การพัฒนาระบบแชทบอทบริการด้านสุขภาพสำหรับโรงพยาบาลส่งเสริมสุขภาพบางเตย อำเภอสามโคก จังหวัดปทุมธานี

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บทคัดย่อ

การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อพัฒนาระบบแชทบอทบริการสุขภาพและประเมินความพึงพอใจของผู้รับบริการต่อระบบแชทบอทของโรงพยาบาลส่งเสริมสุขภาพตำบลบางเตย อำเภอสามโคก จังหวัดปทุมธานี โดยใช้รูปแบบการวิจัยกึ่งทดลองแบบวัดผลก่อนและหลังการทดลอง (pretest–posttest) ร่วมกับกระบวนการวิจัยและพัฒนา (Research and Development: R&D) เพื่อพัฒนาและประเมินผลระบบแชทบอทสำหรับบริการด้านสุขภาพ ร่วมกับแนวคิดการจัดการแบบลีน (Lean Management) ในการพัฒนาบนแพลตฟอร์ม LINE Official Account ระบบให้ข้อมูลวันและเวลาทำการ ข้อมูลการให้บริการ ตารางแพทย์ การนัดหมาย และคำแนะนำก่อนเข้ารับบริการ กลุ่มตัวอย่างคือผู้รับบริการจำนวน 100 คน คัดเลือกโดยวิธีการสุ่มอย่างง่าย เครื่องมือที่ใช้ในการวิจัยประกอบด้วยระบบแชทบอท และแบบสอบถามความพึงพอใจ วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนา ได้แก่ ความถี่ ร้อยละ ค่าเฉลี่ย ส่วนเบี่ยงเบนมาตรฐาน และสถิติ paired t-test

ผลการวิจัยพบว่า การพัฒนาระบบแชทบอทสำหรับการให้บริการด้านสุขภาพของโรงพยาบาลส่งเสริมสุขภาพตำบลบางเตยผ่านแพลตฟอร์ม LINE Official Account โดยระบบสามารถให้ข้อมูลเกี่ยวกับเวลาทำการ การให้บริการด้านสุขภาพ ตารางแพทย์ การจองคิว และการเตรียมตัวก่อนเข้ารับบริการได้อย่างสะดวกและรวดเร็ว พบว่า คะแนนความพึงพอใจของผู้ใช้บริการหลังการใช้ระบบแชทบอทบริการสุขภาพสูงกว่าก่อนการใช้ระบบอย่างมีนัยสำคัญทางสถิติในทุกด้าน โดยความพึงพอใจโดยรวมของผู้ใช้บริการเพิ่มขึ้นเท่ากับ 1.11 (95% CI 1.00–1.22; $p < 0.001$) ซึ่งแตกต่างกันอย่างมีนัยสำคัญทางสถิติ พิจารณาเป็นรายประเด็นพบว่า ความพึงพอใจด้านเนื้อหา ด้านการออกแบบ และด้านการใช้งานเพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติ ($p < 0.001$)

สรุปผลการศึกษา ระบบบริการสุขภาพสำหรับโรงพยาบาลส่งเสริมสุขภาพตำบลบางเตย สามารถให้บริการข้อมูลสุขภาพเป็นที่น่าพึงพอใจของผู้ใช้งาน

คำสำคัญ: แชทบอท, LINE Official Account, การจัดการแบบลีน, ความพึงพอใจ

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Development of a Healthcare Service Chatbot for Bang Toei Subdistrict Health Promoting Hospital, Sam Khok District, Pathum Thani Province.

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Abstract

This study employed a quasi-experimental one-group pretest–posttest design combined with a Research and Development (R&D) process to develop and evaluate a healthcare service chatbot system for Bang Toei Subdistrict Health Promoting Hospital, Sam Khok District, Pathum Thani Province. Lean Management principles applied to system development. The chatbot was developed through the LINE Official Account platform to provide information on operating days and hours, healthcare services, physicians' schedules, appointment services, and pre-service guidelines. The sample consisted of 100 service recipients selected by simple random sampling. The research instruments included the healthcare service chatbot system and a satisfaction questionnaire. Data were analyzed using frequency, percentage, mean, standard deviation, and paired t-test.

