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Situation of Data and Pharmaceutical Information Systems in Thailand

Netnapis Suchonwanich, B.S. (Pharmacy), M.S. (Information Technology Management)*
Sermsiri Sangroongruangsri, B.Pharm., M.Sc. (Clinical Pharmacology), Ph.D. (Social, Economic and Administrative Pharmacy)**
Nitichen Kittiratchakool, Pharm.D.*
Anchalee Jitruknatee, B.S. (Pharmacy)***
Kritsada Limpananont, B.Sc. (Pharmacy), M.Sc. (Pharmaceutical Chemistry)***
Amnouy Prukpakpoom, B.S. (Pharmacy), M.Sc.(Public Health)****
Oraluck Pattanaprateep, B.Sc. (Pharmacy), M.E., M.B.A., Ph.D. (Pharmacy Administration)*****
Wereyarmarst Jaroenkunathum, M.Sc.(Biochemistry)******
Juntana Pattanaphesaj, B.S. (Pharmacy), M.Sc., Ph.D. (Pharmacy Administration)*******
Woranan Witthayapipopsakul, B.Sc. (Pharmacy), M.Sc. (Health Systems and Public Policy)********
Paithip Luangruangrong, B.Sc. (Pharmacy), M.S. (Pharmaceutical Sciences)*********
** Health Intervention and Technology Assessment Program, Ministry of Public Health, Thailand*
*** Faculty of Pharmacy, Mahidol University*
**** Bureau of Drug Control, Food and Drug Administration, Ministry of Public Health*
**** Oharmacy Department, Samutsakhon Hospital, Samut Sakhon Province*
***** Faculty of Medicine, Ramathibodi Hospital, Mahidol University*
****** Institute of Biological Products, Department of Medical Sciences, Ministry of Public Health*
******* Bureau of Drug and Narcotic, Department of Medical Sciences*
******** International Health Policy Program, Ministry of Public Health*
********* Health Administration Division, Office of the Permanent Secretary, Ministry of Public Health*

Abstract Nowadays, advanced information technology (IT) has played a key role in all processes of drug supply chain as well as in the national health insurance system. However, the situation of pharmaceutical information systems in Thailand has not been scrutinized and revised since 2002. This study aimed to review and analyze the current situation of data and pharmaceutical information systems in Thailand as well as to propose recommendations for future development. The study was conducted by reviewing relevant literature and websites in conjunction with organizing semi-structured interviews. The result of the study indicated that in Thailand, the emphasis on an application of IT to efficiently maximize information management and usage had become the national strategic focal point. In general, data and pharmaceutical information systems were sparsely managed by multiple authorized bodies in Ministry of Public Health and could be publicly accessed. Drug information

systems in healthcare facilities and the national health insurance system had been continuously improved and employed for efficiency enhancement in the management and service provision with the goal to achieve desired outcomes of drug and health systems. Regarding future directions for national development, the focus should be on improving the lack of the necessary foundations. The main point was to establish a primary body responsible for the development of the national pharmaceutical information system in all aspects: relevant laws and regulations should be appropriately developed, and personnel should be sufficiently allocated to relevant tasks and undergo IT skill development. Additionally, there should be a formal development of the standard drug codes and standards for data linkages among related organizations. Applications of modern technologies to be able to link and exchange health information efficiently, safely, and seamlessly as well as development of platforms and databases for research purposes should be considered as key focuses.

Keywords: **data, information; information technology; drug system; Thailand**

Introduction

In the past decades, information technology including hardware, software, and information management systems, has been developed rapidly. Telecommunication systems are so robust to seamlessly connect multiple forms of information from several sources, resulting in changes in various areas such as society, education, medicine, and public health. However, the technological revolutions have changed very swiftly in many other industries when compared to the health system which seems to be moving slower due to many reasons.

In Thailand, drug system is also affected by advances in information technology especially in automated pharmaceutical production processes ranging from research, production in industrial plants, drug registration, procurement and distribution from manufacturers or importers to public and private sectors. Throughout the pharmaceutical supply chain from hospitals, clinics, pharmacies to consumers, advanced information technology has been heavily utilized to conduct transactions, starting from purchasing process, delivery management, drug and medical supply management, tracking of drug usage, monitoring drug quality problems before and after sales, managing counterfeit drug issues, observing adverse drug reactions and evaluating drug rationality. This drug information is recorded, created, and continuously developed by certain departments; nonetheless, it is not fully connected.

Drug information and information technology system are very important for health management and development in every country since drug expenditures are relatively high when compared to overall health expenses. During 2012-2013, the proportion of health expenses was higher than 6 percent of gross domestic product (GDP) and tends to increase every year. Moreover, the proportion of drug expenses in 2013 was approximately 24 percent of health expenditures (the cost of drugs, at the manufacturer's prices, is approximately 140,000 million baht).[1] Drug information and information technology system relate to patients or consumers, service providers, manufacturers, importers, regulators, and most importantly, public and private health insurance funds.

