A CAUSAL MODEL OF OCCUPATIONAL HEALTH SERVICES DELIVERY IN THAI PRIMARY CARE UNITS

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Yuwadee Wittayapun

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A CAUSAL MODEL OF OCCUPATIONAL HEALTH SERVICES DELIVERY IN THAI PRIMARY CARE UNITS

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ABSTRACT

At present, occupational health services delivery is needed at the community level. This study was a sequential mixed methods research composed of two phases. The first phase used qualitative methods with aims to explore the development of OHSs delivery as well as explore important elements according to the model of occupational health programs and services in PCUs. This model consists of system inputs, throughputs, OHSs, outputs, and feedback. The second phase employed the quantitative approach and aimed to examine a causal model of OHSs delivery in Thai PCUs. Rogers' model of occupational health programs and services was applied in order to guide a conceptual framework of this study. Phase I had 2 portions: a) in-depth interviews with staff whose responsibility involved support for the establishment of OHSs delivery in PCUs; b) focus group discussions with stakeholders, including nurses and public health personnel working in PCUs, employees, employers, and OHSs related authorities. A summarizing content analysis was used to analyze qualitative data. In phase II, a cross-sectional study was carried out. The mailed questionnaires were used to collect data with the samples of 403 nurses and public health personnel working in PCUs located in 6 provinces nationwide. Multi-stage sampling was used. Descriptive statistics and structural equation modeling were analyzed using SPSS and LISREL programs.

The findings revealed that several pilot projects of developing OHSs delivery in Thai PCUs have been launched in 89 PCUs in 18 provinces nationwide since 2003. There were 24 important elements of OHSs delivery in Thai PCUs, including 8, 6, 4, 3 and elements of system inputs, throughputs, OHSs, outputs, and feedback, respectively. A causal model based on Rogers' model explained OHSs delivery in Thai PCUs well (χ^2=424.56, df=176, p<.001, CFI=.99, GFI= .92, RMSEA= .05). The system inputs and system throughputs were two key predictors in a causal model of OHSs delivery. The system inputs had a total direct positive effect on system throughputs (β=.96, p<.001); the system throughput had the high level of total effects on OHSs, outputs, and feedback (β=.81, p<.001; β=.84, p<.001; β=.79, p<.001, respectively). However, 10 elements in system inputs and system throughputs (e.g., collaborative network building and receiving additional support) had scores at a low level indicating that some improvement was needed.

The research findings indicate that the coverage of OHSs delivery in PCUs should be extended nationwide. A causal model of OHSs delivery in Thai PCUs could be used as a guideline in improving and developing OHSs delivery. The interventions should start at system inputs and throughputs and be given importance for the improvement and the development of 10 problematic elements.

KEY WORDS: OCCUPATIONAL HEALTH SERVICES/ PRIMARY CARE UNITS/ ROGERS' MODEL OF OCCUPATIONAL HEALTH PROGRAMS AND SERVICES/ STRUCTURAL EQUATION MODELING

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แบบจำลองเชิงสาเหตุของการให้บริการอาชีวอนามัยในหน่วยบริการปฐมภูมิของไทย

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บทคัดย่อ

ปัจจุบันการให้บริการอาชีวอนามัยเป็นที่ต้องการในระดับชุมชน การศึกษานี้เป็นการวิจัยแบบผสมผสานวิธี มี 2 ระยะ ระยะแรกใช้วิธีการวิจัยเชิงคุณภาพเพื่อศึกษาพัฒนาการของการให้บริการอาชีวอนามัย และศึกษาองค์ประกอบที่สำคัญตามรูปแบบการจัดโปรแกรมและบริการอาชีวอนามัยในหน่วยบริการปฐมภูมิที่ประกอบด้วยปัจจัยนำเข้า ปัจจัยด้านกระบวนการ การให้บริการอาชีวอนามัย ผลลัพธ์ และข้อมูลย้อนกลับ ระยะที่สองเป็นการวิจัยเชิงปริมาณเพื่อทดสอบแบบจำลองเชิงสาเหตุของการให้บริการอาชีวอนามัยในหน่วยบริการปฐมภูมิของไทย โดยนำรูปแบบการจัดโปรแกรมและบริการอาชีวอนามัยของโรเจอร์มาเป็นแนวทางในการสร้างกรอบแนวคิดการวิจัย ระยะแรกของการวิจัยแบ่งเป็น 2 ขั้นตอน ได้แก่ 1) สัมภาษณ์เชิงลึก เจ้าหน้าที่ผู้มีส่วนสนับสนุนการจัดให้มีบริการอาชีวอนามัยในหน่วยบริการปฐมภูมิ และ 2) สนทนากลุ่มกับผู้มีส่วนได้ส่วนเสียในการให้บริการอาชีวอนามัย ได้แก่พยาบาล เจ้าหน้าที่สาธารณสุขที่ปฏิบัติงานในหน่วยบริการปฐมภูมิ ลูกจ้าง นายจ้างและเจ้าหน้าที่อื่น ๆ ที่เกี่ยวข้องกับการให้บริการอาชีวอนามัย วิเคราะห์ข้อมูลเชิงคุณภาพด้วยวิธีการวิเคราะห์เนื้อหาแบบสรุป ระยะที่สองของการวิจัยเป็นการศึกษาแบบภาคตัดขวาง เก็บข้อมูลด้วยแบบสอบถามที่จัดส่งทางไปรษณีย์ กับกลุ่มตัวอย่างคือพยาบาลและเจ้าหน้าที่สาธารณสุข จำนวน 403 ราย ที่ปฏิบัติงานในหน่วยบริการปฐมภูมิ 6 จังหวัดทั่วประเทศ ที่ได้จากการสุ่มตัวอย่างด้วยวิธีการสุ่มแบบหลายขั้นตอน วิเคราะห์ข้อมูลด้วยสถิติบรรยายและทดสอบโมเดลเชิงสาเหตุ โดยการใช้โปรแกรม SPSS และ LISREL

ผลการวิจัยปรากฏว่ามีการจัดทำโครงการนำร่องเพื่อพัฒนาการให้บริการอาชีวอนามัยในหน่วยบริการปฐมภูมิ จำนวน 89 แห่ง ใน 18 จังหวัดทั่วประเทศ ตั้งแต่ปี 2546 มีองค์ประกอบที่สำคัญของการจัดบริการอาชีวอนามัยในหน่วยบริการปฐมภูมิ จำนวน 24 องค์ประกอบ ประกอบด้วย 8, 6, 4, 3 และ 3 องค์ประกอบของปัจจัยนำเข้า ปัจจัยด้านกระบวนการ การให้บริการอาชีวอนามัย ปัจจัยด้านผลลัพธ์ และข้อมูลย้อนกลับตามลำดับ แบบจำลองเชิงสาเหตุของการให้บริการอาชีวอนามัยที่พัฒนาจากโมเดลของโรเจอร์สามารถอธิบายรูปแบบการให้บริการอาชีวอนามัยในหน่วยบริการปฐมภูมิของไทยได้ดี (χ^2=424.56, df=176, p<.001, CFI=.99, GFI=.92, RMSEA=.05) โดยปัจจัยนำเข้าและปัจจัยด้านกระบวนการเป็นสองปัจจัยหลักในการอธิบายการให้บริการอาชีวอนามัย ทั้งนี้ปัจจัยนำเข้ามีอิทธิพลโดยตรงทางบวกต่อปัจจัยกระบวนการ (β=.96, p <.001) ขณะเดียวกันปัจจัยกระบวนการมีอิทธิพลโดยรวมในระดับสูงต่อการให้บริการอาชีวอนามัย ผลลัพธ์ และข้อมูลย้อนกลับ (β=.81, p<.001; β=.84, p<.001; β=.79, p<.001 ตามลำดับ) อย่างไรก็ตาม 10 องค์ประกอบในปัจจัยนำเข้าและปัจจัยกระบวนการ (ตัวอย่างเช่น องค์ประกอบการสร้างเครือข่ายการทำงาน และการได้รับการสนับสนุนทรัพยากร) มีคะแนนอยู่ในระดับต่ำ ควรได้รับการปรับปรุง

ผลการวิจัยบ่งชี้ว่าการให้บริการอาชีวอนามัยในหน่วยบริการปฐมภูมิควรได้รับการขยายให้ครอบคลุมทั่วประเทศ แบบจำลองเชิงสาเหตุของการให้บริการอาชีวอนามัยในหน่วยบริการปฐมภูมิของไทย สามารถใช้เป็นแนวทางในการพัฒนาบริการอาชีวอนามัยได้ ทั้งนี้การปรับปรุงพัฒนาควรเริ่มที่ปัจจัยนำเข้าและปัจจัยด้านกระบวนการก่อนเป็นลำดับแรก และควรให้ความสำคัญกับการปรับแก้ 10 องค์ประกอบที่เป็นปัญหาเป็นหลัก

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CHAPTER I
INTRODUCTION

1. Background & Significance

Thailand has experienced health sector reform since 2000 (Ministry of Public Health, 2005). Many fundamental changes of the health care system's characteristics under health sector reform are financing, health care delivery, as well as organization and management (Towse, Mills, & Tangcharoensathien, 2004; Lethbridge, 2004). The most outstanding changed situation of Thai health care reform is the Universal Coverage (UC) health care scheme initiated in April 2001 and extended nationwide in October 2001. This policy was practically supported by determining primary care as a key mechanism to provide health care for all. With the important reasons that primary care is located at the best setting close to the community making the provider better capable of giving quality care based on holistic approach; and as a gatekeeper, primary care is expected to lower overall health care costs (World Health Organization [WHO], 2003; 2004). As a consequence, the health centers, which are the existing health care facilities in the communities, have been reorganized; and primary care units (PCUs), which did not exist in Thai health care system, have been established. For example, currently 6,608 health centers account for 67.7 percent of health centers serving as primary care units. Also, both health centers and primary care units had to be supported by the Contracting Unit for Primary Care such as a Community Hospital or Provincial Hospital as a part of a network of primary care units (Ministry of Public Health, 2005; Department of Health Service Support, 2005).

In the same way, efforts to reach all of the working population, through the concept of establishing occupational health services (OHSs) in all levels of health care system including health centers and primary care units was proposed in

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2002 under Thai health care reform as well (Occupational Health Development Committee, 2002).

At least two main issues have been shown as crucial evidence calling for delivering occupational health services in primary care setting. First, Thai occupational safety and health laws do not cover all working populations. It is estimated that over a half of the workforce do not have any form of statutory protection from workplace hazards in the workplace, including workers in the agricultural, home-based work, self-employed, commerce and services, and the government servant sector (Chaikittiporn, 2002; Hay, 2002). Second, occupational health problems found in workers in small- and medium-sized enterprises as well as the agricultural sector were at high levels. Approximately, 97.6% of the total 359,616 establishments in Thailand were small- and medium-sized enterprises and the data revealed that nearly a half of workers' deaths and injuries occurred in these establishments (Workmen's Compensation Fund, 2002; National Statistical Office, 2003). The Ministry of Public Health also indicated that pesticide poisoning among farmers was the top occupational health problem reported. Existing evidence reflects the occupational safety and health needs among agricultural and small enterprise sectors. Hence, making occupational health care accessible to all workers not merely for the industrial sector as is usually focused on, but for underserved working people and remote areas nationwide is what is now required.

Not only were both the health centers and primary care units affected from reorganizing the Thai health care system, but they also have received the new concept to deliver occupational health services in their settings. Although the Occupational Health Development Committee (2002) has established *practical guidelines* of occupational health services delivery in all levels of the health service system in order to assist health care personnel to have a criterion for improving quality and developing occupational health services, the delivery of occupational health services in primary care settings still has hardly been performed. For example, a survey study showed that carrying out occupational health services in 172 primary care units in five provinces sampled was at a middle

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level (Siriruttanapruk et al., 2006). As a result, the initial practical guidelines were revised recently in order to more easily implement by adding evaluation criteria in each practical guideline and index in 2005 (Bureau of Occupational and Environmental Disease, 2005a).

Preliminary studies for more additional information relating to occupational health services in primary care units were conducted in PhaNakorn Sriayuthaya and Surat Thani provinces. Each was reported as one of the top five provinces in the Central and Southern regions having a large number of cases of occupational diseases or injuries (Workmen's Compensation Fund, 2002). The first preliminary study was performed in a primary care unit of Bangsai District, PhaNakorn Sriayuthaya Province. Qualitative data were collected using in-depth interview with a part-time doctor, and two focus groups with three public health personnel and five injured workers who received treatment for their work-related injuries at this primary care unit. It was found that the three staff were willing to change to such a practical guideline but had many criticisms, including lack of occupational health knowledge, lack of clear understanding on working procedures, inadequate personnel, and time constraint. In addition, the finding from an in-depth interview with the doctor also confirmed these issues and showed other aspects that influenced the establishment of occupational health care provision in terms of low priority of occupational health problems. Focus groups with patients found that these workers knew well about the risk conditions of their work, but they did not protect themselves and worked carelessly. For example, they did not use an existing finger guard while cutting material.

The second preliminary study was conducted in two primary care units of Surat Thani Hospital network, Muang District, Surat Thani Province**.** Using the focus group technique, qualitative data were collected from two groups of staff, including four nurses and a public health worker of Tapee Primary Care Unit as well as a nurse and three public health personnel of Suntornniwas Health Center. The results were consistent with information obtained from the study in Bangsai District, PhaNakorn Sriayuthaya Province mentioned earlier such as time limitation of staff because of having many other jobs to be carried out. Besides,

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participants accepted they did not realize the occupational health issues directly in daily services. For example, the recent case of an injured worker in the construction site near the Tapee Primary Care Unit and had a nail fall in his eye accidentally and only received primary medical care and did not have any report concerning occupational health issues. Participants also claimed that this was because of no explicit policy information available, no practical manual for reference, no formal diagnosis of occupational diseases seen, and no report forms for notification and recording.

The information from two preliminary studies illustrated the need to study more deeply delivery of occupational health services in primary care settings. Also, it should become evident that occupational health problems exist in primary care and often are not identified, recorded, or reported as occupational health problems, similar to the findings in a few published relevant studies (Herbert et al., 1997; Elms et al., 2005; Benavides et al., 2005). Consequently, the burden of occupational diseases still has been greater than revealed in official statistics (Levy, Wegman, Baron, and Sokas, 2006; Benavides et al., 2005). Ultimately, the workers still have not accessed occupational health care. These illustrations need to be discussed in more clarity.

The occupational health care system is based on different assumptions than the general health care system. In a prepaid plan, for example, in which a fixed amount of money is paid for services provided to each patient regardless of the services actually performed, the intrinsic incentives tend toward under-utilization of services because the profit margin will increase if the health care cost does not deplete the whole of the funds provided (Guidotti, Cowell, Jamieson, & Engleberg, 1989). In addition, occupational health services are complex. It requires the knowledge and skills of many disciplines to assess both nonmedical and medical care needs (Guidotti et al., 1989; International Labour Organization [ILO], 2000; WHO, 2002; Rogers, 2003). Furthermore, occupational health services need to be comprehensive not only to avoid duplication of effort and competition among different units or responsibilities but also to be attractive to both management and workers as well as to preserve, protect and improve the

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health of the workforce (Rex, 1991; Cooper & Dehr, 1996; Childre, 1997; Rogers, 2003). Hence, health care providers should know what important factors are needed to be able to provide occupational health services effectively (Rogers, 2003). However, the occupational health care system is less familiar for health personnel. Although occupational health hazards have been recognized for a long time, organized occupational health services is relatively an innovation (Guidotti et al., 1989).

Several models are available for the provision of occupational health services (Guidotti et al., 1989; Jeyaratnam, 1992; Childre, 1997; Rantanen, 2004, 2005a, 2005b, 2005c). The plant dispensary with medical and non-medical personnel has been the norm of the occupational health services model (Guidotti et al., 1989). However, it is a lesson from many countries that one model alone is not sufficient to ensure full coverage of services for all workplaces and all working people (Rantanen, 2005a). Also, as mentioned previously, the occupational health problems actually are presented and basic health care is provided in primary care, interests of integrating occupational health services into the primary care setting has been increasing (Rex, 1991; Herbert et al., 1997; Hughes, Philipp, & Harling, 1999, 2003; Harber & Merz, 2001; O'Hara et al., 2004; Elms et al., 2005; Siriruttanapruk et al., 2006). Empirical studies illustrated that primary care professionals face difficulties in the delivery of occupational health services in primary care setting (Harber & Merz, 2001; O'Hara et al., 2004; Elms et al., 2005). Hence, the important issues are what supports exist to help integrate occupational health services delivery in Thai primary care units, what are the perceptions of stakeholders on these problems are, and what involving factors should be considered. With this concern, a Rogers' model of occupational health programs and services (Rogers, 2003) was brought in as the underlying theoretical lens in this study. Rogers' model is based on a systematic approach and focuses on the interactions and relationships within and among system inputs, system throughput processes, interventions, system outputs, and feedback aiming to achieve desired outcomes or goals (Rogers, 2003). It provides multiple perspectives to examine the entire system of Thai primary care units and offers opportunities for considering

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improvements, changes, and developments of this system that require strengthening for deliver occupational health services.

Siriruttanapruk and colleagues (2006) also revealed their efforts of the development of occupational health services model in Thai primary care units. The model of occupational health services in Thai primary care units was established by integrating both passive and proactive occupational health services to existing health care services. The passive services emphasized provision of medical treatments or primary care treatments. The proactive services focused on prevention of occupational diseases and injuries for agricultural workers. This model appeared to be in the first stage of development emphasizing some sectors of working population due to several limitations in Thai primary care units, and needed further expansion.

In addition, a few studies in developed countries provided some information benefit to develop occupational health services delivery in the primary care setting. For example, the nurse and the primary care personnel were two categories of health personnel who have played and will continue to play an important and critical role in the network of health services including occupational health services delivery (Glass, 1992; O'Hara et al., 2004**;** Elms et al., 2005). However, previous empirical studies did not identify exactly what problems staff had and what other factors were related in delivering occupational health services in primary care context in a real situation. Previous studies only implied the problem of inadequate knowledge of staff and emphasis of curative approach rather than preventive services (Rex, 1991; Herbert, 1997; Bratveit, McCormack, and Moen, 2001).

Furthermore, the need to apply scientific evidence from several studies to clinical practice in primary care is the challenge. One reason that scientific evidence is often not applied into practice is the lack of a proper fit with the particular patient, family, community, or practice setting in which the evidence is being applied, since context does matter in primary care practice (Stange, 2004). This idea is consistent with the new concept in occupational health services, Basic Occupational Health Services (BOHS), which has been launched by the

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International Commission on Occupational Health (ICOH), ILO, and WHO since 2003 to improve the global coverage of services and guide to appropriate content of services necessary for all the world's workplaces (in both industrialized and developing countries), in terms of an important paradigm emphasizing four important components including policy, infrastructure, appropriate content in the form of good practices, and the availability of human resources (Rantanen, 2005a, 2005b, 2005c) that need to be recognized. Also, it is compatible to Rogers' model of occupational health services and programs, the application of a systems approach to examining the occupational health unit system as a whole for assessing, analyzing, and developing occupational health services.

With the recognition of the importance of the previously findings, the overall paradigm of Basic Occupational Health Services, and Rogers' model, this research aimed not only to respond to the advent of new federal concepts and to fulfill the gaps of those studies on occupational health services in the primary care setting, but also to reveal the significant entities in occupational health services model as a causal model in Thai primary care units.

This was accomplished by using a mixed methods research approach, both qualitative and quantitative methods were combined and integrated within a single study (Creswell, 2003; Creswell**,** Fetters, and Ivankova, 2004) to develop a causal model of occupational health services in Thai primary care units. The qualitative methods were conducted in the first phase, and then the quantitative approach was used in the second phase. The purposes of the first phase qualitative study were to explore the development of occupational health services delivery in Thai primary care units, and the essential elements of occupational health services model in Thai primary care units. While the purpose of the second phase was to test whether the proposed model of occupational health services delivery worked equally well in Thai primary care units. Since no accessibly published studies address a causal model of occupational health services in Thai primary care units, the causal model resulting from this study was a guideline benefiting all occupational health services related stakeholders, especially nurses and public

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health personnel for further instituting occupational health services in Thai primary care units for a safe and healthy workforce, workplace, and environment.

2. Research Questions

Does a causal model of occupational health services delivery fit with the context of Thai primary care units?

3. Research Objectives

This study has the following general and specific objectives:

3.1 General Objective

To examine a causal model of occupational health services delivery in Thai primary care units.

3.2 Specific Objectives

The specific objectives of this study are as follows:

3.2.1 To explore the development of occupational health services delivery in Thai primary care units.

3.2.2 To explore the important elements in system inputs, throughputs, occupational health services, outputs, and feedback of occupational health services model in Thai primary care units.

3.2.3 To examine the causal model of occupational health services delivery in Thai primary care units.

4. Research Hypotheses

The research hypotheses for examining a causal model of occupational health services delivery in Thai primary care units are listed as follows:

4.1 System inputs have a direct positive effect on system throughputs, and an indirect positive effect on occupational health services, system outputs, and feedback by affecting system throughputs; system throughputs and occupational health services; system throughputs, occupational health services, and system outputs, respectively.

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4.2 System throughputs have a direct positive effect on occupational health services and outputs, an indirect positive effect on system outputs by affecting occupational health services, and indirect positive effect on feedback by affecting occupational health services and system outputs.

4.3 Occupational health services have a direct positive effect on system outputs and an indirect positive effect on feedback by affecting system outputs.

4.4 System outputs have a direct positive effect on feedback.

5. Scope of the Study

With a mixed methods approach, this study has three scopes.

First, this research studies the development of occupational health services delivery in Thai primary care units from the insightful perspectives of five public health personnel who work in three main organizations of the Ministry of Public Health at the central, regional, and provincial level as well as those whose responsibilities involve the support given to establishing occupational health services delivery in Thai primary care units and health centers.

Second, the study explores the important elements in system inputs, throughputs, occupational health services, outputs, and feedback of occupational health services model in Thai primary care units from the opinion of 53 stakeholders, including 18 nurses and public health personnel working in primary care units, 10 occupational health services related authorities working in other associated agencies, as well as 15 employees and 10 employers working in agricultural and non-agricultural sectors in Phayao Province.

Third, this research examines a causal model of occupational health services delivery in Thai primary care units regarding dependent relationships among system inputs, system throughputs, occupational health services, system outputs, and system feedback. Mailed questionnaires are used to collect data from 403 nurses and public health personnel working in primary care units (i.e., an inclusion of both primary care units and health centers) in 6 provinces from June-November, 2007. These are randomly sampled from the population of nurses and public health personnel working in 3,365 primary care units in 18 provinces

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nationwide, including Chiang Mai, Lamphun, Phayao, Nan, Mae Hong Son, Lampang, Songkhla, Nakhon Si Thammarat, Phattalung, Narathiwat, Sakon Nakhon, Khon Kaen, Nakhon Ratchasima, Si Sa Ket, Surin, Supanburi, Nakhon Pathom, and Ayutthaya Provinces.

6. Definition of Terms

A causal model of occupational health services delivery in Thai primary care units is composed of five variables, including system inputs, system throughputs, occupational health services, system outputs, and feedback. All are latent variables/constructs, meaning they cannot be measured directly but can be represented or measured by one or more variables. The system inputs is an exogenous construct (i.e., it is independent). The rest of four latent variables are endogenous constructs (i.e., they are dependent).

With a mixed methods approach, these five latent constructs are operationally defined for the purpose of examining a causal model of occupational health services delivery in Thai primary care units in the second phase using quantitative method as follows:

6.1 System Inputs

System inputs are organizational elements and resources that directly affect throughputs and indirectly affect occupational health services, outputs, and feedback of an occupational health services delivery model in Thai primary care units operationally. The system inputs are composed of eight components, including 1) Knowledge and Understanding about Occupational Health Services of Personnel, 2) Skills about Health Screening, Disease Diagnosis, and Treatment in Occupational Health Services Delivery of Personnel, 3) Personnel Capability in Evaluating Occupational Health Services Delivery, 4) Adequate Personnel, 5) Basic Information about Occupational Health, 6) Statistical Reports of Occupational Health Services Delivery, 7) Operational Resources, and 8) Occupational Health Unit Goals. The system inputs is measured by the System Inputs Assessment Scale (SIAS) developed from the findings of qualitative methods by the researcher.

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6.2 System Throughputs

System throughputs are management processes resulting from the interaction in the system inputs and directly affecting occupational health services and outputs, as well as indirectly affecting feedback of an occupational health services delivery model in Thai primary care units operationally. The system throughputs are composed of six components, including 1) Organizing Record, Register, and Report Systems of Occupational Health Services Delivery, 2) Training, Continuing Education, and Research of Public Health Personnel, 3) Communication about Occupational Health Services to Clients, 4) Cooperation with Other Authorities Involved in Occupational Health Services, 5) Collaborative Network Building, and 6) Receiving Additional Support. The system throughputs are measured by the System Throughputs Assessment Scale (STAS) developed from the findings of qualitative methods by the researcher.

6.3 Occupational Health Services (OHSs)

Occupational health services are health and safety care activities delivered to meet the needs of a working population identified through the throughput processes that directly affect system outputs and indirectly affect feedback of an occupational health services delivery model in Thai primary care units operationally. The occupational health services are composed of four components, including 1) Outreach Occupational Health Services Regarding Work Conditions and Environments, 2) Outreach Occupational Health Services Regarding Employee Health, 3) On-site Occupational Health Services for Employees in Primary Care Units, and 4) Reporting Occupational Diseases and Injuries. The occupational health services are measured by the Occupational Health Services Assessment Scale (OHSAS) developed from the findings of qualitative methods by the researcher.

6.4 System Outputs

System outputs are products of occupational health services and identified through throughputs processes that directly affect feedback of an occupational health services delivery model in Thai primary care units operationally. The system outputs are composed of three components, including 1)

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Number of Outreach Occupational Health Services Conducted in the Community, 2) Number of On-site Occupational Health Services Delivered to Employees in Primary Care Units, and 3) Number of Research Documents Related to Occupational Health Services. The system outputs are measured by the System Outputs Assessment Scale (SOAS) developed from the findings of qualitative methods by the researcher.

6.5 Feedback

Feedback is a product and evaluation mechanism resulting directly from system outputs and indirectly from the interaction of system input, system throughputs, occupational health services, and system outputs of an occupational health services delivery model in Thai primary care units operationally. Feedback is composed of three components, including 1) Trends of Occupational Health Problems, 2) Satisfaction of Employees/Employers, and 3) Evaluation of Occupational Health Services Delivery. Feedback is measured by the Feedback Assessment Scale (FAS) developed from the findings of qualitative methods by the researcher.

