



# Electronic-Prescribing-System Protocol Development for Government Sector Outpatients and Private Drug Stores: Case Study in Kalasin Province, Thailand

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## Abstract

Thai hospitals are overcrowded, with patients spending half of their time waiting for medicines, resulting in increasing patient unhappiness and strain on staff, which leads to medication errors. So, the reducing overcrowding policy was launched to minimize overcrowding by using the e-prescribing system (EPS) that allows patients to obtain medicines at drug stores. However, the existing EPS does not give adequate operational assistance since the system does not cover all areas and there is insufficient financial support. Besides, the EPS does not facilitate information sharing. Therefore, our research objective was to develop an EPS protocol that allows for interoperability between drug stores and outpatients in a government hospital. For this, we utilized a case study in Kalasin province, Thailand. This design and development research was separated into four stages: review of Thailand's EPS, stakeholder analysis, system analysis and design, and system evaluation. Data were collected from 17 key stakeholders at a community hospital, a subdistrict health promoting hospital, and two drug stores in Kalasin province. The new EPS protocol allows patients to choose from a variety of health settings (all-tier hospitals, community health center, and drug stores) to obtain laboratory tests or refill medications

anywhere and at convenient time based on their condition by modifying an appointment through a LINE official account named Morprom. Nevertheless, this protocol should be deployed in practice in the future with numerous settings in Thailand and a larger sample size.

**Keywords:** Electronic prescribing system, reducing overcrowding policy, Kalasin province

### What was Known

- Some Universal Health Coverage Scheme patients can obtain medicine via an electronic-prescribing-system
- Community pharmacists monitor symptoms, refill medicines, and arrange appointments

### What's New and Next

- The new protocol allows patients to choose where and when they want laboratory tests or medicine refills
- The protocol must be implemented in practice

## Introduction

Overcrowding appears to be a hospital-wide problem for many health care facilities<sup>1-3</sup>, and Thailand is no exception. There is currently no clear guideline for how long patients must wait for medicine<sup>4</sup>. Even though certain sites use strategies to lessen waiting times, the average wait time is still prolonged and exceeds the desired requirement. While the average total time from patient registration to obtaining medicine spans from 88 to 112 minutes, patients spent 26.79 to 50.90 minutes (approximately 50% of total time) waiting for medicine<sup>5-8</sup>.

Consequently, the longer the waiting time, the greater the patient displeasure, the greater the strain on staff, and the more crowded the hospital<sup>9,10</sup> leading to errors that result in patient harm ranging from minor to fatal<sup>11</sup>. Some researchers have revealed that these mistakes were caused by fatigued staff as well as computer system problems<sup>12</sup>. Furthermore, problems have developed at drugstores, where it was determined that 27% of prescription drugs were not reported by patients when going to hospital<sup>13</sup>.

Therefore, the demand for Healthcare Information Technology (HIT) system interoperability ensures safe and efficient healthcare<sup>14</sup>. The electronic prescribing system (e-

prescribing system or EPS) is the first step toward achieving interoperability between pharmacists and physicians<sup>15</sup>.

The benefits of EPS have been cited as improving the quality of health services<sup>14,16,17</sup>, increasing efficiency in prescribing and dispensing<sup>14,16</sup>, reducing medication errors, lowering medication costs, and reducing patient waiting time<sup>14,16,17</sup>. By great benefits of EPS, health authorities throughout the world have advocated for the use of EPS<sup>14,16-20</sup>. Thai Ministry of Public Health (MOPH) also launched a policy that made use of the EPS to reduce crowding in hospitals<sup>2</sup>.

By 2020, 29,299 patients in 130 hospitals around Thailand had joined in the policy, of which 37.69% were community hospitals and 25.38% were tertiary hospitals. However, only 1,033 drugstores<sup>21,22</sup> from 16,174 pharmacies joined in<sup>23</sup>. Most hospitals (80.77%) use model 1, in which hospitals prepare medicine and send it to be dispensed at drugstores, followed by model 2 (13.85%), in which hospitals purchase medicine but stock it and have it dispensed at a drugstore. Few hospitals use model 3 which dictates that drugstore do all processes<sup>21,22</sup>.