Reports on pharmaceutical information situation

are parts of the national pharmaceutical system report which was published in 1994[2] and 2002[3]. The reports have not recently been reviewed even though there were significant changes in advanced technologies and social contexts in all areas.

The objective of this study was to review and analyze the current situation of drug information and information systems in Thailand and synthesize suggestions for future development.

Methods

This article on data information and information system was prepared based on the following steps:

1. Defining the scope of the study to gather important occurrences related to drug information and information technology systems in Thailand between 2002 and 2019.

2. Synthesizing important technological framework of the current drug system and provide examples that would play important roles in enhancing the effectiveness of the drug information system and application to achieve excellent results both in the health system and the drug system. These included availability, affordability, accessibility, rational use, and equity which would lead to national drug security and sustainability based on the conceptual framework developed by the Committee on Drug System Reporting of Thailand B.E. 2562 (A.D. 2019).

3. Gathering information and sources on medicines via drug literature reviews and related websites. Semi-structured interviews were conducted with experts and experienced personnel in pharmaceutical and health information systems. The questions were prepared based on current operations, problems, suggestions for future development, including national development direction as well as suggestions for future research proposals.

The study covered the following areas:

(1) Strategy for the development of health information technology systems of the World Health Organization (WHO), International Telecommunication Union (ITU)[4], twenty-year National Strategy (2018-2037)[5], and strategy for health information technology - issued by Ministry of Public Health for 2017-2026[6]

(2) Existing important information in the pharmaceutical system which included product information, drug registration, product safety, product quality, drug prices, drug usage information, a list of drugs in the national drug list, drug procurement information, and drug distribution information as well as drug code standards

(3) Applications of information technology in various systems, such as the drug procurement and distribution system in the health insurance schemes, orphan drug management system, dialysis fluid delivery system for end-stage renal patients

(4) The laws and important regulations in order to manage a variety of processes in the pharmaceutical supply chain

(5) Provision of recommendations regarding future technologies for improving drug information systems; for example, new technologies in big data and blockchain to link product information and its prescriptions

4. Presenting the results of the study, gather recommendations from reviewers and participants in the workshop on the preparation for pharmaceutical system reports of Thailand (report no. 3) to improve the study.

Results

This article presents only partial reviews from the Thai Drug System Report (report no.3), from the chapter: Pharmaceutical information technology.

1. Related strategies, past situations, and problems in brief.

The national strategies prioritized the use of information technology to efficiently manage the information and drive the system in the same direction based on various relevant standards.[5,6] From the strategy analysis at all levels, the health and drug information system were vital components for all the strategies.

In 2002, the demand for drug information became more important after the launching of the Universal Health Coverage scheme. However, the drug information system still could not be fully developed to be able to quickly and efficiently integrate and share information since well-defined drug codes, detailed information on prescribed medication, tracking on drug manufacturing and import information as well as pharmaceutical management information had not been announced. Moreover, the integration complexity was increased because the difference in multiple health fund compensation schemes resulting in the developments of many disparate information systems. All these complications had become a burden for all service units to efficiently develop their general management plan as well as the medical services. Especially in 2017, a new Public Procurement Act was enacted and the e-Government Procurement (e-GP) system was utilized to organize government procurement. These complicated procedures greatly impacted the management of hospital procurement information systems and significantly increased workloads in the initial stages.

In addition, the improvement of the internet usage had made the online drug sales business grow tremendously; an e-pharmacy was created in the pharmaceutical industry although it was difficult to control. On the other hand, in remote areas not easily accessible to health service providers, there were dangerous drugs being illegally sold without license through local grocery stores to consumers. However, qualified pharmacies had been continuously increasing. There were efforts made to develop information systems to connect prescription information between hospitals and qualified pharmacies to facilitate patient drug receptions and truly increase the quality of drug delivery to the public.

Although laws and policies had both direct and indirect influences on health information technology systems, there was no specific law related to the safety and privacies of the health information usage until 27 May 2019, the Personal Information Protection Act B.E. 2562 was announced[7] in which the information technology and communications section included provisions regarding consumer protection on health products which focus only on advertisement. Therefore, the current law still has not been on a par with the digital technology which is rapidly changing. There were delays in the investigations of crimes as well as limitations on the workforce responsible for thoroughly control and oversee the process.[8] Moreover, regulations for selling drugs and medical supplies via online channels (e-pharmacy or online pharmacy)[9] were still not in place.

There was a shortage in the number of related workforce and there were no clearly defined roles and responsibilities for the personnel. For future workforce

planning, knowledge management and skills in managing health information technology systems needed to be firmly developed.

