HUMAN RESOURCE PLANNING FOR PHARMACY DEPARTMENT UNDER THE AGING SOCIETY

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ABSTRACT

Forecasting the hospital pharmacy department manpower is necessary for efficient work in the fast moving environment and aging society. This research aimed to develop an appropriate model to forecast the number of pharmacists required at the in-patient and out-patient pharmacy departments, Ramathibodi hospital, in the next 10 years. A cross-sectional descriptive survey research was employed, the model was constructed by excel software version 2010. Data were retrieved from hospital electronic database and interviewing all the pharmacists working at the in- patients and out-patient pharmacy department. The study was conducted during January 2014 to August 2015. Result: two factors were used to construct the model which were the number of patients per day and the number of drug dispensed per patient. It was found that the number of drug dispensed per patient in combination with the number of drug items dispensed per day played a stronger impact than the number of patients on the number of pharmacists manpower required. Planning for pharmacists working at the in- and out-patient pharmacy departments should be based on many factors not only the number of patients coming to receive services.

KEY WORDS: PHARMACIST MANPOWER PLANNING / PHARMACIST WORKLOAD / AGING SOCIETY

74 pages

การวางแผนทรัพยากรบุคคลสำหรับฝ่ายเภสัชกรรมเพื่อสังคมผู้สูงอายุ

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บทคัดย่อ

การวางแผนกำลังคนสำหรับฝ่ายเภสัชกรรมโรงพยาบาลมีความสำคัญต่อการทำงานที่มีประสิทธิภาพในสภาวะการเปลี่ยนแปลงที่รวดเร็วของสิ่งแวดล้อมและสังคมผู้สูงอายุ งานวิจัยนี้มีวัตถุประสงค์เพื่อสร้างแบบจำลองที่เหมาะสมเพื่อทำนายจำนวนของเภสัชกรที่ต้องการสำหรับฝ่ายเภสัชกรรมผู้ป่วยใน และผู้ป่วยนอกโรงพยาบาลรามาธิบดีในระยะเวลา 10 ปีข้างหน้า ใช้วิธีวิจัยเชิงพรรณนาแบบภาคตัดขวาง สร้างแบบจำลองด้วยเอ็กเซล 2010 โดยใช้ข้อมูลจากฐานข้อมูลอิเล็กโทรนิกของโรงพยาบาลและการสัมภาษณ์เภสัชกรทำงานที่ฝ่ายเภสัชกรรมผู้ป่วยในและผู้ป่วยนอก ทำการศึกษาระหว่าง เดือนมกราคม 2557 ถึงสิงหาคม 2558 ผู้วิจัยใช้ 2 ปัจจัยในการสร้างแบบจำลอง คือจำนวนผู้ป่วยต่อวัน และ จำนวนรายการยาที่จ่ายต่อผู้ป่วยหนึ่งราย ผลการศึกษาพบว่าจำนวนรายการยาที่จ่ายต่อผู้ป่วยหนึ่งราย และจำนวนรายการยาที่จ่ายต่อวัน มีผลกระทบต่อการทำนายจำนวนเภสัชกรสำหรับฝ่ายเภสัชกรรมผู้ป่วยนอกมากกว่าจำนวนผู้ป่วยต่อวัน ดังนั้นการวางแผนกำลังคนสำหรับเภสัชกรเพื่อทำงานที่ฝ่ายเภสัชกรรมผู้ป่วยในและผู้ป่วยนอก ควรคำนึงถึงหลายๆปัจจัยไม่ใช่เพียงจำนวนผู้ป่วยที่มารับบริการ

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LIST OF ABBREVIATIONS

FTE	Full Time Equivalent
OPD	Outpatients Department
IPD	Inpatients Department

CHAPTER I
INTRODUCTION

Background and rationale

The public health system in Thailand is facing the rapid changing from the globalization, the changes of population age structure, social and natural environment. Meanwhile, the people can be able to communicate and gain information through over the world so fast. The modernization and advance technology make the people having a longer life and also expect in the efficient healthcare service system. If Thailand cannot change the government system which is the keyword to organize the country efficiently, also adaptation for the context which is changing all the time, this can make Thailand incapable to compete in this borderless world. Especially, the effect to medical and public health in Thailand which should accessible to health service of the citizen, the expenditure of medical and public health , the prevention of diseases and health promotion workload. All mentioned will be higher. (1)

Recently, both government and private sector is paying attention in "manpower" which is considered as the most valuable resource (human capital) which makes the organization reach to their target. Each human capacity is different so the main point of organization management is depending on "the quality of people and the suitable manpower". The planning in both manpower and ability are the important mission of human resource management in every government sectors. Manpower planning facilitates the organization to specify and assign the exist manpower efficiently. It is seriously performed to ensure that the organization is almost utilize their manpower fully capability. (2)

In pharmacy department, Ramathibodi hospital is the one of the organization that intent to correspond to the policy and mission of standard both in the nation level and hospital level by emphasize on the efficiency management to correspond to the need of the customer which is increasingly. The concept of work study and work measurement will be used to find the standard time of working to

improve the working system, as well as to analyze the optimal between manpower and workload and also able to use in manpower planning in the future in case of any manpower changing somehow.

The vision of Ramathibodi hospital is "to become a leading guide for national health advocacy and one of the foremost academic institutions in Thailand with an established international reputation." And one of the missions is "to be the leading medical university delivering excellence of health services". (3) As per the mission of the organization, pharmacy department has to improve the operation plan but recently, pharmacy department is facing the problem of lacking manpower both the pharmacist and pharmacist assistant. The workforce planning to comply with the existing tasks is one of the answers to help pharmacy department to achieve the goals effectively.

Forecasting the pharmacy department manpower, it is necessary to know the existing current tasks and the future tasks which must to have work study and forecast the required manpower in the future for the efficient work.

Objective of the study

General objective

This research aims to develop a model to forecast the number of pharmacists required at the in- patient and out-patient pharmacy departments in the next 10 years.

Specific objectives

1. To forecast the number of patients and number of drugs dispensed in the next 10 years

2. Develop a model to forecast the number of pharmacists required for aging society.

Expected outcome

The result from this study will be used as information to improve the process of manpower planning in pharmacy department and for set the goal standard of pharmacy department in order to defend the position of pharmacist.

Conceptual framework

The aim of this study is to find out the number of pharmacists needed for future in- and out-patient services during 2015-2024. The framework for this study will concern on the major factors impact on the number of pharmacists required for services at the in-patient and out-patient pharmacy units, which are number of in- and out- patients, number of drug dispensed, number of drug per patient. Future hospital policy toward pharmacy services will affect the performance and number of pharmacists required in the future. The full capacity workload is the buffer between the present workload and the maximum workload that the present number of pharmacists can be able to handle. Number of more pharmacists required is the gap between the future workload and the full capacity workload.

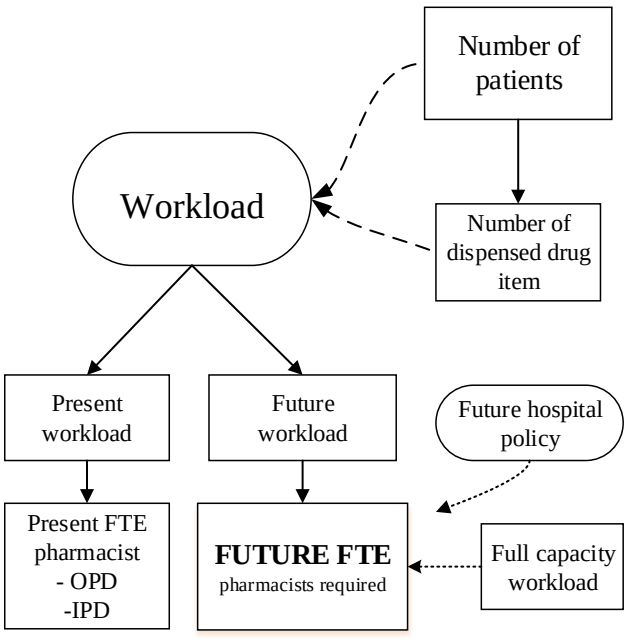

Figure 1.1 Conceptual framework

CHAPTER II
LITERATURE REVIEW

There are 9 parts in the literature review:

- Demographic trends of population ageing
- Drug utilization in elderly people
- Factors influencing the demand for pharmacists and pharmaceutical care services
- Manpower planning
- Workforce plan in the health sector
- Workforce planning model
- ASHP Guidelines: minimum standard for pharmacies in hospitals
- Role of pharmacist in the future
- Pharmacist to patient's workload proportion

Demographic trends of population ageing

According to data from World Population Prospects: the 2015 Revision (United Nations, 2015), the number of older persons-those aged 60 years or over-has increased substantially in recent years in most countries and regions, and that growth is projected to accelerate in the coming decades.

Between 2015 and 2030, the number of people in the world aged 60 years or over is projected to grow by 56 per cent, from 901 million to 1.4 billion, and by 2050, the global population of older persons is projected to more than double its size in 2015, reaching nearly 2.1 billion.

Globally, the number of people aged 80 years or over, the "oldest-old" persons, is growing even faster than the number of older persons overall. Projections indicate that in 2050 the oldest-old will number 434 million, having more than tripled in number since 2015, when there were 125 million people over age 80. Over the next

15 years, the number of older persons is expected to grow fastest in Latin America and the Caribbean with a projected 71 per cent increase in the population aged 60 years or over, followed by Asia (66 per cent), Africa (64 per cent), Oceania (47 per cent), Northern America (41 per cent) and Europe (23 per cent).

Globally, the number of older persons is growing faster than the numbers of people in any other age group. As a result, the share of older persons in the total population is increasing virtually everywhere. While population ageing is a global phenomenon, the ageing process is more advanced in some regions than in others, having begun more than a century ago in countries that developed earlier, and getting underway only recently in many countries where the development process has occurred later, including the decline of fertility.

Currently, Thailand is experiencing among the most rapid rates of population ageing in the developing world. The demographic shift from younger to older population age structure in Thailand is a recent phenomenon. The rapidity of the current change in Thailand stands in contrast to historical developments in most Western countries. This implies that the country will face emergent issues related to social security, health care costs and intergenerational equity and so on in a far shorter time span than that happened in the West. These issues require appropriate policies and programs development to deal with. Hence, it is imperative that Thailand has a well prepared National Policy and Programme on ageing as well as for long-term care services for older persons. (4)

Drug utilization in elderly people

The era of ageing and health has become a dominant area of concern in the 21st century. This is due to an increase in the absolute and relative numbers of older people in both developed and developing countries. In the year 2000, there were an estimated 600 million people aged 60 years and above in the world. By 2025, this would double to about 1. 2 billion people; and by 2050 there will be 2 billion, with 80 percent of them living in developing countries . The number of elderly in Thailand estimated to increase up to 132 % in 2050 compare to 2012 and older people will be 31.8% of total population is 31.8% .

The rapidly growing numbers and proportion of elderly mean that more people will be entering a period of life where the risk of developing certain chronic and debilitating disease is significantly higher. A survey in Indonesia showed that 78 % of elderly suffered up to 4 medical illness, 38 % of them had more 6 diseases and 13 % suffered more than 8 diseases.

People over the age of 65 years are more likely to be on medication than younger people. They are often taking several drugs at once to treat concomitant disease processes 4. A recent survey of 2590 non-institutionalized older adults in the United States showed an increased usage of all medications with advancing age, the highest prevalence of drug use being in woman 65 years of age and older with 12 % taking 10 or more medications and 23 % taking at least five prescribed drug therapies 5. General practitioners' prescribing rates are 1.6 drugs per patient aged 10-20 years and 2.8 per patient aged 80 years and over; 14% of elderly patients take five or more drugs concurrently. During hospital admission, elderly patients prescribed a mean of 5 to 6 different drugs.

The use of several drugs concomitantly is justified in the treatment of multiple chronic disease may cause polypharmacy. Polypharmacy has been variously defined. It has been defined as the concurrent use of multiple drugs, and some researchers have discriminated between minor (two drugs) and major (more than four drugs) polypharmacy. Others have defined it as the use of more drugs than are clinically indicated or too many inappropriate drugs, as two or more medications to treat the same condition and as the use of two or more drugs of the same chemical class.

Drug related problem in elderly patient

Polypharmacy is known to increase the risk of drug-related problems (DRPs), drug-drug and drug-disease interaction. It has been claimed that patients taking two drugs face a 13% risk of adverse drug interactions, rising to 38 % when taking four drugs and to 82 % if seven or more drugs are given simultaneously. With polypharmacy, duplicative prescribing within the same drug class is prevalent and unrecognized drug adverse-effects are often treated with more drugs thus leading to prescribing cascades. (5)

Approach to prevention of Drug-related problems in elderly patients

Polypharmacy can be appropriate when multiple drug regimens are necessary for the treatment of conditions and are carefully monitored by clinicians for achieving a therapeutic goal and for drug-related problems.

The assessment was based on previously documented criteria for preventability:

1. Definitely preventable—the DRP was due to a drug treatment inconsistent with present-day knowledge of accepted medical practice or was clearly unrealistic, taking the known circumstances into account.

2. Possibly preventable—the prescription was not erroneous, but the DRP could have been avoided by appropriate measures taken by the prescribing physician or community pharmacist over and above the obligatory requirements.

3. Not preventable—the DRP could not have been avoided by any reasonable means or was an unpredictable event in the course of a treatment fully in accordance with accepted medical or pharmaceutical practice.

In all cases of DRPs identified by the review panel, aspects of management of the patient's drug therapy in the community were examined to assess the preventability of the DRPs. If it was considered that substandard care had been received by the patient, the DRP was categorized as preventable.