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CHAPTER II
LITERATURE REVIEW

The ultimate goal of the mixed methods study is to model the key elements related to the delivery of occupational health services in primary care units. The literature review is divided into five components. First, the situation of occupational diseases and injuries in Thai working population is explored to reflect the needs of occupational health services both in industrial and nonindustrial sectors. Second, health service system and occupational health services are discussed to show the developmental degree of occupational health services in Thai health service system including primary care units. Third, the theoretical-based approach addresses Rogers' model (2003) of developing occupational health programs and services applied as a conceptual framework. Fourth, based on Rogers' model, related research and literature selected are examined in terms of system inputs, throughput processes, occupational health services, outputs, and feedback in order to search for consistency of important entities of occupational health services model in primary care units. Finally, a conceptual model for this study is presented to show explicit concepts to be studied. More details of each section are described as follows:

1. Situation of Occupational Diseases and Injuries in Working Population

To reflect the growing needs of occupational health services, situation of occupational diseases and injuries in Thai working population are reviewed as follows:

1.1 Working Population

According to the report on the labor force for the first round in 2006 (January-March), the total Thai population is approximately 65.1 million. Of the

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total population, 35.6 million (54.7%) are working population; 34.6 million (97.2%) are employed; 666,200 people (1.9%) are unemployed; and 314,400 people (0.9%) comprise a seasonally inactive labor force. Among the employed workforce, 12.4 million (35.8%) work in the agricultural sector and 22.2 million (64.2%) are non-agricultural workers (National Statistical Office, 2006). The non-agricultural sector includes those who work in manufacturing industries (5.8 million or 26.1%), trade/business (5.7 million or 25.7%), construction (2.4 million or 10.8%), hotel and restaurants (2.3 or 10.4%), and other service sectors (6.0 million or 27.0%). With the continual increase of women in the workforce, the proportion of employed women is nearly the same as men (i.e., 43.2 and 56.8 percent, respectively) (National Statistical Office, 2005, 2006).

1.2 Occupational Diseases and Injuries

Two main sources of occupational diseases and injuries information in the country are the Workmen's Compensation Fund, Social Security Office, Ministry of Labour and Bureau of Epidemiology, Department of Disease Control, Ministry of Public Health.

1.2.1 Workmen's Compensation Fund

The Workmen's Compensation Fund (2006) reported the number of occupational diseases and injuries from statistical data of workers who registered with the organization. Approximately three to five percent of workers registered with Workmen's Compensation Fund were diagnosed and reported having occupational diseases or injuries each year from 1993-2006. The number of occupational diseases and injuries increased from 156,543 cases in 1993 to 214,235 in 2006, including 601-1,444 deaths, 10-29 cases of disabilities, 3,424-5,469 cases of losing partial limb(s), 150,122-224,042 cases of temporary absenteeism in each year.

In addition, the data in 2002 reported by the Workmen's Compensation Fund showed some interesting details available about the occupational diseases and injuries, as well as size of establishments in which accidents took place and where the workers' deaths occurred. Of the total 190,979 occupational diseases and injuries cases, 181,015 (94.8%) were occupational injury

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cases and the rest of the 9,964 (5.2%) were occupational diseases. The top five were diseases occurring according to the nature or condition of work or due to work (9,482 cases)—which included occupational illness caused by manual handling (5,674 cases), occupational contact dermatitis (2,715 cases), and occupational illness caused by working conditions (1,093 cases)—, chemical or chemical compound poisoning (195 cases), chlorine or chlorine compound poisoning (74 cases), ammonia poisoning (64 cases), and noise-induced hearing loss (31 cases). Also, 21 cases of pesticide poisoning were reported. Regarding workers' deaths in the establishments, the data revealed that 300 (46%) of the total 650 deaths occurred in small enterprises.

1.2.2 Bureau of Epidemiology

The Bureau of Epidemiology receives reports of occupational disease from health care facilities around the country. The data showed 4,213-6,131 occupational disease cases including 7-30 cases of death each year from 1998-2003 (Bureau of Epidemiology, 2005).

Unlike the Workmen's Compensation Fund, the Bureau of Epidemiology reported only 4,604 cases of occupational diseases including 16 fatalities in 2002. The top five occupational diseases were pesticide poisoning (2,571), physical hazard (1,756), pneumoconiosis, petroleum poisoning (75), lead poisoning (56), and gas vapor poisoning (31).

These data showed the contrasts between two main information sources. Workmen's Compensation Fund reported that occupational injury was the top of the total of 190,979 case; whereas the Ministry of Public Health, reported pesticide poisoning of a total of 4,604 cases. However, such data reported helped to know the situation of occupational diseases and injuries in country in diverse aspects, reflecting the need to receive more attention covering workers both in industrial and service and agricultural sectors. Moreover, it is of the essence to realize that the occupational diseases or injuries reported represented only some part of the real situation. The well-recognized underreporting of occupational disease incidents in Thailand may be due to several factors such as the laws not covering all labor forces, the lack of implementation of regular health

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examination of workers exposed to health hazards, lack of work history taken from patients, difficulty in making diagnosis of diseases, unprovided data of employers, as well as lack of awareness among health care personnel, management, and workers (Chaikittiporn, 2002; Hay, 2002; Siriruttanapruk & Anantagulnathi, 2004).

2. Health Services System and Occupational Health Services

To develop a causal model of occupational health services delivery in primary care units effectively, the information on health services system, occupational health services, and also occupational health services in Thai health service system is necessary.

2.1 Health Services System

Three main sectors of agencies implementing health programs in Thailand include public, non-profit and for-profit private sectors. However, the principal agency responsible for the public health nationwide is the Ministry of Public Health having a 60 percent share of health resources. According to the Reorganization of Ministries, Sub-Ministries and Departments Act of B.E. 2545 (2002), the Ministry of Public Heath has powers and responsibilities regarding the promotion of health, prevention/control and treatment of diseases, and rehabilitation of people's health, as well as other official functions as determined by law. The significant purpose of the Ministry of Public Heath is to make all Thai citizens physically and mentally healthy with good quality of life, being able to live a happy life in society and providing valuable resources to the country (Ministry of Public Health, 2005).

2.1.1 Administrative Structure of Public Health Agencies

In accordance with administrative structure, the agencies under the Ministry of Public Heath are divided into two levels—the central and the provincial administration (Ministry of Public Health, 2005).

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2.1.1.1 The Central Administration

Agencies under the central administration are listed as follows:

a) the Office of the Minister,

b) the Office of the Permanent Secretary for Public Health,

c) the Department of Medical Services,

d) the Department for Development of Thai Traditional and Alternative Medicine,

e) the Department of Mental Health,

f) the Department of Disease Control,

g) the Department of Health,

h) the Department of Health Service Support,

i) the Department of Medical Sciences,

j) the Food and Drug Administration, and

k) the Government Pharmaceutical Organization.

2.1.1.2 The Provincial Administration

The Provincial Public Health Offices; hospitals under the Ministry of Public Health including regional hospitals, provincial hospitals general hospitals, community hospitals; district health offices; primary care units and health centers are public health agencies under provincial administration. At present, there are 95 regional/provincial/general hospitals, 725 community hospitals, and 9,765 health centers (Ministry of Public Health, 2005). Approximately, 6,608 health centers have become primary care units (Department of Health Service Support, 2005).

2.2 Levels of Health Services

Levels of health services are classified into three levels in regard the level of services received from health care personnel in health care facilities as follows (Ministry of Public Health, 2005):

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2.2.1 Primary Care

Primary care is the first line health service provided by health personnel. Health centers and primary care units are units responsible to provide services at this level in an integrated, holistic, and continuous manner of health promotion, disease prevention, curative, and rehabilitation.

2.2.2 Secondary Care

Medical and health care at this level are mostly curative care managed by medical and health personnel with intermediate levels of specialization. Secondary care facilities generally are community hospitals and possibly are general, provincial or regional hospitals.

2.2.3 Tertiary Care

Medical and health care at this level are provided by medical specialists and health professionals. Health care facilities at this level include general, regional, and university hospitals.

2.3 Occupational Health Services

2.3.1 Definition of Occupational Health Services

WHO and ILO formulated a definition of occupational health (WHO, 2002) as “the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations; the prevention amongst workers of departures from health caused by their working conditions; the protection of workers in their employment from risk resulting from factors adverse to health; the placing and maintenance of workers in an environment adapted to their physiological and psychological capabilities; and, to summarize, the adaptation of work to workers and of each worker to his or her job.”

In view of that, occupational health services means an implementation of occupational health activity provision that aims at the promotion, protection, prevention and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations.

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2.3.2 Occupational Health Services Models

In general, various models for the provision of occupational health services are available (Guidotti et al., 1989; Jeyaratnam, 1992; Bunn & McCunney, 1998; Rantanen, 2005a). Rantanen (2005a) recently reported seven occupational health services models as follows:

a) Primary health services model integrating basic occupational health services into the primary health care unit's activities,

b) Big company model operating from inside the company by staff employed by the company itself,

c) Social security institution as a service provider,

d) Group service organized jointly by several small and medium-sized enterprises on non-profit basis,

e) Private health centers providing exclusively occupational health services or basic occupational health services as a part of other health services,

f) Private physician who has special competence in occupational health,

g) Local or regional outpatient clinic of hospitals as basic occupational health services providers.

It is a lesson from many countries that one model alone is not sufficient to ensure full coverage of services for all workplaces and all working people. Hence, a flexible use of several models fitting best to real situations is a suggestion (Rantanen, 2005a).

2.3.3 New Concepts in Occupational Health Services

In general, the concept of occupational health services varies between countries and problems blossom (Parmeggiani, 1985; Husman, 1999). Parmeggiani emphasized that the activity of occupational health services was stated essentially to a preventive nature since 1959. Also, occupational health services are dedicated for total health, not limited to diseases of occupation, to be achieved by means of close coordination or full integration of occupational health services with general health services (Parmeggiani, 1985).

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Responding to the growing and urgent needs of occupational health services, the ILO/WHO/ICOH launched global action for basic occupational health services as a new concept in occupational health services in 2003 (Rantanen, 2005a, 2005b, 2005c).

2.3.3.1 Definition and Objectives of Basic Occupational Health Services

The basic occupational health services are defined as essential services to protect people's health at work, to promote health, well-being and work ability, as well as to prevent ill-health and accidents. The basic occupational health services aim to help increase the global coverage of services and guide appropriate content of services so that the occupational health needs of workers and workplaces, in very varying conditions prevailing in different parts of the world, are met. The ultimate objective of basic occupational health services is to provide occupational health services for all the world's workplaces (in both industrialized and developing countries) which so far lack such services available or the services have not fulfilled their occupational health needs.

2.3.3.2 Paradigm of Basic Occupational Health Services

The overall paradigm of basic occupational health services emphasize the role of four important elements: policy, infrastructure, appropriate content in the form of good practices, and the availability of human resources, well-trained experts, their competence, skill and ethical principles as presented in Figure 1.

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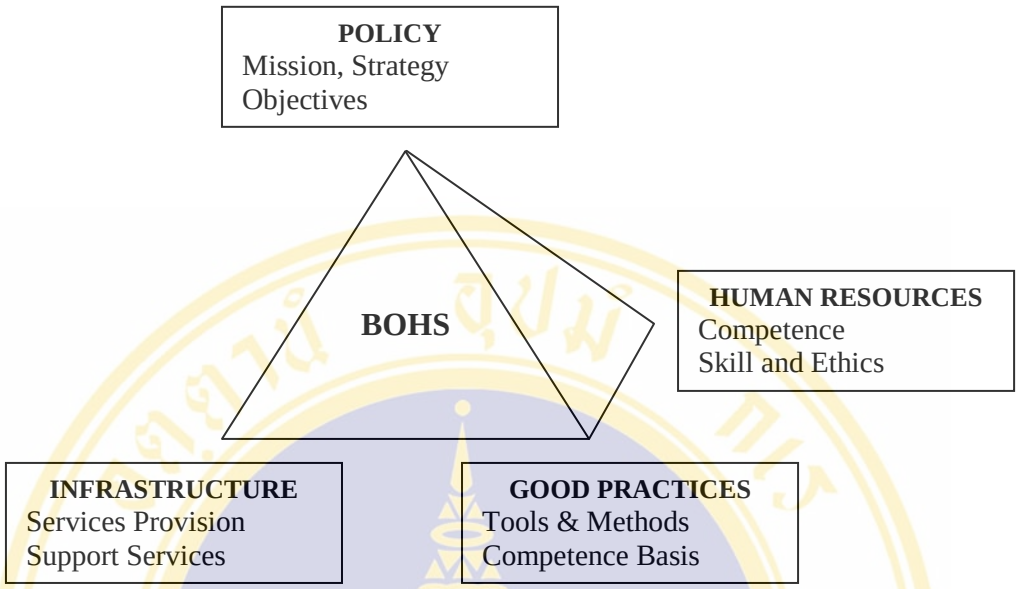

Figure 1 Overall Paradigm of BOHS (Rantanen, 2005a)

2.3.3.3 Content and Activities of Basic Occupational Health Services

The basic occupational health services are designed to keep the content and structure as simple as possible, but still provide competent occupational health services that meet the needs of the workplace and workers. The activities of the basic occupational health services are described as follows (Rantanen, 2004, 2005a, 2005b).

a) Orientation to the Workplace and Planning of Occupational Health Services

These activities involve collecting information on the typical hazards and problems of the economic sector in concern, available data on hygienic measurements, actions undertaken in the past, and records of injuries and diseases.

b) Surveillance of the Work Environment

Surveillance of the work environment is made for identification of workplace hazards and for planning their prevention and control.

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c) Surveillance of Worker Health

Surveillance of worker health is carried out to detect the occupationally determined diseases and to assess their consequence.

d) Assessment of Health and Safety Risks

Assessment of health and safety risks is made and judged for prioritization.

e) Information and Education

Information and education on risks to the employers and workers and advice on the need for preventive and control actions need to be performed.

f) Prevention of Accidents

Participation in actions and campaigns for prevention of accidents and major hazards is needed.

g) First Aid and Emergency Preparedness

Maintaining and training for first aid and participation in emergency preparedness are included.

h) Diagnosis of Occupational and Work-related Diseases

Diagnosis of occupational and work-related diseases and their referral to an assigned clinic needs to be made appropriately.

i) General Health Care, Curative and Rehabilitation Services

General health care, curative and rehabilitation services are provided as a part of occupational health services in many countries.

j) Record Keeping

Record keeping on activities and information on occupational risk, diseases and injuries is important.

k) Evaluation

Evaluation of the effects and impact of occupational health services is made using the recorded data.

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2.4 Stepwise Development of Infrastructure Regarding Occupational Health Services

An infrastructure is required for sustainable occupational health services. Rantanen (2005a) recommended that every country should analyze the situation of occupational health services in country using stepwise development of infrastructure as follows:

2.4.1 Stage I: Starting Level

A reasonable starting point is the services provided to the workers and workplaces, which are not protected by any occupational health services at all. This is the service delivered by field occupational health services workers, who have a short training in occupational health services and who work for a primary care unit or respective grassroots level facility. If it is possible, service providers are a nurse and safety agent. The content of service emphasizes the most important and severe health hazards and their prevention and control.

2.4.2 Stage II: Basic Occupational Health Services

The basic occupational health services are the infrastructure-based services working as close as possible to the workplace and communities. The model of services may vary depending on local circumstances and needs. The personnel include a physician and a nurse with training in occupational health working on full-time or part-time basis depending on needs and local circumstances.

2.4.3 Stage III: Internal Standard Service

This level is the minimum for each country to meet the ILO Convention No. 161. The service infrastructure has various alternative forms. The service content is primarily preventive, although curative services may be appropriate. The service should be provided by a specially trained expert (usually an occupational health specialist physician) and the team should preferably be multidisciplinary.

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2.4.4 Stage IV: Comprehensive Occupational Health Services (COHS)

Comprehensive occupational health services are usually found in big companies of industrialized countries or in the services provided by large occupational health services centers. Team work is multidisciplinary often including several specialists like specialist physician, occupational health nurse, occupational hygienist, ergonomist, psychologist, safety engineer and so on. The content of services is comprehensive with all aspects of occupational health related.

Hence, on the basis of such analysis, occupational health services in Thailand should be examined to show the degree of development.

2.5 Development of Occupational Health Services in Thailand

In Thailand, it was considered for long time that the Ministry of Public Health should be responsible for the main component of occupational health, while the Department of Labour and Ministry of Industry also be responsible but to a lesser extent (Wongpanich, 1985). The Ministry of Public Health has realized the importance of health services for the working population for several decades. Occupational health services have been emphasized under the Department of Medicine since 1967. Later in 1972, growth efforts in delivering occupational health services were remarkably improved by the establishment of the Division of Occupational Health which is currently called the Bureau of Occupational and Environmental Disease (Wutthipong, 1998).

2.5.1 Important Issues Implemented

In the preceding decade, occupational health services have been speedily delivered in health care facilities to cover working populations in all provinces nationwide under the Ministry of Public Health. These illustrated a significant concern as follows (Wutthipong, 1998; Chaikittiporn, 2002; Siriruttanapruk & Anantagulnathi, 2004; Department of Occupational Medicine, Surat Thani Hospital, 1998; Surat Thani Hospital, 2006).

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2.5.1.1 Developing Infrastructure

In respect to the development of infrastructure under the Ministry of Public Health, the Section of Occupational and Environmental Health in Provincial Public Health Offices and the Section of Occupational Medicine in Provincial Hospitals nationwide were established during the 1990's.

2.5.1.2 Developing Report System of Occupational Health Disease

The information report system of occupational health disease has been established under the existing disease report system of the Division of Epidemiology since 1978.

2.5.1.3 Training or Supporting Continuing Education

Training or supporting continuing education regarding occupational health of health care personnel was performed.

2.5.1.4 Allocating Special Equipment

Special equipment was allocated to 40 Provincial Hospitals in new industrial areas determined during the 1990's in order to be able to implement occupational health services. The special equipment allocated is described below:

a) Spirometer,
b) Vision Screener,
c) Equipment for testing physical fitness,
d) Audiometer,
e) Lux Meter,
f) Sound Level Meter,
g) Wet Bulb Globe Thermometer, and
h) Gas Meter.

In addition, some Provincial Hospitals also received laboratory equipment—Atomic Absorption Spectorphotometer.

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2.5.1.5 Collaborating and Implementing Important Projects

Several occupational health projects have implemented and coordinated with other related organizations (Wutthipong, 1998). In collaboration with the Office of Home-based Workers (OHW), the Ministry of Labor and Social Welfare has played important roles in home-based worker activities (Chaikittiporn, 2002). The workers who do the work at home have revealed having problems related to occupational safety; the rate rising from 2.8 percent in 1999 to 33.2 percent in 2002. Also, based on cholinesterase level examinations in farmers since 1992 to 2002, 13-29 percent of farmers had abnormal enzyme levels caused by pesticide exposure (Ministry of Public Health, 2005). As a result, numerous campaigns have been conducted to reduce pesticides and other chemicals utilization in farms by both the Ministry of Agriculture and Ministry of Public Health (Siriruttanapruk et al., 2006).

2.5.1.6 Research and Development

Several research and development activities are conducted both within and between ministries in establishing practice manuals, criteria of occupational disease diagnosis, and conducting research and development of occupational health services models. For example, 12 studies were performed in 2001 by the Bureau of Occupational and Environmental Diseases. Of this number, five studies focused on the situation and identification of occupational health problems in some particular occupations; four studies in training course development; and the rest in research and development of occupational health practice guideline (Siriruttanapruk & Anantagulnathi, 2004).

2.5.2 Current Concerns

Since high risk occupations are in both agricultural and industrial sectors, occupational health services need to be developed to cover all working population.

The important topics that still need to be clarified involve several aspects of occupational health issues as follows (Siriruttanapruk & Anantagulnathi, 2004):

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a) Identification of the situation, magnitude of problems, causes and related factors in occupational health,

b) Development of models related to surveillance systems, health promotion, disease prevention and control measures, integrative management, and quality of services in private sector,

c) Development of information systems,

d) Development of standard guidelines regarding legislation, health and environment assessment, and laboratory standard, and

e) Development of training curriculum for health personnel and local authority personnel.

Currently, several national programs and activities in occupational health have been conducted by the Bureau of Occupational and Environmental Diseases such as the proactive disease surveillance program, the silicosis elimination project, the Healthy Workplace, and the development of the occupational health services model in Thai primary care units (Siriruttanapruk & Anantagulnathi, 2004; Siriuttanapruk et al., 2006).

2.6 Development of Occupational Health Services in Thai Primary Care Units

Before knowing the status of occupational health services in Thai primary care units, it is useful to start with an understanding on primary care units, the new generation in Thai health service system launched in 2001 under health care reform in Thailand. It will be followed up by ongoing efforts to develop the occupational health services model in Thai primary care units of the Bureau of Occupational and Environmental Disease.

2.6.1 Development and Standard of Primary Care Units

The Primary Care Unit (PCU) has been defined as the primary medical and health care units responsible for delivering primary health services in an integrated, continuous, and holistic manner with easy accessibility with a consultant and referral system (Department of Health Service Support, n.d.).

According to the universal coverage policy, a primary care unit will be the main contractor and a unit for population registration instead of a

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big hospital. Direct access to receive health services in hospital is not permitted, except in the case of accident and emergency care. The Contracting Unit for Primary Care (CUP) must manage and be responsible for establishing a primary care unit or a network of primary care units to provide services. The primary care units instituted must be qualified as required by the standard as follows (Srivanitchakorn, Athimanon, Chalordech, Surakitkosol, and Sookpordee, 2002; WHO, 2004).

2.6.1.1 Instituting Primary Care Units

a) Primary care units are established for a population of 10,000 or less. A CUP may have many primary care units.

b) In the area where a hospital is located, the primary care units must be available with the following conditions:

1) In case of less than 10,000 people registered, a primary care unit can be in the area of the hospital with the convenient service system.

2) In case of more than 10,000 people registered, one primary care unit is in the area of the hospital is responsible for 10,000 people, and the other primary care units must be in the community for the rest of people.

3) In case a primary care unit is inside the hospital, the primary care units must be separated from the out-patient department and must have an assigned team to provide services conveniently and fast.

c) Each primary care unit must be placed close to the responsible population (transportation time less than 30 min.).

Figure 2 shows an example of a community hospital that has a network of primary care units which includes both primary care units of the hospital and primary care units transformed from health centers.

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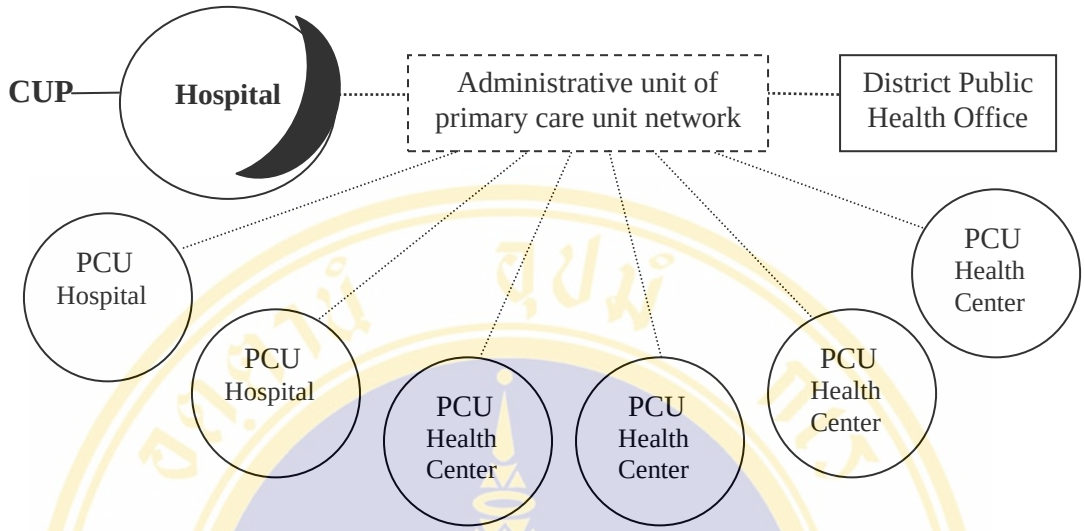

Figure 2 Community Hospital and Its Network of Primary Care

2.6.1.2 Standard of Primary Care Units

The contracting unit for primary care has a role in managing and supporting each primary care unit compatible with the following standards:

a) Capability Standard

1) Provide daily services for all symptom groups in combination with basic recovery and health education for clients. Each primary care unit must be available at least 56 hours/week, link services within the network, and have emergency care both during and after operating hours.

2) Provide at least 40 hours/week for prevention, treatment, and rehabilitation of dental services inside primary care units or refer patient to other units

3) Provide daily services for health education.

4) Provide at least 1-2 days/week for health promotion and disease prevention services such as prenatal care, postnatal care, and family planning including follow-up for continuing services.

5) Provide at least 1-8 days/month for childcare services.

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6) Provide home visits for treatment and continued follow-up in order to make contact, create understanding of health care for family members and giving necessary treatment.

7) Provide at least 10-15 hours/week for proactive services in the community for assessing family's health and factors affecting their health in order to plan and implement health promotion and disease prevention for people in responsible areas.

8) Provide basic rehabilitation services.

9) Provide basic laboratory services as needed and quickly referral system to other related units.

10) Provide pharmacy services, including purchasing system, storage, prescription, and quality control of medicines.

b) Personnel Standard

1) The ratio of nurses or public health personnel per population is not less than 1: 1,250. Of these, one-fourth should be professional nurses.

2) At least three-fourths of nurses and public health personnel must be full time staff in primary care units.

3) The ratio of physicians per population is 1:10,000. In the remote area or where physicians are unavailable, a physician must be substituted by two professional nurses. However, the ratio of physicians per population for consulting must not be less than 1:30,000.

4) The ratio of dentists per population is 1:20,000. In case of inadequate dentists, a dentist must be replaced by two dental health personnel. However, the ratio of dentists per population for monitoring must not be less than 1:40,000.

5) The ratio of pharmacists per population is 1:15,000. In case the pharmacists are not enough, a pharmacist must be replaced by two pharmaceutical personnel or others trained in basic pharmacy. However, the ratio of pharmacists per population for monitoring must not be lower than 1:30,000.

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c) Management Standard

Each primary care unit must have appropriate management systems as follows:

1) The information system of people in the responsible area to know who and where regarding people in responsible area.

2) The system of continuous services such as a appointment and follow-up system.

3) The support system for fast and convenient services.

4) The client's data record system for supporting health promotion or qualified services.

5) The develop and monitor system.

6) The management system.

d) Material and Facility Standard

1) Have equipment and tools for treatment, health promotion, disease control and prevention, and rehabilitation as required by standard and have infection control systems.