Research findings indicate that the development of a chatbot system for health services at the Bang Toei Sub-district Health Promoting Hospital implemented via the LINE Official Account platform enables the convenient and rapid provision of information regarding operating hours, health services, doctor schedules, queue booking, and pre-service preparation. It was found that user satisfaction scores following the use of the healthcare chatbot system were statistically significantly higher than those prior to its implementation across all aspects. Overall user satisfaction increased by 1.11 (95% CI 1.00–1.22; $p < 0.001$), a statistically significant difference. An analysis of specific dimensions revealed statistically significant increases in satisfaction regarding content, design, and usability ($p < 0.001$).

Conclusions: The health service system for Bang Toei Subdistrict Health Promoting Hospital that user satisfaction with health information service.

Keywords: Chatbot, Primary Healthcare, LINE Official Account, Lean Management, User Satisfaction

Introduction

Healthcare systems worldwide have been challenged by increasing service demand and overcrowding, particularly in outpatient departments, which has led to prolonged waiting times and reduced service efficiency. In Thailand, primary healthcare units, especially Subdistrict Health Promoting Hospitals (SHPHs), play a vital role in delivering community-based services, including health promotion, disease prevention, and primary care. However, many SHPHs operate under constraints of limited human resources, particularly in semi-urban and rural areas, which have restricted their capacity to respond effectively to the growing demand for health information and services.[1]

Bang Toei Subdistrict Health Promoting Hospital in Sam Khok District, Pathum Thani Province, has represented a typical example of this issue, as it has been responsible for serving a considerable population with only 1–4 healthcare personnel. This limitation has resulted in inefficiencies in providing essential service information, including operating hours, appointment systems, and healthcare preparation guidelines. Baseline service data showed that the hospital provided services to approximately 150–200 service recipients per day, received approximately 70–100 telephone inquiries per day, and had approximately 50–70 missed appointments, accounting for 25%–46.7% of daily service recipients. In addition, the average waiting time was approximately 30–60 minutes. Consequently, communication delays, increased workload among healthcare staff, and patient dissatisfaction have emerged.

Despite the rapid advancement of digital technologies and widespread use of mobile communication platforms, particularly LINE in Thailand, the integration of automated communication systems such as chatbots into primary healthcare settings remains limited. This gap highlights the need for innovative solutions to enhance service efficiency and accessibility in SHPHs.[2]

Lean Management has been widely recognized as an effective approach for improving organizational efficiency by eliminating non-value-added activities and reducing process waste, thereby enhancing service quality and responsiveness (Womack & Jones, 1996). In healthcare settings, Lean principles have been successfully applied to reduce waiting times, streamline workflows, and improve patient satisfaction. Concurrently, chatbot technology has emerged as a promising digital tool capable of providing real-time, automated interaction with users. Chatbots have been defined as computer-based systems designed to simulate human conversation and deliver instant responses to user inquiries, thereby improving communication efficiency and accessibility.[3] The integration of chatbot systems into healthcare services has demonstrated potential in reducing staff workload, supporting information dissemination, and enhancing user experience.

The combination of Lean Management principles and chatbot technology offers a novel approach to addressing inefficiencies in primary healthcare service delivery.[3] By integrating a chatbot system through the LINE Official Account platform, which is widely adopted among Thai users, healthcare providers can deliver timely and accurate information while minimizing repetitive communication tasks. This integration not only supports process optimization but also enhances accessibility and continuity of care through 24-hour service availability.[4]

Therefore, this study aimed to develop a healthcare service chatbot for Bang Toei Subdistrict Health Promoting Hospital and to evaluate user

satisfaction with the system. The findings are expected to contribute to improving service efficiency in primary healthcare settings and to provide a practical model for the application of digital health technologies in similar contexts.[5,6]