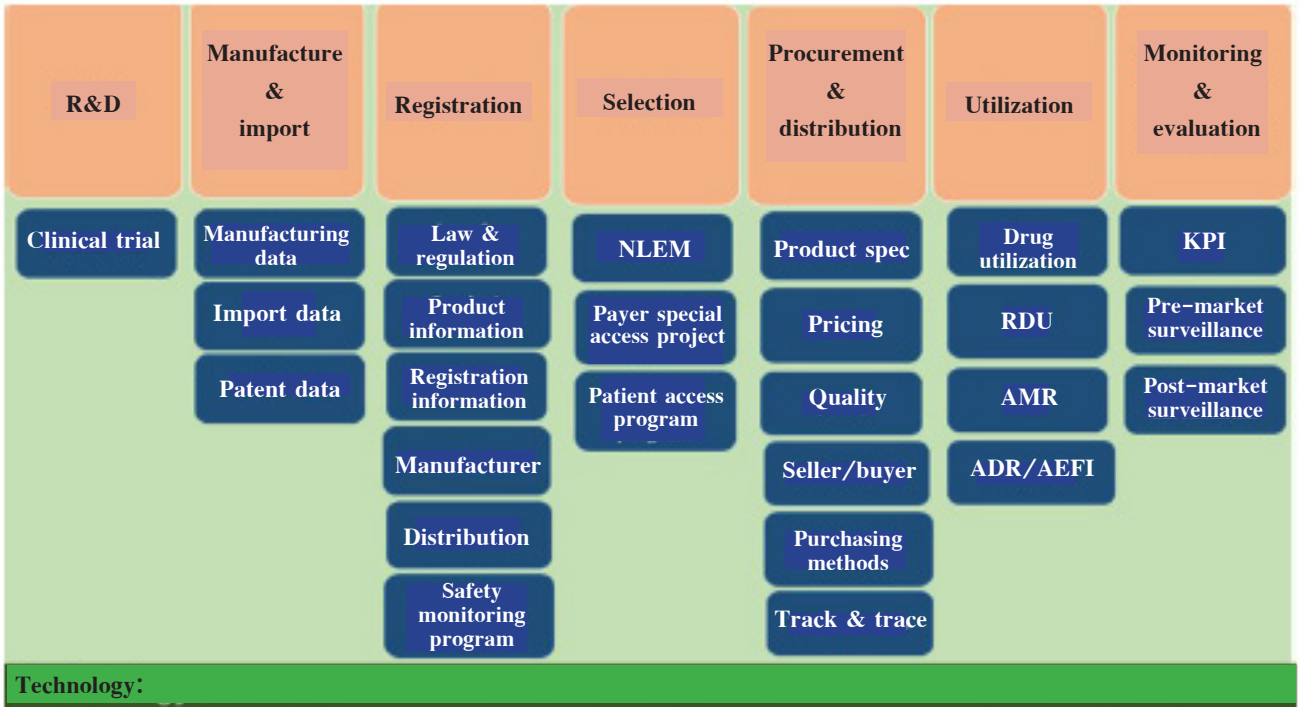
Although consumers could access information more conveniently and quickly with the advanced technology and electronic devices via the internet (the internet-of-things: IoT), they were still unable to fully utilize all new technologies due to the limitations of the users themselves, quality of information and related technologies. Insufficient consumers' health knowledge or health literacy [10, 11] could also prevent consumer from fully realize benefits but instead increase risk exposure.

2. Drug information

2.1 Important information of current drug system

In the drug cycle, there were many types of information being generated which relates to the main activities starting from research and development, production and imports, drug registration, selection, procurement, distribution and usage of drugs - including monitoring and evaluation. There were various technologies which could be utilized to support and make good use of the information, as shown in Figure 1.

Figure 1 Important information of current drug systems and examples of related technology



Note: R & D = research and development; NLEM = National list of essential medicines; spec = specification; RDU = rational drug use; AMR = anti-microbial resistance; ADR/AEFI = adverse drug reactions/adverse events following immunization; KPI = key performance indicator; std. = standard)

2.2 Each type of drug information system of domestic agencies

Thailand had continuously developed important drug information systems based on the drug life cycle since pharmaceutical information is essential in all the processes in the drug supply chain. Additionally, this information was crucial and useful for management for decades, especially in the Ministry of Public Health legally responsible to collect drug information. For example,

1) Pharmaceutical product information which contains information about drug registration, manufacturer and importer, drug registrars and a list of drugs in the National Drug List

2) Drug safety information issued by the Food and Drug Administration (FDA) which contains information on reports of adverse reactions from drugs and surveillance data for adverse reactions from vaccines, issued by the Department of Disease Control

3) Drug quality information which contains information on drug quality assurance, issued by the Department of Medical Sciences, and information on lot release of vaccines

4) Drug price information which contains information on median prices and reference prices, prepared by the Drug and Medical Supply Information Center

5) Drug usage information which contains drug prescribing information from hospitals, rational drug prescribing information, antibiotic prescribing tracking information, and reimbursement information of medical service fees via the Health Insurance Fund