2) Have enough areas that must be private and clean enough for disease diagnosis, treatment, and consultation.

3) Have rapid communication systems with other health units in the network.

4) Have transportation systems for emergency referral to hospital.

2.6.1.3 Referral and Support System for Networking

Each primary care unit must have appropriate referral and support systems as follows:

a) The referral system to and from the unit within the network.

b) The referral system for referring patients to secondary and tertiary care levels.

c) The referral system for investigations.

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d) The referral system for dental services.

e) The referral system for patient information both within and outside the network.

2.6.1.4 Quality Control and Monitoring System

The primary care units must have the following:

a) Standard guidelines for common health problems.

b) Information systems.

c) Quality control system of primary care units within the network

d) The system of human resources development within the network.

e) The development system of primary care units within the network.

2.6.2 Current Number of Primary Care Units

Since 2002, under the universal coverage of health care scheme, some large health centers became primary care units. There were 9,765 health centers in 2003 (Ministry of Public Health, 2005). At present, 6,608 primary care units have been improved from health centers. Another 885 primary care units were remodeled from other types of health facilities, including hospital-initiated community health service centers, municipal health centers or newly established primary care units (Department of Health Service Support, 2005; Ministry of Public Health, 2005).

Also, during the process of development, the number of personnel in each primary care unit is still not stable. The Ministry of Public Health now is in the process of assigning a dental auxiliary, a professional nurse, and a health technician to each primary care unit (Ministry of Public Health, 2005). However, most primary care units still do not have a physician or pharmacist (Department of Health Service Support, 2005).

As presented, the primary care units remain in the developmental stage and need to grow further in order to reach the level of good

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quality as defined in the manual of primary health care unit standard evaluation and quality assurance.

2.7 Development of Occupational Health Services in Thai Primary Care Units

The Bureau of Occupational and Environmental Diseases has launched the first project at the national level that has developed the occupational health services model for primary care units/health centers (Siriruttanapruk et al., 2006). The 46 staff of 10 primary care units/health centers in five provinces of pilot project were offered the 5-day training course on occupational health services. As a consequence, occupational health services have been delivered for agricultural workers in 7 villages and for other community workforces in 3 villages, counted as 70 and 30 percent of target area, respectively. The activities of occupational health services delivered included: workplace survey, data analysis, communicating with workers on the results of the surveys for developing methods to solve problems, and conducting pesticide poisoning screening test for agricultural workers. Also, Siriruttanapruk and colleagues revealed that occupational health services models in primary care units/health centers could be divided into two major types: occupational health services provided in primary care units/health centers or passive services, and occupational health services provided for target population in community or proactive services. In the former, occupational health services emphasize provision of medical treatments or primary treatments for those injured or ill persons and community occupational health services. Roles and function of the health staff focused on diagnosis of diseases or illnesses of working populations related to their work and using data for surveillance of diseases in the working population. In the latter, the services provided for the target population in the community, for which most of the population comprises agricultural workers, emphasizes prevention of occupational diseases and injuries, including health promotion for working populations by integrating these activities into the existing services in primary care units/health centers (Siriruttanapruk et al., 2006).

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The occupational health services model in Thai primary care units seems to be compatible with the occupational health services model in primary health services as defined by Rantanen (2005a) due to the services delivered in primary care setting. However, regarding stage of development of infrastructures as mentioned previously, the development of occupational health services in Thai primary care units appears to be at the first stage of starting level rather than at the second stage of basic occupational health services. This point of view can be explained by two main concerns. First, the health care providers are other trained health personnel instead of a trained physician and nurse as emphasized. Second, the working population targeted for providing occupational health services is focused on agricultural sectors rather than all groups of the working population.

These may result from several limitations in delivering occupational health services in Thai primary care units including the clarity of the policy on this issue and the lack of resources, while it remains in the developmental process under the universal coverage scheme. Hence, implementation of occupational health services in the Thai primary care setting needs to be developed further.

3. Theoretical Framework

The place of occupational health activities in an organization is experiencing change (Moser, 1999). When introducing change in a system, it is crucial to fully understand the complexity of the system and the multiple perspectives of its component parts (Kaner, Steven, Cassidy, and Vardy, 2003). Recognizing the complex and comprehensive nature of occupational health systems (Guidotti et al., 1989; Rex, 1991; Cooper & Dehr, 1996; Childre, 1997; ILO, 2000; Rogers, 2003), the researcher will develop conceptual model for this study based on Rogers' model of occupational health programs and services.

Rogers' Model of Occupational Health Programs and Services

Rogers' model is an application of the systems approach to the occupational health unit. The Rogers' model (2003) (Figure 3) illustrates the interrelatedness of the system as a whole, its external environment, and the internal

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functioning of the system (through the flow of inputs, throughput processes and related interventions, and outputs) to achieve the goals or outcomes measured by feedback or evaluation mechanisms designed.

3.1 Environmental Influences

Occupational health units are affected by external contextual factors that include: (a) population and health care trends reflecting overall workforce characteristics; (b) legislation/regulation and politics affecting industry and occupational health directly and indirectly (c) economics influencing business, employment rate and patterns that indirectly affect occupational health; and (d) technology and its advances involving work processes, employment, systems for more effective monitoring and analysis of work-related illness and injury trends, and computer application for more efficient communication. The relationship of external context and internal function of occupational health unit is depicted via the dotted interface line (Figure 3).

3.2 System Inputs

The system inputs for the delivery of occupational health programs or services includes the following components: (a) the corporate mission of management's commitment in concern to provide worksite health care program; philosophy of management about work and health and their interrelationships affecting workers' productivity, morale, and well-being; and culture in relation to both management's and workers' attitudes, values, and beliefs about work and health ; (b) the workforce in terms of size, distribution, demographic characteristics, health status indicators, and workers' perception and associated behavior; the work in regard to type of work, related work processes; and related hazards in work process, product, and by-products, workers job tasks and demands, and working conditions; (c) the human resources in view of interdisciplinary team, adequate, and appropriate education, knowledge, and related skills; and operational resources including an adequate budget, facilities, equipment, and day-to-day operational supplies necessary; (d) the information resources and data related to making decisions; and (e) the organizational and

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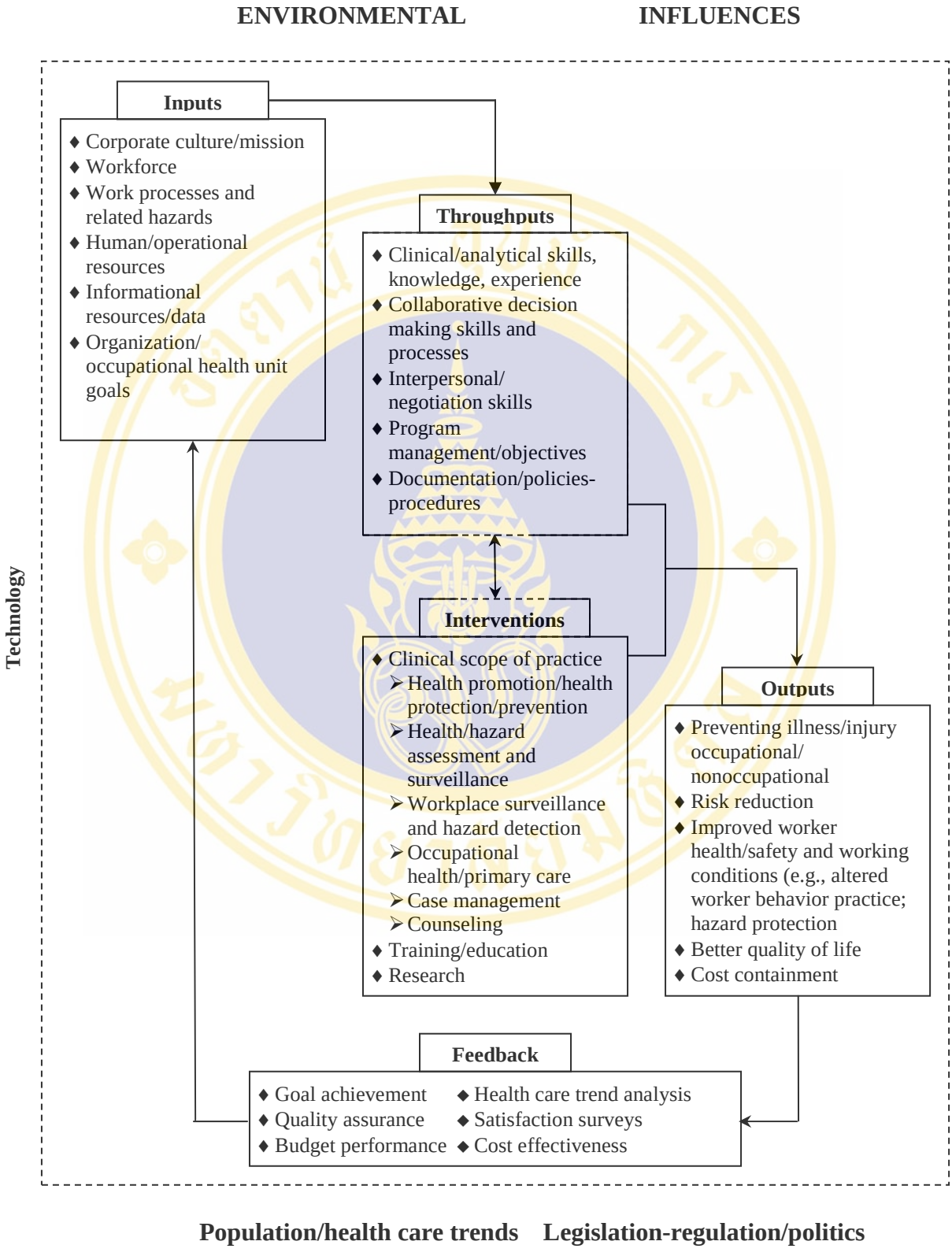

Figure 3 Rogers' Model of Occupational Health Programs and Services (2003)

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occupational health units goals being the blueprint or direction to objectively determine the activity of occupational health unit. System inputs interact together and with the environment and are ultimately converted into system output.

3.3 System Throughput Process and Interventions

System throughput process and interventions are various depending on the system needing to achieve the desired system outputs through organized interventions. The throughputs process the professional need to analyze system inputs, determine performance objectives, develop and implement occupational health policy and procedures, identify and prioritizing interventions, use effective interpersonal skill to communicate to target group and sponsor supported occupational health unit, make collaborative decision with interdisciplinary team, management, and workers.

This means that the professional must be adequately trained, skilled, and prepared and appropriately licensed and/or certified in order to identify and manage occupational health problems, develop comprehensive and specific occupational health services as required by law to reach worker needs, understand business contexts, and continuously examine and monitor the effective decisions made. Interventions derived from the scope of practice are products of the throughput process designed to meet the needs identified through throughput processes and leading to system outputs. Research is one of the essential components in the throughput processes.

3.4 System Outputs

System outputs reveal the product of the occupational health units desired. The objectives identified in throughput process can be measured to show as system outputs. The system outputs are involved preventing work-related illness and injury such as decreasing incidence of work-related injuries, improving health and safety of workforce and work environment such as risk reduction and better quality of life programs, and cost-effective programming such as declining absenteeism.

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3.5 System Feedback

The feedback or evaluation mechanism is designed to know that the system outputs are in compliance with worker needs, enterprise goals, and occupational health unit goals. The important aspects of system feedback are goal achievement, quality assurance, budget performance, health care trend analysis, satisfaction surveys, and cost effectiveness.

4. Related Research and Literature in the Delivery of Occupational Health Services in Primary Care Settings

The application of Rogers' model as a conceptual approach provides the researcher a theoretical framework to examine occupational health services units systematically that will help to meet the demand of nurses and public health personnel that are directed toward improving worker health and reducing work-related risks desired.

Incorporating the Rogers' model (2003), the researcher restricted in part of internal function of occupational health services unit. This means the assessment of the provision of occupational health services deliberately designed is the implicit idea of the consideration of changes in inputs followed by changes in throughput processes and interventions resulting in important changes in outputs and feedback or evaluation mechanisms (Ashford & Rest, 1999; Rogers, 2003). Related research and literature are examined regarding system inputs, throughput processes, outputs, and feedback.

4.1 Related Research and Literature in System Inputs

According to Rogers' model (Rogers, 2003), the system inputs for the delivery of occupational health programs or services consists of several components, including the company mission, philosophy, and culture; the workforce; the work, work processes, and related hazards; the available human and operational resources; the information resources; and the organizational and occupational health unit goals as mentioned earlier. Existing research showed some aspects studied in relation to system inputs as follows:

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4.1.1 Occupational Health Information

A few published studies have shown their concern for the necessity to identify occupational health needs of their target population. For example, the study of activity profiles of the occupational health services in a multinational company by Bratveit and colleagues (2001) explained that health hazards in the production units considered by the project coordinators were repetitive work, noise, dermal exposure to detergents and dyes, and sharp needles and knives. Manual handling of heavy boxes and repetitive work were the most apparent health hazards in the distribution centers. As a result, the data from surveillance of the working environment used as the inputs for creating plans to solve these problems were most often given at health and safety meetings (Bratveit et al., 2001).

In addition, evidence exists to show the concern of the delivery of occupational health services for health care providers in primary care setting. For example, Grime's study (2005) evaluated occupational health services needs of general practitioners and their staff in primary care trust. The results showed that the highest priorities of occupational health services needed was advice on health and safety law and fitness for work assessments, and the lowest was hepatitis B immunization.

Besides, Siriruttanapurk et al. (2006) showed that data collection of working history, job characteristics, and health risks of workers were integrated in existing health services for occupational health services of ten primary care units in five pilot provinces.

4.1.2 Occupational Health Competencies of Public Health Personnel

With respect to human resources, the best way to achieve comprehensive occupational health services is a multidisciplinary approach (Rogers, 2003). Occupational health services are essentially multidisciplinary in nature involving the services of physicians, nurses, hygienists, safety professionals, toxicologists, ergonomists, psychologists, educators and so on (Rogers, 2003; Levy et al., 2006). It is part of public health, defined as the collective performances to

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assure the condition in which people live and work are healthy (Rogers, 2003; Williams, 2004; Levy et al., 2006). The basic concern is the health of the worker, and that all associated activities are a stewardship responsibility of all those who work in public health or in health care (Jeyaratnam, 1992; Levy et al., 2006). However, health personnel educated in occupational health are rare, especially in the developing nations (Jeyaratnam, 1992; Levy et al., 2006). As a result, many developing countries propose an alternative way to integrate occupational health and environmental health services with primary medical care and with broader range of public health services to relieve these problems (Levy et al., 2006). However, it seems to be that the effort to deliver occupational health services in primary care setting led to virtually duplicate the need for health professions, and impose further burdens on an already inadequate pool of health personnel (Jeyaratnam, 1992).

Jeyaratnam (1992) illustrated two facts of history that largely conditioned the development and the present status of occupational health in a great many countries of the world. First, in the provision of health care, planners have quite appropriately developed programs for target clients with a common characteristic, who were probably underprivileged, vulnerable, and at high risk for special attention; in this they were supported by special health programs. It was this concept that programs for the care of the mother and child and the schoolchild as well as programs for family planning and immunizations were developed. All activities led to a great enhancement in the health of those specific sectors of the community, but the planners did not considerate adequate the provision of health care to the working population. The workers' health was not considered a mainstream interest of the health sector; rather, occupational health was considered as an implementation aimed at the control of work practices. Second, lack of interest on the part of the medical world in occupational health resulted from the recognition the relationship between occupational and diseases (Jeyaratnam, 1992). This is in compliance with the study by Elms and colleagues (2005) that lack of occupational health knowledge of general practitioners and practice nurses made it difficult to assess occupational health problems and provide advice in occupational

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health issues. Likewise, O'Hara et al. (2004) found that general practitioners and practice nurses felt ill equipped to deal with some of the occupational health issues in primary care setting. The limited general occupational health knowledge of general practitioners and practice nurses was a barrier to addressing occupational health (O'Hara et al., 2004).

The study by Harber and Merz (2001) found that inadequate knowledge was one of two predominant barriers along with limited time to recognizing occupational diseases.

Siriruttanapruk et al. (2006) found that after received occupational health training, most public health staff in Thai primary care units were able to correctly identify occupational health hazards, assess and control of occupational risks factors, and provide appropriate health services.

These findings showed that occupational health services calls for occupational health professionals be held accountable for possessing the skills and abilities necessary to provide competent care and produce desired outcomes (White, Cox-Cae, and Williamson, 1999). Olson et al.'s study (2005) listed competencies in six common themes—recognition, evaluation, control, communication, behavior, and management—of all occupational health disciplines for consideration in adopting as a set of interdisciplinary core competencies of occupational health and safety professionals.

4.1.3 Adequate Public Health Personnel

A shortage of health care providers trained in occupational health is a common problem of most countries, particularly the developing nations (Jeyaratnam, 1992; Levy et al., 2006). Also, since occupational health services are complex, it needs several professional working as a multidisciplinary team. Bratveit et al.'s study (2001) revealed that occupational health services units in twenty companies studied have at least three of the following professions employed: doctor, nurse, occupational hygienist, ergonomist, social worker and psychologist employed in interenterprise and multidisciplinary services.

Siriruttanapruk and colleagues (2006) discovered that there are limitations in the number of staff working in Thai primary care units, while

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there are various responsibilities and plenty of other political tasks assigned to the staff. As a result, delivery of occupational health services in Thai primary care units is difficult.

4.1.4 Operational Resources

Operational resources pertain to facilities, budget, equipment, and supplies necessary to deliver occupational health services (Rogers, 2003). Regarding operational resources, Siriruttanapruk et al. (2006) revealed that one of the limitations resulting in difficulty and delay of occupational health services provision in Thai primary care units was that no budget allocation existed for occupational health issues in Thai primary care units.

4.1.5 Occupational Health Unit Goals

The last element of system inputs is the occupational health unit goals. The primary philosophical goal of occupational health services is the preservation, protection, and improvement of worker health. The ultimate goal is to ensure a safe and healthful work environment as well as protect and promote the physical and mental well-being of the worker (Rogers, 2003). However, the goals for each occupational health services unit can be different. This can be pointed up by the definition of occupational health services where the ILO focused on the prevention of work-related aspects of ill-health, while the WHO definition includes health promotion activities of a general nature. Of course, there is variation in the content of occupational health services (Husman, 1999). Also, an empirical study by Bratveit and colleagues (2001) showed that the activity profiles of occupational health services of the inter-enterprise, multidisciplinary services used a preventive approach focused on surveillance of workers' health in relation to work and on actions associated with improvement of the working environment rather than curative services for individual workers, while the occupational health services made up of individual physicians and nurses, focusing on curative services, spent much of their time on treatment of occupational and non-occupational diseases (Bratveit et al., 2001).

In Thai primary care units, existing occupational health unit goals depended on occupational health policies of higher agencies. However, the

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occupational health issue is given low priority by the Ministry of Public Health, causing it not to receive high concern in primary care units as well (Siriruttanapurk et al., 2006).

4.1.6 Summarizing System Inputs of Occupational Health Services Model in This Study

Based on Rogers' model (2003), incorporating empirical studies, the system inputs of occupational health units in this study includes occupational health information (Herbert et al., 1997; Bratveit et al., 2001; Gime, 2005; Siriruttanapurk et al., 2006), occupational health competencies of public health personnel (Harber & Merz, 2001; O'Hara et al., 2004; Olson et al., 2005; Elm et al., 2005; Siriruttanapurk, et al., 2006), adequate public health personnel (Bratveit et al., 2001; Siriruttanapurk et al., 2006), operational resources (Bratveit et al., 2001; Siriruttanapurk et al., 2006), and occupational health unit goals (Bratveit et al., 2001; Siriruttanapurk et al., 2006) that showed a direct positive effect on system throughputs, and an indirect positive effect on occupational health services, system outputs, and feedback by affecting system throughputs; system throughputs and occupational health services; system throughputs, occupational health services, and system outputs, respectively. Although these effects in previous studies regarding occupational health services have not been shown obviously in terms of statistic significance due to the lack of rigorous quantitative research methodology and theoretical framework, the study of Lee & Mills (2000) revealed the patient profile variables (as parts of structure dimension) were strong predictors of overall resource use (process dimension). Also, prognosis (as a part of structure dimension) was the strongest predictor of discharge outcomes (outcome dimension).

4.2 Related Research and Literature in System Throughput Processes

System throughput processes include numerous variables, depending on the system and its needs (Rogers, 2003). Major throughput processes found in existing studies include management to operate occupational health services delivery; development of records and reports system; training, continuing

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education, and research of public health personnel; communication about occupational health services to clients; and collaborative network building.

4.2.1 Management to Operate Occupational Health Services Delivery

Herbert et al.'s study (1997) has shown their management to deliver occupational health services in terms of staffing and determining assignment. For occupational health clinics, Herbert et al. also staffed an occupational medicine physician from the Mount Sinai-Irving J.Selikoff Occupational Health Center and a health, safety specialist from the workers' union, and existing primary health care providers in Union Health Center to provide occupational health services. For outreach programs, the health and safety specialist was assigned to educate workers and employers about workplace hazards, conduct worksite evaluations, and provide effective feedback to employers in regard to strategies for hazard abatement.

In managing for delivering outreach occupational health services, Rex (1991) planned activities and locked a budget for delivering services; and allocated 1 part-time doctor, 1 primary care nurse, and 1 lay health educator to work for outreach programs of occupational health services.

4.2.2 Development of Records and Reports System

As occupational health information is needed to help the health professional in making decisions in occupational health issues (Herbert et al., 1997; Bratveit et al., 2001; Rogers, 2003; Gime, 2005), the development of records and reports are necessary (Myerson & Parker-Conrad, 2001).

Herbert et al.'s study (1997) has emphasized this crucial requirement by showing the maintenance system of a database for all patients that could be seen at Union Health Center Occupational Medicine Clinic and was also linked to the statewide occupational disease surveillance efforts of the New York State Clinic Network.

The study of Siriruttanapruk and colleagues (2006) showed that records of illness data to family folder and use of occupational disease report form s were a necessity in occupational health services delivery.

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Elm et al.'s study (2005) revealed 75 percent of general practitioners inquired about the patients occupation and 81 percent recorded the type of occupation in the medical records, whereas practice nurses routinely recorded patients' occupation (Elm et al., 2005).

4.2.3 Training, Continuing Education and Research of Public Health Personnel

Occupational health services in primary care settings are a new perspective that needs trained personnel in occupational health (Jeyaratnam, 1992; Levy et al., 2006). Continuing education and training is necessary to improve and update knowledge, skills, and abilities to apply in throughputs process (Rogers, 2003). Education and training are corner-stones in the development of occupational health programs in all countries (Phoon, 1985; 1992). Empirical studies have confirmed this important issue.

The study by Herbert et al.'s study (1997) demonstrated that prior to the initiation of the occupational medicine clinic, training series were performed for staff in order to be qualified to conduct occupation medicine clinics that included: (a) training physicians in the basic principles of occupational medicine; (b) a health and safety worker, who has a master's level in occupational health trained in occupational illness and workers' compensation; (c) primary care provider trained about the recognition of occupational disease, and access to the worksite.

Also, the study by Bratveit et al. (2001) asked occupational health representatives to select which in-service/training courses that they would like to attend to increase their competence in occupational health. The findings indicated that the preventive issues of occupational health were needed for more competence. Courses in surveillance of the working environment and in ergonomics were given the highest priority for the occupational health representatives from service units having both preventive activity and curative activity profiles (Bratveit et al., 2001).

The study by O'Hara et al. (2004) indicated that the lack of professional training and knowledge in occupational health was the specific

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concern of general practitioners and practice nurses and considered that further training would help the delivery of occupational health in primary care.

Siriruttanapruk and colleagues (2006) offered 5-day training course on occupational health services to enhance the capacities of the primary care units' staff in providing occupational health services.

Bratveit et al.'s study (2001) uncovered that a doctor provided occupational health services in interenterprise and multidisciplinary services was specialized in occupational medicine for at least 1 year. Whereas, 1 in 10 external doctors cooperating with internal or external nurses had at least 1 year of specialization in occupational medicine, and two of them were attending advanced courses within the occupational medicine field at the time of the study (Bratveit et al., 2001).

Benavides et al. (2005) highlighted that general practitioners needed better training in occupational medicine from the findings of their study that a significant proportion of diseases causing sick leave among workers attending the primary care setting were not recognized as occupational diseases.

The studies by Hughes and colleagues (1999, 2003) showed that doctors who provide occupational health services holding specialist qualifications increased in proportion. Namely, the numbers of doctors who obtained formal Faculty of Occupational Medicine qualifications (fellows, members or associates) increased from 52 percent in 1998 to 60 percent in 2001.

Research is also an important element in throughput process. Herbert et al.'s study (1997) was a good example that experience in conducting a research was needed to know the presence of symptoms suggestive of occupational diseases of garment workers prior to starting their development of the occupational medicine clinic.

4.2.4 Communication about Occupational Health Services to Clients

O'Hara et al. (2004) found that poor communication with employers also created problems influencing decisions made by primary care manager and planners. Elms et al.'s study (2005) has emphasized those poor routes

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of communication with the employer often contributed to insufficient responsibility of employers. Both studies showed the need of more responsibility by employers and increased state provision for patients without occupational health services at their place of employment (O'Hara et al., 2004, Elms et al., 2005).

The study by Rex (1991) showed techniques in approaching both management and workers; either workers participated to negotiate with management themselves or Rex's study team presented management with a proposal. However, the capacity to secure agreement from management for worker services is much less efficient than that by the health care team.

The study by Bratveit et al. (2001) showed that the results from surveillance of the working environment were utilized to give advice on the control of hazards in the working environment.

4.2.5 Collaborative Network Building

Making collaborative decisions with appropriate interdisciplinary team members, management, and workers is crucial in the development and implementation of effective strategies to improve worker health (Rogers, 2003).

The study by Herbert et al. (1997) reported that occupational health clinic of the Union Health Center was the result of a collaborative effort among a union-based comprehensive health care center, a union health and safety department, and an academic occupational health center located within a statewide occupational clinic network.

Rex's study highlighted the importance of collaboration of tripartite, which focuses on agreements between management, labour, and health service providers.

Also, the study by O'Hara et al. (2004) and Elms et al. (2005) has highlighted the collaboration required between employer occupational health services and primary care services.