Factors influencing the demand for pharmacists and pharmaceutical care services

Barber and colleagues measured the impact of workload (defined as the number of beds and prescriptions a pharmacist had to monitor) on the number of prescription-monitoring incidents (PMIs) identified by hospital pharmacists in 31 acute hospitals in the UK.39 A PMI was defined as any incident that caused the pharmacists to question the appropriateness of the prescription and take action. They found that the more beds a pharmacist had to monitor, the less likely they were to spot prescriptions which needed attention. This led the authors to conclude that workload did indeed have a detrimental affect on clinical monitoring. (6)

Bond and Raehl explored the association between prescription volume and estimated risk of dispensing errors in both hospital and community pharmacy in the USA and found that a significant relationship existed. They argued that pharmacists filling 23.5 or more prescriptions per hour were most likely to be at the greatest risk of making errors. (7)

In an audit of prescriptions in a US hospital-based outpatient pharmacy setting, Kistner and colleagues found that there was a significant relationship between the number of errors made and the total number of prescriptions dispensed per hour of the day. (8)

Rupp and colleagues used observational methods and data collection of prescriptions to explore the impact of workload on prescribing interventions in a sample of community pharmacists (n=89) in five US states. They found that pharmacists working in high volume pharmacies (>11.3 prescriptions per hour) recorded significantly lower median intervention rates than those working in low volume pharmacies. A regression analysis confirmed that there was a significant negative relationship between rate of pharmacist intervention and hourly prescription volume. (9)

In a study of 14 community pharmacists in the UK, Hawksworth et al. found evidence to suggest that there was a relationship between dispensing volume and the likelihood of pharmacists making a clinical intervention. They found that the lower the number of items a pharmacist dispensed, the greater the percentage of clinical interventions they made. (10)

Manpower planning

Effective manpower planning ensures that services and organizations have the necessary information, capability, capacity and skills to plan for current and future manpower requirements. This means planning a sustainable manpower of the right size, with the right skills and competences, which is responsive to health and social care demand and ensures effective and efficient service delivery across a broad range of services and locations. This is particularly important as an increasing amount of service is moving towards community based care.

Manpower planning is getting the right number of people with the right competencies in the right jobs at the right time. A more comprehensive definition, which highlights some of the procedural issues involved, defines it as: A process in which an organization attempts to estimate the demand for labor and evaluate the size, nature and sources of supply which will be required to meet that demand. (11)

Workforce plan in the health sector

Workforce planning is the systematic assessment of future human workforce needs and the determination of the actions required to meet those needs (Ripley 1996). Workforce planning for health is therefore the process of estimating the required health workforce to meet future health service requirements and the development of strategies to meet that need. It may occur at many levels; international, national, state or regional and organizational. The main focus of this paper is organizational level workforce planning.

Health care is about people providing care to other people. The health workforce is the complement of all individuals involved in the delivery of that care. The health workforce is considered to be the most important of the health system inputs by The World Health Organization (WHO 2000, WHO 2001). (12)

Workforce planning model

The six steps methodology to integrated workforce planning (Skills for Health, 2008) is the workforce planning approach recommended by Scottish government health and social care directorates (SGHD, 2011c).

The six steps are defined as:

- Defining the Plan
- Mapping Service Change
- Defining the Required Workforce
- Understanding the Available Workforce
- Defining an Action Plan
- Implement, Monitor & Refresh

Step 1 : defining the plan

This is the critical first step in any planning process. To understand workforce plan is required and what it will be used for. Determination the scope of the plan, whether it will cover a single service area, a particular patient pathway or a whole health economy and given this, be clear who is responsible for ensuring the plan is delivered and who else will need to be involved in the planning process.

Step 2 : Mapping Service Change

This is the process of service redesign in response to patient choice, changes in modes of delivery, advances in care or financial constraints. To clear about current costs and outcomes and identify the intended benefits from service change. To identify those forces that support the change or may hamper it. There must be a clear statement about whether the preferred model better delivers the desired benefits or is more likely to be achievable, given anticipated constraints.

Step 3 : Defining the Required Workforce

This step involves mapping the new service activities and identifying the skills needed to undertake them and the types and numbers of staff required. This will involve consideration of which types of staff should best carry out particular activities in order to reduce costs and improve the patient experience even where this leads to new roles and new ways of working.

Step 4 : Understanding the Available Workforce

This step involves describing the existing workforce in the areas under consideration, its existing skills and deployment, plus assessing any problem areas arising from its age profile or turnover. It may be the case that the ready availability of staff with particular skills, or, alternatively, the shortage of such staff itself contributes to service redesign and steps 2 and 3 will need to be revisited. Consideration should be given to the practicalities and cost of any retraining, redeployment and / or recruitment activities that could increase or change workforce supply.

Step 5 : Developing an Action Plan

This step involves reflecting on the previous three steps and determining the most effective way of ensuring the availability of staff to deliver redesigned services, even if this means some further service redesign. A plan for delivering the right staff, with the right skills in the right place needs to be developed with milestones and timescales. You should also include in your plan an assessment of anticipated problems and how you will build a momentum for change, including clinical.

Step 6 : Implementing, Monitoring and Refresh

After the plan begins to be delivered, it will need periodic review and adjustment. The plan will have been clear about how success will be measured, but unintended consequences of the changes also need to be identified so that corrective action can be taken. (14)

Requirements for successful workforce planning

There are a number of basic, but essential, requirements for successful workforce planning, which can be summarized as:

- An appropriately resourced organizational structure to oversee the planning
- Stakeholder participation and commitment
- Clear principles, objectives, methodologies, models and processes, including having in place accepted and transparent methodologies and calculation tools
- Describing, evaluating and predicting workforce supply and requirements
- Access to accurate, reliable, relevant and timely data (quantitative and qualitative, supply and requirements). (13)

Benefits of workforce planning

Workforce planning can result in the following benefits:

- The identification of future staffing requirements and any possible skill shortages or over supply

- A planned recruitment strategy including appropriate time frames and costs

- A plan to close skill gaps can be prepared

- Specific recruitment or training initiatives can help plan for new jobs

- Staffing costs may be reduced through close analysis of staffing requirements and ensuring appropriate levels of staff

- Staff development needs can be better identified

- Employees whose skills are unlikely to meet future needs can be retrained. (14)

ASHP Guidelines: minimum standard for pharmacies in hospitals

The following minimum standard guidelines are intended to serve as a basic guide for the provision of pharmacy services in hospitals. These guidelines outline a minimum level of services that most hospital pharmacy departments should consistently provide. The reader is strongly encouraged to review the American Society of Health-System Pharmacy (ASHP) guidance documents referenced throughout these guidelines for more detailed descriptions. Certain elements of these guidelines may be applicable to other health care settings or may be useful in evaluating the scope and quality of pharmacy services. The following minimum standard guidelines are intended to serve as a basic guide for the provision of pharmacy services in hospitals. These guidelines outline a minimum level of services that most hospital pharmacy departments should consistently provide. The reader is strongly encouraged to review the American Society of Health-System Pharmacy (ASHP) guidance documents referenced throughout these guidelines for more detailed descriptions. Certain elements of these guidelines may be applicable to other health care settings or may be useful in evaluating the scope and quality of pharmacy services.

Standard I. Practice management

Effective leadership and practice management skills are necessary for the delivery of pharmacy services in a manner consistent with the hospital's need and

patients' needs. Such leadership should foster continuous improvement in patient care outcomes. The management of pharmacy services should focus on the pharmacist's responsibilities as a patient care provider and leader of the pharmacy enterprise through the development of organizational structures that support that mission. Development of such structures will require communication and collaboration with other departments and services throughout the hospital, which every member of the pharmacy team should cultivate at every opportunity.

A. Pharmacy and Pharmacist Services

Pharmacy mission, goals, and scope of services. The pharmacy shall have a written mission statement that reflects both patient care and operational responsibilities. Other aspects of the pharmacy's mission may require definition as well (e.g., educational and research responsibilities). The mission statement shall be consistent with the mission of the hospital and, if applicable, aligned with the health system of which the hospital is a component. The development, prioritization, and implementation of the pharmacy's goals should be consistent with the mission statement. Determination of short- and long term goals and the undertaking of implementation activities should be performed in collaboration with institutional leadership and other hospital staff (e.g., pharmacy, nursing, and medical staff), and these should be integrated with the goals of the hospital. The mission statement may also incorporate consensus based national goals, such as those expressed in the recommendations from the ASHP Pharmacy Practice Model Initiative.

B. Laws and Regulations

Applicable local, state, and federal laws and regulations shall be met, and relevant documentation of compliance shall be maintained.

C. Policies and Procedures

There shall be a policy and procedures manual governing pharmacy functions (e.g., administrative, operational, and clinical), and all pharmacy personnel shall follow those policies and procedures. The manual may include a statement of the pharmacy's mission, philosophy, or values (e.g., the pharmacy's mission or vision statement), but it should concentrate on operational policies and procedures to guide and direct all pharmacy services. The pharmacy's policies and procedures should be consistent with the hospital's policies and procedures, and the manual should be

reviewed by a designated medical staff committee for potential conflicts and other medical issues. The manual shall be reviewed by pharmacy staff on a regular basis and revised as necessary to reflect changes in procedures, organization, objectives, or practices. The manual shall be accessible to pharmacy department personnel as well as other hospital employees (e.g., through the hospital's intranet), and all pharmacy personnel should be familiar with its contents. Appropriate mechanisms to ensure compliance with the policies and procedures should be established.

D. Human Resources

Areas of responsibility within the scope of pharmacy services shall be clearly defined. The responsibilities and related competencies of professional and supportive personnel shall be clearly defined in written position descriptions. These position descriptions shall be reviewed and revised as required by the hospital's policies. Position descriptions should reflect more general aspects of performance (e.g., communication, motivation, teamwork) in addition to specific responsibilities and competencies.

E. Facilities

Pharmacy. Adequate space, equipment, and supplies shall be available for all professional and administrative functions relating to pharmacy services. These resources shall meet all applicable laws and regulations; shall be located in areas that facilitate the provision of services to patients, nurses, prescribers, and other health care providers; and shall be integrated with the hospital's communication and delivery or transportation systems.

Medication storage and preparation areas. There shall be suitable facilities to enable the receipt, storage, and preparation of medications under proper conditions of sanitation, temperature, light, moisture, ventilation, segregation, and security to ensure medication integrity and personnel safety throughout the hospital.

Compounding areas. There shall be suitable facilities to enable the compounding, preparation, and labeling of sterile and non-sterile products, including hazardous drug products, in accordance with established quality-assurance procedures. The work environment should promote orderliness and efficiency and minimize the potential for medication errors and contamination of products. Patient assessment and consultationarea. In outpatient settings, a private area for pharmacist–patient

consultations shall be available to confidentially enhance patients' knowledge of and adherence to prescribed medication regimens.

Office and meeting space. Adequate office and meeting areas shall be available for administrative, educational, and training activities. Automated systems. There shall be policies and procedures for the evaluation, selection, use, calibration, monitoring, and maintenance of all automated pharmacy systems.

Automated mechanical systems and software can promote safe, accurate, and efficient medication ordering and preparation, drug distribution, and clinical monitoring. Use of such systems and software shall be structured so as to not hinder the pharmacist's review of (and opportunity to intervene in) medication orders before the administration of first doses. The maintenance, calibration, and certification of all automated systems shall be performed and documented as required by all applicable laws, regulations, and standards. All automated systems shall include adequate safeguards to maintain the confidentiality and security of patient records, and there shall be procedures to provide essential patient care services in case of equipment failure or downtime.

Information technology. A comprehensive pharmacy computer system shall be employed and should be integrated to the fullest extent possible with other hospital information systems and software, including computerized provider-order-entry, medication administration, electronic health record, and patient billing systems. Computer resources should be used to support clerical functions, maintain patient medication profile records, provide clinical decision support, perform necessary patient billing procedures, manage drug product inventories, provide drug information, access the patient medical record, manage electronic prescribing, and interface with other computerized systems to obtain patient-specific clinical information for medication therapy monitoring and other clinical functions and to facilitate the continuity of care to and from other care settings. Pharmacists should be involved in the development and maintenance of order sets, templates, and dose ranges used in computerized provider-order entry and clinical decision-support systems. Pharmacy computer systems should be integrated with the hospital's clinical, financial, and administrative information systems. All computer systems shall include adequate safeguards to maintain the confidentiality and security of patient records, and a backup

system should be available to continue essential computerized functions (e.g., those that support patient care) during equipment failure.

Drug information. Adequate space, current resources, and information handling and communication technology shall be available to facilitate the provision of drug information. The department of pharmacy shall select its drug information resources, and pharmacists shall play a leadership role in the selection of drug information resources used by other health care providers in the hospital. Up-to-date, objective drug information shall be available, including current print or electronic periodicals, newsletters, best-practices guidelines, and recent editions of reference books in appropriate pharmaceutical and biomedical subject areas. Electronic drug information databases are preferred because they are frequently updated and can be made available to all health care professionals, but sufficient access to print information shall be available in case of equipment failure or downtime. Electronic and print drug information may be supplemented with medical libraries and other available resources. Appropriate drug information resources shall be readily accessible to pharmacists locatedin patient care areas.

F. Committee Involvement

A pharmacist shall be a member of and actively participate in hospital and health-system committees responsible for establishing and implementing medication-related policies and procedures as well as those committees responsible for the provision of patient care, including the P&T, infection-prevention and control, patient care, medication use evaluation, medication safety, nutrition, and pain management committees (or their equivalents), as well as the institutional review board, quality-improvement, and information technology committees (or their equivalents).

Standard II. Medication-use

Policy Development

A. Policy Development

All committees that make decisions concerning medication management and use shall have at least one pharmacist as a member. This includes the P&T, infection-control, patient care, medication-use evaluation, medication safety, nutrition, pain management, and information technology committees, as well as the institutional

review board (or their equivalents). Pharmacists shall be involved in the development, implementation, and assessment of care plans (protocols, critical pathways, disease statement management programs, or clinical practice guidelines), standing orders, and order sets that involve medication therapy.