6) Drug code standard information which could specify generic names, trade names, drug strength, and drug types. Since there were many agencies that developed drug code standards causing the service units to have multiple in-use drug code standards. This included the 24-digit drug code which was the first version of the drug codes developed by the Drug and Medical Information Center.[12] Later, Thai Medicines Terminology (TMT) was developed by the Thai Health Information Standards Development Center (THIS) where the health insurance funds as well as the hospitals utilized to disburse medication and purchase drugs via the e-GP system. The Comptroller General's Department also used this terminology for drug monitoring and control.[13] In addition, there were also other types of codes used in pharmaceutical companies such as barcodes and GS1 codes which were applied to use in logistics and warehouses. [14,15] In 2019, The Thai FDA studied and applied the Identification of Medicinal Products (IDMP), a set of five International Standard Organization (ISO) norms being implemented in the Marketing Authorization Application process.[16,17] The IDMP was developed in response to a worldwide demand for internationally harmonized specifications for medicinal products with the basis for the unique identification of medicinal products, in order to respond to the objectives from a variety of regulatory activities (development, registration and life cycle management of medicinal products; pharmacovigilance and risk management).[16]

There were many agencies responsible for constantly producing and maintaining this data system, most of which were in the Ministry of Health. Additionally, these agencies also developed websites to allow people to publicly access the information. Examples of the data sources are shown in Table 1.

Table 1 Examples of important information sources of the current drug system

Process	Information	Example of current data sources
1. Research and development	1.1 Clinical trials	• Thai Clinical Trials Registry (http://www.clinicaltrials.in.th/)
2. Manufacture and import	2.1 Manufacturing data	• Annual reports for the pharmaceutical licensee (http://www.fda.moph.go.th/sites/drug/SitePages/report-form.aspx) • Production value and importing or ordering value (http://www.fda.moph.go.th/sites/drug/SitePages/Statistic.aspx)
	2.2 Import data	• Report Systems of Production and Distribution of Health Products, by Narcotics Control Division (http://www.fda.moph.go.th/sites/Narcotics/SitePages/%E0%B8%A3%E0%B8%B0%E0%B8%9A%E0%B8%9A%20e-sub%20%E0%B8%A2%E0%B8%AA.4.aspx) • Requests for Drug Imports (http://www.fda.moph.go.th/sites/Logistics/SitePages/AllNews.aspx?ListName=DrugNews) • Public guidelines (Requesting permission to import or order drugs) (http://www.fda.moph.go.th/sites/drug/SitePages/Manual-Population.aspx) • Production value and Importing or Ordering Value (http://www.fda.moph.go.th/sites/drug/SitePages/Statistic.aspx)
	2.3 Patent data	• Patented drugs (Sorted by generic name) http://www.fda.moph.go.th/sites/drug/Post/SitePages/Certificate.aspx) • Drug patent information center (https://www.gpo.or.th/Default.aspx?tabid=301&language=th-TH) • DIP :Thailand Patent Search (http://patentsearch.ipthailand.go.th/DIP2013/simplesearch.php) • Drug patent database (http://wwwapp1.fda.moph.go.th/patent/homepage.html)
3. Drug registration	3.1 Laws and regulations	• The Bureau of Drug Control has compiled drug laws (http://www.fda.moph.go.th/sites/drug/SitePages/กฎหมายยา.aspx) • Compiled in the 3rd edition of the Thai Drug System Report in Drug Laws and Drug Selection chapters.
	3.2 Product information	• Folk Doctor Foundation (https://www.doctor.or.th/doctorme/medicine) • Faculty of Pharmacy, Ubon Ratchathani University (https://drugiden.ubu.ac.th/) • Ranelagh Company Limited (https://www.pobpad.com/%E0%B8%A2%E0%B8%B2-a-z) • HonestDocs (https://www.honestdocs.co/drugs) • Medthai (https://medthai.com/drugs/)

Table 1 Examples of important information sources of the current drug system (continued)

Process	Information	Example of current data sources
		• Haamor.com (http://haamor.com./th/วิกิยา) • Pharmaceutical System Research and Development Foundation (http://yaandyou.net/) • List of narcotics (http://www.fda.moph.go.th/sites/Narcotics/List_of_Narcotic/NARCO_list%20_25.04.2019.pdf) • List of active ingredients (http://www.fda.moph.go.th/sites/Narcotics/List_of_Narcotic/PHYCHO_list_25.04.2019.pdf) • List of new generic drugs that are equal in treatment with conventional drugs (orange-book) (http://www.fda.moph.go.th/sites/drug/SitePages/NewDrug-BE.aspx) • Drug information for medical personnel (http://www.fda.moph.go.th/sites/drug/SitePages/ข้อมูลสำหรับบุคลากรทางการแพทย์.aspx) • List of drug information for citizens (http://www.fda.moph.go.th/sites/drug/SitePages/ข้อมูลยาสำหรับประชาชน.aspx) • New drug information (http://www.fda.moph.go.th/sites/drug/SitePages/DrugProducts.aspx) • Search function for common household drugs (http://www.fda.moph.go.th/sites/Drug/SitePages/Queries_Medicine.aspx)
	3.3 Registration information	• Checking product numbers (http://pca.fda.moph.go.th/service.php) • Checking for health product numbers (https://oryor.com/oryor2015/css_check_product.php) • Searching health product numbers (https://oryor.com/%E0%B8%AD%E0%B8%A2/index/check_product) • Searching product information (http://porta.fda.moph.go.th/FDA_SEARCH_ALL/MAIN/SEARCH_CENTER_MAIN.aspx) • Oryor Digital Library (https://oryor.com/%E0%B8%AD%E0%B8%A2/)
	3.4 Manufacturer information	• Company list (http://medicaldevices.oie.go.th/Company List. aspx?tid=1&id=2) • List of committees of Thai Pharmaceutical Manufacturers Association 2018-2019 (http://www.tpma.or.th/V2/home.php?guid=04&page=01) • PReMA member (http://www.prema.or.th/www/en/member.php) • List of GMP Compliance Manufacturers (http://www.fda.moph.go.th/sites/drug/Post/SitePages/Certificate.aspx) • Drugs-Pharmaceutical products-Wholesales and Manufacturers (https://www.yellowpages.co.th/heading/ยา-ผลิตภัณฑ์-ขายส่งและผู้ผลิต)