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4.2.6 Summarizing Throughput Processes of Occupational Health Services Model in This Study

Due to Rogers' model (2003) consolidating with empirical studies, the system throughput processes of occupational health units in this study includes management to operate occupational health services delivery (Rex, 1991; Herbert et al., 1997; Bratveit et al., 2001), development of records and reports system (Herbert et al., 1997; Elm et al., 2005; Siriruttanapruk et al., 2006); training, continuing education, and research of public health personnel (Herbert et al., 1997; Hughes et al., 1999, 2003; Bratveit et al., 2001; O'Hara et al., 2004; Benavides et al., 2005; Siriruttanapruk et al., 2006), communication about occupational health services to clients (Rex, 1991; Bratveit et al., 2001; O'Hara et al., 2004; Elm et al., 2005), and collaborative network building (Rex, 1991; Herbert et al., 1997; O'Hara et al., 2004; Elm et al., 2005) that showed a direct positive effect on occupational health services and output, an indirect positive effect on system outputs by affecting occupational health services, and an indirect positive effect on feedback by affecting occupational health services and system outputs.

4.3 Related Research and Literature in Occupational Health Services

Over the last five decades, an effort to struggle against and alleviate occupational accidents and diseases required social partners (employers and employees) and governments to establish an occupational health infrastructure, with occupational health services as an advisory and supportive component of that infrastructure (WHO, 2002). In recent years there has been increasing concern for the justification of activities conducted for occupational health services from employers, governments, trade unions, insurance companies, etc. (Bratveit et al., 2001). There is a variation in the characteristic of occupational health services (Husman, 1999; Muto, Mizoue, Araki, Miyazaki, and Marut, 2002).

Published studies have described the different activities of occupational health services in different locations. For example, Bratveit et al.'s study (2001) showed the general profile occupational health services in a multinational company included: (a) curative services for occupational diseases,

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which were provided for occupational diseases/injuries, first aid, rehabilitation/resettlement of workers; (b) curative services for non-occupational diseases that included vaccination programs; (c) preemployments examination before or after the workers had signed the work contract and specific health examination; (d) activities related to the work environment such as surveillance of the working environment and advice on the control of hazards and advice on planned changes in the working environment; and (e) health education/lifestyle/ health promotion such as smoking cessation, AIDS awareness, healthy diet, physical activity, etc (Bratveit et al., 2001).

The occupational health services provided in the primary care setting in Herbert et al.'s study (1997) included (a) clinical care, which includes evaluation of work-related conditions; treatment of work-related conditions and feedback to employers, unions, and public health agencies; rehabilitation services facilitating workers' safe return to employment; social work services; assistance in obtaining workers compensation and disability benefit; and worker education; (b) disease prevention services that include industrial hygiene services and feedback to public health and regulatory agencies; and (c) data management that was designed to allow surveillance for occupational disease.

The study of Rex (1991) proposed an outreach program for occupational health services that was composed of health promotion; on-site screening at plants; fast queue curative and emergency care at primary care setting; information systems of local industrial health problems; and referrals for specialized consultations that included industrial hygiene. Health promotion activities presented half-hourly sessions once a month at the workplace during a tea or lunchtime. Health promotion topics were selected from a list including AIDS and other sexually transmitted diseases, smoking, alcohol, occupational hygiene (specific to the industry concerned), tuberculosis and family planning. On-site clinics were offered with annual visits to the workplace by a primary care nurse. If it was possible, workers are screened for both conditions related to work and other common diseases such as hypertension. The service included full medical examination, basic medication, referring to the primary care setting with support

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from a referral system to a medical officer and the National Centre for Occupational Health. A computerized record system was planned to be implemented for a valuable database. A fast queue clinic was accessible for all members of the workers' health outreach program, which was staffed by nursing clinicians and referral system to a doctor available at all times.

Sirirattanapruk et al.'s study (2006) discovered that occupational health services in five pilot provinces were divided into two types, passive and proactive services. The former emphasized the provision of medical treatments or primary treatments for those injured or ill persons and then utilization of the data for surveillance of the diseases in the working population. The latter were the services provided for the target population in the community and emphasized prevention of occupational diseases and injuries, including health promotion for the working population. Occupational health services provided in these pilot primary care units are the integration of additional activities to existing health services, including collection of working history, job characteristics, risk factors affecting the health of workers for early diagnosis of occupational diseases; record of illness history to family folders; implementation of proactive occupational health services in the community by emphasizing participation of community and workers; identification of working hazards using risk assessment forms and health records for employees aged 15 years and over; collection and analysis of data, prioritization of problems, problem-solving; and monitoring activities at regional, provincial, and central level.

Elms et al. (2005) stated that occupational health services was recognized as a special issue that needed experts for better advice for general practitioners and practice nurses, support services as well as referring patients. Improved referral routes were identified as a factor that would help addressing the patients' occupational health needs.

A referral system was needed even in the fairly perfect occupational health units as in Herbert et al.'s study (1997). Garment workers, deemed to have definite occupational health diseases, were referred to the Mount Sinai-Irving

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J. Selikoff Occupational Health Clinical Center for further, specialized treatment and help for workers' compensation.

Nevertheless, a few studies showed the concern in establishing occupational health services for health care providers in the primary care setting. For example, the study by Hughes and colleagues (1999), aiming to know the current level of provision of occupational health services in the National Health Service (NHS), showed that 99.6 percent of trust and health authority employers claimed that some form of occupational health services were provided to their employees, but no service was provided to other staff such as general practitioners, general dental practitioners, and their staff. Only about a third to a quarter of NHS staff had accessed to a specialist occupational physician.

This illustrates that occupational health services has a long list of tasks that bear on workers' health. The concept of occupation health service is different in different countries and problems blossom (Parmeggiani, 1985; Husman, 1999). However, Parmeggiani (1985) emphasized that the activity of occupational health services was stated essentially as a preventive nature since 1959. The occupational health services are dedicated for total health, not limited to diseases of occupational, to be achieved by means of close coordination or full integration of occupational health services with general health services (Parmeggiani, 1985).

In conclusion, due to Rogers' model (2003) consolidating empirical studies, the occupational health services of occupational health units in this study includes work and health risk assessment (Bratveit et al., 2001; Sirirattanapruk. et al., 2006); health education, health promotion, and disease and injury prevention (Rex, 1991; Herbert et al., 1997; Bratveit et al., 2001; Elms et al., 2005; Sirirattanapruk. et al., 2006); curative and referral services (Rex, 1991; Herbert et al., 1997; Bratveit et al., 2001; Elms et al., 2005; Sirirattanapruk. et al., 2006); and data management (Rex, 1991; Herbert et al., 1997; Sirirattanapruk. et al., 2006), which were divided into two categories—outreach and on-site occupational health services (Rex, 1991; Sirirattanapruk. et al., 2006)—and showed a direct positive

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effect on system outputs and an indirect positive effect on feedback by affecting system outputs.

4.4 Related Research and Literature in System Outputs

System outputs reflect the products or services of the occupational health unit related to achievement on a healthy worker (Rogers, 2003). The objectives in program planning should be measured to present effective achievement. For example, the objective, "provide occupational health services to an underserved population," is seen to be at high risk of the development of occupational disease. Herbert et al.'s study (1997) reported that garment workers, a largely minority population potentially at risk of a number of occupational health disease, received services delivered. From July 1990 to May 1993, 208 new patients visited the occupational medicine clinic that reflects that existing services are desired, objectively.

Sirirattanapruk et al.'s study (2006) concluded that occupational health services offered for agricultural work groups in seven villages, for other community workforces in three villages.

Rex's study (1991) revealed that fifty-one factories were approached for outreach occupational health services, and 34 agreed to the service. Fifteen on-site annual periodic examinations were conducted; 1,145 workers were examined.

In conclusion, due to Rogers' model (2003) consolidated with empirical studies, the system outputs of occupational health units in this study relied on the practice of occupational health services by counting the number of activities delivered, both outreach and on-site occupational health services (Rex, 1991; Herbert et al., 1997; Sirirattanapruk et al., 2006) that showed a direct positive effect on system feedback.

4.5 Related Research and Literature in System Feedback

Feedback is the concern of identifying and measuring goal/objective achievement (Rogers, 2003). The study by Herbert et al. (1997) conducted evaluation mechanisms to judge the success of their study by following up the changes of lead level in the blood of workers who had lead exposure. They found that no workers had lead levels in excess of 25 μg/dl at that time.

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Another example is the case of the study of system feedback in terms of employee satisfaction. The study by Rogers, Winslow, & Higgins (1993) showed that all occupational health services provided satisfied employees especially services of a periodic physical examination and health history update. The importance of knowing what employees think about the various dimensions of health care services provided implies the idea of an effort to improve services delivery (Rogers et al., 1993; Rogers, 2004).

Sirirattanapruk et al. (2006) showed that one of the factors enhancing the health care team in Thai primary care units on delivery of occupational health services was continuous support, evaluation, and monitoring by their research team from central and regional government agencies.

In conclusion, due to Rogers' model (2003) consolidated with empirical studies, the system feedback of occupational health units in this study is consistent with occupational health services provided and system outputs existing by the analysis of the health care trend (Herbert et al., 1997), study of client's satisfaction (Rogers et al., 1993), and the evaluation of occupational health services delivery (Sirirattanapruk et al., 2006).

5. Conceptual Model of the Study

A theory-based approach to structural equation modeling is a necessity. Structural equation modeling needs to have a strong theory and/or existing empirical base (Stevens, 1996; Kaplan, 2000). Based on this principle, the researcher proposes a conceptual model of the delivery of occupational health services in primary care units deduced from Rogers' model, principle, research and literature related to occupational health services delivery.

5.1 Theoretical Framework

Rogers' model is selected as the theoretical framework of this study with attention to a systematically improvement principle for occupational health services delivery in Thai primary care units. Strength and limitation of Rogers' model are described as follows:

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5.1.1 Strength of Rogers' Model

5.1.1.1 Based on System Approach

The development of Rogers' model is based on the General Systems Theory. A key distinction of a system approach is the feedback and evaluation mechanism for responding in the system to both internal and external events (International Occupational Hygiene Association, 1998). Also, a system approach focuses on the interactions and relationships within and among system input, system throughput processes, interventions, system outputs, and feedback aiming to achieve desired outcomes or goals (Rogers, 2003). Comparatively, in the occupational programmatic approach, the focus is on accomplishment of program objectives rather broader impact on occupational health services. A program operates as singular or vertical, and is based on the traditional command-control regulations. Conversely, a system approach broadens the program, affects other programs and examines whether the program improves workers health or not. Furthermore, a system approach focuses on improvement, not exclusively on its consistency to program standard (International Occupational Hygiene Association, 1998).

As Rogers' model is developed using a systematic approach, the framework provides the researcher the full range of examining the system of Thai primary care units. It offers opportunities for considering improvements, changes and developments of this system that require strengthening occupational health services delivery. Furthermore, such a system approach potentially offers opportunities for advancement of occupational health services integrated in Thai primary care units as a part of the public health system.

5.1.1.2 Consistency with Public Health Quality Measurement Concept

Although occupational health currently seems to be a field of its own, involving medical and technical expertise, politicians, public administrations, trade unions and employers associations, its roots are to be found in the general history of public health (Rogers, 2003; Williams, 2004; Levy et al., 2006; Beckman & Sundin, 2006). Rogers' model shows consistency with the

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Public Health Quality Measurement concept, which is an innovative conceptual framework incorporating quality measurement into public health developed by Derose and colleagues in 2002 (Derose, Schuster, Fielding, and Asch, 2002). This conceptual framework evolved from the efforts of Donabedian's quality measurement of public health practice, developing a conceptual framework to measure performance of the public health system (Turnock & Handler, 1997; Handler, Issel, and Turnock, 2001). The main components of Rogers' model are consistent with the public health quality measurement concept—structure, process, intermediate outcomes, and outcomes. In brief, assessing structural quality is the examination of the capacity and organizational characteristics of public health agencies. Process quality assesses the activities carried out by public health agencies. Outcomes quality assesses the products of public health agencies actions on the public's health and includes intermediate outcomes. The inputs, processes, and outcomes are highly interrelated: structural elements make certain processes possible; processes, in turn, lead to short-term results (intermediate outcomes) and ultimately to community health outcomes (Derose et al., 2002; Derose, Asch, Fielding, and Schuster, 2003).

It has been confirmed that Rogers' model can bring the researcher to a well-established conceptual model of occupational health services delivery in Thai primary care units, then to well-developed measurement; which can help primary care units monitor their progress toward occupational health goals, continuing improvement, and become more accountable to both the populations they serve and policy makers.

5.1.2 Limitation of Rogers' Model

The limitation of Rogers' model of occupational health services seems to be the same as found in the public health practice, that is, measuring or evaluating performance. In public health practice, performance measurement is crucial to what public health practice is, what it does, and how it does what it does. In fact, both measuring and examining the relations among input, processes, output, and outcomes of public health system are needed (Turnock & Handler, 1997; Hulshof, Verbeek, Dijk, Weide, and Braam, 1999).

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However, past efforts of measurements focused on measuring some aspects of the public health system, and were not clear in the links between input and outputs. Also, most examined whether things were being done correctly rather than measuring whether the right things were being performed (Turnock & Handler, 1997). Besides, a majority of little existing evidence is qualitative or descriptive studies rather than quantitative studies (Derose et al., 2002). Even at the end of the twentieth century, neither a clear nor a complete picture of the status of public health practice existed (Turnock & Handler, 1997).

It is similar to the evolution of measuring fr occupational health practice. Occupational health services currently confuse public health professionals regarding what occupational health services are, what they do, and how they are carried out, particularly in the primary care setting (Harber & Merz, 2001; O'Hara et al, 2004; Elms et al., 2005; Siriruttanapruk et al., 2006). Besides, a more common problem in evaluating occupational health services is the fact that other worker-related and community-related factors affect outcome. It is often difficult to attribute a specific outcome to the intervention of nurse or public health personnel (Myerson & Parker-Conrad, 2001). This can be illustrated by the study of the nature and extent of evaluation research in occupational health services published between 1985 and 1996 by Hulshof et al. (1999). The study results found that the empirical studies on the evaluation of occupational service of occupational health services activities was extremely limited having only 52 studies. Also, most the studies were descriptive and lacked statistical analyses of the results. Besides, the study of audit tools for occupational health management by Shelmerdine and Williams (2003) showed that even in the case where assessment instruments existed, it was a lack of ability to use the tool when there is no comprehensive health and safety management system existed within the organization.

No existing system recognizing occupational health services is a crucial point to be realized. Consequently, it is a limitation to understand, improve, and control occupational health services. At present, delivering occupational health services in Thai primary care units is at the starting level as

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mentioned earlier. The present is an appropriate time to examine the entire system of Thai primary care units regarding occupational health services to solve problems systematically.

5.2 Conceptual Model

Rogers' model incorporating empirical studies presented the relationships among five dimensions of the system, including system inputs, throughput processes, occupational health services, system outputs, and feedback that forms the conceptual model of this study as shown in Figure 4.

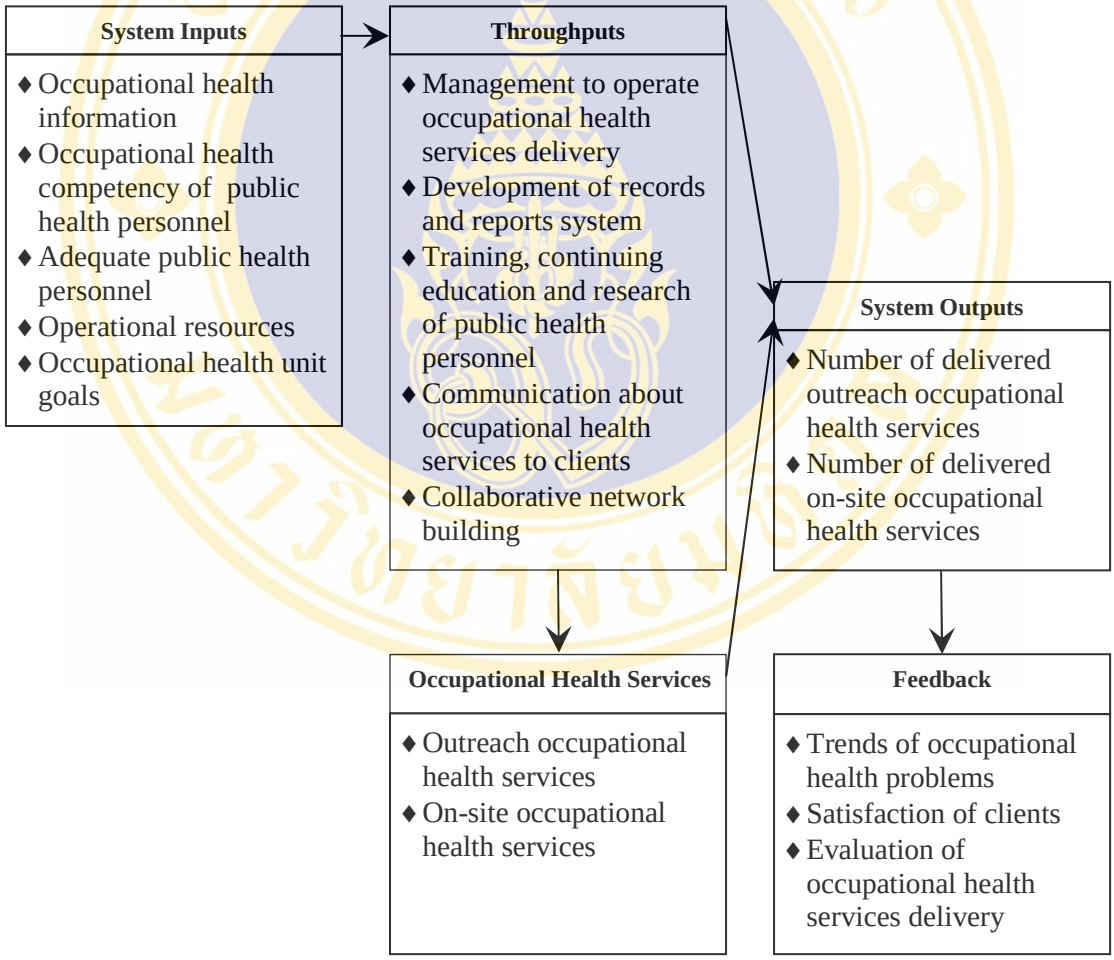

Figure 4 Conceptual Model

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CHAPTER III
METHODOLOGY

The research methodology in this study is described below, including research design, research methods regarding population, samples, sampling procedure, data collection, data analysis, as well as ethical consideration.

1. Research Design

This study used a mixed methods approach called sequential transformative design. It was conducted in two phases. Phase 1 began with qualitative methods, followed by the quantitative approach in Phase 2. This design is briefly illustrated in Figure 5.

2. Research Methods

2.1 Phase I: Qualitative Methods

To explore the development of occupational health services delivery and the important elements of the occupational health services model in Thai primary care units, in-depth interviews and focus group techniques were used to collect qualitative data. The sample for in-depth interviews and focus groups in the first phase were recruited using purposive sampling.

2.1.1 In-depth Interviews

2.1.1.1 In-depth Interview Preparation

a) Identification of Participants

The key informants of governmental organizations, under the Ministry of Public Health, whose responsibilities involve the support given to establishing occupational health services delivery in Thai primary care units and health centers, were invited to participate in in-depth interviews, including representatives from the Bureau of Occupational and Environmental

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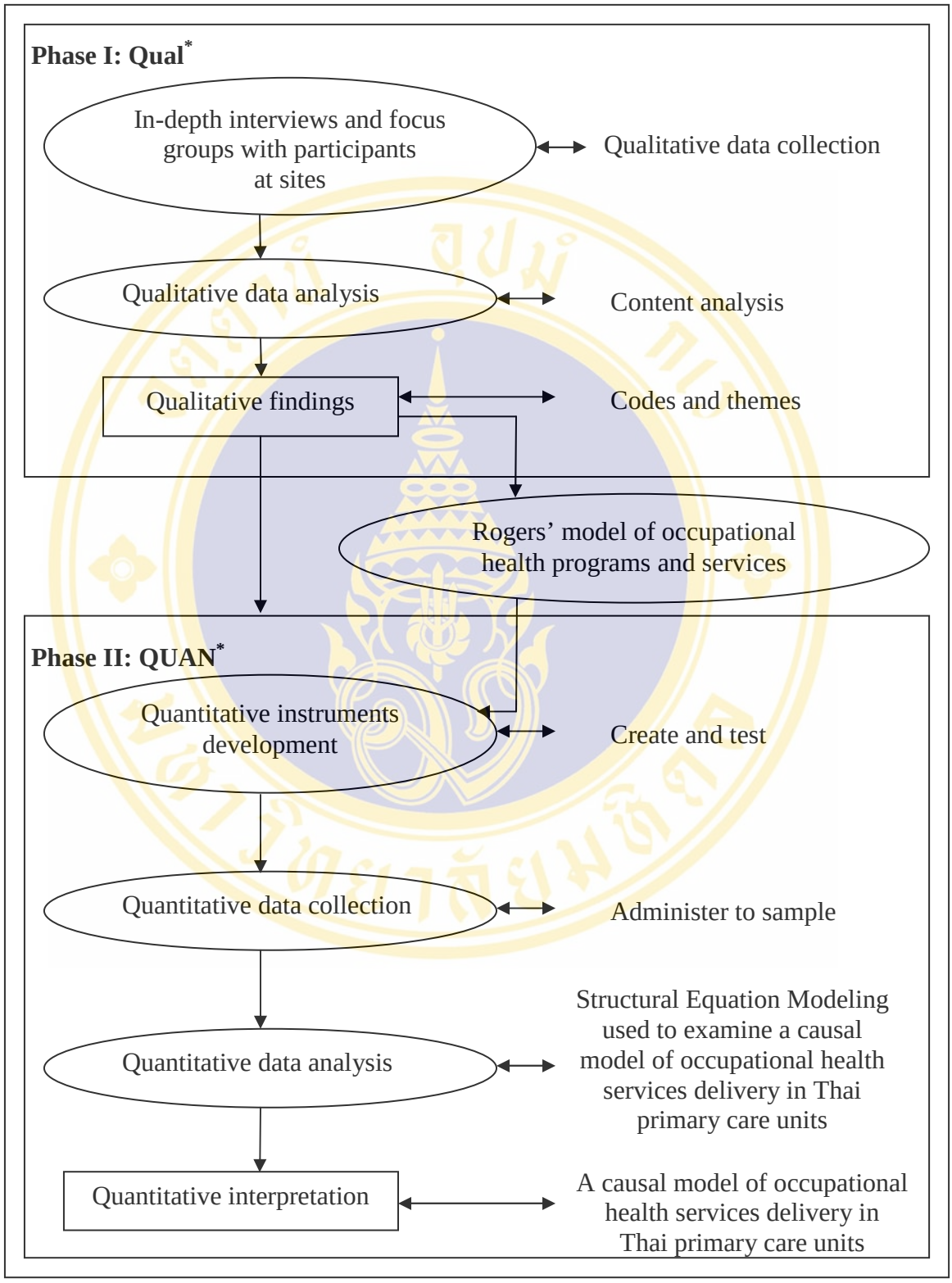

Figure 5 Visualization for Mixed Methods Procedures

* "Quan" and "Qual" locate for quantitative and qualitative, respectively. Capitalization (QUAN) indicates an emphasis or priority given on the quantitative data and analysis in the study.

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Disease, the Sixth Office of Disease Prevention and Control, Khon Kaen, as well as Phayao Provincial Public Health Office. The key persons were purposefully chosen based upon their roles and functions that have a high-level of involvement within the arena of encouraging, supporting or facilitating occupational health services delivery in Thai primary care units.

b) Making Contact and Setting Interview Dates, Times, and Locations

1) Permission of Organization Directors

The Director of the Bureau of Occupational and Environmental Disease, and the Sixth Office of Disease Prevention and Control, as well as the Phayao Provincial Public Health Officer was sent a directors' cover letter produced by the Faculty of Graduate Studies, directors' information letter, and an institutional approval letter. The directors' information letter described the study purposes, data collection methods, target population and sample, confidentiality assurance, benefit of the study, and permission request to collect data from the organization's staff. The institutional approval letter requested the directors' agreement for collecting data.

2) Participants

The participants' information letter, participant's approval letter, and the In-depth Interview Guide (IIG) (Appendix A) were distributed to key informants in each setting. The participants' information letter described the purpose of study, methods of data collection, target population and sample, confidentiality assurance, benefit of the study, and invitation to participate in the study. The exclusion criterion was the participants' refusal to participate in this study. The participant's approval letter requested the participant's agreement for participation and asked for the interview dates, times, and locations convenient to participants.

c) Preparing the Interview Guide and Conducting In-depth Interviews

The IIG and a digital recorder were used in conducting in-depth interviews. The IIG was developed by the researcher based on principles,

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theories, and literature related to occupational health delivery, Rogers' model of occupational health services, as well as research objectives and research questions. The IIG consisted of a list of questions or topic to be discussed by the interviewer with respondents. Main topics used in IIG included the background and significance of the efforts to establish occupational health services, activities/plans/projects designed to be done and undertaken until now, and the results of those activities/plans/projects/programs performed. Also, respondents were asked about 5 main concepts, including the characteristics of occupational health services in primary care units as well as significant factors, in terms of inputs and throughputs contributing to occupational health services delivery and outcomes, and feedback responding to delivering occupational health services in primary care units according to their perceptions and expectations.

d) Conducting In-depth Interviews

Five in-depth interviews were carried out in November 2006. Two key informants working in the Bureau of Occupational and Environmental Disease conveniently offered to conduct in-depth interviews in their office in Bangkok; another working in the Bureau of Occupational and Environmental Disease, in their office in Bangkok, another working in the Phayao Provincial Public Health Office, in a meeting room of her organization in Phayao Province, and another, working in the Sixth Office of Disease Prevention and Control, Khon Kaen, in a convenient place in Bangkok.

Participants were asked to sign two participants' informed consent forms to confirm each participant's agreement to participate. One copy was given to the participant, and the other copy retained for research records.

2.1.2 Focus Groups

2.1.2.1 Focus Group Preparation

a) Identification of Study Participants and Setting

According to the findings from in-depth interviews and the suggestions from interviewees, nurses and public health personnel, who work in primary care units in Phayao Province, considered to be the greatest

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information-rich sources, were asked to participate firstly. The focus groups were constructed with representatives of nurses and public health personnel with/without experience of occupational health services from primary care units and health centers under the primary care units' network of Provincial Hospital and District Hospital in Phayao Province as recommended by the key informant, a participant in the in-depth interviews. Then, the employees, employers, and other related authorities were asked to participate.

. **b) Group Membership/Inclusion Criteria**

Purposive sampling was used to purposefully select a sample that was compatible with the inclusion criteria listed below to assure specific homogeneity needed in each focus group.