B. Formulary Management

Formulary. A well-controlled formulary of approved medications shall be maintained and regularly updated by the P&T committee (or its equivalent). The impact of and compliance with the formulary should be periodically reviewed (e.g., through drug-utilization reviews), and the P&T committee should regularly review the formulary for safety information. The P&T committee shall be responsible for developing and maintaining written criteria for drug product selection, which shall address formulary requests for medications intended for use in special populations (e.g., pediatric or geriatric populations). The P&T committee shall be responsible for developing and maintaining adequate product specifications to aid in the purchasemof medications and related supplies. The pharmacy shall disseminate the formulary by electronic (preferred) or other means to meet the needs of all health care professionals.

C. Drug Information

Drug information requests. The pharmacist shall provide patient specific drug information and accurate and comprehensive information about drugs and drug therapy to health professionals, patients, and patients' caregivers as appropriate. Responses to general and patient specific drug information requests shall be provided in an accurate and timely manner by a pharmacist, and there should be a process for assessing and ensuring the quality of responses.

Standard III. Optimizing medication therapy

An important responsibility of the pharmacist is optimizing medication use. Pharmacists, in collaboration with medical and nursing staff, shall develop policies and procedures based on demonstrated best practices for ensuring the quality of medication therapy. Clinical imperatives should be the primary determinants of medication-use decisions.

A. Creating a relationship with the patient

Pharmacist role in direct patient care. Hospital and pharmacy department policies should encourage pharmacists to provide direct patient care to the greatest extent possible in both inpatient and outpatient settings. Hospital and pharmacy department policies should encourage pharmacists to engage in medication therapy management, collaborative drug therapy management, immunization, medication ordering and administration, and other patient care activities to the extent permitted by law, regulation, and hospital requirements.

Continuity of care. Pharmacists should assume responsibility for continuity of care for patients' medication therapy. Pharmacists and pharmacy departments should take a leadership role in developing and implementing policies and procedures for admissions, discharges, and transfers so that patients' medication therapy is well managed regardless of patient transitions across care settings (e.g., among different components of a health system or between inpatient and community pharmacies or home care services). Patient confidentiality. Systems shall be in place to ensure that patient confidentiality is maintained in accordance with applicable laws and regulations. All pharmacy personnel shall respect and protect patient confidentiality by safeguarding access to all patient information. Patient information shall be shared only with authorized health professionals and others authorized within the hospital or health system as needed for the care of patients. Pharmacy personnel should periodically receive training in how to comply with patient confidentiality laws and regulations.

B. Acquiring essential patient data

Pharmacists should obtain, prepare, or have immediate access to comprehensive medication histories for each patient, from the patient's medical record or other databases (e.g., a medication profile), or both. A pharmacist-conducted medication history for each patient is desirable. Electronic medical records should be constructed so that medication histories and other data required for medication management, including medication reconciliation, are available to all health professionals caring for a patient.

C. Consulting with other health professionals about medication therapy

Pharmacist's consultations. Pharmacists should provide oral and written consultations to other health professionals regarding medication therapy selection and management.

Medical record documentation. There shall be policies and procedures for pharmacist review of and documentation in patients' medical records. Recommendations made by the pharmacist and actions taken in response to those recommendations should be documented in the patient's medical record so that other health care providers have access to that information.

Medication therapy decisions. The pharmacist's prerogatives to initiate, monitor, and modify medication therapy for individual patients, and to order laboratory tests to exercise those responsibilities, consistent with laws, regulations, and hospital policy, shall be clearly delineated and approved by the appropriate committee (e.g., P&T, patient care, or medical executive committee).

Standard IV. Drug product procurement and inventory management

The pharmacy shall be responsible for the procurement, distribution, and control of all drug products used in the hospital for inpatient and ambulatory patients. Policies and procedures governing these functions shall be developed by the pharmacy with input from other appropriate hospital staff and committees.

A. Selecting sources of pharmaceutical products

Medication acquisition. There shall be policies and procedures for managing medication acquisition.These policies and procedures should address such issues as formulary development (including initial evaluation for formulary consideration, medication-utilization review programs, and therapeutic interchange), competitive bidding, group purchasing, best practices, medication shortages, outsourcing, and cost-effective patient services. Benchmarking of medication costs should be performed to determine whether medication expenses and the change in medication expenses over time are consistent with industry standards.

B. Managing inventory

Medication storage. Medications shall be received, stored, and prepared under proper conditions of sanitation, temperature, light, moisture, ventilation, segregation, and security to ensure medication integrity and personnel safety.

Drug shortages. There shall be policies and procedures for managing drug product shortages. The pharmacy's inventory management system should be designed to detect subminimum inventory levels and alert the pharmacy to potential shortages, and pharmacy staff should monitor reliable sources of information regarding drug product shortages (e.g., the ASHP34 and FDA35 drug shortages web resource centers). The pharmacy should develop strategies for identifying alternative therapies, working with suppliers, collaborating with physicians and other health care providers, and conducting an awareness campaign in the event of a drug product shortage.

C. Inspecting storage areas and inventory items

All stocks of medications shall be inspected routinely to ensure the absence of outdated, unusable, recalled, or mislabeled products. Storage conditions that would foster medication deterioration, storage arrangements that might contribute to medication errors, and other safety issues shall be assessed, documented, and corrected.

D. Returning recalled, expired, and other unusable items

There shall be a written procedure for the timely handling and documentation of a drug product recall. These procedures should include an established process for removing from use any drugs or devices subjected to a recall, notifying appropriate health care professionals, identifying patients who may have been exposed to the recalled medication, and, if necessary, communicating available alternative therapies to prescribers. The pharmacy shall be notified of any defective drug products or related supplies and equipment encountered by the nursing or medical staffs. All drug product defects should be reported to the FDA's Med Watch reporting program.

Standard V. Preparing, packaging, and labeling medications

A. Preparing medications

Compounding. drug formulations, dosage forms, strengths, and packaging that are not available commercially but are needed for patient care shall be prepared by appropriately trained personnel in accordance with applicable practice standards and regulations. The pharmacy shall provide adequate quality-assurance procedures for these operations. Written master formulas and batch records (including product test

results, as appropriate) shall be maintained, and a lot number or other method to identify each finished product with its production and control history shall be assigned to each batch sterile preparations. When possible, manufactured sterile preparations should be preferred to compounding in the pharmacy. All sterile medications shall be prepared and labeled in a suitable environment by appropriately trained personnel in accordance with established quality assurance and expiration dating procedures. The use of sterile medications compounded outside the pharmacy should be avoided to the extent possible; when they are used, there shall be procedures for aseptic preparation, quality assurance, expiration dating, and ongoing competency evaluations for compounding personnel Sterile compounding outside the pharmacy or satellite pharmacies (e.g., on nursing units) should be minimized and occur only in emergency situations Hazardous drug products. There shall be policies and procedures that describe special precautions, equipment, and training for preparation, handling, storage, and disposal of hazardous drug products and products used in their preparation. These policies and procedures shall be consistent with applicable laws and regulations and should be adequate to ensure the safety of staff, patients, visitors, the community, and the environment.

B. Packaging medications

Unit dose packaging. Whenever possible, medications shall be available for inpatient use in single unit packages and in a ready-to-administer form. Manipulation of medications before administration (e.g., withdrawal of doses from containers, reconstitution of powdered drug products, labeling of containers, and splitting of tablets) by final users should be minimized.

Bar-coding of unit dose packaging and point of care administration. Unit dose packages should contain a bar code and that code should be used in inventory management, dose preparation and packaging, dispensing, and administration. It is the responsibility of the pharmacy department to ensure the quality of all aspects of bar-code medication administration, including scan ability of bar codes and database management.

Standard VI. Medication dispensing and delivery

A. Medication dispensing

Prescribing. Medications shall be prescribed by individuals who have been granted appropriate clinical privileges in the hospital and are legally permitted to order medications. The pharmacy shall advocate and foster practitioners' conformance with standardized, approved, and safe terminology and abbreviations to be used throughout the hospital when prescribing medications and discourage use of nonstandard and unapproved terminology and abbreviations.

Diagnostic or therapeutic purpose. Pharmacists should have immediate access to the patient's diagnosis or the intended therapeutic or medical purpose of medications. Medication orders. All patient medication orders shall be contained in the patient's medical record. A direct copy of the prescriber's order, either hard copy (including facsimile) or prescriber-entered electronic transmission (preferred method), shall be received by the pharmacist. Oral orders should be avoided to the extent possible. When oral orders are necessary, they shall follow the organization's established procedures for their use and documentation. Order transmittal safeguards should be used to ensure the security of the prescriber's order. Appropriate records of each medication order and its processing in the pharmacy shall be maintained in accordance with applicable laws and regulations.

B. Medication delivery and administration

Drug delivery systems, administration devices, and automated distribution devices. The pharmacy shall have responsibility for developing policies, procedures, and quality assurance programs regarding drug delivery systems, administration devices, and automated distribution devices that ensure safety, accuracy, security, and patient confidentiality. The potential for medication errors associated with such systems and devices should be thoroughly evaluated. Pharmacy personnel shall supervise the stocking and documentation of medications in automated dispensing devices. Whenever possible, automated dispensing cabinets should employ profile-based technology integrated with remote medication order-entry capabilities.

Medication administration. Only personnel who are authorized by the hospital in accordance with applicable laws and regulations and appropriately trained shall be permitted to administer medications to a patient. All administered, refused, or omitted medication doses should be recorded in the patient's medical record according to an established procedure, and all medications that have not been administered

should be returned to the pharmacy. No medication should be administered to a patient unless medical and nursing personnel have been provided with adequate information about, and are familiar with, its therapeutic use, and method of administration, potential adverse effects, and dosage.

Standard VII. Monitoring medication use

A. Reviewing patient responses to medication therapy

Medication therapy monitoring shall be conducted by pharmacists. Medication therapy monitoring includes a proactive assessment of patient problems and an assessment of

a. The therapeutic appropriateness of the patient's medication regimen.

b. Therapeutic duplication or omissions in the patient's medication regimen.

c. The appropriateness of the dose of the medication, as well as the route, method, and frequency of administration of the medication.

d. Patient adherence to the prescribed medication regimen.

e. Medication–medication, medication–food, medication– dietary supplement, medication– laboratory test, and medication– disease interactions.

f. Adverse drug reactions and other undesired effects.

g. Patient medication allergies and sensitivities.

h. Clinical and pharmacokinetic laboratory data to evaluate the efficacy and safety of medication therapy and to anticipate toxicity and adverse effects.

i. Physical signs and clinical symptoms relevant to the patient's medication therapy.

j. Assessment of the effectiveness of the patient's medication therapy.

B. Educating and counseling patients and family

Pharmacists shall be available to participate in patient education. Pharmacists should help to ensure that all patients are given adequate information about the medications they receive in order to help patients participate in their own health care decisions and encourage adherence to medication regimens. Patient education activities shall be coordinated with the nursing, medical, and other clinical staff as needed. Medication related material developed by other services and

departments as well as commercial sources should be reviewed by the pharmacy staff for accuracy, currency, literacy appropriateness, and completeness. If necessary, interpretative language services (written or oral) should be made available to patients.

Standard VIII. Evaluating the effectiveness of the medication-use system

There shall be an ongoing, systematic program for quality assessment and improvement of pharmacy services and the medication-use system. The program should include routinely evaluating the literature for new technologies or successful practices that have been demonstrated to enhance safety in other organizations to determine if such technologies or practices can improve the hospital's medication-use system. This program should be integrated with the hospital's or health system's quality assessment and quality improvement activities. Quality-improvement activities related to the selection, prescription, procurement, storage, preparation, dispensing, distribution, administration, documentation, monitoring, and use of medications shall be routinely performed in cooperation with other health care providers. Feedback to appropriate individuals or entities about the quality achieved shall be provided.

A. Assessing pharmacy services and practices

Documentation of pharmacist provided patient care services and medication therapy outcomes. The pharmacy shall have an ongoing process for consistent documentation of the patient care services provided by pharmacists and patient outcomes from medication therapy.

Workload and financial performance. A process shall exist to routinely monitor and document workload and financial performance. Metrics should encompass the full scope of patient care services provided by pharmacists and the pharmacy enterprise. This process should provide for the determination and analysis of hospital and system wide costs of medication therapy. A pharmacist should be an integral part of the hospital's leadership teams (e.g., administrative, financial).

B. Improving the medication-use process

Medication-use evaluation. There shall be an ongoing program for monitoring drug utilization and costs to ensure that medications are used appropriately, safely, and effectively and to increase the probability of desired patient

outcomes. The P&T committee (or its equivalent) should define specific parameters for evaluation (e.g., disease state, pharmacological category, or high-use/high-cost drug products) as appropriate for the organization. Through the ongoing evaluation of medication use, areas in need of improvement in medication prescribing and management can be identified and targeted for intervention.

Medication safety. Pharmacists should provide leadership to and participate in collaborative, multidisciplinary efforts to prevent, detect, and resolve drug-related problems that can result in patient harm.

Pharmacists and other appropriate hospital personnel shall establish and regularly revise policies and procedures regarding medication error and adverse event prevention and reporting. Monitoring, detecting, review, and analysis of the hospital and health system's medication errors and near-misses should be an ongoing process in a just culture environment, and corresponding corrective actions should be documented. An ongoing program for preventing, monitoring, resolving, and reporting adverse drug events shall be developed. A pharmacist shall participate in appropriate organizational committees and work with physicians, nurses, administrators, and others to examine and improve systems to ensure that medication-use processes are safe.