Table 1 Examples of important information sources of the current drug system (continued)

Process	Information	Example of current data sources
	3.5 Distributors	• Distributors (http://www.prema.or.th/www/en/images/publications/SRAP%20Content%20Handbook%20M123.pdf)
	3.6 Safety Monitoring Program: SMP	• Updated manuals / New drug safety tracking guidelines (Safety Monitoring Program) (http://www.fda.moph.go.th/sites/drug/Shared%20Documents/Law04-Notification-ThFDA/FDA-20120706.pdf)
4. Drug selection	4.1 National List of Essential Medicines: NLEM	• National list of Essential drugs and evidences (http://ndi.fda.moph.go.th/drug_national)
	4.2 payer special access program	• Special projects (https://www.nhso.go.th/frontend/page-contentdetail.aspx?CatID=MTA4Mw==) • NHSO's Annual Reports(https://www.nhso.go.th/frontend/page-about_result.aspx)
	4.3 Patient access program	• GIPAP project (http://www.wongkarnpat.com/viewya.php?id=2277#.XYDwqSgzY2w) • Axios (https://axiosint.com/accessinthailand)
5. Drug procurement and distribution	5.1 Product specifications	• Drug specific characteristics (http://dmsic.moph.go.th/dmsic/index.php?p=1&type=3&s=3&id=4514)
	5.2 Pricing	• Median prices (http://ndi.fda.moph.go.th/drug_value) • Drug and Medical Supply Information Center, Ministry of Public Health (DMSIC) (http://dmsic.moph.go.th/index/index) Median prices (Medicines) (http://dmsic.moph.go.th/index/drugsearch/3) Reference prices for normal purchase (Medicines) (http://dmsic.moph.go.th/index/drugsearch/1) • Searching and comparing system for drug prices in private hospitals (https://hospitals.dit.go.th/app/drug_price_search.php) • Health service fees of service units under the Ministry of Public Health on the website of Health Administration Division (HAD) (https://phdb.moph.go.th/main/index/dep/18)
	5.3 Quality	• Searching information GREEN BOOK (https://bdn.go.th/th/ebook) • Quality inspection reports (http://biology.dmsc.moph.go.th/page-view/77) • List of GMP Compliance Manufacturers (http://www.fda.moph.go.th/sites/drug/Post/SitePages/Certificate.aspx)
	5.4 Seller/ buyer	

Table 1 Examples of important information sources of the current drug system (continued)

Process	Information	Example of current data sources
	5.5 Purchasing method	• Procurement Statistics (Comptroller General's Department) (http://www.gprocurement.go.th/wps/portal/egp/Stat/!ut/p/z1/04_Sj9CPykssy0xPLMnMz0vMAfIjo8zifQ3djQydnQ18DSzdLQwc_Syc3d0szA0tPMz1w8EKDHAARwP9KGL041EQhd_4cP0oVCv8w4zNDBzNA3yd_QM9DAycDaEK8JhRkBsaYZDpqAgADkN7HA!!/dz/d5/L0lDUmlTUSEhL3dHa0FKRnNBLzROV3FpQSEhL3Ro/)
		• Information System on Government spending (https://govspending.data.go.th/dashboard/2)
	5.6 Track and trace	• Rajavithi Hospital (https://www.rajavithi.go.th/rj/?p=10325#)
		• Government Pharmaceutical Organization (https://scm.gpo.or.th/vmi/)
6. Drug utilization	6.1 Drug utilization	• NHSO's Annual Reports (https://www.nhso.go.th/frontend/page-about_result.aspx)
	6.2 Rational drug use: RDU	Examples of knowledge sources
		• Rational Drug Use ; RDU (http://ndi.fda.moph.go.th/drug_use)
		• Instruction manuals for rational drug usage (http://www.fda.moph.go.th/sites/drug/Shared%20Documents/RationalDrugUse/RDU05.pdf)
		• Hospital manuals for rational drug usage (https://www.hsri.or.th/sites/default/files/attachment/RDU%20Book.pdf)
	6.3 Antimicrobial resistance: AMR)	• Drug resistance circumstance (http://narst.dmsc.moph.go.th/)
		• Percentage of antibiotics usage (https://hdcservice.moph.go.th/hdc/main/search.php?search=%E0%B9%83%E0%B8%8A%E0%B9%89%E0%B8%A2%E0%B8%B2%E0%B8%9B%E0%B8%8F%E0%B8%B4%E0%B8%8A%E0%B8%B5%E0%B8%A7%E0%B8%99%E0%B8%B0)
		• Thailand's Antimicrobial Resistance Management Strategy 2017-2021 (http://narst.dmsc.moph.go.th/documentation/AMR%20strategy%202560-2564.pdf)
		• Management System of Antimicrobial Resistance: AMR) (http://www.fda.moph.go.th/sites/drug/SitePages/AMR.aspx)
	6.4 Adverse drug reactions/ adverse events following immunization: ADR/AEFI)	• Health Product Vigilance Center (http://thaihpvc.fda.moph.go.th/thaihvc/index.jsf)
		• Surveillance of symptoms after immunization (http://www.boe.moph.go.th/boedb/prior09/aefi/)
		• Safety Network in Chiang Rai, for Drugs and Health Products (http://crapr.org/crapr/) must log in