1) Group of Nurses and Public Health Personnel

Nurses and public health personnel targeted to participate in the study were listed from the key informant, a participant in the in-depth interviews. The inclusion criteria of this group included being a nurse and/or public health personnel working in primary care units or health centers in Phayao Province during the period of data collection, having at least one year experience delivering health care services in primary care units or health centers, and voluntarily willing to participate in focus group discussion in this study.

2) Group of Workers and Employers

Workers and employers both in non-agricultural and agricultural sectors targeted to participate in the study, were listed from nurses and public health personnel, participants in the focus group discussions in this study. For worker groups, the inclusion criteria were workers in the agricultural sector, large/medium/small enterprises, services, home-based work, self-employed, and/or non-factory enterprises, and voluntarily consenting to participate in focus group discussions in this study. The inclusion criteria of employer group were being the employers or representatives working in large/medium/small enterprises, self-employed, and/or non-factory enterprises, and voluntarily consenting to participate in focus group discussions in this study.

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3) Group of Other Related Authorities

Other related authorities targeted to participate in the study were listed by the key informant, an interviewee in in-depth interviews. Other related authorities comprising representatives working in governmental organizations and communities, including representatives from the Provincial Public Health Office, District Public Health Office, General Hospital, Municipality Office, Provincial Labor Protection and Welfare Office, Provincial Social Security Office, and the Alternative Agriculture Group, who volunteered to be participants.

c) Number of Groups and Participants

Seven focus group discussions were carried out in November 2006. The seven focus groups comprised three groups of nurses and public health personnel (n=18), two groups of workers (n=15), and one group each of employers (n=10) and occupational health services related authorities (n=10). Each focus group was composed of 5 to 10 participants (Table 1).

Table 1 Number of Groups and Participants in Focus Group Discussions

Participants	Number of Groups	Number of Participants in Each Group	Total
Nurses and public health personnel	3	5, 6, 7	18
Workers (agricultural and non-agricultural sectors)	2	6, 9	15
Employers	1	10	10
Occupational health services related authorities	1	10	10
Total	**12**	**53**	**53**

The participants in the group of other related authorities were representatives from eight organizations, including the District Public Health Offices, District Hospital, Provincial Hospital, Municipality Office, Provincial Public Health Office, Provincial Labor Protection and Welfare Office, Provincial Social Security Office, and the Alternative Agriculture Groups.

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d) Making Contact and Recruiting Participants

1) Nurses and Public Health Personnel

In making contact and recruiting nurses and public health personnel, the Phayao Provincial Chief Medical Officer, Phayao Hospital Director, and Phayao Muang District Health Officer were sent a directors' cover letter produced by the Faculty of Graduate Studies, a directors' information letter, and an institutional approval letter. Then, the participants' information letter and focus group recruitment script were distributed to all nurses and public health personnel recommended. The focus group recruitment script invited the target sample to participate in focus groups, asked about inclusion criteria, and requested the target sample to indicate whether they were interested in participating in focus groups. The exclusion criterion was the participants' refusal to participate in this study. The researcher checked participants' willingness to participate in focus groups from the focus group recruitment script returned. Once the researcher determined that the individuals contacted were compatible with inclusion criteria, the participants were given a confirmation letter.

2) Workers, Employers and Other Related Authorities

The researcher and research assistants made contact with all of the potential participants of workers, employers and other related authorities and asked them to participate in the study.

e) Generating the Focus Group Guideline

The Focus Group Protocol (FGP) (Appendix B) and a digital voice recorder were used in conducting focus group discussions. The FGP was developed by the researcher based on principles, theories, literature related to occupational health delivery, *practical guideline*s of occupational health services delivery in Thai health services system (Bureau of Occupational and Environmental Disease, 2005a), Rogers' model of occupational health services (Rogers, 2003), as well as research objectives and research questions. This was used in conducting focus groups. The FGP format comprised two parts. Part I was focus group preparation providing information on materials needed and site

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preparation. Part II included the actual conducting of the focus group, including the content of the opening session and used focus group questions as a detailed outline for the moderator leading the focus group discussion. The opening session included the introduction, ground rules, and the icebreaker. Note-taking and digital recording were done by the researcher. A digital voice recorder (with the capacity of recording 11-16 hours continually) was used. Focus group questions were presented in a sequence, beginning with background information, thus allowing participants to reflect and think of experiences involving the study topic, then moving into key questions, obtaining participants' insights on occupational health services delivery in primary care units, and ending by participants' describing orally and writing note cards to develop categories based on a system approach to ensure that all the important categories of the five main concepts of system inputs, throughputs, occupational health services, outputs, and feedback were included. This FGP was used for all seven focus groups in Part I, with differing details in Part II regarding the main questions for the focus groups of workers, employers, and occupational health services related authorities.

f) Pilot Study

A pilot study was carried out with a "target audience" using a convenient sample of nurses and public health personnel working in health centers and primary care units under the network of Photharam Hospital, Photharam District, Ratchaburee Province. The researcher assistant contacted each individual to determine willingness. Six individuals who were voluntary participants were asked to participate in the pilot focus group. The purpose of the pilot study was to test the FGP to determine whether the wording of questions was appropriate, whether the questions elicited discussion and whether they were easily understood, and to determine the length of time required to obtain rich and meaningful data. The focus group pilot study lasted 2 hours and was conducted in a meeting room of the Photharam Hospital convenient to participants. Light refreshment was served. Pilot subjects were asked to include comments on the focus group discussion for the questions that were unclear, difficult to understand,

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or questions that seemed inappropriate for ascertaining information related to the purposes of the study.

2.1.2.2 Conducting Focus Groups

All of the seven focus groups were conducted in participants' selected settings at Muang District, Phayao Province. Three focus groups of nurses and public health personnel as well as a group of employees were conducted in two meeting rooms available of the Phayao Provincial Public Health Office. The other employees focus groups were conducted in a community, while the groups of employers and representatives conveniently participated in a conference room of the Phayao Provincial Social Security Office. A digital voice recorder was used for recording focus group discussion lasting 1 ½ - 2 ½ hours. Participants gave voluntary consent to their participation in this study.

Although slightly different questions were used in later groups resulting from the answers obtained in previous groups, all 53 respondents were asked about 5 main concepts, including the characteristics of occupational health services in primary care units as well as significant factors in terms of inputs and throughputs contributing to occupational health services delivery and outcomes, and feedback responding to delivering occupational health services in primary care units. These information-rich cases brought the saturated findings of interests with them and no more participants were recruited.

2.1.2.3 Analyzing Results of Focus Groups

All recordings were transcribed verbatim and analyzed by the researcher without using any qualitative data analysis software, resulting in common story lines relevant to the five main themes based on the purpose of the study. By using summarizing content analysis (Mayring, 2000; Flick, 2006), all stories in each theme were explored and categorized as nearly as possible with the participants' stories compatible to theoretical subcategories relying on Rogers' model. Each category was summarized as an important element, and supplemented with note cards written by 18 nurses and public health personnel, 10 employers, and 10 other related authorities. Note cards were not collected from 15 workers because of problems with literacy. Credibility of the findings (Creswell, 1998;

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Polit & Beck, 2004) was increased by asking three participants (a public health staff and two nurses who participated in focus group discussions) and five occupational health service researchers (an Occupational Health Physician and four Public Health Technical Officers) to carefully evaluate the summaries and make recommendations regarding thematic categorization.

2.2 Phase II: Quantitative Methods

Since the objectives of this mixed methods research pertained to understanding the phenomenon being studied and also in establishing evidence for relationships from a sample to a population, the quantitative methods in the second phase were designed as a cross-sectional study. Structural equation modeling (SEM) was used to empirically test a causal model created to determine how well the hypothesized model fits the data.

2.2.1 The Population and Sample

2.2.1.1 Population

According to the findings from in-depth interviews, nurses and public health personnel working in Thai primary care units in 18 provinces—Chiang Mai, Lamphun, Phayao, Nan, Mae Hong Son, Lampang, Songkhla, Nakhon Si Thammarat, Phattalung, Narathiwat, Sakon Nakhon, Khon Kaen, Nakhon Ratchasima, Si Sa Ket, Surin, Supanburi, Nakhon Pathom, and Ayutthaya Provinces—were offered opportunities in several pilot projects aiming to develop occupational health services delivery in Thai primary care units. Hence, the target population of this study comprised nurses and public health personnel working in 3,365 primary care units/health centers located in these provinces in 2007.

2.2.1.2 Sample Size Estimation

SEM is an extension of multivariate technique combining aspects of factor analysis and multiple regression (Hair, Black, Babin, Anderson, and Tatham, 2006). Consequently, a sample size that is sufficient for one purpose might not be enough for other related purposes (MacCallum, Browne, and Sugawara, 1996). Hence, the determination of the necessary sample size in this study was based on a set of considerations including power analysis, number of

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observations per variable, estimation technique, and missing data (Cohen, 1988; MacCallum et al., 1996; Hair et al., 2006).

a) Power Analysis

Power analysis was given importance in determining the minimum sample size for the purpose of model testing based on the MacCallum and colleagues approach (MacCallum et al., 1996). With this approach, the hypothesis being tested is the hypothesis of close fit using the RMSEA fit index. Accordingly, a minimum sample size can be determined depending upon four parameters: a) desired power, b) significance level, c) degrees of freedom, and d) effect size (i.e., the difference between values of the RMSEA index specified in null and alternative hypothesis in the test of close fit). Given the values of these parameters, Preacher & Coffman (2006) recently provided computer software for computing a minimum sample size available at website http://www.psych.ku.edu/preacher/rmsea/rmsea.htm.

In this study, the desired power value and significance criterion were conventionally determined at .80 and .05, respectively (Cohen, 1988); the RMSEA values of null and alternative hypothesis of close fit were defined as lower than or equal to .05, and equal to .08, respectively (MacCallum et al., 1996). The final factor, degree of freedom, was calculated by the formula below:

$$df = \tfrac{1}{2}[(p)(p+1)] - k \quad \text{(Hair et al., 2006)}$$

Where, df = degree of freedom

p = total number of observed variables = 24

k = number of estimated parameters in SEM model = 52 (Appendix F)

$$df = \tfrac{1}{2}(24 \times 25) - 52 = 248$$

These values were filled in the computer software via the web page of http://www.psych.ku.edu/preacher/rmsea/rmsea.htm. The computed minimum sample size was 74 cases.

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b) Number of Observations per Variable

Factor analysis is a starting place in the data analysis of SEM. As such, a general rule regarding sample size for factor analysis, that the minimum sample size must have at least five times as many observations as the number of variables to be analyzed, was applied (Hair et al., 2006).

In this study, the maximum number of items among the five research instruments for testing model was a 68-item scale of the System Inputs Assessment Scale (SIAS). Based on this rule, at least 340 subjects were needed.

c) Estimation Technique

Although a number of SEM estimation procedures were available, this study choose the maximum likelihood (ML) method, which is the most common SEM parameter estimation (MacCallum et al., 1996; Hair et al., 2006). Noticeably, when the sample size becomes large (>400), this technique becomes more sensitive and almost any difference is detected, making goodness-of-fit measures indicate poor fit. As a result, sample sizes about 150–400 are recommended (Hair et al., 2006).

For the purpose of conducting parameter estimation using the common maximum likelihood method, the sample size was also similarly determined to be 340.

d) Missing Data

Usually, remedying missing data is reduced to some extent from the original number of sample size. The researcher should increase the sample size to offset any problems of missing data (Hair et al., 2006).

Based on this consideration, ten percent of the sample size of 340 (34 observations) was added, totaling 374 subjects.

In addition, it is possible that some of the people in the desired sample size will decline to participate in the study (Johnson & Christensen, 2004). For example, the recent survey of performances of occupational disease prevention and control in primary care units in five provinces of the piloted project found a response rate of 77.4% to mailed questionnaires from health care staff

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(Bureau of Occupational and Environmental Disease, 2005b). Hence, the researcher applied the formula below to adjust the original sample size desired (Johnson & Christensen, 2004).

$$\frac{\text{Desired sample size}}{\text{Proportion likely to respond}} = \text{Number of the final sample}$$

$$\frac{374}{.774} = 403$$

The desired sample size number in this study was 403 participants.

2.2.1.3 Sampling Procedure

Multi-stage sampling was used in the second phase of this study. First, 6 of 18 provinces were randomly selected proportional to the size in each region. These six provinces were Nakhon Pathom, Lamphun, Phayao, Sakon Nakhon, Khon Kaen, and Songkhla Provinces. Then, a sampling frame of primary care units of 6 sampled provinces was developed by the researcher based on the database of the Provincial Public Health Office of each province via website of the Ministry of Public Health (i.e., http://www.moph.go.th). Using this sampling frame, 403 subjects were then randomly selected proportional to the size in each province. Questionnaires were mailed to 403 potential participants in the first round of data collection. However, after 1 ¾ months of collecting data, 174 copies were returned. As a result, second round questionnaires were mailed to potential participants. The total number of questionnaires sent out was 632. Finally, 403 returned and useable questionnaires produced a response rate of 63.7 percent at the end of data collection.

2.2.2 Developing Measurement Instruments

The development of research instruments of latent constructs was divided into three stages as follows:

2.2.2.1 Constructs Identification

The five constructs of system inputs, system throughputs, occupational health services, outputs, and feedback were identified as latent variables to be measured by multiple variables. These constructs of the research

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instrument were accomplished through literature review and based on the research objectives, questions, and hypotheses, as well as conceptual model, which were theoretically developed based on Rogers' model of occupational health programs and services (Rogers, 2003).

2.2.2.2 Generating Scales

The research instruments in the second phase of this study were designed as mailed questionnaires, including 1) General Information Assessment Scale (GIAS), and 2) Occupational Health Services Assessment Instrument (OHSAI) (Appendix C).

a) General Information Assessment Scale (GIAS)

The GIAS was composed of 13 items of both close- and open-ended questions about general information of the participants: gender, age, education, office, years of work, position, working as a primary care unit head, the number of office staff, the number of people/villages in the responsible area, the number of enterprises in the responsible area, occupational health services delivery in primary care units, participating in occupational health training, and additional comments related to occupational health services delivery.

b) Occupational Health Services Assessment Instrument (OHSAI)

The Occupational Health Services Assessment Instrument (OHSAI) was composed of five subscales. All five subscales were four-point rating scales with response options ranging from yes or truly met, high partially met, low partially met, and no or fairly met. The scores of 4, 3, 2, and 1 were given to responses of yes or truly met, high partially met, low partially met, and no or fairly met, respectively.

In generating potential items of the OHSAI, the qualitative findings from all 58 participants' views indicating 15 appropriate elements in occupational health services model in the first phase were used. Also, the instrument development practically complemented the second edition of *practical guideline*s of occupational health services at all levels of the health service system revised by the Bureau of Occupational and Environmental Disease

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(2005a). Moreover, a set of 29 interdisciplinary core competencies for Occupational Health and Safety Professionals, divided into six categories as domains common to all occupational health and safety disciplines (i.e., recognition, evaluation, control, communication, behavior, and management), developed by Olson et al. (2005) was modified to identify items of the OHSAI. In addition, the content and activities of the basic occupational health services (Rantanen, 2005a, 2005b, 2005c) were tailored in item generation.

Furthermore, based on the recommendation that the number of initial items should be twice the size of the final scale (Netemeyer, Bearden, and Sharma, 2003), a large pool of items was created to share a common conceptual domain of system inputs, system throughputs, occupational health services, system outputs, and feedback in developing five subscales. Accordingly, items were generated to adequately tap the contents relying on Rogers' model, related concepts, empirical studies, and the first-phase findings of reality in Thai primary care units, meaning that the range of component details in five main concepts existing appropriately as part of Thai primary care units were completely examined and used to guide item generations. Consequently, the initial SIAS, STAS, OHSAS, SOAS, and FAS consisted of 71, 53, 38, 20, and 16 items, respectively.

2.2.2.3 Judging Initial Scales

a) Content Validity of Initial Scales

To assess content validity, the research instruments were submitted to a panel of eight experts (Appendix D). The panel of experts was composed of both professional experts and lay experts as recommended by Rubio and colleagues (Rubio, Berg-Weger, Tebb, Lee, and Rauch, 2003). The three professional experts holding knowledge, experience, and research in occupational health services in primary care units and health centers included an occupational health physician, and four public health technical officers. Three lay experts, for whom the issue of interest was most salient (Rubio, et al., 2003), were a public health technical officer and two nurses who worked in three primary care units. The experts were requested to comment on three aspects, including the

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representativeness of the content domain, comprehensiveness of the research instrument, and clarity of the items.

To evaluate the representativeness or an item's ability to represent the content domain of five subscales of the OHSAI including SIAS, STAS, OHSAS, SOAS, and FAS, the experts were asked to rate each item on a score from 1 to 4. The value of each response was described as follows:

1 = item is not representative.
2 = item needs major revisions to be representative.
3 = item needs minor revisions to be representative.
4 = item is representative.

The content validity index (CVI) for individual items was calculated first by counting the number of experts who rated the item as three or four and dividing that number by the total number of experts, giving the proportion of experts who deemed the item as valid content. Then, the CVI for the entire measurement was the average of the CVI across all items (Rubio et al., 2003; Wynd, Schmidt, and Schaefer, 2003).

The eight experts participated in the content validity examination by returning the research instruments with a response rate of 100%. The CVI of the SIAS, STAS, OHSAS, SOAS, and FAS were .94, .94, .98, .95, and .90, respectively. These CVI were above the .80 criteria (Grant & Davis, 1997). Although the majority of the CVI for each item of those five sub-scales was higher than .80, 15 items with a CVI lower than this acceptable level were obtained. Based on the values of CVI and experts' suggestions for revisions, addition, or deletion of any item, the ten items were deleted, including 3, 6, and 1 item(s) of the SIAS, STAS, and OHSAS, respectively. An item was added for the FAS. Also, wordings of several items were slightly revised (Table 2).

b) Reliability of Initial Scales

The corrected instruments were pilot-tested with 30 nurses and public health personnel working in 30 primary care units/health centers

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in Photharam District, Ratchaburi Province whose characteristics were similar to the sample in the second phase of this study. The pilot study was conducted on June 9, 2007 in the meeting room of the Photharam District Public Health Office. The 30 participants were asked to complete the self-administered questionnaire and return it to researcher. Completing the questionnaire spent approximately 45-55 minutes.

The results of the study showed the Cronbach's alpha of the SIAS, STAS, OHSAS, SOAS, and FAS were .98, .97, .98, .97, and .98, respectively (Table 2). The size of Cronbach's alpha was greater than the acceptable level of .70 (Hair et al., 2006).

Table 2 CVI, Cronbach's Alpha and Number of Items of Each Scale

Initial Scales	No. of Items		CVI[1]	Cronbach's Alpha[2]
	Before	After		
System Inputs Assessment Scale (SIAS)	71	68	.94	.98
System Throughputs Assessment Scale (STAS)	53	47	.94	.97
Occupational Health Services Assessment Scale (OHSAS)	38	37	.99	.98
System Outputs Assessment Scale (SOAS)	20	20	.96	.97
Feedback Assessment Scale (FAS)	16	17	.89	.98

Note: [1] CVI = content validity index of scales judged by 8 experts
[2] Reliability of scales gained from pretest with 30 participants having characteristic similar to the sample

2.2.3 Data Collection of Quantitative Methods in Phase II

2.2.3.1 Permission of Organization Directors

The Provincial Chief Medical Officer, Hospital Director, District Health Officer, and Head of Primary Care Units were sent a directors' cover letter produced by the Faculty of Graduate Studies, a directors' information letter, an institutional approval letter, and a copy of the questionnaire. The directors' information letter described the study purposes, target sample, data collection methods, information about keeping data confidential, and asked for agreement to collect data from the organization's staff for the second phase of this

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study. The institutional approval letter requested the directors' permission for collecting data.

2.2.3.2 Administrating Questionnaires

The participants' information letter, two participants' informed consent forms, a copy of research questionnaires, and pre-stamped addressed envelopes were packed in an envelope addressed and mailed to potential participants. The participants' information letter explained the study purpose, target sample, data collection methods, information about keeping data confidential, and asked for participation in this study by completing the attached questionnaire. The participants were asked to sign two participants' informed consent forms to indicate consent to participate in this study. Also, the participants were asked to return completed questionnaires and signed participants' informed consent forms with the enclosed pre-stamped addressed envelope to the researcher. A post office box was rented for the surveys to be mailed back.

These procedures were conducted on two occasions. The first round of data collection was conducted on June 25, 2007; the second round, on August 23, 2007. A reminder letter was also added in the second round. Collecting data stopped on November 5, 2007.

2.2.4 Data Analysis of Quantitative Methods in Phase II

Data analysis in the second phase of this study was performed as follows:

2.2.4.1 Descriptive Statistics

Descriptive statistics including frequencies, percentage, mean, standard deviation, skewness and kurtosis were performed to examine the accuracy of data entry, assess basic assumptions, and present the general information about the sample and studied variables using SPSS program.

2.2.4.2 Structural Equation Modeling

Structural equation modeling was conducted to statistically test a priori hypothesized model against empirical data using the LInear Structural RELations (LISREL) Program (Joreskog & Sorbom, 1996; Kaplan, 2000; Polite & Beck, 2004; Hair et al., 2006). The analysis of SEM

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proceeded with a two-step approach (Hair et al., 2006). The first step was to test the measurement model, second step, the structural model.

3. Ethical Considerations

This mixed methods research was reviewed and approved based on the Declaration of Helsinki by the Committee on Human Rights Related to Human Experimentation, Mahidol University, Bangkok, Thailand prior to data collection. The number of the documentary proof of ethical clearance is MU 2006-211 (Appendix E). Based on ethical considerations, all participants were informed of the purposes of study, target population and sample, methods of data collection, use of the results, and that no direct benefit or risks are expected by participating in the study. Participants were informed of their right to refuse or to withdraw from the study at any time. Also, a code number and letter format were assigned to ensure confidentiality.

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CHAPTER IV
RESULTS

The main purpose of this mixed method study was to examine a causal model of occupational health services delivery in Thai primary care units. In-depth interviews and focus group discussions to explore the development of occupational health services delivery and the important elements in system inputs, throughputs, occupational health services, outputs, and feedback of primary care units with stakeholders were conducted firstly. Next, a survey to examine a causal model of occupational health services delivery in Thai primary care units was carried out by administrating mailed questionnaires to nurses and public health personnel working in Thai primary care units. The qualitative investigation (Phase I) and the quantitative section (Phase II) were distinct in their approaches: results were presented separately for each phase. As this study was a mixed methods research, a linkage of both qualitative and quantitative needed was also proposed.

1. Results of Phase I: Qualitative Methods

The salient findings were described according to general characteristics of the sample and the specific objectives, which were investigated in the first phase using qualitative methods.

1.1 General Characteristics of the Sample

1.1.1 Sample of In-Depth Interviews

Five in-depth interviews were held with five interviewees, including an occupational health physician and two public health technical officers working in the Bureau of Occupational and Environmental Disease, a public health technical officer working in the Sixth Office of Disease Prevention and Control, Khon Kaen, and a public health technical officer working in the Phayao Provincial Public Health Office. All were female, had completed bachelor, master, and

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doctoral degrees, aged 38-49 years, and had 3-5 years experience working in the establishment of occupational health services delivery in Thai primary care units.

1.1.2 Sample of Focus Group Discussions

Seven focus groups were organized, including three groups of nurses and public health personnel (n=18), two groups of workers (n=15), and one group each of employers (n=10) and the other related authorities (n=10) in Phayao Province. The sample in groups of nurses and public health personnel working in primary care units, aged 23-57 years, had 1–20 years experience of current work, and had completed diploma, bachelor degree, and master degree. Ten of 18 nurses and public health personnel were male. For groups of employees, participants aged 22-64 years, were workers in the agricultural sector, home-based working, and self-employed in commerce, and had 5-30 years of experience of current work. Eleven of 15 employees were male. For employers, the sample, aged 24-51 years, were self-employed in commerce and services, and had 3-14 years of experience. Two of 10 employers were male. In a group of occupational health services related authorities, participants, aged 24-47 years, had completed bachelor and master degrees, had 1–18 years experience of present work, and worked as mid-level administrators in the Provincial/District Public Health Office, General Hospital, Municipality Office, Provincial Labor Protection and Welfare Office, Provincial Social Security Office, and Alternative Agriculture Group. Six of 10 occupational health services related authorities were male.

1.2 Specific Objective I: Development of Occupational Health Services Delivery in Thai Primary Care Units

1.2.1 Background and the Beginning of Development of Occupational Health Services in Thai Primary Care Units

The results of in-depth interviews with interviewees from three main organizations under the Ministry of Public Health located at the central, regional, and provincial levels were consistent in the perceptions that development of occupational health services delivery in Thai primary care units was launched in 2003, approximately. However, at present, the Ministry of Public Health still has not created a policy regarding occupational health issues. The background of the

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development of occupational health services delivery in Thai primary care units resulted from increased health concerns to workers in informal sectors as well as financial support from several institutes, including the Bureau of Occupational and Environmental Disease, Thailand Research Fund, Thai Health Promotion Foundation, Homenet, and ILO. This viewpoint, and those that follow, can be evidenced by the following remarks obtained from in-depth interviews:

> "So far as I know, there is no policy regarding occupational health practices. There was a policy of establishing primary care units and assigning them to deliver health care for people in responsible area but not specific to occupational health care. It seems in year 2003, three years ago, a non-governmental organization named Homenet shared questions regarding informal workers' health problems versus recognizing these problems of primary care units' personnel. It was an appropriate time to support the establishment of occupational health services at the grass roots level or primary care units."