Antimicrobial stewardship and infection prevention and control. There shall be policies and procedures to promote the optimal use of antimicrobial agents, reduce the transmission of infections, and educate health professionals, patients, and the public about these topics. Pharmacists should participate in antimicrobial stewardship and infection-prevention and control efforts through clinical endeavors focused on proper antimicrobial utilization and membership on relevant multidisciplinary work groups and committees within the health system. Pharmacists should monitor patients' laboratory reports of microbial sensitivities or applicable diagnostic markers and advise prescribers if microbial resistance is suspected, evaluate trends in microbial prescribing relative to changes in microbial resistance patterns, and assist in developing prescribing patterns to help minimize the development of drug resistance.

Standard IX. Research

The pharmacist should initiate, participate in, and support clinical and practice-related research appropriate to the goals, objectives, and resources of the specific hospital.

Policies and procedures. The pharmacist shall ensure that policies and procedures for the safe and proper use of investigational drugs and medication-related devices are established and followed and that these policies and procedures meet all applicable laws and regulations. There shall be a procedure to assure that informed consent is obtained from the patient before the first dose of the study drug is administered.

Procurement, distribution, and control of investigational drugs. The pharmacy shall be responsible for overseeing the procurement, distribution, and control of all investigational drugs. Investigational drugs shall be approved for use by an institutional review board and shall be dispensed and administered to consenting patients according to an approved protocol.

Institutional review board. A pharmacist shall be a member of the hospital's institutional review board (or equivalent body), if one exists.

Information regarding investigational drugs. The pharmacy shall have access to information on all investigational studies and similar research projects involving medications and medication-related devices used in the hospital. The pharmacy shall provide pertinent written information (to the extent known) about the safe and proper use of investigational drugs, including possible adverse effects and adverse drug reactions, to nurses, pharmacists, physicians, and other health care professionals called upon to prescribe, dispense, and administer these medications. (15)

Role of pharmacist in the future

The list below, to a great extent, is based on the information, analyses, and forecasts stated in "a vision of pharmacy's future roles, responsibilities, and manpower needs in the United States". As is the case in all visioning efforts, much of what they expect may not come to pass; new, unforeseen developments may influence

profoundly the future of the pharmacy profession. However, they offer the following predictions of how events affecting pharmacy may unfold during the next decade:

1. Health care will place increasing emphasis on drug therapy to improve patient outcomes and quality of life. Prescription drug use will continue to rise, creating greater risk of drug-related morbidity.

2. Society will become increasingly technology literate and technology driven. Technology will be deployed fully to dispense most prescriptions, provide drug information to patients, and facilitate the exchange of patient-specific data among and within health care systems.

3. Pharmacy will transform itself from a primarily product-centered profession to a patient care-oriented profession.

4. Patient care rendered by pharmacists, including those not directly involved with drug product distribution, will be reimbursed by payers.

5. Corporate pharmacy and independent pharmacy owners will find pharmacists' patient care services to be profitable and will commit resources to this market, including enhanced use of technology and technicians.

6. State boards of pharmacy and governmental legislation will enable and facilitate pharmacists' patient care activities, both individually and in collaboration with other health care professionals.

7. Technician certification will be mandated to protect the public.

8. Pharmacy education will prepare graduates for increasingly complex patient and population drug therapy management and problem-solving, and supervision of prescription dispensing and processing by technicians and automated technology.

9. Pharmacy schools will experience an unprecedented increase in graduates due to a continued rise in demand for pharmacists, popularity of health care careers, and an increased visibility of pharmacists' patient care roles in the 21st century.

10. Appropriate credentials that document clinical practice abilities will be a prerequisite for all pharmacists who provide patient care services. Eventually, residency training will be an expectation of most entry-level pharmacists. (16)

Riemschneider B noted that the role of the pharmacist has been transformed from that of a dispenser of medications to a vital health care team member, who consults closely with patients with chronic diseases, offers medication adherence strategies, and broadens the profession's influence overall. (17)

Ernest P. claimed that the current trend toward pharmacy specialization is rooted in many factors. Chief among them is that pharmacy students today receive more clinical training than ever before. The six-year Pharm D program includes many more hours of clinical medication management than did the shorter programs. Residency and fellowship requirements for pharmacists have also become increasingly stringent and demanding. (18)

The Pharmacy Sector Action Group developed the vision, focus on the future: the ten year vision for pharmacists in New Zealand (2004-2014) as following

a. Pharmacists will provide a health promotion and assessment service that proactively promotes good primary healthcare, identifies and treats patients' minor ailments and health concerns, and assesses and refers to other members of the primary healthcare team as required.

b. Pharmacists will have a collaborative role in assisting doctors and nurses in prescribing decisions especially for patients with chronic or enduring illnesses. Accredited pharmacists will carry out prescribing in accordance with collaborative arrangements agreed within the healthcare team.

c. Pharmacists will provide a safe, efficient dispensing service for "prescription", "pharmacist-only" and "pharmacy-only" medications (through their community pharmacy network and any other distribution methods which they may evolve) which promotes patient education and safety, provides education on prescribed medicines and prevents, detects and reports adverse reactions and medication error.

d. Pharmacists will provide a range of enhanced medicine management services, each with its own training/ proficiency requirements, within the scope of practice of accredited pharmacists and tailored to local patient and community priorities. These services, which will support independent living, are likely to include a range of core pharmacy services and advanced and complex services such as: patient needs assessment, information management, medicine compliance assessment and

support, medicine information for patients and prescribers, disease state management services, quality use of medicines, medicine review programmes and chronic case management services.

e. Pharmacists will provide health assessment, monitoring and screening tests for patients and the general public where clinically warranted under protocols agreed within the primary healthcare team. (19)

Harskuti K. claimed that in next 10-20 years, the role of the pharmacist is changing as following :

Market Concentration

Over the next 10-20 years, general practitioners will fade away. What used to be prescribed by practitioners will now be able to be prescribed by pharmacists. Hospitals and doctors will stick to consolidated offerings and specialized treatments. A few organizations may even buy out smaller doctor's offices.

Self-reliance

The economic downturn has made many people less likely to visit an actual doctor. This means that many people will turn to their pharmacist long before they ever step into a doctor's office. Patients are looking for prevention and self-care methods, rather than treatments like they wanted before. This will enabled pharmacists to become involved with lifestyle management.

Medication Therapy Management (MTM)

Medication Therapy Management is a new role for pharmacists. This is an important role that will only become more important as the decade progresses. MTM is designed to help patients receive the best treatment options for their unique needs, and the pharmacist can take on that role with ease.

Pharmacogenetics

Could medications be used based on the genetic makeup of a person? In modern medicine, the practice is not widely used, but in the future, it is likely that many medications will be offered based on genetics. Pharmacists will be able to help provide the flexibility necessary to identify which medications belong with each unique set of genetics. Pharmacists have a chance to lead along with scientists to discover the true benefits of genetic-based medications.

Primary Care

One new role for the pharmacist is the role of primary care. With the new ability to dispense certain medicines and provide an advice-based role, many pharmacists are uniquely qualified to act as primary care providers for many low-risk patients of any age.

Pharmacists as Doctors

In the past, the pharmacy was simply for dispensing medication. However, today, the pharmacy is more of a community health center, offering health screenings, immunizations, and more. This hybrid between pharmacy and doctor's office is something that is only beginning to emerge, but has the chance to become a community-based medical center that provides for all patient needs.

Prevention

Prevention is something that the medical industry hasn't really focused on before now. However, with patients living longer and healthier lives, prevention becomes more important. Nutraceuticals, are foods and food products that provide medical and health benefits on more of a preventative role. This is something that a pharmacist can provide to patients- perhaps even uniting with fitness centers for a total health approach.

The role and future of pharmacists is changing. Rather than simply being pill pushers, the profession is changing and taking a more active role in the prevention and curing of medical illnesses. The pharmacist of today is able to interact directly with patients, offer medical advice, and help a patient take an active, preventative role in his or her health. (20)

Pharmacist to patient's workload proportion

Thai government pharmacist workforce planning is now considered by the proportion of pharmacist to patients as follow.

Out-patient pharmacy service

1) Regional hospital (A) (500-700 beds) 1 pharmacist: 80 prescriptions

2) General hospital (S) (400 – 500 beds) 1 pharmacist: 80 prescriptions

3) Small general hospital (M1) (250--300 beds) 1 pharmacist: 80 prescriptions

4) Contracting unit for primary care hospital (M2) (120 beds) 1 pharmacist: 80 prescriptions

5) Large community hospital (F1) (90-120 beds) 1 pharmacist: 80 prescriptions

6) Middle community hospital (F2) (30-90 beds) 1 pharmacist: 80 prescriptions

7) Small community hospital (F3) (30 beds) 1 pharmacist: 80 prescriptions

8) Sub-contracting unit for primary care hospital 1 pharmacist: hospital

All levels of hospital the proportion of pharmacist to patients are 1 pharmacist: 80 prescriptions except sub-contracting unit for primary care hospital. (1)

CHAPTER III
METHODOLOGY

The pharmacy manpower forecasting model will be constructed by excel software version 2010. The values of each variable in the model will be derived from interview and hospital electronic database.

Study design

Descriptive and quantitative study.

Study location

Pharmacy department, Ramathibodi hospital.

Study period

January 2014 to August 2015

Sample

This study focused on the prediction of pharmacist manpower required to dispensing task for in- and out-patient departments at Ramathibodi hospital, the Main building, Queen Sirikit Medical Center (QSMC) building and Somdech Phra Debaratana Medical Center building. Samples were all pharmacists working on dispensing at these three buildings during the time of data collection.

Data sources and data collection

The data regarding pharmacists and workload were retrieved from interview, observation, recorded report and hospital electronic database. The proposal passed review from faculty of medicine Ramathibodi hospital, Mahidol university ethical committee on 28 May 2014 with the reference number ID 04-57-28. Data retrieved were the number of prescriptions, number of drugs dispensed and number of patients during 2012-2014 (3 years).

There are 5 sections in pharmacy department including administrative section, medical product management section, pharmacy service section, medical production section and clinical pharmacy section. This study collected the work task information as follow.

Work task; identify the current work tasks and future work tasks of pharmacist in the pharmacy department. The data of current process of work tasks were collected from interviewing pharmacists. The data of future work tasks were collected from interviewing the director of pharmacist at Somdech phra debaratana medical center building.

Future number of patient and number of drug dispensed. Data from the data base including number of patient and number of drug dispensed were used to plot graph between years and number of patient and number of drug dispensed, then the linear regression equation were obtained from the graph. The equation was used to forecast the future number of patient, and number of drug dispensed.

Ability to perform the work task; Current ability to handle the dispensing tasks for in- and out-patients at the three buildings was obtained from the output as number of patients and number of drugs dispensed.

The maximum capacity by pharmacists to handle the dispensing task in the future was concluded from interviewing pharmacists who have more than 5 years' experience.

The maximum capacities by in- and out-patient department were obtained from interviewed staffs of involved department for the maximum number of patients to handle with.

Factors affecting pharmacist workload were obtained from pharmacy staff interview and literature review.

Instrument

- Interview record form
- Flow process chart
- Microsoft office excel 2010

Data analysis

The pharmacist manpower needed in the future was calculated by the following formula.

Manpower required

Manpower required =Workload/(Maximum capacity of pharmacist)

Workload = number of patients, prescriptions or drug items

Maximum capacity of pharmacist

Maximum capacity of pharmacist =(Maximum capacity of workload)/(Full time equivalent (FTE))

Maximum capacity of workload obtained from interviewing pharmacist for the number of patient, prescription and patient to handle with.

The manpower forecast model were simulated by Microsoft office excel 2010.

The change rate of workload and measurable factor affecting workload when time passes will obtained from regression equation by using Microsoft office excel 2010.

Full time equivalent (FTE) of future pharmacist manpower required was calculated as:

Future manpower required

Future manpower required =(Future workload)/(Maximum capacity of pharmacist)

Full time equivalent (FTE) form in- and out patients department were obtain from working time of full time pharmacist 7 hours per day

CHAPTER IV
RESULTS

The result will be presented into 3 parts as follow;

Present profile of hospital pharmacy Ramathibodi Hospital.

- Out-patient and In-patient pharmacy workload during 2012-2014
- Responsibilities of hospital pharmacists working at the out-patient and in-patient pharmacy department.

Future profile of hospital pharmacy, Ramathibodi Hospital

- Forecast number of out-patients and workload during 2015-2024
- Forecast number of in-patients and workload during 2015-2024
- Factors affect the number and responsibilities of hospital pharmacists in the future.

Forecast the number of pharmacy staffs required in the next 10 years, during 2015-2024

- Model 1: Forecast number of pharmacists needed by the number of patients.
- Model 2: Forecast number of pharmacists needed by the number of dispensed drug items.
- Sensitivity analysis

Present profile of hospital pharmacy Ramathibodi hospital

The hospital pharmacist job at Ramathibodi Hospital is divided into 5 parts, administrative part, medical product management part, medical production section, clinical pharmacy part and dispensing part (or service part). This research

will be related to the dispensing part at the OPD and IPD only. In 2014, there were 54 full time pharmacists and 25 FTE part time pharmacists working at 10 out-patients dispensing pharmacy rooms, (Table 4.1) The average number of out-patients per day during the morning shift (8.30-16.30) was three times more than in the evening shift (16.30-19.30), also the average number of drugs dispensed per day. But when look at the workload, as Number of patient/pharmacist/day, the Number of prescription/ pharmacist/day and per hour, and the Number of drug item/pharmacist/day and per hour, it can be seen that the workload of pharmacists working during the evening shift was higher than those working during the morning shift.

Regarding the in-patient, there were 10 full time pharmacists and 9 FTE part time pharmacists, total 19 FTE pharmacists working at three in-patients dispensing pharmacy rooms. The workload at the in-patient wards, as number of patient/pharmacist/day, number of prescription/pharmacist/day, and number of item/pharmacist/day are 40, 167, and 294 unit per pharmacist per day respectively.

Table 4.1 Profile of out-patient and in-patient pharmacy rooms in the year 2014.