Researchers have found that this system can reduce waiting time and travel time by 37.5 minutes (22%), increase pharmacist consultation time by 4.5 minutes (56%), and reduce overcrowding by 10–20%<sup>24</sup>. Furthermore, hospital pharmacists indicated that EPS minimized their workload, and community pharmacists stated that they had more time to consult and readily identify drug-related problems<sup>25</sup>.

However, the current EPS faces three major challenges: the system does not cover all areas, cost support is insufficient, and the information system does not support the transfer of information between hospitals and drugstores<sup>24,26</sup>.

The causes of the first and second challenges are the limited confidence of the hospital staff to send patients to the pharmacy<sup>26</sup>. The last issue is that the drugstore system is incompatible with the hospital system. Community pharmacies have worked in silos, with no access to or sharing of information about their activities with hospitals<sup>14</sup>.

In conclusion, the purpose of this research is to develop an EPS protocol that allows for interoperability between private drug stores and outpatients in a government hospital. This has the potential to alleviate pressure on hospital staff as well as reduce overcrowding in hospitals.

## Materials and Methods

### *Ethical approval*

This research has been approved according to the Declaration of Helsinki by the Ethical Review Committee for Human Research, Faculty of Public Health, Mahidol University, Thailand (MUPH 2022-037).

### *Data collection method and research tools*

The method was designed and the developed research was divided into four stages.

Stage 1: reviewing the EPS of Thailand: the existing EPS and healthcare system in Thailand, the restriction of EPS, and the reimbursement system were investigated by searching the internet.

Stage 2: stakeholder analysis: qualitative research was used to assess users' needs and identify some information to develop the system. In-depth interviews with stakeholders (either face-to-face or online) lasted 30-60 minutes. Two experts in health statistics and health informatics reviewed the research tools, which were a socio-demographic form and a semi-structured interview form. The semi-structured interview form had 30 open-ended questions (current EPS, EPS software development, prescription detail, and other factors). Socio-demographic information was analyzed using descriptive statistics.

Stage 3: system analysis and design: a new EPS protocol that strictly adhered to HIPPA<sup>27-29</sup> and Thailand's PDPA<sup>30, 31</sup> was developed using information from a literature review (data from stage 1), stakeholder analysis (data from stage 2), and PESTLE<sup>32, 33</sup> and SWOT analysis<sup>34</sup> to fulfil the needs of stakeholders for usage in Kalasin province. The PESTLE analysis used all samples as the target group, and the SWOT analysis used healthcare staff as the target group.

Stage 4: system evaluation: semi-structured in-depth interviews were used to suggest the system feasibility and stakeholder's requirements for the new protocol produced in stage 3. Research tools were the same as in stage 2 and were reviewed by two experts in health statistics and health informatics. However, the semi-structured interview form was different, with 10 open-ended questions (satisfaction and how to improve the new protocol and system feasibility).

### *Sample size and sampling technique*

The sample was collected by purposive sampling at all-tier government hospitals and private drug stores in Kalasin province because the author intended to develop the new EPS protocol that encompassed and utilized all available healthcare settings in Thailand. Kalasin province was chosen since the Northeast has the highest proportion of noncommunicable disease mortality in Thailand (31%)<sup>35</sup>. Moreover, 1 hospital and 7 drugstores in Kalasin province also joined in the existing EPS protocol<sup>36</sup>.

Due to the nature of qualitative research, the sample size was chosen to give enough information<sup>37-40</sup> until saturation was reached, or no new topics or patterns arose<sup>41-44</sup>. The sample in stage 2 and 4 was the same individual, however, the expert was only present at stage 4. The following stakeholders were related to the new EPS protocol (not every invitation was accepted):

1. Physician: 3 doctors (as general practitioners)
2. Pharmacist: 3 heads of the pharmacy department and 3 community pharmacists
3. Healthcare administrators: 3 hospital directors, 3 drug store owners, and 1 director of the Provincial Public Health Office
4. Thai patients and caregivers: 5-10 Thai patients/caregivers in the medicine outpatient department
5. Information technician: 3 information technicians
6. Expert: 1 expert in health informatics

#### *Inclusion criteria*

The sample was over 18 years of age, able to speak, read, write, and understand Thai, and able to provide informed consent.

