health services), and participant demographics. This probabilistic sampling approach enhances the precision of parameter estimates while minimizing sampling error (Etikan, 2016). Sample size determination adheres to established guidelines for Structural Equation Modeling (SEM), which recommend 5-10 participants per observable parameter to ensure robust model estimation (Hair et al., 2019). Given the study's 22 observable variables, the target sample size ranges from 220 to 440 patients across the three telemedicine platforms, providing sufficient statistical power for reliable model validation and hypothesis testing.

1. Population and Sample: The study population encompasses key stakeholders within Thailand's telemedicine ecosystem, with three distinct cohorts representing the spectrum of telemedicine service delivery and utilization.

2. Research Tools: The quantitative method implements stratified random sampling to ensure proportional representation across key demographic strata within patients using major telemedicine platforms, such as Mordee, DoctorAnywhere, and Clicknic, including geographical distribution (urban, suburban, and rural zones), types of virtual care services utilized (primary care, specialist consultations, and mental health services), and participant demographics.

For data interpretation, the researcher employed descriptive statistics to analyze and discuss the characteristics of the collected data. The analysis framework was structured according to appropriate statistical measurement scales, encompassing nominal, ordinal, interval, and ratio scales. A five-point

Likert scale was implemented as the primary measurement instrument to analyze respondents' perceptions regarding telemedicine acceptance systematically.

The scale was operationalized with the following interpretative criteria:

The respondent's level of agreement was measured on a scale ranging from 1 to 5, where:

- 5 represents "Strongly Agree."
- 4 represents "Agree."
- 3 represents "Somewhat Agree."
- 2 represents "Disagree."
- 1 represents "Strongly Disagree."

3. Data Collection: The researcher employed a mixed-mode data collection strategy utilizing both online and traditional methods to ensure comprehensive coverage of the target population. The primary data collection instrument was implemented through an online survey platform, with the questionnaire distributed via secure URL links through various healthcare-related professional networks and social media channels. This approach aligns with contemporary healthcare research methodologies that emphasize the importance of digital data collection methods, particularly in telemedicine studies (Eysenbach & Wyatt, 2002; Wright, 2005).

This calculation yielded a class interval width of 0.8, which was used to establish distinct interpretative ranges for the measured variables. This standardized approach to interval determination ensures precise categorization of respondent attitudes and perceptions across all study variables. The calculated interval width provides a robust foundation for subsequent statistical analysis and interpretation of the data within the context of telemedicine acceptance research. The range intervals of each variable are as follows:

Table 1: Interpretation Scale for Perceived Ease of Use (PEOU) Measurement

Mean Score Range	Interpretation Level	Mean Score Range	Interpretation Level
4.21 - 5.00			Very High Perceived Ease of Use
3.41 - 4.20			High Perceived Ease of Use
2.61 - 3.40			Moderate Perceived Ease of Use
1.81 - 2.60			Low Perceived Ease of Use
1.00 - 1.80			Very Low Perceived Ease of Use

These interval ranges were derived using the previously calculated class width of 0.8, providing a systematic framework for evaluating respondents' perceptions of how effortless they find telemedicine system usage. This standardized interpretation scale enables consistent analysis of PEOU scores across different user groups and contexts within the Thai healthcare system. The five distinct levels allow for a nuanced understanding of users' perceptions, facilitating more precise identification of potential barriers or enablers to telemedicine adoption related to system usability.

The instrument's content validity was established through a systematic evaluation process focusing on linguistic clarity and communicative accuracy of the questionnaire items. The researcher sought expert validation from three specialists with relevant telemedicine, healthcare technology, and research methodology expertise. The panel of experts included:

1. A medical professional with telemedicine implementation experience
2. A research methodology specialist

3. A healthcare management professional

The experts evaluated each item using the Index of Item-Objective Congruence (IOC) with the following scoring criteria:

- +1 = The item aligns with the research objectives
- 0 = The item's alignment with research objectives is unclear
- 1 = The item does not align with the research objectives