		Out-patient Pharmacy		In-patient pharmacy
		8.30-16.30 (8 hrs.)	16.30-19.30 (3 hrs.)	
Number of Pharmacist (FTE)	Full time	54	0	10
	Part time	25	16	9
	Total	79	16	19
Number of patient/day		3,798	1,260	752
Number of prescription/day		3,341	1,108	3,173
Number of drug item/day		9,550	3,168	5,574
No.patient/pharmacist/day		60	79	40
No.prescription/pharmacist/day		53	70	167
No.drug item/pharmacist/day		150	198	294
No.prescription/pharmacist/hour		7	24	NA
No.drug item/pharmacist/hour		19	66	NA
No. of drug item / patient		3	3	8

Out-patient and In-patient pharmacy workload during 2012-2014

From Ramathibodi hospital's database number of in-patients prescriptions in 2012 was 1,221,993 prescriptions and in 2014 was 1,592,542 prescriptions, the in-patient prescriptions increase 30.32% from 2012. Number of out-patients prescriptions in 2012 was 1,462,499 prescriptions and in 2014 was 1,740,317 prescriptions, out-patients prescriptions increase 19.00% from 2012. The number of medicines dispensed at IPD in 2012 was 2,224,882 items and in 2014 was 2,728,108 items, number of medicines dispensed at IPD increased 22.62% from 2012. Number of medicines dispensed at OPD in 2012 was 4,062,128 items and in 2014 was 5,212,520 items, number of medicines dispensed at OPD increased 28.32% from 2012. Number of medicines per prescriptions (IPD) in 2012 was 1.82 and in 2014 was 1.71, number of medicines per prescriptions (IPD) decreased 5.91% from 2012. Number of medicines per prescriptions (OPD) in 2012 was 2.78 and in 2014 was 2.99, the number of medicines per prescriptions (OPD) increased 7.84% from 2012. (Table 4.2)

Table 4.2 Out-patient pharmacy workload during 2012-2014

	Working hour (8.30-16.30)			Extra-working hour (16.30-19.30)		
	2012	2013	2014	2012	2013	2014
No. of Pharmacist (FTE)	79	79	79	16	16	16
No. of patient/day	3,486	3,724	3,798	1,178	1,246	1,260
No. of prescription/day	3,067	3,277	3,341	1,037	1,097	1,108
Number of drug item/day	8,765	9,365	9,550	2,962	3,134	3,168
No.patient/pharmacist/day	87	69	48	74	78	79
No.prescription/pharmacist/day	77	61	43	65	69	69
No.drug item/pharmacist/day	219	173	121	185	196	198

Since 2012 the number of in-patients and out-patients has been increased, also the number of prescriptions and number of medicines dispensed by the pharmacist

has been increased as well. The number of medicines per OPD patient was approximately 3 and IPD patient was approximately 8.

Table 4.3 Number of patients by age groups in 2012-2014

Age	Year					
	2012		2013		2014	
NA	4	0.00%	4	0.00%	3	0.00%
0-15	29,346	10.06%	30,417	9.92%	31,549	10.00%
16-30	39,904	13.68%	41,149	13.42%	41,199	13.06%
31-45	52,114	17.86%	54,143	17.66%	55,574	17.61%
46-59	77,690	26.63%	79,726	26.00%	79,432	25.18%
>60	92,721	31.78%	101,181	33.00%	107,753	34.15%
Total	291,779	100.00%	306,620	100.00%	315,510	100.00%

Table 4.4 Number of drug dispensed items by age groups in 2012-2014

Age	Year					
	2012		2013		2014	
NA	7,231	0.11%	5,703	0.08%	5,755	0.07%
0-15	624,156	9.38%	642,488	8.88%	658,786	7.87%
16-30	518,298	7.79%	568,842	7.86%	581,796	6.95%
31-45	816,891	12.28%	883,927	12.21%	979,066	11.70%
46-59	1,547,369	23.26%	1,625,677	22.46%	1,853,607	22.16%
>60	3,138,293	47.18%	3,511,632	48.51%	4,287,137	51.24%
Total	6,652,238	100.00%	7,238,269	100.00%	8,366,147	100.00%

Table 4.5 Percentage of elderly patients (>60 years old) and dispensed drug items

Year	Percentage of elderly patients	Percentage of number drug dispense
2012	32%	47%
2013	33%	49%
2014	34%	51%

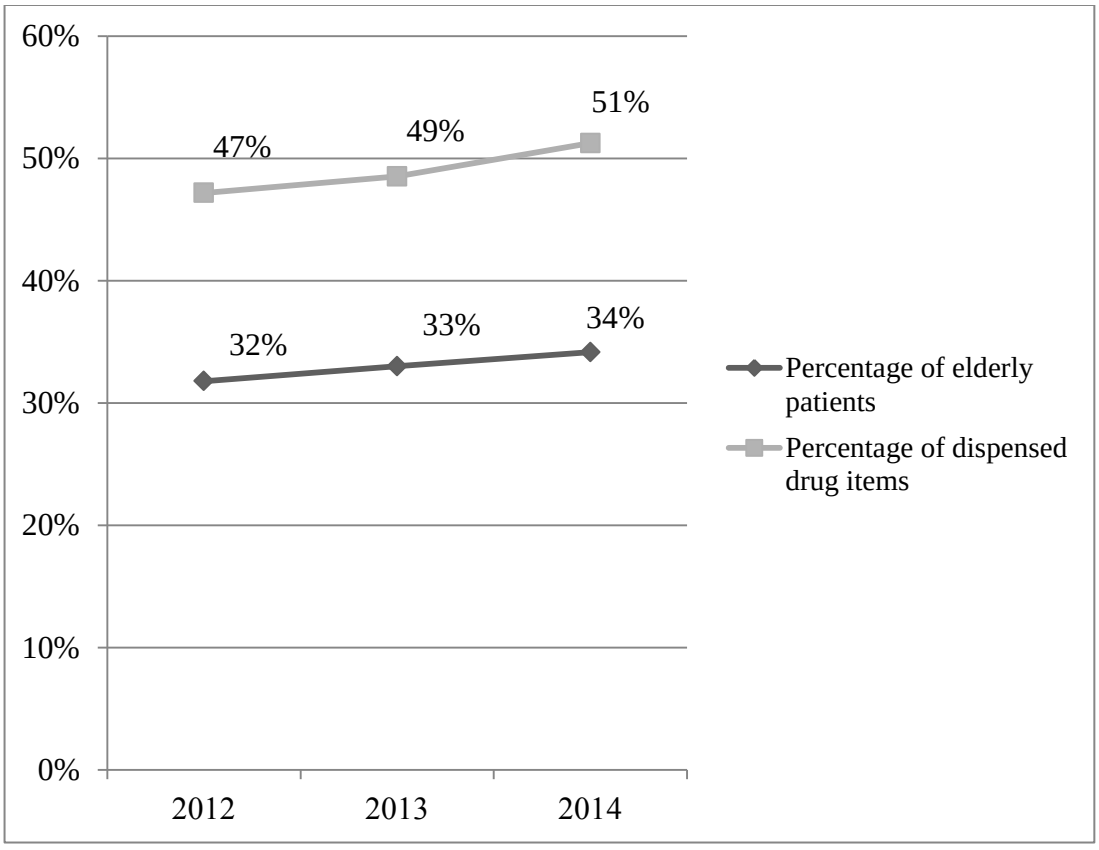

Figure 4.1 Percentage of elderly patients (>60 years old) and dispensed drug items

Number of elderly patients (>60 years old) in 2014 was 107,753 approximately 1 of 3 of all ages patients and tend to increase in a coming year (table 4.3). Table 4.4 shows number of dispensed drug items of elderly patients in 2014 was 4,287,137 approximately half of dispensed drug items of all ages.

The increasing rate of elderly patients was 1% per year but for dispensed drug items was 2% per year.

Table 4.6 Average number of drug dispensed per patient in elderly patients at Ramathibodi hospital from 2012-2014

Year	Average number of drug dispensed per patient in elderly patients
2012	6
2013	6
2014	7

Average number of drug dispensed per patient in elderly patients, Ramathibodi hospital in 2012 – 2013 was 6 items per patients and in 2014 was 7 items per patients.

Responsibilities of hospital pharmacists working at the out-patient and in-patient pharmacy department.

The out-patient and in-patient pharmacists are responsible for the following task; drug dispensing and counseling, preparing drugs and medical devices, and sub-stock inventory management (checking drug expiry date and stock). The detail of work at the out-patient pharmacy was documented from observation and interviewing working staff.

At the OPD

When patients arrive at the hospital, either by appointment or without, they have to go to the registration counter for verifying the payment scheme and picking the medical record. These medical record will be transferred to OPD where the patients wait to see the doctors. In case of advance appointment the medical record were transferred in advance to the OPD.

At the OPD, advance appointed patients will wait to see the doctors, while the non-appointment will be queued last. The doctor will write the order for medicines twice, one on the medical record and the other on the prescription paper

(sometime the nurses will do when the doctors are too busy). The patients will take the prescriptions to the pharmacy OPD. In case of the patients need to see more than one doctors, some will hand in the prescription one at a time but some will collect the prescriptions till the last doctor before handing in.

The patients will hand in prescriptions to pharmacy room, prescriptions will be keyed in to the computers to generate labels. The pharmacist assistants will pick medicines, and then will be checked by the pharmacists. In case that some medicines are shorted, the pharmacists will call the doctor to change the medicines or let them bought from the drugstores. This process will take 15 to 30 minutes. The prescription flow in rate is higher than the dispensing rate, so cumulative of undelivered prescriptions cause the patients' long waiting time.

The prices of medicines will be sent online to the finance office close to the pharmacy room.

When the patient's name and medicine prices appear on the monitor, he/she will contact the finance office to pay. Some patients did not have enough money, so they will contact the pharmacist to reduce the number of medicines then patients will bring the prescriptions to the doctors once more and the process will be repeated.

After payment, then patients will receive medicines at the pharmacy room from the pharmacists. Also patients will check for the number of medicine items and quantities. The pharmacists will dispense the medicines with proper instruction, which take 1-3 minutes. Some patients need special counseling such as patients with DM, asthma, warfarin, COPD and patients with special drug delivery kit such as inhaler, nasal spray, and eye drop. This counseling accounts for 5-10 minutes. The number of patients need special counseling are 2-3 percent according to different out-patient pharmacy rooms, thus account for 98-147 patients per day. (Total OPD patients are approximately 4,900 per day).

The process of sub-stock inventory management account for checking drug expiry date, checking for drug number needed to be filled up, place order to the main pharmacy stock to replenish the medicine stock, check the received medicines. Placement of medicines on the shelves is done by the assistants. There are 10 out-

patient pharmacy rooms, each room requires 2 pharmacists work for 50-60 minutes every day.

All the processes are summarized in figure:

Registration	OPD	Pharmacy	Finance
Arrival of patients Registration			
	Seeing doctors Write prescriptions		
		Hand in prescriptions by patients Key in prescriptions Print labels Picking by pharmacist assistants Checking by pharmacists	
		Receive medicines	Payment
Total time		15-30 minutes Plus- providing medical instruction 1-3 minutes -special counseling 5-10 minutes	

Figure 4.2 Flow of OPD service

At the IPD

At SDMC there is one in-patient pharmacy room located on the sixth floor serving 377 beds. There are 3 in-patient pharmacy rooms at the Main building serving 946 beds, 1 in-patient pharmacy room at Queen Sirikit building serving 55 beds.

The in-patients pharmacist are responsible for 5 tasks ; fulfill of medication order, preparation for home medicines, confirmation of warfarin orders, replace medicines to emergency cart and ward stock inventory management.

1) Fulfill of medication order.

This process accounts for 0.5 minutes per item, start from: receive medication orders via online program, calculate the number of medicine units to be dispensed (the quantity will cover 1 day for injection preparations and 3 days for oral and external use preparations), print medicine labels (the orders will be printed out separately for each ward, once a day containing every patient name), fill the medicines each ward according to the labels, check the medicines, and prepare the checked medicines in the boxes of each ward.

2) Preparation for home medicines

This process accounts for 0.5 minutes per item, starts from: receive medication orders via online program, checking the order and label, print medicine labels, fill the medicines each ward according to the labels, check the medicines, and place the checked medicines in the boxes of each ward.

3) Confirmation of warfarin orders

This process accounts for 3 minutes, starts from: receive warfarin orders via online program, check for INR level of the patients who were prescribed with warfarin, call the ward to confirm warfarin dose and administration, calculate the number of warfarin to be dispensed, and record the information in warfarin record book.

4) Replace medicines to emergency cart.

This process accounts for 30 minutes, 2-3 times per week. When emergency carts were used, it will return to in-patient pharmacy room to replace the medicines. The pharmacist checks the number of used medicines and medical equipment in the emergency cart, calculate the price of used medicines for the patient, replace the medicines and medical equipment in the emergency cart according to the list.

The process of sub-stock inventory management account for checking drug expiry date, checking for drug number needed to be filled up, place order to the main pharmacy stock to replenish the medicine stock, check the received medicines.

Placement of medicines on the shelves is done by the assistants. There are 3 in-patient pharmacy rooms, each room requires 1 pharmacist work for 50-60 minutes every day.

Future profile of hospital pharmacy, Ramathibodi hospital

There are many factors influencing the workload of hospital pharmacists such as number patients, severity and type of disease, types of pharmacy services provided, technology, work process, and pharmacy organization structure.

Forecast number of out-patients and workload during 2015-2024 during 2015-2024

The number of patients in Ramathibodi hospital from 2012-2014 were used to forecast the number in the next 10 years. (Table 4.7)

At present the number of patients handle by OPD pharmacists were 4,075 and the maximum number of patients that can be handled by the existing number of OPD in 2014 were 5,125. This figure comes from the combination of the maximum number of patients that can be handle in each OPD clinic. The number of future the patients from the year 2015 to 2024 came from the extrapolation of number of patients in 2012 to 2014, by the equation $y = 156x + 3357.3$ Comparison of the forecast patient number during 2015 and 2024 with the maximum number of patients that can be handle is shown in the table 4.3. In the year 2023 the pharmacy service provided will be less than required by the number of incoming OPD patients.