#### *Exclusion criteria*

The sample had been working at health care setting for less than 6 months<sup>45</sup>.

## Results

#### *Socio-demographic data of the respondents*

Data were collected from 17 key people at 1 community hospital, 1 subdistrict health promoting hospital, and 2 drug stores. They were as follows: 1 physician, 1 hospital pharmacy director, 2 community pharmacists (who both owned a drugstore, and 1 pharmacist who joined the existing EPS), 1 nurse from a subdistrict health promoting hospital (who worked as a doctor

and pharmacist), 1 hospital director, 9 patients/caregivers, 1 information technician, and 1 expert in health informatics. The socio-demographic data are presented in Table 1. The average age of the sample was 50.35 years (standard deviation 15.12 years). Chronic diseases such as hypertension, hyperlipidemia, asthma, and thyroid illness affected half of the sample. The other half is disease-free, but were caregivers.

### *PESTLE analysis*

This PESTLE analysis investigated major macroenvironmental factors influencing EPS.

#### *Political factors*

The reducing overcrowding policy is useful in preventing the spread of COVID-19 infection and relevant to the National Health Development Plan Issue 12. However, this study found that many patients were dissatisfied with the policy because the patient was required to travel back and forth from the hospital to the drug store due to the pharmacist's inability to consult with the doctor when they discovered an incorrect prescription or the patient's symptoms worsened. The reason being that the doctor disliked speaking over the phone because they believed it would take too long and they were busy.

#### *Economic factors*

According to Credit Suisse 2018, 1% of Thais own 66.9% of the country's assets. Thailand also has a Gini index of 0.90, which means high inequality. Besides, according to the Bank of Thailand 2022, the minimum wage in Thailand is 336 Baht per day. So, it is not surprising when someone refuses to spend their money on medication, or when people gather and split the cost of a car rental to save money. However, most interviewees are willing to spend 70 Baht or less than 50% of a drug's price if they can receive medicines quickly or choose the drug brand.

#### *Social factors*

According to March 2022 statistics, Kalasin province has 974,657 inhabitants living in 18 districts, with more than half under the age of 25 years, and more than a third over the age of 60 years. However, Thais lack health literacy, and almost all interviewees did not know the policy. Besides, Northeastern Thais will go to the hospital if they are extremely ill because they fear a doctor. However, someone enjoys seeing the doctor because they can share their concerns.

**Table 1** Socio-demographic data (n=17)

	n	%
<b>Age (years)</b>		
20-30	1	5.88
31-40	6	35.29
41-50	3	17.65
51-60	1	5.88
61-70	4	23.53
71-80	2	11.76
<b>Sex</b>		
Male	11	64.71
Female	6	35.29
<b>Education level</b>		
Elementary school	2	11.76
Diploma certificate	1	5.88
Bachelor degree	6	35.29
Master degree	2	11.76
Doctoral degree	2	11.76
No data	4	23.53
<b>Insurance status</b>		
UHCS	5	29.41
CSMBS	7	41.18
SSS	1	5.88
Other	4	23.52

UHCS, Universal Health Coverage Scheme; CSMBS, Civil Servant Medical Benefit Scheme; SSS, Social Security Scheme; Other, Insurance for elderly, insurance for persons with disabilities, and insurance for retired civil servant.

### *Technological factors*

According to 2020 statistics, 94.0% of Northeastern Thais own a phone, and 70.9% have internet access. Although the young and middle-aged have smartphones, the elderly do not. This research found that rural areas have no electricity or have frequent power failures. Nevertheless, people want to talk to doctors via telemedicine, but doctors despise it.