Table 1 Examples of important information sources of the current drug system (continued)

Process	Information	Example of current data sources
		• Community of pharmacy practice ADR (https://www.facebook.com/ADCoPT-247094745310607/) There are information on various training courses.
7. Monitoring and evaluation: M&E)	7.1 Key performance indicator: KPI	• Many studies (18-20) shows that Thailand has made efforts to develop drug system indicators at various levels but found that these indicators have not been widely used and continuously monitored, especially at the national level. • Thai Drug Watch & Development Center uses indicators to review the situation of Thailand's drug system in 7 dimensions, such as good governance, self-reliance, safety, equity, drug quality, accessibility and affordability, rational use • The systematic drug analysis results have been reported in these indicators in the 2009 Drug System Situation Report (21) and found no further reports after that.
	7.2 Pre-marketing surveillance	• Pre-marketing surveillance (http://www.fda.moph.go.th/sites/drug/SitePages/SupervisionPrior.aspx)
	7.3 Post-marketing surveillance	• Post-marketing surveillance (http://www.fda.moph.go.th/sites/Drug/Pages/Main.aspx)
8. Others	Drug codes	• TMT drug codes by Thai Health Information Standards Development Center (THIS) (http://tmt.this.or.th/dm9Emxc7e0~oKj7U6OrddW/$/; http://this.or.th/tmtrf_downloads.php) • 24-digit drug codes on THCC website (http://thcc.or.th/homemedicin.php), or, searching through the standard drug code management system (http://drug.nhso.go.th/DrugCode/searchDrug.zul)

3. Information system development

3.1 In service place

For the development of information systems in service places, especially at the hospital level at the initial stages, Information Technology system was implemented to mainly manage pharmaceutical warehouses and subsequently developed programs to provide medical services to patients. However, most system designs lacked of data governance which required data integration and management, information disclosure, and information security.

While drug information systems had been contin-

uously developed in many work processes from various departments; for example, reports on adverse drug reactions or vaccines to the Ministry of Public Health, reports on procurement data to the Medical Information Center for use in the development of median prices and reference prices for government services for the benefit of drug and medical supply procurement, it were still difficult to integrate information across departments or insurance funds due to the limitation in drug information standards. To be able to serves the monitoring of adverse drug reactions, vaccines or herbal medicines, service units should be able to record drug information deep into the production model or serial number to control, regulate safety and, in some cases to manage recalls. With all these reasons, the government had set a twenty-year national strategy plan B.E. 2561-2580 (2018-2037) which harmonize the development of drug information databases, research and innovation databases as well as data links among government agencies. To maximize competitive advantage from data, the development should be modernized, governed and sustainable.[5]

From a review of the information technology systems utilization in Thailand, it indicated that new medical technologies in medicines had been increasingly utilized. This matched the trend of pharmacy practice which had been progressively used to support personnel involved in medical management. For example,

- Doctor prescribing drugs via Computerized Prescriber Order Entry (CPOE) and Electronic Health Record (EHR) where CPOE would prevent medication errors caused by transcribing errors. Moreover, CPOE also increased the possibility to do data mining which assist decision making process with real-time medication control and cost saving; while the EHR supported transferring data in organization efficiently, being able to show basic information and clinical data of patients with real-time processing.
- Drug distribution using an inventory management system by vendors (Vendor-Managed Inventory: VMI), Pharmacy-based Automated Dispensing machine, Unit-based Dispensing Machine, Cytotoxic Preparing Machine, drug delivery through Pneumatic Tube or Dump Waiter
- Medication Administration using Electronic identification, Smart pump, Electronic Medication Administration Record (eMAR)
- Big data collection and analysis using information systems. These also helped to understand the situation and accomplish better decision making
- "RDU – knowing drug issues" is a mobile application developed in associations with many sectors to promote rational drug use (RDU). In addition to providing drug information, the users could save important information about their "personal drug information" as well. This would be very useful in communicating with medical personnel who provide further care.