The number 5,125 will represent the maximum number of patients that can receive services from the hospital OPD. So by the year 2023, the number of patients coming to OPD clinics (5,023 patients) will exceed the capacity of the hospital (5,125 patients).

This table also shows the number of the maximum capacity number of patients that can be serviced each day by OPD pharmacists which is 4,075 patients. This figure comes from interviewing pharmacists in each OPD pharmacy room about the maximum number of patients that they can service in each day. By the year 2016, the number of patients coming for services will be exceed the capacity of OPD pharmacist's available.

Another perspective to forecast the number of pharmacists needed besides the ratio between the number of pharmacist and patients was the ratio between the number of pharmacist and drug dispensed. According to Table 4.1, the number of drug per patient was 3, so the number of drugs to be dispensed by OPD pharmacists during the working hour was calculated as shown in the table 4.3, while the maximum capacity of pharmacist that can handle the number of drugs per day was 10,247 drug items. At present (2014), 79 pharmacists were able to cope with maximum of 4,075 patients per day, or 52 patients/pharmacist/day under the assumption of the number of drug items per patient was 3, or 52x3 = 156 drug items/pharmacist/day. By the year 2016 the capacity of work will be overload.

For the extra-working hour, the forecasted number of patients came from extrapolating the number of patients during 2012-2014, was shown in the Table 4.3. The linear regression equation was $y = 40.9x – 81104$ ($R^2 = 0.8695$).

The maximum number of patients that can come to the OPD extra-clinics were 1,640 patients per day, but the maximum capacity of pharmacists to handle patients during the extra-working hour was only 1,388 patients.

So in 2017 the work capacity of OPD pharmacist at extra-clinics will be overload, which is almost the same year as regular OPD during the working hours.

When looking at the number of drug items of OPD extra-clinics the maximum number of drug items handle at pharmacy were 3,489 items per day.

If the number of drugs per prescription increases, direct impact will go to the number of pharmacists required.

Table 4.7 Number of patients at OPD and Maximum available of number of patients handle at OPD during the working hour and extra-working hour in 2012 – 2024

Year	Number of patients at OPD (Working hour)	No. of drug items at pharmacy (Working hour)	Number of pts. at OPD (extra-working hr.)	No. of drug items at pharmacy (extra-working hr.)
2012	3,486	8,765	1,178	2,962
2013	3,724	9,365	1,246	3,134
2014	3,798	9,550	1,260	3,168
2015	3,981	10,011	1,310	3,294
2016	**4,137**	**10,404**	1,351	3,397
2017	4,293	10,796	**1,392**	**3,500**
2018	4,450	11,188	1,433	3,603
2019	4,606	11,581	1,474	3,706
2020	4,762	11,973	1,514	3,809
2021	4,918	12,365	1,555	3,912
2022	5,074	12,758	1,596	4,015
2023	**5,230**	12,887	**1,637**	4,118
2024	5,386	12,887	1,678	4,221

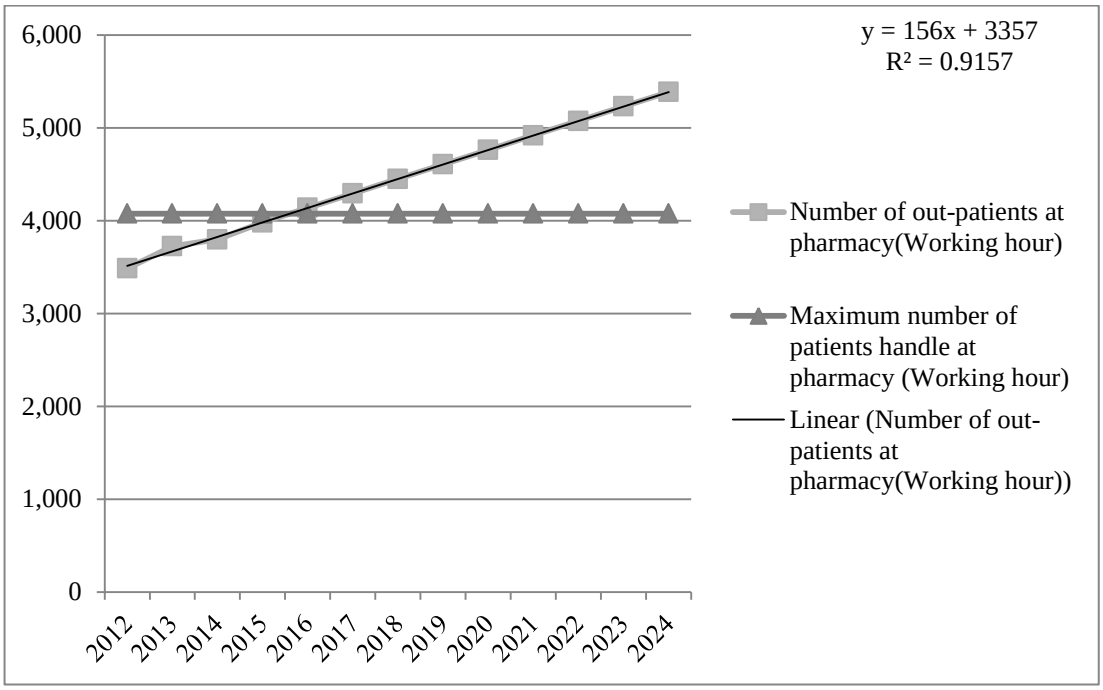

Figure 4.3 Forecast Number of out-patients at pharmacy and maximum number of patients handle at pharmacy (Working hour) in 2012 – 2024

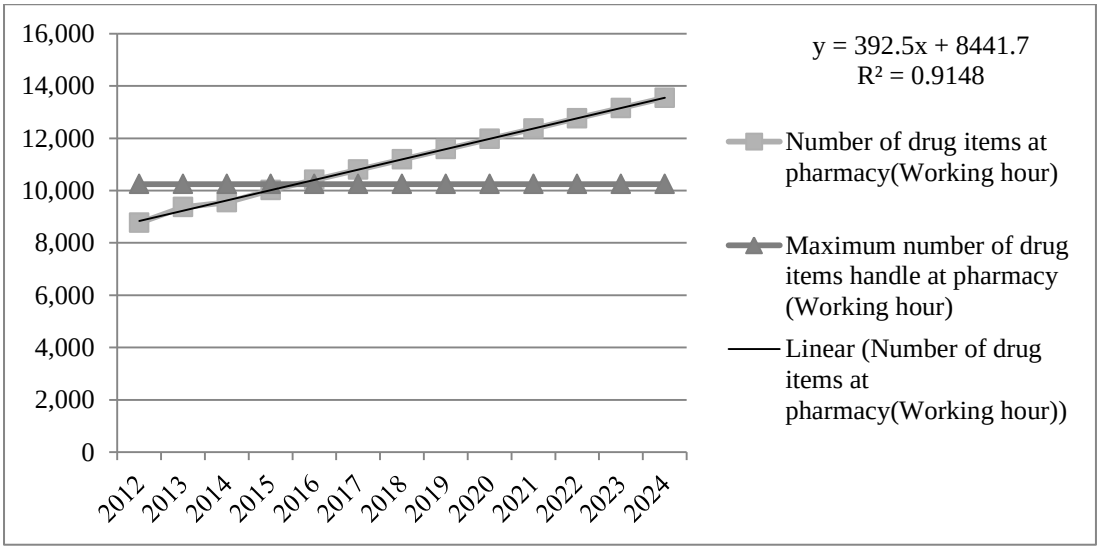

Figure 4.4 Forecast number of drug items at pharmacy (working hour) and maximum number of drug items handle at pharmacy (working hour) in 2012 - 2024

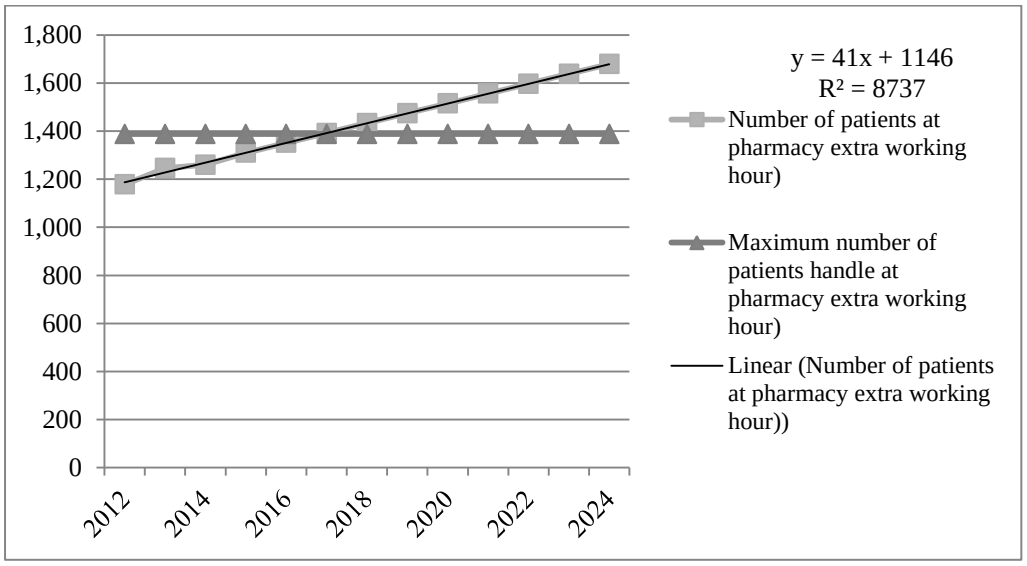

Figure 4.5 Forecast Number of patients at pharmacy and Maximum number of patients handle at pharmacy (off working hour) in 2012 – 2014

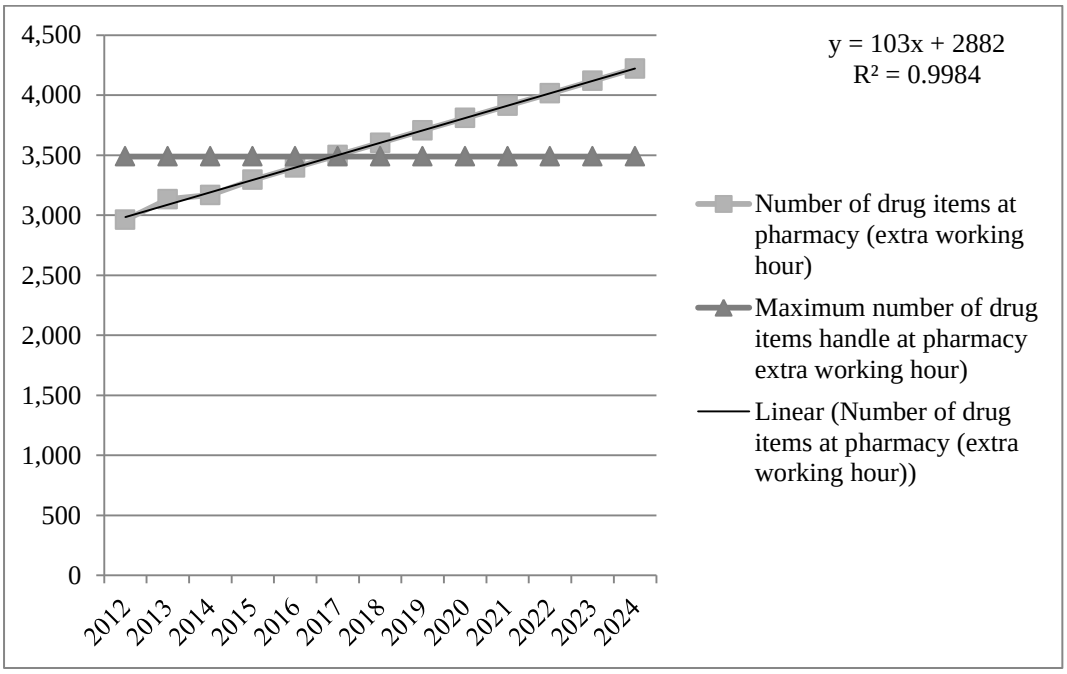

Figure 4.6 Forecast Number of drug items at pharmacy (extra working hour) and maximum number of drug items handle at pharmacy (extra working hour) in 2012 – 2024

Forecast number of in-patients and workload during 2015-2024

Based on the number of in-patients at Ramathibodi hospital during 2012-2014, the increase rate was 6.98%, and the number in-patients from 2015 to 2024 was calculated. (Table 4.8) Total number of beds for in-patient were 936 beds, so in the year 2020 the number of in-patients will be at its maximum of 936 patients.

When look at the workload of pharmacists for the in-patient at present (2014), it was found that one pharmacist has to service 40 patients per day and 294 drug items per day, under the consumption that there were 8 drug items per one patient as from the Table 4.1. The forecasted number of drug items to be dispensed by IPD pharmacists were calculated and presented in Table 4.8, while the maximum capacity of IPD pharmacists could provide services at 6,536 drug items per day. By the year 2019 the work capacity of IPD pharmacists would be overload.