Furthermore, because hospitals and drugstores use various EHR systems, each patient's health records are not linked.

#### *Environmental factors*

Kalasin province has 18 districts, with 1 tertiary hospital in Muang District, 17 community hospitals (one hospital in each district), 59 subdistrict health promoting hospitals, and 120 drug stores (most in the city). However, only 1 hospital and 7 drug stores have adopted the policy. So, the community health center was constructed in 2010 in every village to expand health services. Every 3–6 months, Village Health Volunteers (VHM) assess patients' blood pressure and blood sugar levels and record the results in a patient book. VHMs may also invite people to the community health center. Then, healthcare providers from a subdistrict health promoting or community hospital visited the community health center to evaluate each patient's chart and perform blood tests. They then gave medicines to VHMs and allow them to dispense the medicines.

#### *Legal factor*

This finding showed that paying 70 Baht per prescription, or the median drug price, is not worth it because overall expenses are higher. Each healthcare setting pays a varied drug price based on order quantity; the higher the quantity, the lower the drug cost. Furthermore, the roles of Thai doctors and pharmacists overlap. However, in several countries, pharmacists and doctors have independent duties. A doctor prescribes medicine, while a pharmacist dispenses it.

#### *SWOT analysis*

This SWOT analysis examined internal and external factors that could affect EPS.

#### *Strengths*

NHSO web-based software establishes a communication channel between the hospital and the drugstore, providing interoperability, reduced bustling, and the opportunity for patients to select a drugstore. As it is easier and faster to attend, patients feel more relaxed while conversing with professionals at the drug store and subdistrict health promoting hospital. Furthermore, drug stores provide a wide range of medicine brands. For the same reason, patients can choose both high-quality and low-cost drugs.

#### *Weaknesses*



Health information is kept private and only used with the owner's permission. The lack of electricity and internet in some areas limits the sharing of healthcare information. Patients, particularly those living in rural areas, may be dissatisfied and ignore the policy because: 1) most pharmacists work in the evenings; 2) some drug stores employ non-pharmacists; and 3) patients dislike the drugstore's medicine brand. The hospital, instead, will be dissatisfied because drug sales cost them a lot of money.

### *Opportunities*

Bringing the patient to the drug store for medicine and using telemedicine; boosting the drug store's customer base; limiting COVID-19 infection transmission; and expanding patient health services.

### *Threats*

The incorrect prescription was found by a community pharmacist but not by a hospital pharmacist, resulting in disagreement between them. The pharmacist's and doctor's roles overlap. Both can diagnose and prescribe.

### *The new EPS protocol*

The new EPS protocol is divided into five processes (see Figure 1):

#### *Registration for the policy and the first-time getting medicine*

##### *Policy registration and how to schedule a medication refill*

Patient signs a consent form and chooses a prescription form (paper-based or electronic-based), which can change at any time. Then, the doctor enters patient information into NHSO's web-based software, print paper prescriptions for patients who want them, and allow patients to go home.

Later, patients make an appointment for receiving medicine in the Line official account named "Morprom." However, patients who are unable to access Morprom can inform medical staff to book an appointment before going home. Patients can also schedule or change an appointment at least three days before the date. Patients must choose the date, drug store, and service fee options.

- Option 1: pay a service fee of 30 Baht but not possible to select a drug brand

- Option 2: pay 50% of the medicine price as a service fee for those who want to choose the drug brand (patient must type the medicine's name).

Then, the patient will receive a confirmation SMS in Morprom (see the left picture in Figure 2).

*Getting medicine for the first time and at any time*

The pharmacist receives an SMS in the Line official account named “Rak-Ya” (see the middle picture of Figure 2). Then, the pharmacist enters the software to review the patient profile. If the pharmacist discovers any issues, he or she will contact the doctor through email or phone. Then, the pharmacist will prepare the medicine and make a phone call to the patient who selected Option 2 to inform them of the service price. If the patient doesn’t agree to the price, patient must reschedule the appointment.