Research Objectives

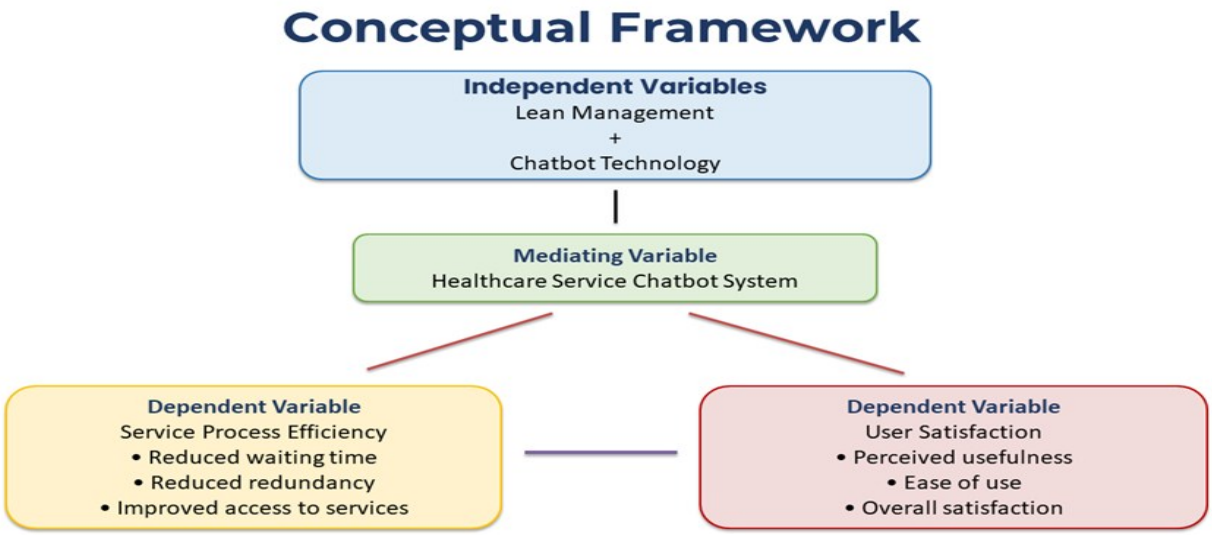
1. To develop a healthcare service chatbot for Bang Toei Subdistrict Health Promoting Hospital.
2. To evaluate users' satisfaction with the developed chatbot system.

Conceptual Framework

This study developed a conceptual framework integrating Lean Management principles and chatbot technology to enhance the efficiency of healthcare services and user satisfaction.[3] Lean Management focuses on eliminating non-value-added activities and reducing process waste to improve operational efficiency, service flow, and service quality. Meanwhile, chatbot technology serves as an automated communication system that enables real-time interaction with users, allowing them to access healthcare information quickly, continuously, and conveniently.[6]

In this study, the healthcare service chatbot system was the intervention It was developed based on Lean Management principles and chatbot technology to improve access to healthcare service information and communication process.

Service process efficiency was considered a mediating variable that influenced user satisfaction, which was defined as the dependent variable of the study. It was expected that improvements in service efficiency, particularly faster communication, reduced waiting time, and easier access to information, would lead to higher levels of overall user satisfaction with the healthcare service chatbot system.



Study Design

This study employed a quasi-experimental one-group pretest–posttest design combined with Research and Development (R&D) to develop and evaluate a Healthcare Service Chatbot System. The development process comprised four phases: 1) Problem Analysis, 2) System Development, 3) Implementation, and 4) Evaluation.

Setting and Participants

The study was conducted at Bang Toei Subdistrict Health Promoting Hospital, located in Sam Khok District, Pathum Thani Province, Thailand. The target population consisted of healthcare service recipients aged between 18 - 60 years who accessed services during the study period. The sample included 100 participants probability sampling was used.

Inclusion and Exclusion Criteria

Inclusion Criteria:

- Aged 18–60 years
- Able to use smartphones
- Willing to participate

Exclusion Criteria:

- Unable to complete chatbot usage
- Withdraw during the study

Research Instruments

1. Healthcare Chatbot System

The healthcare service chatbot was developed using the LINE Official Account platform to facilitate access to healthcare information and services. The chatbot was designed to provide the following functions:

- Hospital information (location, contact details, and operating hours)
- Medical service information
- Physicians' schedules
- Guidelines before receiving medical care

The system was developed based on Lean Management principles, aiming to reduce waiting time, eliminate redundant processes, and improve communication efficiency between healthcare providers and service users.

2. Questionnaire

The questionnaire was divided into three parts as follows:

Part 1: Demographic Information

This section consisted of multiple-choice questions regarding the respondents' general characteristics, including:

- Age
- Education level
- Current status
- Frequency of using health services at the hospital
- Main purpose of service use
- Experience using LINE application

Part 2: System Evaluation and User Satisfaction

This section assessed user perceptions of the chatbot system using a Likert scale and was divided into two dimensions:

1. Effectiveness and Efficiency

This dimension included the following items:

1.1 The system provides accurate responses that meet user needs.

1.2 The system's responses are clear and easy to understand.

1.3 The system responds promptly.

1.4 The system provides up-to-date information.

The criteria for interpreting mean scores of efficiency and effectiveness in meeting user needs were defined as follows:

4.51–5.00: Highest level

3.51–4.50: High level

2.51–3.50: Moderate level

1.51–2.50: Low level

1.00–1.50: Lowest level

2. User Satisfaction

This dimension included the following items:

2.1 Level of interest in using the system

2.2 Ease of use

2.3 User preference (liking)

2.4 Overall satisfaction

User satisfaction was measured using a 5-point Likert scale. The interpretation of mean scores was defined as follows:

4.51–5.00: Highest level of satisfaction

3.51–4.50: High level of satisfaction

2.51–3.50: Moderate level of satisfaction

1.51–2.50: Low level of satisfaction

1.00–1.50: Lowest level of satisfaction

Part 3: Comments and Suggestions

This section consisted of open-ended questions designed to collect qualitative data regarding users' opinions, comments, and suggestions for system improvement.

Content Validity

The questionnaire was reviewed by three experts in healthcare, health informatics, and research methodology. The Index of Item-Objective Congruence (IOC) was calculated for each item. Items with IOC values of 0.50 or higher were considered acceptable and retained in the final version of the questionnaire.

Reliability

The reliability of the questionnaire was assessed using Cronbach's alpha coefficient. The instrument was pilot-tested with a group of participants whose characteristics were similar to those of the study sample (n = 100). A Cronbach's alpha coefficient of 0.70 or higher was considered acceptable, indicating adequate internal consistency of the instrument.

Data Analysis

The data collected from the sample were analyzed using statistical methods with a statistical software package, SPSS for Windows (Statistical Package for the Social Sciences), version 29, under a concurrent user license.

1. Descriptive statistics were used to analyze the data, including frequency, percentage, mean, and standard deviation (SD).

2. Inferential statistics were used to test the research hypothesis regarding the difference in user satisfaction scores before and after using the chatbot system. Prior to hypothesis testing, the normality of the data distribution was examined using the Shapiro–Wilk test. When the data satisfied the assumption of normal distribution, the paired-samples t-test was used to compare the pre- and post-intervention satisfaction scores. When the assumption of nonnormal distribution, the non-parametric Wilcoxon signed-rank test was used instead. All statistical tests were two-tailed, and a p-value of less than 0.05 was considered statistically significant.

Research Ethics

This research has been reviewed and approved by the Human Research Ethics Committee of Shinawatra University, project code IRBS 24/25, dated October 22, 2024.

Research Method

1. A situational analysis of the appointment system at Bang Toei Subdistrict Health Promoting Hospital revealed several limitations in the existing process. Previously, service recipients were required to schedule appointments directly with healthcare staff at the facility. Appointments were recorded manually in a logbook, and details were communicated verbally to patients. This system resulted in several challenges. Many service recipients were unable to contact staff during official working hours due to work commitments, or caregivers were unavailable to accompany them to the facility. In addition, appointment cancellations or rescheduling could only be conducted via telephone during office hours. Some patients forgot their scheduled appointments, leading to missed visits. Furthermore, overlapping or duplicated appointments occasionally occurred, resulting in inefficiencies and unnecessary travel for service recipients. Given these issues, there is a need to develop an appointment system on the Line Official Account platform to improve accessibility, convenience, and efficiency in service delivery.

2. Development of an Appointment System Using a Healthcare Service Chatbot for Service Recipients at Bang Toei Subdistrict Health Promoting Hospital

The development of the appointment system using Healthcare Service Chatbot for service recipients at Bang Toei Subdistrict Health Promoting Hospital was designed based on two main components.

2.1 Design and Development of the Healthcare Service Chatbot

The system was developed by first creating a Healthcare Service Chatbot. Subsequently, an appointment system was implemented using the Glide App platform. The system was integrated with Google Sheets as a database to record and verify appointment information selected by service recipients, including their preferred registration date and time.

Afterward, the system was connected to Dialog flow by creating a chatbot agent. The LINE chatbot was designed to provide automated responses and facilitate real-time interaction with users. The overall system workflow and architecture are illustrated in Figure 1.