Table 4.8 Forecast the number of in-patient and drug items needed to be dispensed in the next 10 years 2012 – 2024

Year	Number of In-patient	In-patient drug items needed to be dispensed
2012	690	5,115
2013	735	5,447
2014	752	5,574
2015	788	5,838
2016	819	6,068
2017	850	6,298
2018	881	6,528
2019	**912**	**6,756**
2020	943	6,985
2021	974	7,215
2022	1005	7,444
2023	1036	7,674
2024	1067	7,903

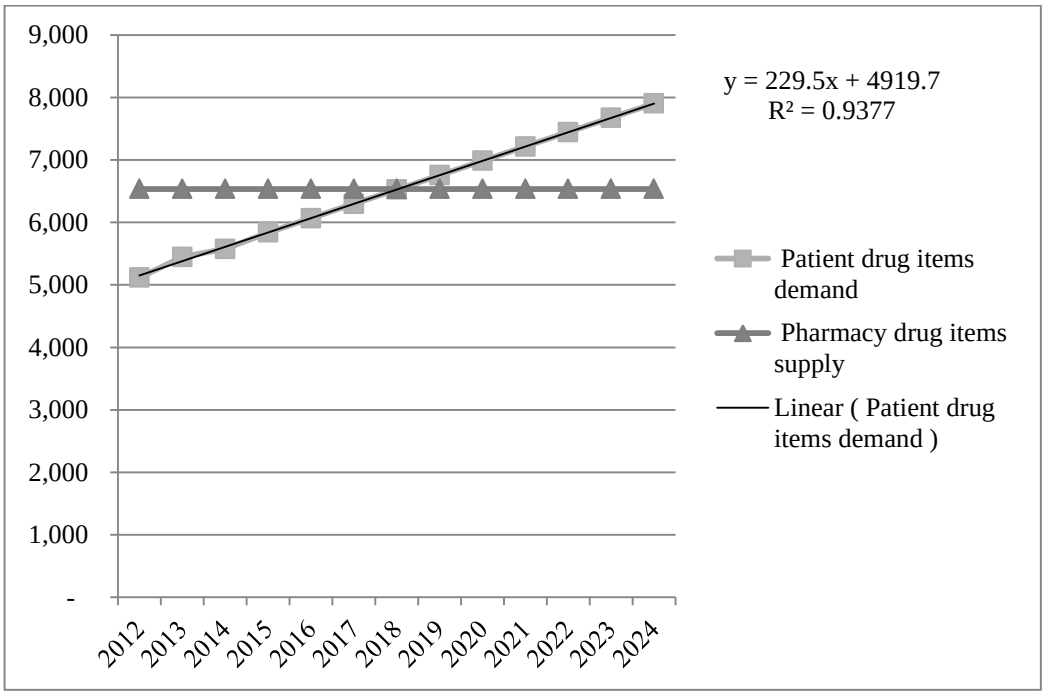

Figure 4.7 forecast the number of in-patient and drug items needed to be dispensed in the next 10 years 2012 – 2024

Factors affect the number and responsibilities of hospital pharmacists in the future

1) Severity and types of diseases

The policy of Ramathibodi hospital is to be the best tertiary care hospital, to treat patient with complex diseases referred from secondary or primary care hospitals. This policy will result in increase the number of the patients with more complex diseases that need to treat with sophisticate medicines. Also the number of medicine per patient or prescription will increase. It is necessary to require expert pharmacists specialized in each disease and it will take more time to deal with patients. (Table 4.9)

Table 4.9 Top ten diseases found at the out-patient department.

no.	Disease	Number of patients
1	Essential (primary) hypertension	588,685
2	Disorders of lipoprotein metabolism and other lipidaemias	503,878
3	Non-insulin-dependent diabetes mellitus	289,154
4	Gonarthrosis [arthrosis of knee]	173,337
5	Vasomotor and allergic rhinitis	170,581
6	Chronic renal failure	151,520
7	Senile cataract	126,547
8	Malignant neoplasm of breast	122,873
9	Glaucoma	101,711
10	Conductive and sensorineural hearing loss	96,696

2) Technology and software

In 2 years, Ramathibodi hospital plans to use a robot to fill the medicines in OPD in order to reduce the medication error and workload.

In the future Ramathibodi hospital plan to use computerized physician order program (CPOE) instead of hand writing prescriptions from doctor to pharmacy. This software aims to reduce the process of keying medicine by the pharmacy staff and reduce the medication error from doctor handwriting.

3) Structure

At present the pharmacy department has no plan to change the structure of OPD pharmacy rooms.

4) Clinical role3 at OPD

The administrator plans to have pharmacists working in a clinical role at the OPD in some diseases such as congestive heart failure, warfarin clinic and elderly patient clinic. The congestive heart failure clinic requires 2 pharmacists for 3 hours every Tuesday. Warfarin clinic requires 2 pharmacists for 6 hours every Wednesday

and elderly patient clinic requires 2 pharmacists for 3 hours every Monday. In the future there will be the asthma clinic, the COPD clinic, and the HIV clinic

5) Research

One of the hospital mission is "To be the research center for medical innovations and public healthcare services." To comply this mission, pharmacists have to conduct researches such as routine to research (R2R) or participate as a co-researcher to improve the quality of service.

6) Academic role

"To be the leadership in health education." is another hospital mission. At present pharmacy council states the changes of pharmacy curriculum from 5 years to 6 years. Pharmacy student have to enroll in training both in the faculty and in the work field. The hospital is asked to be a training center for pharmacy students. The pharmacists have to improve themselves both knowledge and skill to be qualified preceptors.

In conclusion, the number of pharmacists working at OPD in the future will increase due to more clinical role, higher severity of diseases, more complicated case mix and higher number of patients. New technology may decrease number of require pharmacists.

Forecast the number of pharmacy staffs required in the next 10 years, during 2015-2024

Model 1: Forecast number of pharmacists needed by the number of patients.

During working hours

Model 1 was constructed to forecast the number of pharmacists needed to work at the OPD pharmacy rooms during the working hours from 8.30-16.30, under the assumption that the maximum capacity of 79 FTE pharmacists to handle patients was 4,075 patients per day or 52 patients/pharmacist/day and the number of drug dispensed was 3 drug items per patient. The present number of 79 FTE of OPD

pharmacists would not be enough in the year 2016, in which required 81 FTE pharmacists. By the year 2023, the capacity of the hospital OPD will come to its maximum, thus the maximum number of OPD pharmacist will be 100, under the present workload of 3 drug items per one patient. (Table 4.10)

During extra-working hours

To forecast the number of FTE pharmacists required for the extra-OPD clinics, the ratio of the number of maximum patients that can be served and the number of FTE-pharmacists was employed. As 1,388 patients are the maximum capacity for 16 FTE-pharmacists, or 87 patients/ FTE –pharmacist, and 3 drug items per one patient.

In the year 2017, the number of OPD patients would exceed the capacity of existing 16 FTE-pharmacists (max = 1,388 patients).

By the year 2024, the number of OPD patients would equal to the maximum capacity of the OPD department (max= 1,640 patients). So, the maximum number of FTE pharmacists needed for the extra-OPD would be 21.

IPD pharmacists

The maximum capacity of workload by 19 IPD pharmacists was to be able to serve 819 patients per day or 40 patients per pharmacist, so by the year 2016 it will be the time. In the year 2017, the number of pharmacists should be increased to be 20. The number of IPD patients will come to the maximum limit by the number of IPD beds by the year 2020, which required 23 IPD pharmacists, under the assumption that there are 8 drug items per patient.

Table 4.10 Model 1: Forecast the number pharmacists required from 2012 – 2024, by the number of patients

Year	No. of patients at OPD pharmacy	No. of pharmacist at OPD pharmacy	No. of patients at extra-OPD pharmacy	No. of pharmacist at extra-OPD pharmacy	No. of patients at IPD pharmacy	No. of pharmacist at IPD pharmacy
2012	3,486	79	1,178	16	690	19
2013	3,724	79	1,246	16	735	19
2014	3,798	79	1,260	16	752	19
2015	3,981	79	1,310	16	787	19
2016	4,137	81	1,351	16	819	19
2017	4,293	84	1,392	18	850	21
2018	4,450	87	1,433	18	881	22
2019	4,606	90	1,474	19	912	23
2020	4,762	93	1,514	19	936	23
2021	4,918	96	1,555	20	936	23
2022	5,074	99	1,596	20	936	23
2023	5125	100	1,637	21	936	23
2024	5125	100	1640	21	936	23

Model 2: Forecast number of pharmacists needed by the number of dispensed drug items.

During working hours

Model 2 was constructed to forecast the number of pharmacists needed to work at the OPD pharmacy rooms during the working hours from 8.30-16.30, under the assumption that 79 FTE pharmacists are able to dispense at the maximum of 10,247 drug items/day, or 130 drug items/pharmacist and 3 drug items per one patient.

The present number of 79 FTE of OPD pharmacists would not be enough in the year 2016, in which required 81 FTE pharmacists. By the year 2023, the

capacity of the hospital OPD will come to its maximum, thus the maximum number of OPD pharmacist will be 100.

During extra-working hours

To forecast the number of FTE pharmacists required for the extra-OPD clinics, the ratio of the number of maximum drug items that can be dispensed per FTE-pharmacists was also employed. The maximum number of 3,489 drug items per day can be dispensed under the capacity of 16 FTE pharmacists or 218 drug items per one FTE pharmacist and 3 drug items per one patient.

In the year 2017, the number of OPD patients would exceed the capacity of existing 16 FTE-pharmacists (max = 3,489 drug items).

By the year 2024, the number of OPD patients would equal to the maximum capacity of the OPD department (max= 1,640 patients). So, the maximum number of FTE pharmacists needed for the extra-OPD would be 21.

IPD pharmacists

The maximum capacity of workload by 19 IPD pharmacists was to be able to dispensed 6,068 drug items per day or 294 drug items per pharmacist, so by the year 2016 it will be the time that meets the maximum capacity. In the year 2017, the number of pharmacists should be increased to be 20. The number of IPD patients will come to the maximum limit by the number of IPD beds by the year 2020, which required 23 IPD pharmacists, under the assumption that there are 8 drug items per patient.

Table 4.11 Forecast number of pharmacists needed by the number of dispensed drug items

Year	No. of drug items at OPD pharmacy	No. of pharmacist at OPD pharmacy	No. of drug items at extra-OPD pharmacy	No. of pharmacist at extra-OPD pharmacy	No. of drug items at IPD pharmacy	No. of pharmacist at IPD pharmacy
2012	8,765	79	2,962	16	5,115	19
2013	9,365	79	3,134	16	5,447	19
2014	9,550	79	3,168	16	5,574	19
2015	10,011	79	3,294	16	5,838	19
2016	10,404	81	3,397	16	6,068	19
2017	10,796	84	3500	18	6,298	21
2018	11,188	87	3603	18	6,528	22
2019	11,581	90	3706	19	6749	23
2020	11,973	93	3807	19	6926	23
2021	12,365	96	3910	20	6926	23
2022	12,758	99	4013	20	6926	23
2023	12,887	100	4116	21	6926	23
2024	12,887	100	4123	21	6926	23

Sensitivity analysis

The sensitivity analysis was performed by varying the number of patient and the number of drug items per patient to increase by 10 percent. Thus the number of OPD drug items per patient will increase from 3 to 4, and IPD will be from 8 to 9.

- OPD Pharmacy (Working times 8.30-16.30)

The number of OPD patients was increased by 10 percent and the number of drug items per one patient was increased from 3 to 4. The number of OPD pharmacists required was calculated under the assumption of 52 patients/pharmacist and 130 drug items/pharmacist. The result shows in the Table 4.12, which can be seen

that variation of the number of drug items per patient would affect the requirement of pharmacists more than varying the number of patient.

Table 4.12 Forecast number of OPD pharmacists required after 10 percent increased of demand.

Year	10% increase number of patient	1) Number of Pharmacist required	10% increase no. of drug/pt 4 items/patient	2) Number of Pharmacist required
2012	3,835	75	13,944	107
2013	4,096	80	14,896	115
2014	4,178	82	15,192	117
2015	4,379	86	15,924	122
2016	4,551	89	16,548	127
2017	4,722	93	17,172	132
2018	4,895	96	17,800	137
2019	5,067	99	18,424	142
2020	5,238	103	19,048	147
2021	5,410	106	19,672	151
2022	5,581	109	20,296	156
2023	5,638	111	20,500	158
2024	5,638	111	20,500	158

During extra-working hours

The number of OPD patients at the extra-OPD clinics were increased by 10 percent and the number of drug items per one patient was increased from 3 to 4. The number of OPD pharmacists required was calculated under the assumption of 87

patients/pharmacist and 218 drug items/pharmacist. The result shows in the Table 4.13

Table 4.13 Forecast number of extra-OPD pharmacists required after 10 percent increased of demand

Year	10% increase number of patient	3) Number of Pharmacist required	10% increase no. of drug/pt 4 items/patient	4) Number of Pharmacist required
2012	1296	16	4712	24
2013	1371	17	4984	25
2014	1386	18	5040	25
2015	1441	18	5240	26
2016	1486	19	5404	27
2017	1531	19	5568	28
2018	1576	20	5732	29
2019	1621	21	5896	30
2020	1665	21	6056	31
2021	1711	22	6220	31
2022	1756	22	6384	32
2023	1801	23	6548	33
2024	1804	23	6560	33

The number of IPD patients was increased by 10 percent and the number of drug items per one patient was increased from 8 to 9. The number of IPD pharmacists required was calculated under the assumption of 40 patients/pharmacist and 294 drug items/pharmacist. The result shows in the Table 4.14.

Table 4.14 Forecast number of IPD pharmacists required after 10 percent increased of demand.

Year	10% increase number of patient	5) Number of Pharmacist required	Drug items 9/patient	6) Number of Pharmacist required
2012	759	19	6,210	21
2013	809	20	6,615	23
2014	827	21	6,768	23
2015	866	22	7,083	24
2016	901	23	7,371	25
2017	935	23	7,650	26
2018	969	24	7,929	27
2019	1,003	25	8,208	28
2020	1,030	26	8,424	29
2021	1,030	26	8,424	29
2022	1,030	26	8,424	29
2023	1,030	26	8,424	29
2024	1,030	26	8,424	29

In conclusion, variation in the number of drug items per one patient will affect the number of pharmacists required more than increasing the number of patients.