When the appointment day arrives, the receiver must show the patient's and receiver's national ID card and paper-based prescription (if the patient chooses paper-based) to confirm their identities. Then, the pharmacist will ask the receiver to pay the service fee, dispense the medicine, and record dispensing data into the software.

Besides, Morprom will notify the patient three times if he or she does not arrive to pick up the medicine. If the patient does not appear, the pharmacist must enter the absence into NHSO's web-based software.

*Appointment for physical examination and laboratory test process*

The patient receives a message (see the right picture of Figure 2) one month before the appointment date from Morprom to modify the date and location based on the patient's condition.

- Stable condition: patient can choose any hospital and community health center
- Unstable condition: patient can choose only tertiary or community hospital

Patients can reschedule at least 7 days before the scheduled date. If the patient does not respond to the message within one week or does not have electricity or internet, the hospital will contact the patient. If there is still no answer, the hospital will contact the VHMs to notify the patient.

*Physical examination and laboratory test*

Each environment has its own process which is divided into three.

- Community hospital and tertiary hospital

After a patient receives a body checkup, healthcare staff enter the laboratory results into the software. Then the patient is allowed to go home. Patients who do not have smartphones or internet access can tell the staff which drugstore they want to visit before heading home.

- Subdistrict health promoting hospital

The patient receives a body checkup and waits for medicine. The nurse then records the results in the patient book and the software.

- Community health center

VHM records the patient's blood pressure and blood sugar levels in a patient's book one week before the appointment. When the appointment day arrives, VHM or patients who require a laboratory test travel to the community health center and deliver the patient book to the staff before receiving the test. After the test, VHM and the patient must wait for their medicine.

#### *Refill medicine, referral, and therapeutic monitoring processes*

Following a review of the patient's profile and lab findings, patients with a critical condition should be referred to the hospital. If the patient's condition is stable, the refill process is separated as follows:

- Community hospital and tertiary hospital

The patient will receive an SMS to schedule a medication refill appointment in Morprom. This process is like the process 1.2.

- Subdistrict health promoting hospital

Nurse prescribes and dispenses the medicine to the patient. If the hospital doesn't have electricity or internet, the nurse may send the record to their branch hospital for assistance in recording.

- Community health center

Then, the staff prescribes the medicine, enter the data into the patient book and the software, and follow by sending the medicines to VHM and the patient, who comes to the community health center. After that, VHMs distribute the medicine to patients who are waiting at home.