The Item-Objective Congruence (IOC) was calculated following the expert evaluation to assess the consistency between questionnaire items and measurement objectives. According to both classical and contemporary research methodology literature (Rovinelli & Hambleton, 1977, pp. 49-60; Turner & Carlson, 2003: 163-172; Zamanzadeh et al., 2015: 165-173), an acceptable IOC value should exceed 0.80. The calculation was performed using the following formula:

$$IOC = \frac{\sum R}{N}$$

Where:

- IOC = Index of Item-Objective Congruence
- $\sum R$ = Sum of expert ratings
- N = Number of experts

Reliability and Validity Testing

Following the refinement of the questionnaire based on expert recommendations and advisor feedback, the researcher conducted a pilot study with 50 participants who shared characteristics and contexts similar to those of the target population. The data collected from this pilot study was used to assess the reliability of the measurement instrument through internal consistency analysis using Cronbach's Alpha Coefficient, a widely accepted measure of scale reliability (Taber, 2018).

The evaluation of reliability followed the "Rules of Thumb" criteria established by George and Mallery (2003), with the following interpretation scale:

- $\alpha > 0.9$ Excellent reliability
- $0.7 < \alpha < 0.9$ Good reliability
- $0.6 < \alpha < 0.7$ Acceptable reliability
- $0.5 < \alpha < 0.6$ Poor reliability
- $\alpha < 0.5$ Unacceptable reliability

Following Pallant's (2007) recommendations for social science and demographic research, supported by recent methodological studies (Hair et al., 2019; Taber, 2018), a Cronbach's alpha coefficient of at least 0.7 is required to establish high reliability and demonstrate strong internal consistency of the measurement instrument. Hair et al. (2019) emphasize this threshold's importance in structural equation modeling studies, noting its crucial role in establishing measurement reliability before proceeding with more complex analyses.

For this study investigating telemedicine acceptance in Thailand, the researcher adopted the criterion of 0.7 or higher for Cronbach's alpha coefficient. This rigorous reliability threshold aligns with current best practices in technology acceptance research and ensures sufficient measurement precision for valid

CONCLUSION AND FUTURE WORK

Telemedicine's emergence as a cornerstone of Thailand's healthcare system represents a significant step in the nation's journey toward more accessible and equitable healthcare delivery. The convergence of technological innovation, supportive government policies, and private sector initiatives has created unprecedented opportunities to extend quality medical care beyond traditional boundaries. This transformation has been particularly evident in the wake of the COVID-19 pandemic, which demonstrated telemedicine's crucial role in maintaining healthcare services during times of crisis.

The progress thus far tells a compelling story of adaptation and innovation in healthcare delivery. From sophisticated virtual consultation platforms to AI-driven diagnostic tools, Thailand has embraced various technological solutions to enhance healthcare accessibility. Government programs, particularly the integration of telemedicine into the Universal Coverage Scheme, have provided a strong foundation for widespread adoption. Meanwhile, private sector contributions have accelerated innovation and expanded service offerings, creating a dynamic ecosystem of digital health solutions.

However, the path forward requires addressing several critical challenges. The digital divide between urban and rural areas remains a significant concern, with infrastructure limitations and digital literacy gaps potentially exacerbating healthcare inequalities. Data privacy and security considerations, particularly concerning the PDPA requirements, demand careful attention and robust solutions. The regulatory landscape must evolve to provide clear guidelines while fostering innovation and maintaining high standards of care.

The future success of telemedicine in Thailand will depend on how effectively these challenges are addressed through collaborative efforts between the public and private sectors. By focusing on infrastructure development, digital education, regulatory refinement, and security enhancement, Thailand can work toward a healthcare system that leverages telemedicine to its full potential. This commitment to overcoming current obstacles will be crucial in realizing the vision of accessible, efficient, and high-quality healthcare for all Thai citizens, regardless of their location or socioeconomic status.

ACKNOWLEDGEMENTS

I would like to express my sincere thanks to Suan Sunandha Rajabhat University for invaluable help throughout this research.

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