CHAPTER V
DISCUSSION

This research aimed to forecast the number of patients and number of drugs dispensed in the next 10 years and develop a model to forecast the number of hospital pharmacists required for aging society. There were 3 parts of results as follow;

Present profile of hospital pharmacy Ramathibodi Hospital

Future profile of hospital pharmacy, Ramathibodi Hospital

Forecast the number of pharmacists required the next 10 years, during 2015-2024

Present profile of hospital pharmacy Ramathibodi Hospital

The results of present profile of hospital pharmacy Ramathibodi hospital table 4.1 found that the average number of prescriptions (OPD and IPD) to number of pharmacist was 97 prescriptions per pharmacist. The proportion prescription to pharmacist as suggested from the Bureau of Health Administration, Ministry of –was 80 prescriptions per pharmacist, so this proportion was not consistent with Thai government pharmacist to prescription's workload proportion 2013. (1) Due to Ramathibodi hospital is tertiary care unit, patients with complex diseases were referred from other hospitals to Ramathibodi hospital while also have to treat primary care and secondary care patients so the number of prescriptions to one pharmacist should be less than 80

Future profile of hospital pharmacy, Ramathibodi Hospital

The percentage of elderly patients in Ramathibodi hospital from table 4.5 increased year by year from 32 per cent in 2012 to 34 per cent in 2014; these findings

are consistent with world population ageing 2015 United Nations, 2015 (4) The number of elder people in Thailand nearly doubled between 2000 and 2015, and their number is projected to continue to grow. Demographic of Thailand shift from younger to older population.

Forecast the number of pharmacists required the next 10 years, during 2015-2024

The numbers of drug dispensed items per day and drug items per patient in the future from forecasting model tend to increase; these findings were consistent with Doubova SV. Et al (21), 14% of elderly patients take five or more drugs concurrently. During hospital admission, elderly patients prescribed a mean of 5 to 6 different drugs elderly patients had more non-communication chronic diseases and consumed more drugs.

From the study, there were 2 models to forecast number of pharmacists required, model 1 was constructed to forecast the number of pharmacists needed to work at the IPD and OPD pharmacy rooms by the number of patients under the assumption that the maximum capacity of 79 FTE pharmacists to handle patients was 4,075 patients per day in OPD working hour, 1,388 patients are the maximum capacity for 16 FTE-pharmacists in OPD extra hour and 19 IPD pharmacists was to be able to serve 819 patients per day in IPD. Advantages of this model are easy to use, update and collect the data. The model can forecast number of pharmacists needed as model 2. From sensitivity analysis, when the patient increase the number of pharmacists needed was increased as well. If patient increased use more drug item per patient the model are less precision to forecast than model 2.

Model 2 was constructed to forecast the number of pharmacists needed to work at the IPD and OPD pharmacy rooms by the number of drug dispensed per patient. under the assumption that the maximum capacity of 79 FTE pharmacists are able to dispense at the maximum of 10,247 drug items in OPD working time, the maximum number of 3,489 drug items per day can be dispensed under the capacity of 16 FTE pharmacists in OPD extra working hours and the maximum capacity of workload by 19 IPD pharmacists was to be able to dispensed 6,068 drug items per day.

From sensitivity analysis, if number of drug item per patient constant at 3 items per patient model 1 and model 2 can forecast the number of pharmacists needed with the similar result, but if number of drug item per patient changes model 2 is more sensitive than model 1.

The appropriate method should be employed to forecast the proper number of pharmacists working at the pharmacy department, as it will lead to patient satisfaction. Planning for pharmacists working at the out-patient pharmacy department should be based on many factors not only the number of patients coming to receive services. This research proved that the impact of the number of drug items per patient in combination with the number of drug items dispensed per day played more significant role than the number of patients. In the era of Aging Society, the number of aged population increased, there will be more patients and more consumption of drugs due to non-communication and chronic diseases, thus the number of patients per day and the drug items per patients should increase. So the number of pharmacist required to work should be more than forecasted from this research. Moreover the future roles of pharmacist will impact both the number and the skill.

CHAPTER VI
CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Thailand is facing the aging society as many countries around the world. Pattern of drug utilization for elderly is a poly-pharmacy and they tend to have drug related problems more than other age groups. Pharmacists working at the hospitals will face higher workload due to higher number of drugs prescribed per patient and management of higher rate of drug related problems. A method to forecast the number of manpower in relation to the number of patients or beds might not be suitable.

A research entitled ‘human resource planning for pharmacy department under the aging society’ was conducted during January 2014 to August 2015. Two models were constructed to forecast the pharmacy manpower (as Full Time Equivalent, FTE) required for dispensing task at the in- and out-patient departments, Queen Sirikit Medical Center (QSMC) building and Somdech Phra Debaratana Medical Center (SDMC)building, Ramathibodi hospital. The excel software version 2010 was employed. The information and data regarding pharmacist workload were retrieved from interview, observation, department reports and hospital electronic database.

This thesis aims to explore the followings issues at the hospital:

1. Describe the future responsibilities at in-patient and out-patient pharmacy departments

2. Develop a model to forecast the number of pharmacists required in the next 10 years, during 2015-2024

The findings from this study will be used as information for pharmacy department manpower planning in the coming year.

The research proposal passed review from Faculty of Medicine Ramathibodi Hospital, Mahidol University ethical committee on 28 May 2014 with the reference number ID 04-57-28.

The conclusion of the results are:

Present profile of hospital pharmacy Ramathibodi Hospital.

The hospital pharmacist job at Ramathibodi Hospital was divided into 5 parts, administrative part, medical production part, procurement and inventory part, clinical part and dispensing part (or service part). This research dealt with the dispensing part at the OPD and IPD only. In 2014, there were 54 full time pharmacists and 25 FTE part time pharmacists working at 10 out-patients dispensing pharmacy rooms. The average number of out-patients per day during the morning shift of 8 hours (8.30-16.30) was three times more than in the evening shift of 3 hours (16.30-19.30), also the average number of drugs dispensed per day. But when looked at the workload, as number of patient/pharmacist/day, the number of patient/ pharmacist/day, and the number of drug item/pharmacist/day, it was seen that the workload of pharmacists working during the evening shift was higher than those working during the morning shift.

Regarding the in-patient service, there were 10 full time pharmacists and 9 FTE part-time pharmacists, total 19 FTE pharmacists working at three in-patients dispensing pharmacy rooms. The workload at the in-patient wards were, 40 patients/pharmacist/day, 167 prescriptions/pharmacist/day, and 294 drug items/pharmacist/day.

From 2012 to 2014, the number of prescriptions for in-patients increased by 30.32 per cent, and out-patients increased by 19.00 per cent. The number of drugs dispensed at IPD increased by 22.62 per cent and at the OPD increased 28.32 percent. Number of medicines per IPD patients were 8 and OPD patient were 3, which remained still during 2012-2014.

The in-patients pharmacist were responsible for 5 tasks; fulfill of medication order, preparation for home medicines, confirmation of warfarin orders, replace medicines to emergency cart and ward stock inventory management. The out-patient pharmacists were responsible for the following task; drug dispensing and counseling, preparing drugs and medical devices, and sub-stock inventory management (checking drug expiry date and stock).

Future profile of hospital pharmacy, Ramathibodi Hospital

At present (2014), 79 pharmacists were able to cope with maximum of 4,075 patients per day and 10,247 drug items, or 52 patients/pharmacist/day under the assumption of the number of drug items per prescription was 3, or 52x3 = 156 drug items/pharmacist/day. By the year 2016 the capacity of work will be overload.

At the OPD extra-working hour clinics, the maximum capacity of pharmacists to handle patients was only 1,388 patients and 3,489 drug items per day. So in 2017 the work capacity of OPD pharmacist at extra-clinics will be overload, which is almost the same year as regular OPD during the working hours. If the number of drugs per prescription increases, direct impact will go to the number of pharmacists required.

Total number of beds for in-patient were 936 beds, so in the year 2020 the number of in-patients will be at its maximum of 936 patients. During 2014, it was found that one pharmacist had to service 40 in-patients per day and 294 drug items per day, under the consumption that there were 8 drug items per one patient. By the year 2019 the work capacity of IPD pharmacists would be overload.

Factors influencing the workload of hospital pharmacists were number patients, severity and type of disease, types of pharmacy services provided, technology, work process, and pharmacy organization structure.

Forecast the number of pharmacy staffs required in the next 10 years, during 2015-2024

There were 2 models built to forecast the number of pharmacists needed at the OPD Pharmacy department, both at official and extra working hour, and at the IPD department. These two models used different parameters to forecast. The first model used the number of patient, as recommended by the Ministry of Public Health (1), and the second model used the number of drug dispensed, as in the aging society patients would use more medicines. The sensitivity test was conducted by 10 percent increasing workload demand in terms of the number of patients receiving services and number of medicines received per one patient.

Forecasting the number of pharmacists needed under current situation either by the number of patients (model 1) or by number of drugs dispensed per one patient (model 2) revealed the same results.

During regular working hours under the present workload of 3 drug items per one patient, the present number of 79 FTE of OPD pharmacists would not be enough by the year 2016, in which required 81 FTE pharmacists. By the year 2023, the capacity of the hospital OPD will come to its maximum, thus the maximum number of OPD pharmacist should be 100.

During extra-working hours, by the year 2017, the number of OPD patients would exceed the capacity of existing 16 FTE-pharmacists. By the year 2024, in which the number of OPD patients would equal to the maximum capacity of the OPD department, thus needed 21 FTE pharmacists for the extra-OPD.

Regarding 19 IPD pharmacists, their workload would be at the maximum capacity of workload. The number of IPD patients will come to the maximum limit by the number of IPD beds by the year 2020, which required 23 IPD pharmacists, under the assumption that there are 8 drug items per patient.

Table 6.1 Comparison of the output between model 1 and model 2 as number of pharmacists required.

	2016		2017	
	Model 1	Model 2	Model 1	Model 2
Regular OPD	89	127	93	132
Extra hour OPD	19	27	19	28
IPD	23	25	23	26

But on the sensitivity analysis, as the number of patients increased by 10 percent and the number of medicines dispensed per one OPD patient increased from 3 to 4, and IPD patient from 8 to 9, the output of 2 models showed much different as per Table 6.1 For example, in the year 2016 the number of pharmacists required for the extra OPD were 19 and 27 according to the model 1 and 2.

When compared the output of year 2016 with 2017; model 1 was not respond to the increment of number of patients, while model 2 did. So, model 2 had higher sensitivity than model 1.

In conclusion, it was clearly seen that if the parameter 'Number of patients' was used; the forecasting number of pharmacist required would be less than when the parameter 'Number of drug per patient' was used. Moreover, the second model is more sensitive to the changing of prescribing behavior, which could be seen when compare the output of the year 2016 with 2017.

The appropriate method should be employed to forecast the proper number of pharmacists working at the pharmacy department, as it will lead to patient safety. Planning for pharmacists working at the out-patient pharmacy department should be based on many factors not only the number of patients coming to receive services. This research proved that the impact of the number of drug items per patient in combination with the number of drug items dispensed per day played more significant role than the number of patients. In the era of Aging Society, the number of aged population increased, there will be more patients and more consumption of drugs due to non-communication and chronic diseases, thus the number of patients per day and the drug items per patients should increase. So the number of pharmacist required to work should be more than forecasting by the present formulation suggested by the Ministry of Public Health. Moreover the future roles of pharmacist will impact both the number and the skill needed.

Recommendations

The results of this research provide some valuable recommendations to the health policy maker for human resource planning and the hospital administrator.

Health policy maker for human resource planner

Due to changing of patient age distribution profile as a result of aging society, the number of elderly patients will increase. The responsibility of hospital pharmacists will be more complex by higher poly-pharmacy and higher incidence of adverse drug reactions. In the future their workload should not depend on the number

of patients but rather on the number of drug dispensed. Human resource planning by the present method would result in under number of working pharmacy staff and lead to poor quality of medication care.

A new regulation of hospital pharmacist manpower planning should be considered on the role of pharmacist under the ageing society.

Hospital administrator

The hospital administrator should regularly monitor the statistics related to patient services especially the patient aging distribution profile, number of medicines dispensed per one patient, and some trigger indicators about drug related problems. Utilize these information to effectively plan the manpower requirement is essential.

Researcher

There are much more room for researchers to explore the appropriate ratio between the number of pharmacists and different type of responsibilities, thus providing relevant information for the decision makers and administrators. If the workload data available more than five years, multivariate analysis should be used in the research to analyze any factors that can affect pharmacists manpower required in order to obtain more precise results.

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APPENDIX

คณะแพทยศาสตร์โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล
๒๗๐ ถนนพระราม ๖ แขวงทุ่งพญาไท เขตราชเทวี กทม. ๑๐๔๐๐
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Documentary Proof of Ethical Clearance
Committee on Human Rights Related to Research Involving Human Subjects
Faculty of Medicine Ramathibodi Hospital, Mahidol University

MURA2014/222

Title of Project	Future Research on Forecasting the Pharmacy Staffs Manpower Demand at Ramathibodi Hospital by STELLA Software
Protocol Number	ID 04-57-28
Principal Investigator	Mr. Apinan Khampetdee
Education Address	Faculty of Pharmacy Mahidol University

The aforementioned project has been reviewed and approved by the Committee on Human Rights Related to Research Involving Human Subjects, based on the Declaration of Helsinki.

Signature of Secretary Committee on Human Rights Related to Research Involving Human Subjects	..... Prof. Duangrurdee Wattanasirichaigoon, M.D.
Signature of Chairman Committee on Human Rights Related to Research Involving Human Subjects	..... Prof. Pratak O-Prasertsawat, M.D.
Date of Approval	May 28, 2014
Duration of Study	11 Months

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