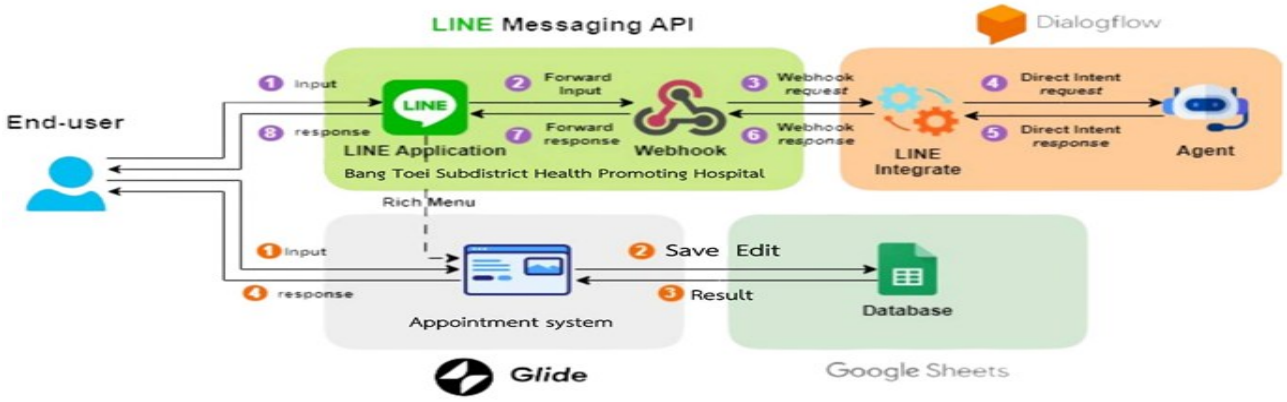


Figure 1: Entity–Relationship (E-R) Diagram of the Healthcare Service Chatbot for Service Recipients at Bang Toei Subdistrict Health Promoting Hospital

2.2 Main User Interface The main user interface allows service recipients to access the system by adding the Healthcare Service Chatbot using the LINE ID “@bangtoey.” The interface displays the main operational screen, which consists of four primary menus: Appointment Booking, General Information, Q&A, and Contact. The Appointment Booking menu enables users to schedule appointments for medical services and also allows them to cancel existing bookings. The General Information menu provides service guidelines for Bang Toei Subdistrict Health Promoting Hospital. The Q&A menu presents frequently asked questions related to the hospital, including scope of services, physicians’ schedules, service fees, operating hours, location, and directions. The Contact menu provides automated messages regarding the communication channels of Bang Toei Subdistrict Health Promoting Hospital. The interface of the system is illustrated in Figure 2.