1.2.2 Pilot Projects Performed in Thai Primary Care Units

Several pilot projects were performed with efforts of those three organizations in supporting the establishment of occupational health services in Thai primary care units. The common projects offered to Thai primary care units were described as follows:

a) Enhanced occupational health competency of personnel working in primary care units/health centers (e.g., offering training courses, learning with other primary care units, and giving consultations):

> "Primary care units' personnel lacked knowledge regarding occupational health or they knew; however, they didn't have skills. What they needed to know or be trained was brought to create curriculum. The first pilot project training course on occupational health services was offered to primary care unit personnel involved in handicraft centers. In 2005, staff of 10 primary care units in five provinces were trained. "

b) Developed management strategies to deliver occupational health services (e.g., creating a system of recording histories of work and health hazard exposure of employee in a family folder, reporting occupational diseases by using the 506/2 form, adding records of work setting or enterprises location on community map in the family folder):

> "It began with creating an information system of population in terms of occupations, hazard, and risk groups. There was a survey where do workers live and work. Later, stamps regarding work settings of employees and where they were located were made to mark on a family folder. This was done for communication among primary care unit staff. Workers attending primary care units need to ask about illness and work histories, and consider the relationships between work and illness."

c) Emphasized communications with all the stakeholders both inside the Ministry of Public Health (e.g., communicating with the Contracting Unit for Primary Care, District/Sub-district Public Health Office,

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Provincial Public Health Office, Office of Disease Prevention and Control; and Bureau of Occupational and Environmental Disease) and outside agents (e.g., negotiating with workers, employers, the community, the Tambon Administration Organization, Provincial Social Security Office, and Provincial Labor Protection and Welfare Office) in order to build collaborative network for more additional support:

"In case primary care unit staff didn't have confidence to work with enterprises, they informed personnel working in Provincial Hospital and Provincial Public Health Office for help. Then, the informed persons co-operated with staff of Provincial Social Security Office and Provincial Labor Protection and Welfare. Finally, they all visited the enterprise simultaneously. That happened in the first year; in the second year primary care units' staff were able to do by themselves. At present, it has been a part of the community plan."

d) Allocated budget and/or advice on financial resources. Additional funds were budgeted by both internal and external organizations of the Ministry of Public Health. The internal budget included resources from the Provincial Public Health Office, Office of Disease Prevention and Control, and Bureau of Occupational and Environmental Disease. The external budget consisted of funding from the Thailand Research Fund, ILO, Homenet Thailand, and Tambon Administration Organization:

"We persuaded primary care units' personnel to provide occupational health services by giving budget, supporting mentors who work in regional centers or universities nearby including our team. We asked the District Public Health Office, Provincial Public Health Office, and Office of Disease Prevention and Control that if primary care units would like to do this work what are their supports," "We recommended primary care unit staff to seek funding from external financial resources. Some contacted the Tambon Administration Organization or Office of Disease Prevention and Control depended on their styles," "At present, the five to six primary care units continued to do this work, because they made a connection with and were funded by the Tambon Administration Organization."

1.2.3 Number of Primary Care Units Involved in those Pilot Projects of Developing Occupational Health Services Delivery

According to those projects offered, 89 Thai primary care units in 18 provinces engaged in. The names of provinces and the number of primary care units/health centers in each province are illustrated (Table 3). Of the 89 primary care units, some of them had opportunities to participate in projects conducted by national, regional, and provincial agencies. In other words, overlapping participation of primary care units occurred:

"In the first year, 7 primary care units took part in our project. We then extended to another 21 primary care units, totaling to 28 primary care units.", "In 2005, staff of 10 primary care units in five provinces were trained.", "In 2004, I proposed a training project that was organized by the Provincial Public Health Office, and funded by the Bureau of Occupational and Environmental Disease support budget.

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Approximately 30 primary care units joined this project," "Nine primary care units were involved in the development," "In 2005, 2 primary care units were contacted to delivery services for workers in informal sectors. These primary care units were a part of projects conducted by staff of the Bureau of Occupational and Environmental Disease as well."

Table 3 Number of Primary Care Units/ Health Centers Participating in Pilot Projects and Organizations Producing Projects Classified by Region/Province

Regions Provinces	No. of Primary Care Units/ Health Centers Participated	Projects Produced By Organization(s) at		
		Provincial Level	Regional Level	Central Level
Central				
1. Supanburi	4			/
2. Nakhon Pathom	2			/
3. Ayutthaya	1			/
North				
1. Chiang Mai	4			/
2. Lamphun	8			/
3. Phayao	41	/		/
4. Nan	1			/
5. Mae Hong Son	1			/
6. Lampang	2			/
North-East				
1. Sakon Nakhon	4			/
2. Khon Kaen	7		/	/
3. Nakhon Ratchasima	1			/
4. Si Sa Ket	1			/
5. Surin	1			/
South				
1. Songkhla	6			/
2. Nakhon Si Thammarat	3			/
3. Phattalung	1			/
4. Narathiwat	1			/
Total	**89**			

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Although several pilot projects were offered to nurses and public health personnel working in primary care units that aimed to help them establish occupational health services delivery, only some of them continued to deliver occupational health services. An arising problem was what key elements made occupational health services delivery in Thai primary care units succeed or fail. Focus group discussions with stakeholders in the next step helped to explain this issue.

1.3 Specific Objective 2: Important Elements of Occupational Health Services Model in Thai Primary Care Units

As shown in Table 4, the findings of qualitative data suggest that a total of 15 appropriate elements exist in Thai primary care units within the five main components of the occupational health services model: system inputs, throughputs, occupational health services, outputs, and feedback.

a) System Inputs

1) Occupational Health Competencies of Public Health Personnel

Respondents expressed several opinions related to individual competencies contributing to delivering occupational health services in Thai primary care units, including knowledge and understanding, attitude, as well as skill and experience of staff:

> "Personnel should have skill, good attitude, and interest in relation to occupational health. If they don't appreciate the work, it is then difficult to do. For instance, one nurse working in a primary care unit usually works only on curative tasks and pays less attention to prevention."

2) Adequate Personnel

Respondents felt that the number and types of public health personnel needed a balance when compared to the variety and multitude of jobs in primary care units:

> "Staff in a primary care unit should be multidisciplinary and at least four persons, including the Health Administration Officer, Public Health Technical Officer, Professional Nurse, and Technical Nurse," "Even in the case of having four personnel, they usually don't see each other each day. One person went to a meeting somewhere; one did home visits for post partum cases," and "the more responsible the tasks are, the less time there is—Three days spent for curative work; one for financial work; then time is up."

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Table 4 Elements of Occupational Health Services Model in Thai Primary Care Units

System Inputs	Throughputs Processes	Occupational Health Services (OHSs)	Outputs	Feedback
1. Occupational health competencies of public health personnel 2. Adequate personnel 3. Occupational health profile 4. Operational resources 5. Occupational health unit goals	1. Management to operate occupational health services delivery 2. Training, continuing education, and research of public health personnel 3. Collaborative network building	1. Outreach occupational health services in a community 1.1 Work environment investigation 1.2 Health screening 1.3 Health promotion 1.4 Health prevention 1.5 Health protection 2. On-site occupational health services in a primary care unit 2.1 Health screening 2.2 Health education 2.3 Basic cure 2.4 Basic occupational diseases diagnosis and report 2.5 Referral service	1. Outputs of outreach occupational health services 1.1 The number of accomplished outreach occupational health services 1.2 The number of worksite/ enterprises having health and safety hazards 1.3 The number of employees who are at risks 2. Outputs of on-site occupational health services 2.1 The number of accomplished on-site occupational health services 2.2 Incidence and/or prevalence of basic occupational disease and injury	1. Trends of occupational health problems 2. Satisfaction of employees/ employers 3. Evaluation of occupational health services delivery 3.1 Monitoring service delivery 3.2 Monitoring health behavior changes in workers

3) Occupational Health Profile.

The findings revealed that basic occupational health information and statistics were crucial in helping public health personnel know the needed services of their targets:

> "If there are no data, it is difficulty to work. For example, I conducted a farmers' register. How many registering workers are there? How many years have they worked? How many years have they used chemical agents? What were the health impacts? We rushed to do this task for basic information," and "then, we identified programs needed such as a health examinations program for a high risk group."

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4) Operational Resources

Recognizing activities to be done and feedback from clients, respondents needed operational resources available in primary care units in terms of forms, equipment/arrangement for recording and registering services, budgets, and guidelines:

> "Finances and equipment should exist," "If equipment isn't available in the local setting, it should be accessible in the Provincial Public Health Office," "Basically, we can tell workers or employers the results after we have investigated health hazards in a work setting," and "it would be better if we could say it was dangerous, but we have no proof."

5) Occupational Health Unit Goals

Participants revealed the first obstacle hindering occupational health services delivery was a lack of goals and indicators of occupational health services. Since many different types of jobs or tasks need to be done in primary care units, participants felt it would be easier if they knew what activities occupational health services have to conduct:

> "First of all we must address a policy," "A policy must noticeably point that every primary care unit/health center must deliver occupational health services," "What are lists of occupational health services that have to be achieved in primary care settings, first, second, third?", "Then, occupational health services will have to be performed almost certainly."

b) Throughput Processes

1) Management to Operate Occupational Health Services Delivery

Participants addressed the requirements of management in delivering occupational health services. Resulting from a need to know occupational health information, a record and report system would need to be created. Also, realizing various types of work in a primary care unit, participants emphasized staff meetings, identifying occupational health procedures, and writing plans:

> "This task needed team work," "Every staff had to know every job in an organization more or less," "Meetings of staff in a health center were needed to inform about activities being performed currently," and "We needed to talk with our team about recording risk exposure of workers in family folders."

2) Training, Continuing Education and Research of Public Health Personnel

Respondents perceived that occupational health is a special subject, while most of the public health personnel in primary care units lacked

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occupational health knowledge and skills. Hence, conducting conferences or knowledge exchange related to occupational health was necessary to enhance competencies of public health personnel working in primary care units:

> "Each staff should receive at least a training course regarding occupational health. Training should be held annually or biannually," and "Developing a body of knowledge in staff in local settings is one factor contributing to achievement of occupational health services delivery goals."

3) Collaborative Network Building

Network building between employees, employers, as well as health care providers and other related authorities was vital to get support and/or cooperation in occupational health services delivery:

> "We (public health personnel) have authority just for academic advice, but in situations that involve law we had to collaborate with the Tambon Administration Organization," "Workers need clarity. For example, the result of blood examination for cholinesterase levels examinations in farmers showed abnormal levels, but the farmers still felt healthy. As a result, the farmers were not interested in their health prevention," further, "we need cooperation from the enterprises first because usually they don't permit us to visit."

c) Occupational Health Services (OHSs)

Regarding occupational health services, participants felt that some occupational health services in Thai primary care units have been carried out for years. The pattern of delivery of occupational health services was organized into two categories, Outreach and On-site occupational health services, based on the service setting. The outreach occupational health services covers health care activities offered to workers in their workplaces/communities or outside primary care units, while on-site occupational health services were delivered in primary care units.

1) Outreach Occupational Health Services

Respondents revealed continuing problems in the delivery of occupational health services in the community caused by heavy workloads as mentioned previously in the system inputs. However, one occupational health services outreach target that was familiar to staff was existing services for agricultural workers. Recently, in some primary care units staff received training courses about occupational health, outreach occupational health services were extended to other sectors of the working population such as home-based workers with more attention given on work environment investigation and health screening.

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Also, programs of health promotion, health prevention, and health protection were offered to target groups:

"We have a lot of responsible tasks. It is impossible to pay sole attention particularly on occupational health services. But, it doesn't mean that we don't work in community," "Blood examinations to know cholinesterase levels in farmers have been done for more than a decade." "After I received a training course related to occupational health in 2004, I now conduct walk-through surveys as well as blood pressure, blood sugar, and health examinations. I created forms for workers to check about their health," and "we assessed health risks. Then, we planned to conduct programs about giving knowledge on occupational health."

2) On-site Occupational Health Services

Providing on-site activities was not a problem in cases that needed to have curative treatment for occupational health problems, since basic treatment for all of the patients regardless of age, sex, or occupation already existed. Rather, the number of clients was the perceived burden. Also, other difficulties included how to manage occupational diseases diagnoses and reports:

"If patients attended a primary care setting, the majority of the work included health examinations and basic treatment varied by patient's signs and symptoms. If it is necessary, we ask more questions about occupation, and maybe focus on occupational disease reporting. In the case clients' needs are beyond our capacities, we will refer." "The impact of work on health is unclear." "It is difficult to draw a conclusion that it is on occupational disease," and "staff still don't know about occupational health."

d) Outputs

1) Outputs of Outreach Occupational Health Services

Although there were no consistently observed existing criteria for delivering occupational health services in primary care units, participants usually had written plans concerning the outreach occupational health services delivery that included to what extent outputs needed to be achieved. For that reason, they simply measured the effective achievement by only considering activities that were accomplished and making a basic comparison with planned details in projects:

"We have written plans of outreach occupational health services delivery, which identified what occupational health services tasks and where we will work, who is responsible, who are the target groups, and how many activities are needed. Finally, we can compare the results of programs with those predetermined in projects."

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2) Outputs of On-site Occupational Health Services

As a majority of the on-site services were curative, investigation of outputs were focused on the incidence and prevalence of occupational disease and injury, as well as the number of workers who came for services. However, record and report systems of occupational health services delivery still had major problems (e.g., missing reports, incompleteness of reports, and/or insufficient enforcement of the rules of report submission). Also, the problems still continued related to the diagnosis of occupational diseases in the services process:

> "Although clients who attend primary care units so far have occupational health problems, we cannot diagnose occupational diseases." "We don't have data that show how many cases of occupational diseases exist. We don't have records regarding occupational health problems."

d) Feedback

1) Trends of Occupational Health Problems

To know whether occupational health services delivery was acceptable or not, participants required an appraisal of trends of occupational health problems. However, problems related to the diagnosis of occupational diseases have continued. In reality, records rarely existed for analyzing trends for occupational health problems:

> "We can look at statistical information." "Staff can tell the situation of an illness at present and compare it to those in the past," and "if it has positive impact on health, it is acceptable."

2) Satisfaction of Employees/employers

Assessment of the satisfaction of employees and/or employers was discussed as one method in evaluating occupational health services delivery.

> "There should be evaluation of client's satisfaction for delivered services." "It is important to know clients are satisfied with activities that we performed."

3) Evaluation of Occupational Health Services Delivery

On the subject of evaluation of occupational health services delivery, participants put emphasis on monitoring service delivery of staff and health behavior changes of workers.

> "I think evaluation should be divided into two parts, namely, in a health service system and work setting." "We can ask workers 'How do you protect yourself in working?" "Administrators have to give more attention in encouraging personnel to work well" and "it involves moral support. Since occupational health practices don't exist in policy, there are no criteria for evaluation. "Without this,

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working on occupational health issues is a waste of time." "We felt that we have attempted to work on this task, but evaluation of results was nothing. Why do we work?"

2. Integration of Qualitative and Quantitative Methods

The important rationale of this sequential mixed methods research was development, meaning the use of the findings from one method to help develop or inform another method (Johnstone & Onwuegbuzie, 2004; Rocco et al., 2003). As a result, those qualitative findings of all 58 participants' views in the first phase were utilized for developing research instruments.

The development of research instruments (described in the Chapter 3) included three-step procedures including identifying constructs, generating initial scales, and judging initial scales. Those procedures revealed that all five subscales of the OHSAI including SIAS, STAS, OHSAS, SOAS, and FAS had good content validity and reliability.

These five subscales were used to collect data to be analyzed using SEM for the research's main objective of testing a causal model of occupational health services delivery in Thai primary care units. However, it is important to acknowledge that valid structural theory tests cannot be conducted with improper measures. In other words, it needs to have good measures to know what the constructs truly mean (Hair et al., 2006).

Accordingly, exploratory factor analysis (EFA) was brought to identify the dimensionality of a set of variables (defining the factors). In factors extraction, a maximum likelihood estimation technique, which is the most commonly used and appropriate when the objective is to search for the latent dimensions (MacCallum, et al., 1996; Hair et al., 2006), was used with the varimax rotation method. With these procedures, the second specific objective, to explore important elements of occupational health services delivery was statistically validated, indicating the meaning of each construct.

Since exploratory factor analysis was performed after colleting data with the sample of 403 subjects in the second phase, it then was described in the next section.

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3. Results of Phase II: Quantitative Methods

The important findings in the second phase were described according to the general profile of the sample, the second specific objective, the main objective and the third specific objective, as well as research hypotheses, which were investigated using quantitative methods.

3.1 General Profile of the Sample

The sample in the second phase of this study consisted of 403 subjects. The gender proportion of sample was nearly equal between male and female (51% and 49%, respectively). The sample was 23-59 years with a mean age and standard deviation of 41 and 8 years, respectively. The majority of respondents were 40-49 years (44.5%) and next 30-39 years (38.4%). The respondents' education consisted of Bachelor degree, Diploma, and Master Degree. Most of the sample had completed bachelor degree (79.0%). Respondents had 1–36 years experience working in primary care units with a mean and standard deviation of 8.4 and 7 years, respectively. Two-thirds (61%) of respondents had 1-9 years experience. The position of respondents working in primary care units included Health Administration Officers, Health Technical Officers, Public Health Officers, Professional Nurses, and Technical Nurses; a majority of the sample consisted of Public Health Administration Officers (42.3%). The number of public health personnel working in primary care units ranged from 1 – 11 persons with a mean and standard deviation of 4 and 2 persons, respectively. More than a half (59.5%) of the sample worked in primary care units having 1-3 staff. The number of population in the responsible area of the sample ranged from 1,060-26,082 people with a mean and standard deviation of 5,561 and 3,289, respectively. Most of the sample (49.6%) worked in primary care units having a population in their responsible area less than 5,000 people. The sample worked in primary care units both with and without existing enterprises in their responsible area nearly equal (49.1% and 50.9%, respectively) (Table 5).

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Table 5 Number and Percentage of the Sample Classified by Studied Variables (n=403)

Studied Variables		Number	%
Gender	Male	205	51.0
	Female	197	49.0
Age (years)	23-29	27	6.8
	30-39	153	38.4
	40-49	177	44.5
	50-59	41	10.3
	Min=23, Max=59, Mean=41, SD.=8		
Education	Diploma	45	11.4
	Bachelor Degree	312	79.0
	Master Degree	38	9.6
Years of Experience	1-9 Years	246	61.8
	10-29 Years	145	36.4
	30-36 Years	7	1.8
	Min=1, Max=36, Mean=8.4, SD.=7		
Position	Public Health Administration Officers	170	42.3
	Health Technical Officers	117	29.1
	Public Health Officers	57	14.2
	Professional Nurses	55	13.7
	Technical Nurses	3	0.7
Number of Public Health Personnel in Office	1-3	239	59.5
	4-6	140	34.9
	7-9	19	4.7
	> 10	3	0.7
	Min=1, Max=11, Mean=4, SD.=2		
Number of Population in Responsible Area	< 5,000	200	49.6
	5,000-9,999	141	35.0
	≥ 10,000	62	15.4
	Min=1,060, Max=26,082, Mean=5,561, SD.=3,289		
Existing Enterprises in Responsible Area	None	193	49.1
	Existing	200	50.9

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3.2 Specific Objective II: Important Elements of Occupational Health Services Model in Thai Primary Care Units

As mentioned previously, this section presents a statistical methods using exploratory factor analysis to statistically validate attributes of five domains, system inputs, throughputs, occupational health services, outputs, and feedback.

Recall that the initial conceptual model (Figure 4) proposed five principal domains, dependent relationships, and their properties, which will then be evaluated with SEM procedure. The OHSAI, including five subscales of SIAS, STAS, OHSAS, SOAS, and FAS**,** was developed to collect data.

Using exploratory factor analysis, factor extraction was performed depending on several considerations, including a) items with value of item-to-total, inter-item correlation, communalities, and variable's measure of sampling adequacy (MSA) less than .5, .3, .5, and 5, respectively as well as partial correlation above .7 are candidates for deletion, b) items must have factor loading equal to or greater than .5 to ensure practical significance, and c) items that load on two or more factors are usually deleted (Hair et al., 2006). Also, to ensure practical significance for the derived factors, the factors that had eigenvalues greater than 1 and a percent of the total variance greater than 60 were considered significant. In addition, the deletions/retentions of items and how many factors to extract were carefully combined with theoretical justification and objectives of this study.

As shown in Table 6, with cautious consideration against those rules, the 39, 24, 23, 14, and 13 items of the SIAS, STAS, OHSAS, SOAS, and FAS, respectively that had factor loading higher than .5 were retained in the final factor solution. The exploratory factor analysis yielded 8, 6, 4, 3, and 3 factors of the SIAS, STAS, OHSAS, SOAS, and FAS, respectively. All factors of each scale explained the variance of their items greater than 60 percent of acceptable criteria.

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Table 6 No. of Factors, No. of Retaining Items, Range of Factor Loading, and Percent of Variance of Each Scale Resulting from EFA (n = 403)

Scales - Extracted Factors (Constructs)	No. of Factors	No. of Items	Range of Factor Loading	Percent of Variance
SIAS	**8**	**39**	**.51-.88**	**66.76**
1. Knowledge and Understanding about Occupational Health Services of Personnel		4		
2. Skills about Health Screening, Disease Diagnosis, and Treatment in Occupational Health Services Delivery of Personnel		7		
3. Personnel Capability in Evaluating Occupational Health Services Delivery		3		
4. Adequate Personnel		4		
5. Basic Information about Occupational Health		3		
6. Statistical Reports of Occupational Health Services Delivery		8		
7. Operational Resources		4		
8. Occupational Health Unit Goals		6		
STAS	**6**	**24**	**.58 - .93**	**73.68**
1. Organizing Record, Register, and Report Systems of Occupational Health Services Delivery		3		
2. Training, Continuing Education, and Research of Public Health Personnel		3		
3. Communication about Occupational Health Services to Clients		3		
4. Cooperation with Other Authorities Involved in Occupational Health Services		4		
5. Collaborative Network Building		5		
6. Receiving Additional Support		6		
OHSAS	**4**	**23**	**.60 - .87**	**71.56**
1. Outreach Occupational Health Services Regarding Work Conditions and Environments		6		
2. Outreach Occupational Health Services Regarding Employee Health		3		
3. On-site Occupational Health Services for Employees in Primary Care Units		10		
4. Reporting Occupational Diseases and Injuries		4		
SOAS	**3**	**14**	**.69 - .91**	**82.12**
1. Number of Outreach Occupational Health Services Conducted in the Community		4		
2. Number of On-site Occupational Health Services Delivered to Employees in Primary Care Units		6		
3. Number of Research Documents Related to Occupational Health Services		4		
FAS	**3**	**13**	**.72 - .92**	**85.57**
1. Trends of Occupational Health Problems		4		
2. Satisfaction of Employees/Employers		4		
3. Evaluation of Occupational Health Services Delivery		5		

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These extracted factors of each scale were named having a meaning close to all items assigned to each. The meanings of these 24 factors were described to be easily understood as follows:

3.2.1 Eight Factors of System Inputs

3.2.1.1 Knowledge and Understanding about Occupational Health Services of Personnel

The knowledge and understanding about occupational health services of personnel means the ability of nurses and public health personnel to describe the scope and aims of occupational health, occupational health hazards in work conditions and environment, and occupational health and safety risks.

3.2.1.2 Skills about Health Screening, Disease Diagnosis, and Treatment in Occupational Health Services Delivery of Personnel

The skills about health screening, disease diagnosis, and treatment in occupational health services delivery of personnel means the ability of nurses and public health personnel to perform health screening, disease diagnosis, and treatment for employees.

3.2.1.3 Personnel Capability in Evaluating Occupational Health Services Delivery

The personnel capability in evaluating occupational health services delivery means nurses and public health personnel's ability to gather, analyze, and evaluate outputs of occupational health services delivery; assess feasible strategies for improving and developing occupational health services delivery; and write plans/projects/programs of occupational health services delivery.

3.2.1.4 Adequate Personnel

Adequate personnel refers to the number of public health personnel of primary care units whether equal to or more than the standard number of public health personnel in a primary care unit identified by the Ministry of Public Health; the number of public health personnel aids to partially support establishing occupational health services delivery; types of public health personnel, whether consistent or more diverse than the standard types of public health

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personnel in a primary care unit identified by the Ministry of Public Health; and types of public health personnel aids to partially support establishing occupational health services delivery.

3.2.1.5 Basic Information about Occupational Health

The basic information about occupational health refers to information about the numbers of the workforce in the responsible area; occupational categories of workers in the responsible area; and the number of occupational groups, organizations, and enterprises in the responsible area.

3.2.1.6 Statistical Reports of Occupational Health Services Delivery

The statistical reports of occupational health services delivery refers to statistical reports of abnormal health discovered from health screening; work conditions and environments discovered from walk-through surveys including health hazards; accidents/disasters of occupational groups, organizations, and enterprises visited/occurred; target or high-risk groups of workers, organizations, or enterprises to deliver occupational health services; occupational health services plans/projects/programs done completely; and degree of satisfaction with occupational health services delivery of employees, employers, and/or organizations. Also, it includes whether those statistical reports are highlighted with charts/graphs to show crucial occupational health issues and whether they are usually updated.

3.2.1.7 Operational Resources

Operational resources refers to whether primary care units have forms for walk-through surveys and for basic health screening; as well as equipment/ arrangements for recording work history and health hazard exposure and for registering services offered to employees.

3.2.1.8 Occupational Health Unit Goals

Occupational health unit goals refers to whether primary care units have goals/indicators of occupational health services delivery determined by related organizations or staff, including the District/Sub-district Public Health Office, Contacting Units for Primary Care, other organizations involved in

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supporting occupational health services delivery, head of a primary care unit/health center, and other staff in primary care units/health centers. Also, whether there are written documents of goals/indicators of occupational health services delivery exist such as in a long-term plan.

3.2.2 Six Components of System Throughputs

3.2.2.1 Organizing Record, Register, and Report Systems of Occupational Health Services Delivery

Organizing record, register, and report systems of occupational health services delivery refers to having meeting/informing/managing work history records and health hazard exposure of employees in family folders or related others; registration system of services offered to employees; and report system of occupational diseases/injuries.

3.2.2.2 Training, Continuing Education, and Research of Public Health Personnel

The training, continuing education, and research of public health personnel refers to whether there are need assessments of trainings, field visits, continuing education, and/or research presentations about occupational health of public health personnel; staff who were received trainings, field visits, and/or continuing education in relation to occupational health; and support/encouragement given to public health personnel to conduct occupational health research or others related to primary care units.

3.2.2.3 Communication about Occupational Health Services to Clients

The communication about occupational health services to clients refers to whether nurses and public health personnel communicate with agricultural workers, representatives of occupational groups, and community leaders.

3.2.2.4 Cooperation with Other Authorities Involved in Occupational Health Services

The cooperation with other authorities involved in occupational health services refers to cooperation with representatives of the

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Municipality Office, Provincial Social Security Office, Provincial Labor Protection and Welfare Office, and Provincial Industry Office.

3.2.2.5 Collaborative Network Building

Collaborative network building refers to whether all related stakeholders form collaborative networks to support occupational health services delivery; and, whether there is an official name list of collaborative networks, meeting plans, regular meetings, and meeting reports of collaborative networks.

3.2.2.6 Receiving Additional Support

The receiving of additional support refers to whether supports is received, including working team; budget; forms of walk-through surveys; and projects/programs (even proposed by primary care units, all stakeholders, and external related organizations).

3.2.3 Four Components of Occupational Health Services

3.2.3.1 Outreach Occupational Health Services Regarding Work Conditions and Environments

The outreach occupational health services regarding work conditions and environments refers to occupational health services that are delivered to workers in workplaces/communities with regard to work conditions and environments, including conducting walk-through surveys at work sites; recording the results of walk-through surveys; informing the results of walk-through surveys and advising about preventive and control measures to employees, employers/enterprises, and other organizations related; participating in correcting or improving work conditions and environments; and visiting to follow up corrected or improved work conditions and environments.