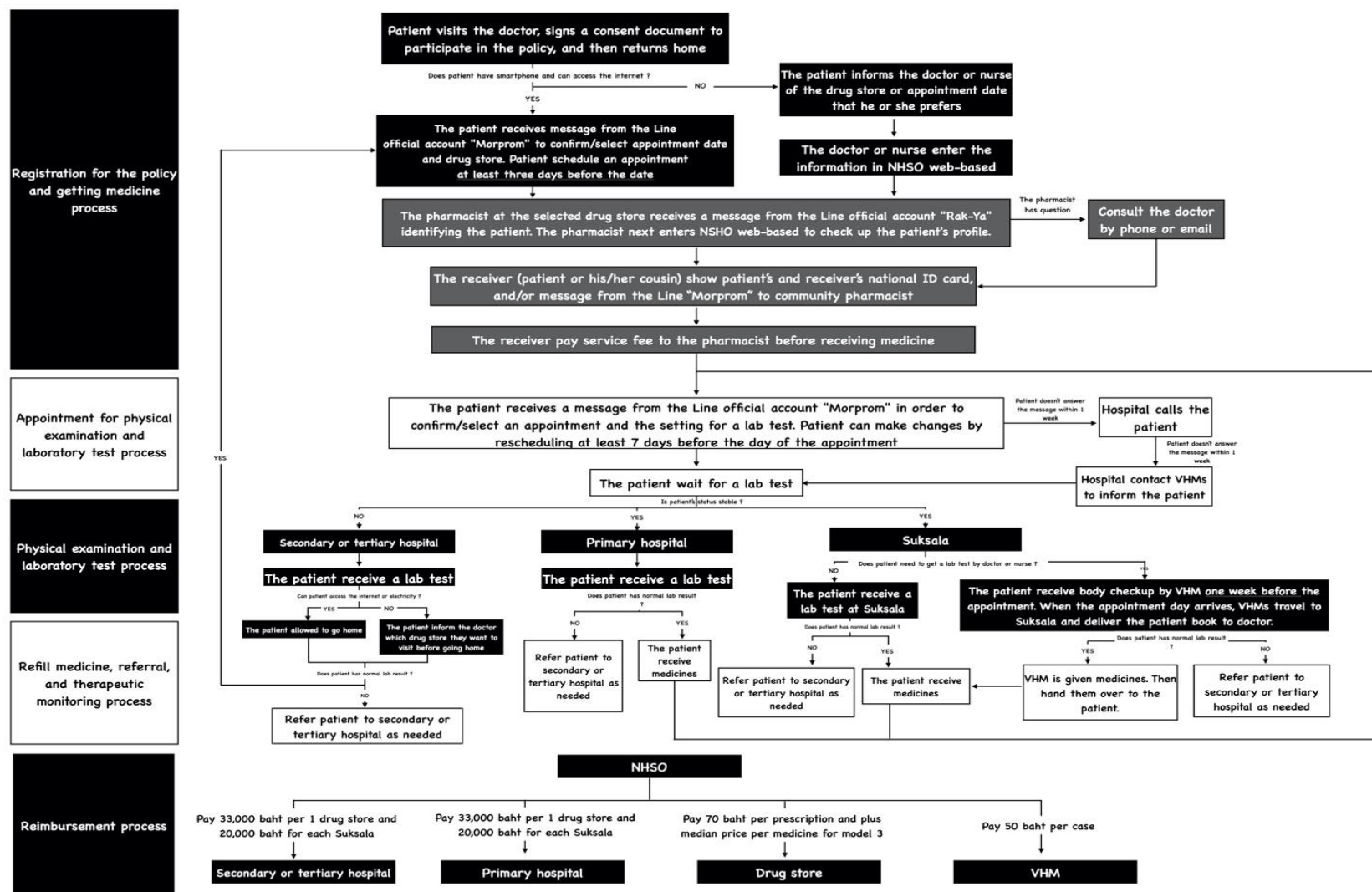


Figure 1 The new EPS protocol process

<b>Confirmation for medicine pickup</b> Time: 2.00 - 3.00 pm Date: May 31, 2022 <hr/> Patient name: Mr. Jaidee Yangyun Option: 1 (not specific medicine brand) Service fee: 30 baht <hr/> Hospital name: Metta hospital Contact number: 074-289-0888 Doctor's visit date: May 25, 2022 <hr/> Drug store name: Karun Pharmacy Location: 11 Karuna Road, Muang District, Kalasin province Contact number: 087-837-8378	<b>Receiving medicine notification</b> <b>Karun Pharmacy</b> Time: 2.00 - 3.00 pm Date: May 31, 2022 <hr/> Patient name: Mr. Jaidee Yangyun Option: 1 (not specific medicine brand) Service fee: 30 baht <hr/> Hospital name: Metta hospital Contact number: 074-289-0888 Doctor's visit date: May 25, 2022 <hr/> Doctor name: Dr. Man Kong E-mail: <a href="mailto:man.k@gmail.com">man.k@gmail.com</a> Contact number: 096-666-666	<b>Confirmation for a physical examination or lab test</b> Time: 10.00 am - 3.00 pm Date: August 1, 2022 <hr/> Patient name: Mr. Jaidee Yangyun Physical examination list: checking blood pressure and blood sugar levels Stop eating or drinking anything except water for 8 hours before your test <hr/> Locations for lab tests: Arak Hospital Location: 11 Aree Rd, Nana district, Kalasin province Phone number: 079-299-0999
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Figure 2 Notification in Line official account

### *Reimbursement process*

NHSO will gather dispensing data from the software. Then, NSHO must pay the service fee depending on the health setting and personnel, which pay 33,000 Baht per subbranch drugstore and 20,000 Baht per community health center to hospitals, 70 Baht per prescription to drugstores, and 50 Baht per case to VHM.