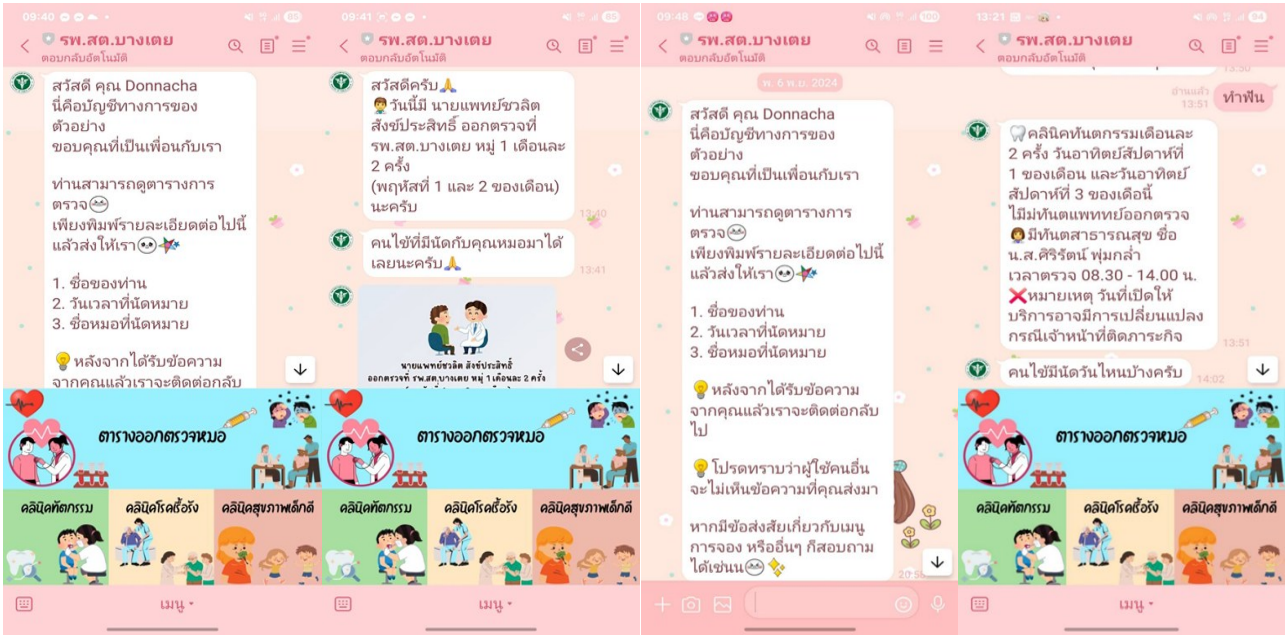


Figure 2: Main Menu Interface of the Healthcare Service Chatbot for Service Recipients at Bang Toei Sub-district Health Promoting Hospital

Results of the quality assessment of the Healthcare Service Chatbot for service recipients at Bang Toei Subdistrict Health Promoting Hospital.

A total of 100 healthcare service recipients participated in the study, most of whom were female (62.0%) and aged 31–40 years (34.0%). The majority held a bachelor’s degree (39.0%) and worked as private company employees (28.0%). Nearly half (46.0%) had used the hospital’s services 1–2 times in the past 6 months, mainly for general illness treatment (34.0%) and chronic disease follow-up (28.0%), and most (81.0%) reported daily use of the LINE application. **(**Table 1**)**

Table 1: Baseline Characteristics of Participants (n = 100)

Characteristics	Number (n)	Percentage (%)
Gender		
Male	38	38.0
Female	62	62.0
Age group (years)		
18–30	26	26.0
31–40	34	34.0
41–50	24	24.0
51–60	16	16.0
Education level		
Primary school or lower secondary school	15	15.0
High school / Vocational certificate	38	38.0
Bachelor's degree	39	39.0
Higher than bachelor's degree	8	8.0
Occupation		
Government officer / State enterprise employee	16	16.0
Private company employee	28	28.0
Self-employed / Business owner	22	22.0
Agriculturist / General laborer	20	20.0
Unemployed / Homemaker	14	14.0
Frequency of using health services at the hospital		
First-time service user	18	18.0
1–2 times in the past 6 months	46	46.0
3 times or more in the past 6 months	36	36.0
Main purpose of service use		
General illness treatment	34	34.0
Chronic disease follow-up	28	28.0
Health promotion / Screening / Vaccination	21	21.0
Appointment, health information, or consultation	17	17.0
Experience using LINE application		
Daily use	81	81.0
Occasional use	16	16.0
Rarely use	3	3.0

After implementation the reported evaluation scores were higher than those before implementation in all dimensions. The mean content score increased from 3.46 to 4.49, the design score increased from 3.42 to 4.49, and the usability score increased from 3.41 to 4.58. Overall score increased from 3.41 to 4.52. These results indicate improvement in users' perceptions of the healthcare service chatbot following its implementation. (Table 2)

Table 2. Comparison of the Quality Assessment of the Healthcare Service Chatbot Before and After Implementation, as Evaluated by Service Users at Bang Toei Subdistrict Health Promoting Hospital (n = 100)

Item	Before Mean	After Mean	Level Before	Level After
1. Content				
1.1 Coverage and usefulness	3.40	4.45	Moderate	High
1.2 Accuracy of appointment information	3.44	4.47	Moderate	High
1.3 Accuracy in canceling appointments	3.48	4.51	Moderate	Highest
1.4 Correct display of information according to sequence	3.52	4.53	High	Highest
Total – Content	**3.46**	**4.49**	**Moderate**	**High**
2. Design				
2.1 Appropriate arrangement of font size, color, and background	3.36	4.45	Moderate	High
2.2 Clear and understandable language	3.40	4.47	Moderate	High
2.3 Appropriate use of symbols or images	3.44	4.51	Moderate	Highest
2.4 Appropriate positioning on the screen	3.48	4.53	Moderate	Highest
Total – Design	**3.42**	**4.49**	**Moderate**	**High**
3. Usability				
3.1 Fast data loading	3.35	4.52	Moderate	Highest
3.2 Convenient use of menu commands	3.39	4.56	Moderate	Highest
3.3 Fast system response	3.43	4.60	Moderate	Highest
3.4 Ease of searching for information	3.47	4.64	Moderate	Highest
Total – Usability	**3.41**	**4.58**	**Moderate**	**Highest**
Overall user satisfaction	**3.41**	**4.52**	**Moderate**	**Highest**