3.2.3.2 Outreach Occupational Health Services Regarding Employee Health

The outreach occupational health services regarding employee health refers to occupational health services that are delivered to employees in workplaces/communities in relation to employee health, including screening employee health; asking employees about work histories and health

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hazard exposure, and recognizing the interaction between health and work, including the severity of diseases and work; and recording the work history and health hazard exposure, and results of health screening such as recording in family folders.

3.2.3.3 On-site Occupational Health Services for Employees in Primary Care Units

The on-site occupational health services for employees in primary care units refers to occupational health services that serve employees who attend health services in primary care units, including asking employees about work history and health hazard exposure, and recognizing the interaction between health and work; recording the work histories and health hazards exposure, and results of health screening; diagnosing occupational disease and injuries; recording the results of diagnosis; treating employee diseases/injuries; referring employees for further investigation of occupational diseases; informing employees of the results of health screening and investigating; advising employees on changing health behaviors, work conditions and environments; and informing other staff in primary care units the name list of employees needed to be visited to follow up the changing health behaviors, work conditions and environments.

3.2.3.4 Reporting Occupational Diseases and Injuries

Reporting occupational diseases and injuries refers to reporting occupational diseases and injuries with form 506/2, a special form for occupational diseases often found in community, and by computer system monthly.

3.2.4 Three Components of System Outputs

3.2.4.1 Number of Outreach Occupational Health Services Conducted in the Community

The number of outreach occupational health services conducted in the community refers to the number and types of worksite/enterprises that were walk-through surveyed; the problems of worksites/enterprises that have health and safety hazards existing in work conditions and environments; the number of employees who are at risk of health

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and safety problems or work under inappropriate work conditions and environments; and the number of worksites/enterprises found with health and safety hazards existing in work conditions and environments that were advised on preventive or control measures and visited to follow up.

3.2.4.2 Number of On-site Occupational Health Services Delivered to Employees in Primary Care Units

The number of on-site occupational health services delivered to employees in primary care units refers to the number of employees who were screened for health; the prevalence of employees who were screened for health with abnormal results; the number of employees who were investigated for health and diagnosed diseases; as well as the prevalence of occupational diseases, injuries, and general diseases among employees who attended services.

3.2.4.3 Number of Research Documents Related to Occupational Health Services

The number of research documents related to occupational health services refers to the number of research documents of outreach occupational health services performed by staff in a primary care units and also performed by staff in a primary care units together with other related organizations; and the number of research documents of outreach occupational health services performed by staff in primary care units and also performed by staff in primary care units together with other related organizations.

3.2.5 Three Components of Feedback

3.2.5.1 Trends of Occupational Health Problems

The trends of occupational health problems refers to whether nurses and public health personnel can describe the top five occupational health diseases and injuries; trends of occupational health diseases/injuries; and trends of employees/enterprises that are important target groups of occupational health services.

3.2.5.2 Satisfaction of Employees/Employers

The satisfaction of employees/employers refers to whether nurses and public health personnel can describe the proportion of employees' and

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employers/enterprises' degree of satisfaction; the comments and/or recommendations of employees and employers/enterprises that need primary care units to be improved or corrected.

3.2.5.3 Evaluation of Occupational Health Services Delivery

The evaluation of occupational health services delivery refers to whether nurses and public health personnel are assessed about delivering occupational health services by staff of the Contacting Units for Primary Care Unit, District/Sub-district Public Health Office, Provincial Public Health Office, and other organizations involved in supporting occupational health services delivery. Also, assessments are done by making comparison with policies/goals/ indicators of related organizations.

Using EFA, it can be claimed that those processes evidently characterized what the five main domains of the occupational health services model in Thai primary care units were.

Consequently, the initial structural model was slightly revised in terms of main concept properties, but it still had the same dependent relationships between main concepts, reflecting the research hypotheses for further evaluation with SEM method in the next step (Figure 6). The abbreviations of factors in Figure 6 are shown in Table 7.

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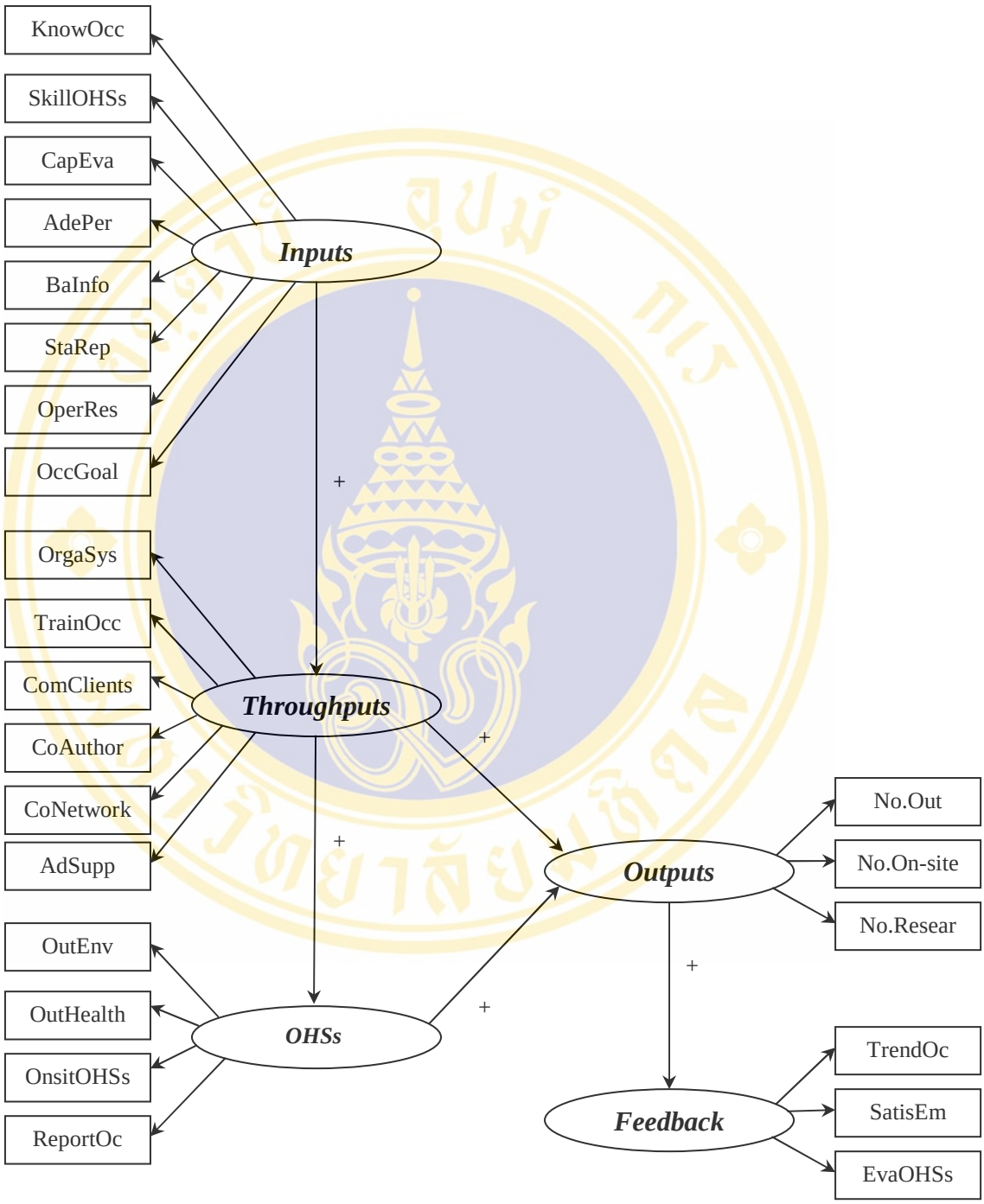

Figure 6 Hypothesized Model

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Table 7 Abbreviation of Extracted Factors of Each Concept

Main Concept or Latent Variable - Component or Observed Variable	Abbreviation
(Inputs)	
1. Knowledge and Understanding about Occupational Health Services of Personnel	KnowOcc
2. Skills about Health Screening, Disease Diagnosis, and Treatment in Occupational Health Services Delivery of Personnel	SkillOHSs
3. Personnel Capability in Evaluating Occupational Health Services Delivery	CapEva
4. Adequate Personnel	AdePer
5. Basic Information about Occupational Health	BaInfo
6. Statistical Reports of Occupational Health Services Delivery	StaRep
7. Operational Resources	OperRes
8. Occupational Health Unit Goals	OccGoal
(Throughputs)	
1. Organizing Record, Register, and Report Systems of Occupational Health Services Delivery	OrgaSys
2. Training, Continuing Education, and Research of Public Health Personnel	TrainOcc
3. Communication about Occupational Health Services to Clients	ComClients
4. Cooperation with Other Authorities Involved in Occupational Health Services	CoAuthor
5. Collaborative Network Building	CoNetwork
6. Receiving Additional Support	AdSupp
(Occupational Health Services)(OHSs)	
1. Outreach Occupational Health Services Regarding Work Conditions and Environments	OutEnv
2. Outreach Occupational Health Services Regarding Employee Health	OutHealth
3. On-site Occupational Health Services for Employees in Primary Care Units	OnsitOHSs
4. Reporting Occupational Diseases and Injuries	ReportOc
(Outputs)	
1. Number of Outreach Occupational Health Services Conducted in the Community	No.Out
2. Number of On-site Occupational Health Services Delivered to Employees in Primary Care Units	No.On-site
3. Number of Research Documents Related to Occupational Health Services	No.Resear
(Feedback)	
1. Trends of Occupational Health Problems	TrendOc
2. Satisfaction of Employees/Employers	SatisEm
3. Evaluation of Occupational Health Services Delivery	EvaOHSs

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3.3 Main Objective: To Examine a Causal Model of Occupational Health Services Delivery in Thai Primary Care Units

In testing a SEM, item parceling was done to form sets of several variables called summated scales by summing the items, which had high loading on a factor. As such, the occupational health services model profile was presented firstly followed by SEM testing.

3.3.1 Occupational Health Services Model Profile

As shown in Table 8, with the scores of 4, 3, 2, and 1 given to responses of yes or truly met, high partially met, low partially met, and no or fairly met, respectively, the possible total score of each observed and latent variable was calculated.

The actual score was classified into two levels—low and high. The low level was a case having actual scores lower than 70 percent of total scores; the high level, equal to or higher than 70 percent of total scores.

The cut-off point of 70 percent was based on the lowest criterion for evaluating occupational health services in all levels of the health service system determined by the Bureau of Occupational and Environmental Disease (2005a). As such, a high level was acceptable and a low level needed to be improved.

3.3.1.1 System Inputs

As shown in Table 8, the actual range of inputs scores was 45-146. In two classified categories, a majority of respondents (79.7%) had system inputs at a low level. Of the total of eight components of system inputs, a majority of respondents (78.9-92.3) revealed that a half of them including 1) personnel capability in evaluating occupational health services delivery, 2) statistical reports of occupational health services delivery, 3) operational resources, and 4) occupational health unit goals had their scores at a low level, indicating the need to be improved, especially the personnel capability in evaluating occupational health services delivery. The rest of the four components had scores at an acceptable level.

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Table 8 Profile of Each Domain and Its Components (n=403)

(Latent Variable) - Observed Variables	No. of Items	Total Scores	Actual Range	$\bar{x}$	SD.	Low Level		High Level	
						No.	%	No.	%
(Inputs)	**39**	**156**	**45-146**	**93.8**	**17.6**	**321**	**79.7**	**82**	**20.3**
1. Knowledge and Understanding about Occupational Health Services of Personnel	4	16	4-16	11.5	2.4	166	41.2	237	58.8
2. Skills about Health Screening, Disease Diagnosis, and Treatment in Occupational Health Services Delivery of Personnel	7	28	7-28	20.5	4.1	143	35.5	260	64.5
3. Personnel Capability in Evaluating Occupational Health Services Delivery	3	12	3-12	8.0	3	372	92.3	31	7.7
4. Adequate Personnel	4	16	4-16	9.0	2.7	190	47.1	213	52.9
5. Basic Information about Occupational Health	3	12	3-12	9.1	2.1	127	31.5	276	68.5
6. Statistical Reports of Occupational Health Services Delivery	8	32	8-32	15.7	5.3	349	86.6	54	13.4
7. Operational Resources	4	16	4-16	7.4	2.9	361	89.6	42	10.4
8. Occupational Health Unit Goals	6	24	6-24	12.6	4.4	318	78.9	85	21.1
(Throughputs)	**24**	**96**	**24-77**	**42.5**	**12.8**	**382**	**94.8**	**21**	**5.2**
1. Organizing Record, Register, and Report Systems of Occupational Health Services Delivery	3	12	3-12	6.2	2.3	315	78.2	88	21.8
2. Training, Continuing Education, and Research of Public Health Personnel	3	12	3-12	6.3	2.5	313	77.7	90	22.3
3. Communication about Occupational Health Services to Clients	3	12	3-12	6.5	2.4	304	75.4	99	24.6
4. Cooperation with Other Authorities Involved in Occupational Health Services	4	16	4-16	5.9	2.4	384	95.3	19	4.7
5. Collaborative Network Building	5	20	5-18	7.8	3.3	367	91.1	36	8.9
6. Receiving Additional Support	6	24	6-24	9.9	3.7	375	93.1	28	6.9
(Occupational Health Services)	**23**	**92**	**23-89**	**50.1**	**14.9**	**336**	**83.4**	**67**	**16.6**
1. Outreach Occupational Health Services Regarding Work Conditions and Environments	6	24	6-24	11.2	4.5	340	84.4	63	15.6

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Table 8 Profile of Each Domain and Its Components (n=403) (Continued)

(Latent Variable) - Observed Variables	No. of Items	Total Scores	Actual Range	$\bar{x}$	SD.	Low Level		High Level	
						No.	%	No.	%
2. Outreach Occupational Health Services Regarding Employee Health	3	12	3-12	6.6	2.5	279	69.2	124	30.8
3. On-site Occupational Health Services for Employees in Primary Care Units	10	40	10-40	24.4	7.7	244	60.5	159	39.5
4. Reporting Occupational Diseases and Injuries	4	16	4-16	7.9	3.5	318	78.9	85	21.1
(Outputs)	**14**	**56**	**14-56**	**30.2**	**10.0**	**323**	**80.1**	**80**	**19.9**
1. Number of Outreach Occupational Health Services Conducted in Community	4	16	4-16	8.8	3.3	283	70.2	120	29.8
2. Number of On-site Occupational Health Services Delivered to Employees in Primary Care Units	6	24	4-16	7.2	3.3	403	100	0	0
3. Number of Research Documents Related to Occupational Health Services	4	16	6-24	14.2	5.1	96	23.8	307	76.2
(Feedback)	**13**	**52**	**13-52**	**25.5**	**9.0**	**350**	**86.8**	**53**	**13.2**
1. Trends of Occupational Health Problems	4	16	4-16	8.9	3.5	267	66.3	136	33.7
2. Satisfaction of Employees/Employers	4	16	4-16	7.7	3.2	320	79.4	83	20.6
3. Evaluation of Occupational Health Services Delivery	5	20	5-20	8.9	3.8	341	84.6	62	15.4

3.3.1.2 Throughputs

As shown in Table 8, the actual range of throughputs scores was 24-77. In two classified categories, a majority of respondents (94.8%) had throughputs scores at a low level. Of the total of six components of throughputs, most respondents (77.7-95.3) revealed that all components including 1) organizing record, register, and report systems of occupational health services delivery, 2) training, continuing education, and research of public health personnel, 3) communication about occupational health services to clients, 4) cooperation with other authorities involved in occupational health services, 5) collaborative

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network building, and 6) receiving additional support were needed to be improved ,particularly the cooperation with other authorities involved in occupational health services.

3.3.1.3 Occupational Health Services

As shown in Table 8, the actual range of occupational health services scores was 23-89. In two classified categories, a majority of respondents (83.4%) had occupational health services scores at a low level. Regarding what components needed to be improved, 60.5-84.4 percent of respondents revealed that all components including 1) outreach occupational health services regarding work conditions and environments, 2) outreach occupational health services regarding employee health, 3) on-site occupational health services for employees in primary care units, and 4) reporting occupational diseases and injuries were needed to be improved especially the outreach occupational health services regarding work conditions and environments.

3.3.1.4 Outputs

As shown in Table 8, the actual range of outputs scores was 14-56. In two classified categories, a majority of respondents (80.1%) had outputs scores at a low level. Shedding light on three components of outputs, 76.2 percent of respondents revealed that one of them (i.e., number of research documents related to occupational health services) had scores at a high level. The rest of the two components including 1) number of outreach occupational health services conducted in the community and 2) number of on-site occupational health services delivered to employees in primary care units, 70.2-100 percent of respondents revealed that their scores were at a low level. The number of on-site occupational health services delivered to employees in primary care units was the first priority to be dealt with.

3.3.1.5 Feedback

As shown in Table 8, the actual range of feedback scores was 13-52. In two classified categories, a majority of respondents (86.8%) had feedback scores at low level. Shedding light on three components of feedback, 66.3-84.6 percent of respondents revealed that all components including 1) trends

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of occupational health problems, 2) satisfaction of employees/employers, and 3) evaluation of occupational health services delivery were at a low level that called for improvement, particularly the evaluation of occupational health services delivery.

3.3.2 Testing a Structural Equation Modeling (SEM)

3.3.2.1 Testing a SEM with Two-Step Approaches

The hypothesized causal model depicted in Figure 6 was evaluated using a two-step SEM process. The first step involved testing the measurement model to evaluate model fit. The second step tested the structural model for assessing model fit and testing research hypotheses (Hair et al., 2006).

a) Testing Measurement Model

The first step of testing the measurement model was conducted using confirmatory factory analysis (CFA). The result showed it had a reasonably good fit (χ^2=360.22, df=185, χ^2/df=1.95, p-value<.001, CFI=.99, GFI=.93, RMSEA= .04).

b) Testing Structural Model

After validating the measurement model, the second step of testing the structural model was done using SEM technique focused on two points, including 1) assessing the structural model fit and 2) examining parameter estimates against the research hypotheses as follows:

1) Model Fit

The structural model fit was assessed and model modifications were made based on a set fit index as was the CFA model. Finally, the result showed the structural model had an adequate fit with reality as represented by the sample data (χ^2=424.56, df=176, χ^2/df=2.41, p-value<.001, CFI=.99, GFI= .92, RMSEA= .05) (Figure 7).

Comparisons with the overall fit were made between the structural model and the measurement model. A difference of two χ^2 was 64.34 (= 424.56-360.22) with a difference in degrees of freedom of 9 (=185-176). Generally, the closer the structural model fit the measurement model, the better the structural model fit. In this study, it was larger than the criterion of 3.84

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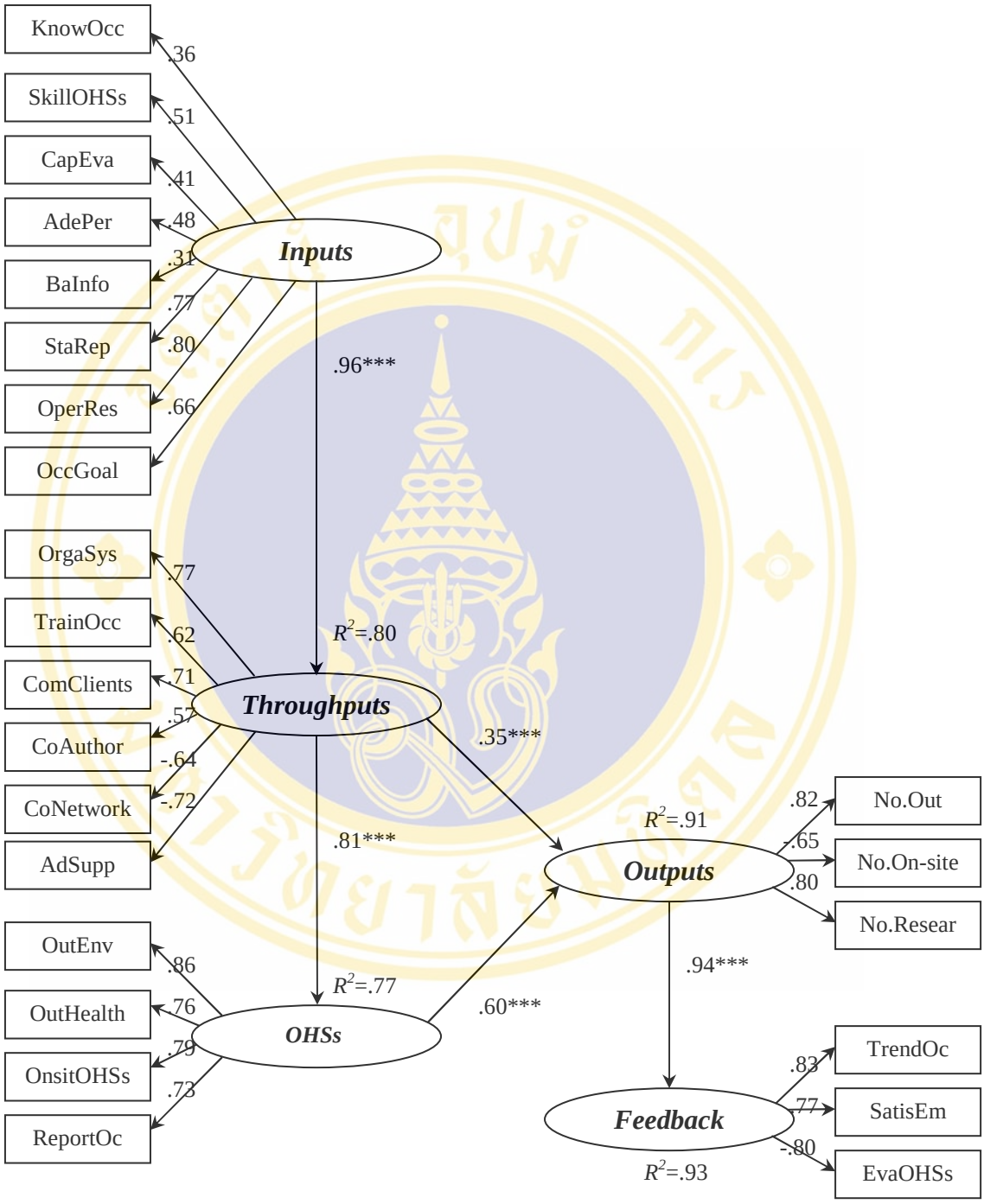

χ^2=424.56, df=176, CFI=.99, GFI=.92, RMSEA= .05

Figure 7 A Causal Model of Occupational Health Services Delivery in Thai Primary Care Units

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at the .05 level (Hair et al., 2006), suggesting that the structural model was a significantly better fit.

2) Parameter Estimates

i. Standardized Factor Loading of Observed variables as well as Variance Extracted (VE) and Construct Reliability (CR) of Latent Variables

As shown in Table 9, standardized factor loading of all observed variables in system throughputs, occupational health services, outputs, and feedback were higher than the criterion of $|.5|$. In view of system inputs, only four observed variables had standardized factor loading higher than a criterion of $|.5|$, including operational resources; statistical reports of occupational health services delivery; occupational health unit goals; and skills about health screening, disease diagnosis, and treatment in occupational health services delivery of personnel. The remaining four components had a quite low standardized factor loading. The standardized factor loadings yielded variance extracted (VE), and construct reliability (CR) of occupational health services, outputs, and feedback higher than the criterion of $|.5|$ and $|.7|$, respectively. The VE of system inputs (.32) and throughputs (.46) was lower than its criterion; however, it did not harm internal consistency as CR of .78 and .83, respectively.

Table 9 Standardized Factor Loading of Observed Variables, Variance Extracted (VE) and Construct Reliability (CR) of Latent Variables (n = 403)

(Latent Variables) - Observed Variables	VE	CR	b	SE_b	t-value	β	R^2
(Inputs)	.32	.78					
- Knowledge and Understanding about Occupational Health Services of Personnel			0.93	0.12	7.77***	0.36	0.15
- Skills about Health Screening, Disease Diagnosis, and Treatment in Occupational Health Services Delivery of Personnel			2.23	0.20	11.39***	0.51	0.30
- Personnel Capability in Evaluating Occupational Health Services Delivery			1.18	0.10	12.03***	0.48	0.33
- Adequate Personnel			1.18	0.14	8.65***	0.41	0.19

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Table 9 Standardized Factor Loading of Observed Variables, Variance Extracted (VE) and Construct Reliability (CR) of Latent Variables (n = 403) (Continued)

(Latent Variables) - Observed Variables	VE	CR	b	SE_b	t-value	β	R^2
- Basic Information about Occupational Health			0.73	0.11	6.75***	0.31	0.12
- Statistical Reports of Occupational Health Services Delivery			4.32	0.23	18.89***	0.77	0.65
- Operational Resources			0.42	0.02	18.22***	0.80	0.62
- Occupational Health Unit Goals			2.96	0.20	14.61***	0.66	0.45
(Throughputs)	.46	.83					
- Organizing Record, Register, and Report Systems of Occupational Health Services Delivery			1.00	-	-	0.77	0.57
- Training, Continuing Education, and Research of Public Health Personnel			0.91	0.07	12.94***	0.62	0.42
- Communication about Occupational Health Services to Clients			4.84	0.33	14.80***	0.71	0.53
- Cooperation with Other Authorities Involved in Occupational Health Services			-0.11	0.01	-12.21***	-0.57	0.38
- Collaborative Network Building			-0.10	0.01	-14.22***	-0.64	0.50
- Receiving Additional Support			-0.08	0.01	-15.64***	-0.72	0.59
(Occupational Health Services)	.62	.87					
- Outreach Occupational Health Services Regarding Work Conditions and Environments			1.00	-	-	0.86	0.57
- Outreach Occupational Health Services Regarding Employee Health			13.78	0.91	15.17***	0.76	0.55
- On-site Occupational Health Services for Employees in Primary Care Units			41.87	2.76	15.17***	0.79	0.55
- Reporting Occupational Diseases and Injuries			0.97	0.07	13.27***	0.73	0.43
(Outputs)	.58	.80					
- Number of Outreach Occupational Health Services Conducted in the Community			1.00	-	-	0.82	0.64
- Number of On-site Occupational Health Services Delivered to Employees in Primary Care Units			-0.02	0.0	-13.27***	-0.65	0.40
- Number of Research Documents Related to Occupational Health Services			1.60	0.09	17.89***	0.80	0.65
(Feedback)	.64	.84					
- Trends of Occupational Health Problems			1.00	-	-	0.83	0.63
- Satisfaction of Employees/Employers			0.16	0.01	16.89***	0.77	0.62
- Evaluation of Occupational Health Services Delivery			-0.01	0.00	-15.43***	-0.80	0.53

Note: ***p-value<.001, b=factor loading, SE_b=standard error, β=completely standardized factor loading, R^2=reliability of observed variables

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ii. Examining Parameter Estimates of Latent Variables

As shown in Table 10, the completely standardized parameter estimates between independent and dependent variables presented in terms of direct effects (DE), indirect effects (IE), total effects (TE) ranged from .35 – .96 and were statistically significant at the .001 significant level.