## Discussion

EPS is used by hospital-based physicians, community pharmacists, hospital pharmacists<sup>19</sup>, and insurers to generate prescriptions and exchange information<sup>20</sup>. Thailand has also attempted to deploy EPS in the reducing overcrowding policy to alleviate overcrowding in hospitals<sup>2</sup>. However, the existing policy has three challenges: it does not cover all areas, insufficient service fee, and hospital and drugstore systems are not connected<sup>24, 26</sup>.

This study discovered that many patients requested to leave the policy program. This finding contradicts the studies of Lertsinudom et al<sup>26</sup> and Loatrakul<sup>46</sup>, which found that patients were satisfied. The reasons for the contradiction could be that most healthcare settings in their research were in cities<sup>47, 48</sup>, while most people who participated in the research reported in this article lived in rural areas. So, patients may have found it difficult to travel between the hospital and drugstores. Besides, several areas in Kalasin province lack electricity and internet and there

are few full-time community pharmacists, but their research chose full-time pharmacists as a sample. So, the patient may have been unable to obtain medication at any moment<sup>23, 42</sup>.

Therefore, the new protocol allows patients to choose and alter the health setting in which they feel safe and comfortable speaking with staff. Furthermore, getting a body checkup and receiving medicine at a subdistrict health promoting hospital or community health center that is near their home benefits the rural population since they save money and time.

Utilizing the Line official account "Morprom," makes it easier and allows them to utilise a channel to complain. In addition, the Line official account "Rak-Ya" can alert pharmacists who do not work at the drugstore the whole day. Web-based software has the advantage of being more easily connected than two fully distinct systems<sup>49</sup>.

This finding also showed that a service fee of 70 Baht per prescription was insufficient, causing the pharmacist to be displeased, which is relevant to Lertsinudom et al's research<sup>26</sup>. Consequently, the new EPS protocol uses patient co-pay to solve this problem, in which patients are allowed to select the service fee options that best suit their financial situation.

This research has some limitations. Firstly, only one community pharmacist had experience with EPS, but the others did not. Secondly, the idea for the protocol came from the narrative people group, and any bias or inaccurate facts from the subject must be accepted. Next, research tools have not been tested before implementation. Finally, the new EPS protocol has not been tested in the real world.

The benefit of this study is that it included many perspectives. Healthcare providers, patients, and caregivers are considered. Furthermore, a protocol for use when users lack electricity or internet was developed, which might be applicable to other locations in any province that lack internet or electricity.

To make this new EPS protocol work most efficiently, the government must publicize the policy information via social media and should extend electricity and internet access. Besides, the government must develop Morprom and Rak-Ya to cooperate with the policy to reduce overcrowding. The roles of the pharmacist and the physician must also be separated, which is relevant with the research of Kwon<sup>50</sup> and Kijpan<sup>51</sup>. Furthermore, the protocol must be deployed in practise in various places with numerous samples to gather feedback on its strengths and flaws before being redesigned to fit all areas in Thailand.

## Conclusion

The goal of this study was to develop an EPS protocol for outpatients in the government sector and private drug stores, utilizing a case study in Kalasin province, to reduce hospital overcrowding and foster interoperability across healthcare settings. This new EPS protocol allows patients to choose where and when they want to get laboratory tests or medicine refills by modifying an appointment using the Line official account "Morprom," which includes all-tier hospitals, community health centers, and drug stores. However, this EPS protocol must be implemented in practice.

## Author Contributions

WW, which is a community pharmacist, designed the study and the intervention tooled, conducted the study, analyze the findings, designed the protocol, and wrote the manuscript, with guidance from JS, PS, and HC. Author and all correspondences read and approved the manuscript prior to submission for publication.

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## Conflicts of Interest

There are no conflicts of interest.

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