3.2 Medical information technology development in the health insurance system

National Health Security Office (NHSO) was utilizing information technology in drug procurement and distribution systems with the service units under the national health insurance system. To achieve this,

there was data integration between the personal information from the Bureau of Registration Administration, Ministry of Interior and health insurance rights data from the National Beneficiaries Registration Center, National Health Security Office. The integration eventually benefited individual pharmaceutical service given that records of medication discharges for patients with specific diseases are collected. Patients with specific diseases gain high benefit from the gathered information on the special medicines in the National List E (2) project, antidotes project, the anti-AIDS and tuberculosis project, and the dialysis solution delivery project for end-stage renal patients. Especially in the antidotes project, there was an introduction of geographic information system (GIS). It was utilized in the administration of antidote reserves based on urgent resuscitation and the provision of medical supplies to patients within the time required, even if the patient hospitalized in a remote area. Remarkably, in the first 2 years of the antitoxin project, the record showed that this project could save the lives of near 100 percent of patients. It was considered an outstanding innovation in IT used in medical systems (as shown in Figure 2).

In addition, IT was also utilized in the logistics system of the peritoneal dialysis project by assigning the Thai Post Company to deliver the reagent and check the remaining stock at the patient's home. Health insurance funds and service units could monitor and direct the delivery of dialysis solutions online. Even during the major flood in 2011, patients were still able to receive dialysis fluid at home. Since 2015, the NHSO had started enforcing the service units in the system to submit individual drug usage data, for both outpatients and inpatients, resulting in establishing a database of patients' drug usage in the national health insurance system.

Figure 2 The use of geographic information for establishing an antidote reserve system for the National Health Insurance System

Discussion

Reliable health information and information technology are at the heart of health policy management, development and decision making. It also helps in planning for cost control which tends to increase continuously.[1]

The advancement of information technology in the past played an important role in the production and dissemination of pharmaceutical information which was an important contribution to driving the drug information system. Thai government has a vision to transform the country into the digital economy and society; thus, the usage of information technology systems is incorporated into diverse national strategies. However, these strategies cannot be completely implemented due to the limitation of necessary foundation for policy and strategy development; for instance, an agency who will cooperate in eHealth management at the national level, laws and regulations that support smooth operations and keep up with precipitously change.

In addition, lack of centralized standards for health information systems as well as IT personnel, both in terms of quality and quantity, were considered as reasons that the integration and exchange information still cannot be efficiently performed and respond to end users.

For the sources of medical information, the related government agencies have collected pharmaceutical information related mainly to their duties considering this information has been processed and analyzed for strategic usage within the department. However, third parties may also be allowed to access the information as well. While the information service sections have drastically been improved resulting in quicker and more convenient access, end consumers still need to improve on health literacy and how to use information efficiently. Moreover, there should be continuous development in information systems in the service places and in the health insurance system which help increase the efficiency of management and services.

For the development direction at the national level, it is recommended that a designated national organization should be established to determine strategic directions, formulate policies and master plans for the development of pharmaceutical information systems and health information technology for the country considering medicine is a data set in the health system. In addition, it is necessary to develop a standard supervision mechanism so that various information systems can work together to create seamless data exchange with security and benefits by studying the feasibility of implementing regulations related to the security and privacy of health information to benefit both in personal information protection and society where it is necessary to violate the privacy of individuals. Finally, sufficient and proficient IT personnel both at operation and executive level, responsible for both information systems and health information technology, can be a key success factor.

For future research, to align with the above development direction, it is recommended that there should be a study of data governance including drug code standards and drug data link standards from relevant agencies in all dimensions. These standards include drug prescriptions, prices, diagnostic codes for use in development of Citizen Health Profile. Appropriate standards will help encourage people to be interested in their health information by using big data and blockchain technology to assure that health

promotion information or access to other benefits provided by the government can be done conveniently.

In addition, a research information system should be developed by determining a well-designed platform that consists of necessary information for research purposes allowing researchers to access it by themselves under confidentiality or privacy of data in accordance with the statutory requirements.

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บทคัดย่อ: สถานการณ์ของระบบข้อมูลและสารสนเทศด้านยาในประเทศไทย