Scores were higher after implementation across all reported dimensions ($p < 0.001$). Overall satisfaction increased from 3.41 ± 0.62 to 4.52 ± 0.51 (mean difference 1.11, 95% CI 1.00–1.22). The content, design, and usability dimensions increased by 1.03, 1.07, and 1.17 respectively. The usability dimension showed the greatest improvement. (Table 3)

Table 3. Comparison of Users' Satisfaction Before and After Using the Healthcare Service Chatbot System (n = 100)

Variable	Before using chatbot Mean ± S.D.	After using chatbot Mean ± S.D.	Mean Difference	95% CI of Mean Difference	p-value
Overall user satisfaction	3.41 ± 0.62	4.52 ± 0.51	1.11	1.00–1.22	<0.001
Content dimension	3.46 ± 0.60	4.49 ± 0.50	1.03	0.92–1.14	<0.001
Design dimension	3.42 ± 0.63	4.49 ± 0.50	1.07	0.95–1.19	<0.001
Usability dimension	3.41 ± 0.66	4.58 ± 0.52	1.17	1.05–1.29	<0.001

Discussions

The findings of this study showed that the developed healthcare service chatbot for Bang Toei Subdistrict Health Promoting Hospital was rated at a high level in terms of overall system quality, while overall user satisfaction was at the highest level. The usability dimension received the highest mean score, indicating that the chatbot system was practical, convenient, and responsive to user's needs. These findings suggest that the LINE Official Account-based chatbot can enhance access to healthcare information, reduce waiting time, and improve communication efficiency in primary healthcare services.

The findings are consistent with the study by Pitchwara Janyam et al., who developed an appointment system through LINE Official Account for a Thai traditional medicine clinic. Their study reported that the system improved convenience and accessibility, with high system quality and very high patient satisfaction, particularly in the usability dimension.[7] Similarly, the findings align with Monticha Ruttanapan and Chatwadee Saiyaitong, who developed a LINE chatbot for research services and found that the chatbot improved service performance and reduced response time.[8] The results are also consistent with Visittha Chunsit and Rangsan Kiatpanon, who reported that chatbot technology could effectively handle basic inquiries, provide users with timely information, and reduce staff workload.[9]

However, the level of satisfaction in this study differed from some previous studies. For example, Pitchaporn Kamtam and Prasart Boonsanong reported a higher overall satisfaction score for a healthcare information chatbot at Naresuan University Hospital (Mean = 4.77, S.D. = 0.57)[10]. In contrast, Monticha Ruttanapan and Chatwadee Saiyaitong reported an overall satisfaction score of 3.83, which was lower than that found in the present study. These differences may be explained by variations in service context, user characteristics, chatbot functions, organizational readiness, and the complexity of information provided. In the present study, the chatbot was developed for a primary healthcare setting where users mainly required essential and practical information, such as operating hours, physicians schedules, appointment services, and pre-service guidelines. Therefore, a simple, accessible, and fast-response system may have directly contributed to higher user satisfaction.

A strength of this study is that the chatbot was developed in response to service problems in a primary healthcare setting and was integrated with Lean Management principles. The system provided Healthcare Service Chatbot, including operating hours, physicians' schedules, appointment services, and pre-service preparation guidelines. Its practical relevance was assessed by experts and service recipients.

The study has several limitations. First, the study was conducted at a single Subdistrict Health Promoting Hospital; therefore, the findings may not be generalizable to all primary healthcare settings. Second, chatbot use depends on user's access to smartphones, internet connectivity, and familiarity with Healthcare Service Chatbot. Older adults or users with limited digital literacy may experience difficulties using the system. Third, the chatbot system requires continuous updating to ensure that healthcare service information remains accurate and current. Moreover, privacy and confidentiality of personal and health-related information must be carefully maintained.

The developed chatbot may be considered for use in similar primary healthcare settings, particularly for providing service information, appointment support, frequently asked questions, and pre-service guidance. Before broader implementation, further studies should evaluate operational outcomes such as waiting time, missed appointments, staff workload, system accuracy, and sustained use, preferably with a concurrent comparison group.

Conclusions

This study developed a healthcare chatbot on LINE Official Account for Bang Toei Subdistrict Health Promoting Hospital. After implementation, patient satisfaction improved significantly across all dimensions.

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