เนตรนภิส สุชนวนิช ภ.บ., วท.ม. (บริหารเทคโนโลยีสารสนเทศ)*; เสรมสิริ แสงรุ่งเรืองศรี ภ.บ., M.Sc. (Clinical Pharmacology), Ph.D. (Social, Economic and Administrative Pharmacy) ; นิธิเจน กิตติรัชกุล ภ.บ.*; อัญชลี จิตรักนที ภ.บ.***, กฤษดา ลิมปานานนท์ ภ.บ., ภ.ม. (เภสัชเคมี)***; อำนวย พฤกษ์ภาคภูมิ ภ.บ., วท.ม. (สาธารณสุขศาสตร์)****; อรลักษณ์ พัฒนาประทีป ภ.บ., M.E., M.B.A., Ph.D. (Pharmacy Administration)*****; วิริยามาตย์ เจริญคุณธรรม วท.ม. (ชีวเคม)******; จันทนา พัฒนเภสัช ภ.บ., ภ.ม., ปร.ด. (บริหารเภสัชกิจ)*******; วรณัน วิทยาภิภพสกุล ภ.บ., วท.ม. (ระบบสุขภาพและนโยบายสาธารณะ)********; ไพทิพย์ เหลืองเรืองรอง ภ.บ., M.S. (Pharmaceutical Sciences)*********

** โครงการประเมินเทคโนโลยีและนโยบายด้านสุขภาพ กระทรวงสาธารณสุข; ** คณะเภสัชศาสตร์ มหาวิทยาลัยมหิดล; *** สำนักยา สำนักงานคณะกรรมการอาหารและยา กระทรวงสาธารณสุข; **** กลุ่มงานเภสัชกรรม โรงพยาบาลสมุทรสาคร; ***** คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล; ****** สถาบันชีววัตถุ กรมวิทยาศาสตร์การแพทย์ กระทรวงสาธารณสุข; ******* สำนกยาและวัตถุเสพติด กรมวิทยาศาสตร์การแพทย์ กระทรวงสาธารณสุข; ******** สำนกงานพัฒนานโยบายสุขภาพระหว่างประเทศ กระทรวงสาธารณสุข; ********* กองบริหารการสาธารณสุข สำนกงานปลัดกระทรวงสาธารณสุข กระทรวงสาธารณสุข*

วารสารวิชาการสาธารณสุข 2563;29(ฉบับพิเศษ):S112-28.

ความก้าวหน้าทางเทคโนโลยีสารสนเทศเข้ามามีบทบาทอย่างมากต่อกระบวนการต่าง ๆ ในห่วงโซ่อุปทานของยา และในระบบประกันสุขภาพ แต่ยังไม่มีการทบทวนสถานการณ์ของระบบข้อมูลข่าวสารด้านยาในระบบยาของประเทศไทยให้เป็นปัจจุบันหลังปี พ.ศ. 2545 การศึกษานี้มีวัตถุประสงค์เพื่อทบทวนและวิเคราะห์สถานการณ์ระบบข้อมูลและสารสนเทศด้านยาในประเทศไทย และเสนอข้อเสนอแนะสำหรับการพัฒนาในอนาคต โดยใช้การทบทวนวรรณกรรมและเว็บไซต์ และการสัมภาษณ์แบบกึ่งโครงสร้าง จากการศึกษาพบว่ามียุทธศาสตร์ระดับชาติซึ่งมีจุดเน้นร่วมกันในการนำเทคโนโลยีสารสนเทศมาช่วยในการบริหารจัดการและใช้ประโยชน์ข้อมูลข่าวสารอย่างมีประสิทธิภาพ ฐานข้อมูลและสารสนเทศด้านยาส่วนใหญ่รับผิดชอบโดยหลายหน่วยงานในกระทรวงสาธารณสุขและมีการเผยแพร่ให้บุคคลภายนอกเข้าถึงได้ ระบบสารสนเทศด้านยาในสถานพยาบาลและระบบประกันสุขภาพได้รับการพัฒนาอย่างต่อเนื่องและนำมาใช้เพิ่มประสิทธิภาพในการบริหารจัดการและให้บริการเพื่อให้บรรลุผลลัพธ์ที่พึงประสงค์ของระบบยาและสุขภาพ สำหรับทิศทางการพัฒนาในระดับประเทศต้องมุ่งเน้นแก้ปัญหาการขาดรากฐานที่จำเป็น ได้แก่ กำหนดหน่วยงานที่รับผิดชอบต่อการพัฒนาระบบสารสนเทศและเทคโนโลยีสารสนเทศสุขภาพของประเทศในทุกด้าน พัฒนากฎหมายและระเบียบอย่างเหมาะสม จัดสรรและพัฒนาบุคลากรที่เกี่ยวข้องให้เพียงพอ ควรมีการศึกษาที่มุ่งเน้นด้านมาตรฐานรหัสยาและมาตรฐานการเชื่อมโยงข้อมูลยาจากหน่วยงานที่เกี่ยวข้องในทุกมิติและมีการนำเทคโนโลยีที่ทันสมัยมาประยุกต์ใช้ โดยมุ่งหมายให้สามารถเชื่อมโยงและแลกเปลี่ยนข้อมูลสุขภาพและยาได้อย่างมีประสิทธิภาพ ปลอดภัย ไร้รอยต่อ นอกจากนี้ควรมีการพัฒนา platform และฐานข้อมูลที่เอื้อต่อการทำงานวิจัย

คำสำคัญ: **ข้อมูล, สารสนเทศ; เทคโนโลยีสารสนเทศ; ระบบยา; ประเทศไทย**