System inputs had a direct effect of .96 on system throughputs and explained 80 percent of variance of system throughputs, indicating that the remaining 20 percent depended on other variables not included in this study.

System inputs had indirect effects of .78 on occupational health services, while system throughputs had direct effects of .81 on occupational health services. Both system inputs and system throughputs explained 77 percent of variance of occupational health services, indicating that the remaining 23 percent depended on other variables not included in this study.

System inputs had indirect effects of .81 on outputs; system throughputs had direct effects of .35 and indirect effects of .49 on outputs; and occupational health services had direct effects of .60 on system outputs. These three variables including system inputs, system throughputs, and occupational health services explained 91 percent of variance of outputs, indicating that the remaining 9 percent depended on other variables not included in this study.

System inputs, system throughputs, and occupational health services had indirect effects of .76, .79 and .57, respectively on feedback, while system outputs had direct effects of .94 on feedback. These four variables, including system inputs, system throughputs, occupational health services, and system outputs, explained 93 percent of variance of feedback, indicating that the remaining 7 percent depended on other variables not included in this study.

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Table 10 Direct, Indirect, and Total Effects of Independent Variables on Dependent Variables

Dependent Variables	R^2	Effects	Independent Variables			
			Inputs	Throughputs	Occupational Health Services	Outputs
Throughputs	.80	DE	.96***	-	-	-
		IE	-	-	-	-
		TE	.96***	-	-	-
Occupational	.77	DE	-	81***	-	-
Health Services		IE	.78***	-	-	-
		TE	.78***	.81***	-	-
Outputs	.91	DE	-	.35***	.60***	-
		IE	.81***	.49***	-	-
		TE	.81***	.84***	.60***	-
Feedback	.93	DE	-	-	-	.94***
		IE	.76***	.79***	.57***	-
		TE	.76***	.79***	.57***	.94***

Note: DE = Direct Effects
IE = Indirect Effects
TE = Total Effects
*** p-value <.001

iii. Supporting the Research Hypotheses

a) Hypothesis One: System inputs have a direct positive effect on system throughputs, and an indirect positive effect on occupational health services, system outputs, and feedback by affecting system throughputs; system throughputs and occupational health services; system throughputs, occupational health services, and system outputs, respectively.

As shown in Table 10, the completely standardized parameter estimate shows the system inputs had a direct positive effect of .96 on system throughputs and indirect positive effect of .78 on occupational health services by affecting system throughputs. Also, the system inputs had an indirect positive effect of .81 on outputs by affecting system throughputs and occupational health services. In addition, system inputs had an indirect positive effect of .76 on feedback by affecting system throughputs, occupational health services, and system output. As a result, hypothesis one was completely supported at the significant level of .001.

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b) Hypothesis Two: System throughputs have a direct positive effect on occupational health services and output, an indirect positive effect on system outputs by affecting occupational health services, and indirect positive effect on feedback by affecting occupational health services and system outputs.

As shown in Table 10, the resulting completely standardized parameter estimate shows system throughputs had a direct positive effect of .81 on occupational health services. System throughputs also had a direct positive effect of .35 on system outputs and indirect positive effect of .49 on system outputs by affecting occupational health services. Besides, system throughputs had an indirect positive effect of .79 on feedback by affecting occupational health services and system outputs. Hypothesis two was also fully supported at the significant level of .001.

c) Hypothesis Three: Occupational health services have a direct positive effect on system outputs and an indirect positive effect on feedback by affecting system outputs.

As shown in Table 10, the resulting completely standardized parameter estimate shows occupational health services had a direct positive effect of .60 on system outputs. The occupational health services also had an indirect positive effect of .57 on feedback by affecting system outputs. Therefore, hypothesis three was also fully supported at the significant level of .001.

d) Hypothesis Four: System outputs have a direct positive effect on feedback.

As shown in Table 10, the resulting completely standardized parameter estimate shows system outputs had a direct positive effect of .94 on feedback. Hypothesis four was also supported at the significant level of .001.

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CHAPTER V
DISCUSSION

This chapter discusses data-based findings of both qualitative and quantitative methods in relation to the study objectives, including the development of occupational health services delivery and essential elements of the occupational health services model in Thai primary care units discovered in the first phase, a causal model of occupational health services delivery in Thai primary care units, and research hypotheses ascertained in the second phase as follows:

1. Discussion of Qualitative Findings in Phase I

1.1 Development of Occupational Health Services Delivery in Thai Primary Care Units

The qualitative findings from in-depth interviews with five participants whose responsibilities involved giving support to establishing occupational health services delivery in Thai primary care units revealed that the development of occupational health services delivery in Thai primary care units was launched approximately in 2003. This seems to be the same time that a new concept in occupational health services, called basic occupational health services (BOHS), was introduced (Rantanen, 2005a, 2005b, 2005c). To some extent the development of occupational health services delivery in Thai primary care units was due to increased health concerns regarding workers in informal sectors. As a result, this concept brought more accessible occupational health care to all workers, not merely for the industrial sector usually focused on that was consistent with the concept of BOHS, which was lunched to respond to the growing and urgent needs of occupational health services for all working people in the world (Rantanen, 2005a, 2005b, 2005c). Several projects were performed at national, regional, and provincial levels with efforts of three main organizations under the

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Ministry of Public Health (i.e., the Bureau of Occupational and Environmental Disease; Sixth Office of Disease Prevention and Control, Khon Kaen; and Phayao Provincial Public Health Office) in supporting the establishment of occupational health services in Thai primary care units. However, the findings showed at present the Ministry of Public Health still has not had an apparent policy on occupational health services. Similarly, Siriruttanapurk et al.'s study (2006) stated that the occupational health issue is given low priority by the Ministry of Public Health, causing it not to receive a high concern especially in Thai primary care units. The results revealed that common projects offered to 89 primary care units included enhancement of occupational health competency of personnel working in primary care units/health centers, development of management strategies to deliver occupational health services, emphases on communication with all the stakeholders both outside and inside the Ministry of Public Health, and allocation of additional funds and/or advice on financial resources. Such efforts showed that it is possible to integrate occupational health services delivery in Thai primary care units by making better changes in human resources, budget, management system, and communication. These were compatible with theoretical principles (Rogers, 2003; Myerson & Parker-Conrad, 2001).

1.2 Appropriate Elements of the Occupational Health Services Model in Thai Primary Care Units

The qualitative data from focus group discussions with 53 stakeholders including 18 nurses and public health personnel working in primary care units, 10 occupational health services related authorities working in other associated agencies, as well as 15 employees and 10 employers working in industrial and informal sector in Phayao Province suggested that a total of 15 important elements existed in Thai primary care units within the five main concepts of the occupational health services model: system inputs, throughputs, occupational health services, outputs, and feedback.

In view of occupational health services delivery in Thai primary care units, nurses and public health personnel were mostly familiar with outreach services, especially for agricultural workers rather than on-site services in primary

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care units as indicated by the comment “a majority of tasks we have done are outreach services.” This seemed to be positive in that it indicated the participants were focusing on prevention, which should be the essential nature of occupational health activity as emphasized by Parmeggiani since 1959 (Parmeggiani, 1985). Although prevention seems to be a focus, the occupational health services had limited recognition in the Thai primary care setting except tasks that involved the project on the surveillance of pesticide poisoning, promoted by the Bureau of Occupational and Environmental Diseases since the early 1990s (Ministry of Public Health, 2005; Siriruttanapruk et al., 2006). Other activities of occupational health services which were recognized by primary care unit staff included tasks carried out in pilot studies during the past three years in some provinces (Pisitkul, Polsuparuk, & Hamvuthipun., 2005; Saengkaeng, 2005; Siriruttanapruk et al., 2006). For example, Siriruttanapruk et al.’s study revealed that additional activities integrated in primary care units in a pilot study included data collection of working history, job characteristics, risk factors affecting health of workers; record of illness data to family folders; implementation of outreach occupational health services in the community; identification of working hazards; analysis of data, prioritization of problems, problem-solving; and monitoring of activities.

For on-site occupational health services, health care services have existed in Thai primary care units but limited only to basic services. When facing occupational health problems, the difficulties were centered on diagnosis and reporting occupational health disease as exemplified by a submitted description of “in case of muscle pain, the question is ‘is it an occupational disease?’ [and] nobody answers.” This statement reflected how hard the diagnoses of occupational disease are. Levy and colleagues (Levy et al., 2000) stated that recognition of work-related disease is often difficult because of the long period between initial exposure and onset of symptoms (or time of diagnosis) making cause-effect relationships difficult to assess. It is also difficult because of the many and varied occupational and nonoccupational hazards to which most workers are exposed. Another important reason is the attention given by health care providers on occupational disease (Levy et al, 2006). Pisitkul et al. (2005) point out that as

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time passes, asking work history is not comprehensive and more often quickly looks at “the illness”, rather than the “human being” and “daily life.” Hence, supplementary actions such as asking more questions about the occupations of clients were recommended to improve on-site occupational health services. Likewise, Siriruttanapruk et al. (2006) showed that the collection of data (e.g., work history, job characteristics, and health risk factors) was an additional activity integrated into existing health services in primary care units to enable recognition of occupational health illnesses.

The discovered elements were generally compatible with basic elements existing in Rogers’ model of occupational health services and programs (2003). However, a difference existed in that the pattern of occupational health services delivery in this study was divided into two categories instead of one service pattern delivered inside a company as occupational health services delivery in primary care units are located in the community.

Although the present research showed 15 practical elements of the occupational health services model in Thai primary care units, there were some interesting elements that participants often discussed or about which they expressed more concern. First, occupational health unit goals were discussed in terms of a high priority or value given to occupational health services. Participants perceived that a policy should come first; tasks needing to be done in primary care units are usually based on whether they were included in the policy or not. This issue was seen as a critical obstacle to offering occupational health services delivery. Siriruttanapruk and colleagues (2006) also claimed that this difficulty resulted from the lack of political advocacy concerning occupational health issues of higher hierarchal organizations (i.e., provincial, regional, and national agents). A second concern was the inadequate number of personnel, especially when compared with the amount of work to be done in delivering occupational health services in primary care units. This issue was consistent with existing evidence (Siriruttanapruk et al., 2006) that many responsibilities and other political tasks are assigned to the limited number of primary care units/health centers staff.

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Third, the narratives about the occupational health competencies of public health personnel (e.g., *"some staff still did not know which services are occupational health services.")* reflected the fact that a shortage of health care providers trained in occupational health is a common problem of most countries (Jeyaratnam, 1992; Levy et al., 2006). This finding was compatible with existing studies that indicate a lack of occupational health knowledge by staff makes it difficult to assess occupational health problems and provide advice about occupational health issues (O'Hara et al., 2004; Elms et al., 2005). Consequently, the efforts to extend occupational health services to primary care settings have doubled the burden for the inadequate and unqualified personnel available for this task.

Fourth, because of the lack of knowledge of occupational health issues, participants called for continuing education or other training methods to be offered to public health staff. This finding echoed the fact that occupational health is construed as a specific subject, and confirmed that it is a necessity to have a continuous training program for public health personnel by providing opportunities for exchanging and updating new knowledge (Kalampakorn, 2005; Saengkaeng, 2005; Siriruttanapruk et al., 2006).

Moreover, the collaborative network building among employees, employers, as well as health care providers and other authorities was perceived as a crucial factor in delivering occupational health services as exemplified by the narrative "we need cooperation from the enterprises first because usually they don't permit us to visit." The finding mirrored the fact that occupational health services needs to be comprehensive not only to avoid duplication of effort and competition among different units or responsibilities but also to be attractive to both management and workers (Guidotti, et al., 1989; Rex, 1991; Cooper & Dehr, 1996; Childre, 1997; ILO, 2000; Rogers, 2003; Pisitkul et al., 2005).

Furthermore, comments such as "there should be continuing monitoring services delivery of staff by related authorities" disclosed participants' attention on the need for a consistent and thorough evaluation of the system. This issue was also recommended by existing evidence that continuous supervision,

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monitoring, and evaluation by local, regional, and central government administration were needed for continuous implementation and effectiveness of occupational health services delivery (Siriruttanapruk et al., 2006).

In conclusion, the focus group discussion findings revealed that at the beginning of the 21st century, Thai primary care units have faced several difficulties needing attention for enhancement and expansion of an occupational health services model in Thai primary care units. Using a broad-involvement design of focus group discussions (Krueger & Casey, 2000), a majority of the factors of the occupational health services model came from groups of nurses and public health personnel, who were seen as the greatest information-rich source called "target audiences" (Krueger & Casey, 2000). Also, the narratives in groups from other related authorities, employees, and employers, the second source of data, showed consistent opinions, in that these elements contributed to or resulted from delivering occupational health services. However, one differing point of view important to mention is the emphasis on treatment vs. prevention of occupational health problems. Professionals focused on disease and injury prevention, and clients still wanted curative services. This was illustrated by the story line that *"we told the farmers that the results of their blood examination were at risk levels and then they asked what your treatment was?"*

As presented, several important discovered issues support the need of systematic improvement and development that could expand and sustain occupational health services delivery in Thai primary care units nationwide. In view of that, Rogers' model provided a main focus helping to assess the full range of occupational health services model in Thai primary care units in the second phase using quantitative methods of this study.

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2. Discussion of Quantitative Findings in Phase II

2.1 A Causal Model of Occupational Health Services Delivery in Thai Primary Care Units

The result showed the structural model had an adequate fit with reality (χ^2=424.56, df=176, p-value<.001, CFT=.99, GFI=.92, RMSEA= .05). Also, the four variables including system inputs, system throughputs, occupational health services, and system outputs explained 93 percent of variance of feedback. The results confirmed that the causal model of this study (Figure 7) was empirically supported as good enough to explain the phenomenon of occupational health services delivery model in Thai primary care units in relation to system inputs, throughputs, occupational health services, outputs, and feedback.

Because the research design in the second phase of this study was a cross-sectional study, Rogers' model (2003) was brought in to play a major role as a theoretical support in establishing a cause-and-effect relationship among constructs. As such, the temporal sequence among constructs in this study were principally guided by Rogers' model, indicating the system inputs must occur before the change in system throughputs, occupational health services, outputs, and feedback, respectively. Based on theoretical framework or a compelling rationale to support causality, the SEM method can then provide some important evidence to confirm such causality among constructs (Hair et al., 2006). As shown in Table 11, all estimated paths in the structural model (i.e., relationships between five main constructs) were statistically significant at a p-value of .001; evidence supporting the existence of causality. Additionally, causal evidence also supported to a larger extent because of nonexisting multicollinearity problems in this study (Appendix F).

Though this study did confirm that the hypothesized model based on Rogers' model worked well in Thai primary care units, the structural model of this study provided limited support for the Rogers' model. That was beacause the causal model of occupational health services delivery in Thai primary care units was a recursive model, meaning the paths between constructs all proceeded only from the predictor (antecedent) construct to the dependent construct

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(consequences) (Hair et al., 2006). As shown in Figure 3, the full Rogers' model had other two feedback loops, including 1) the path from occupational health services back to the system throughputs, and 2) the path from system feedback back to system inputs. These two paths of feedback loop did not exist in this study due to the research design (i.e., a cross-sectional study). Generally, when the relationship between two constructs is a cause and effect of the other, it is more plausible with a longitudinal study (Hair et al., 2006). Besides, the comparisons of the overall fit between the structural model and the measurement model suggested that alternative models possibly exist. Other models would also possibly explain the data equally well or better than the causal model of this study. These issues suggest the need for further modeling strategies either competing models strategy (i.e., a test of different hypothetical structural relationships) or model development strategy (i.e., an improvement of the framework through modification of the structural or measurement models) (Hair et al., 2006) together with considering sufficient evidence and proper research design.

The last concern of the discussion regarding occupational health services delivery model in Thai primary care units was the model's name. The causal model is commonly titled by focusing on the last dependent variable in the model. Based on this norm, the title of the causal model in this study should be "the causal model of feedback or evaluation of occupational health services delivery." By virtue of the study results, the efforts to deliver occupational health services in Thai primary care units were launched just in the past three years. Even the occupational health services are not well known. Some primary care units also have not delivered occupational health services yet. The idea to focus on the last dependent variable as feedback does not reflect the current situation. Thus, the title "the causal model of occupational health services delivery in Thai primary care units" giving importance to occupational health services is perhaps more meaningful, more accessible and also consistent with theoretical framework based on Rogers' model (2003).

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2.2 Research Hypotheses

a) Hypothesis I: System inputs have a direct positive effect on system throughputs, and an indirect positive effect on occupational health services, system outputs, and feedback by affecting system throughputs; system throughputs and occupational health services; system throughputs, occupational health services, and system outputs, respectively.

The completely standardized parameter estimate showed the system inputs had a direct effect of .96 on system throughputs and indirect positive effects of .78, .81, and .76 on occupational health services, outputs, and feedback by affecting system throughputs; system throughputs and occupational health services; system throughputs, occupational health services, and system output, respectively. As a result, this hypothesis was completely supported at a significant level of .001. The results indicated that primary care units with a higher level of system inputs had a higher level of system throughputs, occupational health services, outputs, and feedback. The findings were consistent with the study of Lee & Mills revealing patient profile variables (as parts of structure dimension) were strong predictors of overall resource use (process dimension); and prognosis (as a part of structure dimension) was the strongest predictor of discharge outcomes (outcome dimension). According to Rogers' model (Rogers, 2003), the system inputs needed for the delivery of occupational health program or service consist of several components (e.g., available human and operational resources; information resources; and organizational and occupational health unit goals). In this study, the system inputs were composed of eight components, including knowledge and understanding about occupational health services of personnel; skills about health screening, disease diagnosis, and treatment in occupational health services delivery of personnel; capability in evaluation of occupational health services delivery; adequate personnel; basic information about occupational health; statistical reports of occupational health services delivery; operational resources; and occupational health unit goals. The present findings support the need for the performances in increasing these eight components of system inputs that is consistent with prior work on occupational health information (Herbert et al., 1997; Bratveit et al., 2001;

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Gime, 2005; Siriruttanapurk et al., 2006), occupational health competencies of public health personnel (Harber & Merz, 2001; O'Hara et al., 2004; Olson et al., 2005; Elm et al., 2005; Siriruttanapurk, et al., 2006), adequate public health personnel (Bratveit et al., 2001; Siriruttanapurk, et al., 2006), operational resources (Bratveit et al., 2001; Siriruttanapurk, et al., 2006), and occupational health unit goals (Bratveit et al., 2001; Siriruttanapurk, et al., 2006). Of the eight components in this study, the improvement should especially focus on four of them: capability in evaluation of occupational health services delivery; statistical reports of occupational health services delivery; operational resources; and occupational health unit goals as discovered by their low scores.

b) Hypothesis II: System throughputs have a direct positive effect on occupational health services and output, an indirect positive effect on system outputs by affecting occupational health services, and an indirect positive effect on feedback by affecting occupational health services and system outputs.

The completely standardized parameter estimate showed system throughputs had a direct positive effect of .81 on occupational health services. System throughputs also had a direct positive effect of .35 on system outputs and indirect positive effect of .49 on system outputs by affecting occupational health services. Besides, system throughputs had an indirect positive effect of .79 on feedback by affecting occupational health services and system outputs. Hypothesis two was also fully supported at a significant level of .001. The findings suggest that the more system throughputs increased, the more occupational health services, system outputs, and feedback gained. Rogers (2003) stated that system throughput processes are numerous variables, depending on the system and its needs. In this study, the system throughputs were composes of six components, including organizing record, register, and report systems of occupational health services delivery; training, continuing education, and research of public health personnel; communication about occupational health services to clients; cooperation with other authorities involved in occupational health services; collaborative network building; and receiving additional support. The findings reflected the need for dynamic processes to improve all of the six components in this study because of

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their low scores. The presented findings were consistent with prior studies on management to operate occupational health services delivery (Rex, 1991; Herbert et al., 1997; Bratveit et al., 2001), development of records and reports system (Herbert et al., 1997; Elm et al., 2005; Siriruttanapruk et al., 2006); training, continuing education, and research of public health personnel (Herbert et al., 1997; Hughes et al., 1999, 2003; Bratveit et al., 2001; O'Hara et al., 2004; Benavides et al., 2005; Siriruttanapruk et al., 2006), communication about occupational health services to clients (Rex, 1991; Bratveit et al., 2001; O'Hara et al., 2004; Elm et al., 2005), and collaborative network building (Rex, 1991; Herbert et al., 1997; O'Hara et al., 2004; Elm et al., 2005).

c) Hypothesis III: Occupational health services have a direct positive effect on system outputs and an indirect positive effect on feedback by affecting system outputs.

The completely standardized parameter estimate showed occupational health services had a direct positive effect of .60 on system outputs. The occupational health services also had an indirect positive effect of .57 on feedback by affecting system outputs. Therefore, hypothesis three was also fully supported at a significant level of .001. The results indicated that with increasing occupational health services, primary care units had greater outputs and feedback. Rogers (2003) addressed the practice in occupational and environmental health nursing that included worker/workplace assessment and surveillance, occupational health care and primary care, case management, health promotion, health protection, counseling, management/administration, community orientation, research/trend analysis, and legal/ethical monitoring. In this study, the occupational health services consisted of four components including outreach occupational health services regarding work conditions and environments; outreach occupational health services regarding employee health, on-site occupational health services for employees in primary care units, and reporting occupational diseases and injuries. The findings supported the need for the implementation of intervention for all four components of occupational health services delivery in primary care units as evidenced by their low scores. The

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presented findings were consistent with prior endeavors to deliver work and health risk assessment (Bratveit et al., 2001; Sirirattanapruk. et al., 2006); health education, health promotion, and disease and injury prevention (Rex, 1991; Herbert et al., 1997; Bratveit et al., 2001; Elms et al., 2005; Sirirattanapruk. et al., 2006); curative and referral services (Rex, 1991; Herbert et al., 1997; Bratveit et al., 2001; Elms et al., 2005; Sirirattanapruk. et al., 2006); data management (Rex, 1991; Herbert et al., 1997; Sirirattanapruk. et al., 2006), which were categorized in two categories—outreach and on-site occupational health services (Rex, 1991; Sirirattanapruk. et al., 2006).

d) Hypothesis IV: System outputs have a direct positive effect on feedback.

The completely standardized parameter estimate showed system outputs had a direct positive effect of .94 on feedback. Hypothesis four was also supported at a significant level of .001. The findings specified that primary care units with higher system outputs had feedback at greater levels. Rogers (2003) stated that system outputs reflected whether the occupational health services were effective in meeting their objectives, altering risk, improving health parameter measurement, and reducing costs. In this study, the system outputs included the number of outreach occupational health services conducted in the community, number of on-site occupational health services delivered to employees in primary care units, and number of research documents related to occupational health services. Of three components in this study, two, the number of outreach occupational health services conducted in the community and the number of on-site occupational health services delivered to employees in primary care units, needed to be improved.

The results call for more attention to be given in producing higher outputs of outreach occupational health services conducted in the community and the number of on-site occupational health services delivered to employees in primary care units that was consistent with prior work (Rex, 1991; Herbert et al., 1997; Sirirattanapruk et al., 2006) on counting the number of activities offered for both outreach and on-site occupational health services. In

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doing so, primary care units consequently can make adjustments based on system feedback designed to identify and measure goal/objective achievement (Rogers, 2003). In this study, feedback was concerned with trends of occupational health problems, satisfaction of employees/employers, and evaluation of occupational health services delivery. The results revealed all of them had scores at a low level, indicating need for improvement. The interest in feedback as found in this study was consistent with prior work that showed concern on examining changes of worker occupational health problems (Herbert et al., 1997), studying client satisfaction (Rogers et al., 1993), and evaluating occupational health services delivery (Sirirattanapruk et al., 2006).

In regard to what are the key predictors in occupational health services delivery model, the completely standardized parameter estimate showed that the system inputs and system throughputs were two key predictors in a causal model of occupational health services delivery. While the system throughputs had the highest total effect of .81 on occupational health services, the system inputs had a total direct positive effect of .96 on system throughputs. Hence, to increase the establishment of occupational health services delivery in Thai primary care units, the improvement and development of system inputs and throughputs of primary care units is vital. Such efforts need to focus on ten components, the weak points in these two domains of Thai primary care units.

2.3 Limitations

The limitation of this study involved the application of Rogers' model of occupational health programs and services. According to Rogers' model, the occupational health services unit has interrelatedness of the system both with the external environment and the internal functioning of the system (see more details in the Chapter 2). However, this research focused only on the interrelatedness of the system with the internal functioning. This limited the findings in respect to the external environment involving occupational health issues/units.

In addition, the data gained from the second phase of this study were only from self-reports of nurses and public health personnel in judging how often

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they or other public health personnel performed the activity described. It is possible that the actual activities may vary from their responses.

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CHAPTER VI
CONCLUSION

The delivery of occupational health services should be available and accessible to all the working population. Though various occupational health services models for the provision of occupational health services are presented, the findings from many countries show one model alone is not sufficient to ensure full coverage of occupational health services. Interest in a primary health services model integrating occupational health services in primary health care unit activities is growing with the aim to help increase global coverage of occupational health services.

For the sake of establishing occupational health services delivery in Thai primary care units, the arising concerns were what tasks needed to be done, what were the perceptions of nurses and public health personnel, employees, employers, and occupational health services related authorities, as well as what key predictors of the occupational health services delivery model in Thai primary care units exist. A brief summary of this study, implications, and recommendations is presented as follows:

1. Summary of the Study

With the same goal to help increase the global coverage of occupational health services but in the different context of Thai primary care units, this research was conducted with a sequential mixed method design. It began with the qualitative methods and completed with the quantitative approach. Rogers' model was brought to form a conceptual framework for a comprehensive and complex occupational health services model in this study.

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1.1 Phase I: Qualitative Methods

In phase I, five in-depth interviews with five interviewees from three main organizations located at the central, regional, and provincial level were conducted to explore the development of occupational health services delivery in Thai primary care units. Also, seven focus group discussions with 18 public health personnel working in 18 nurse and primary care units, 15 employees, 10 employers, and 10 occupational health services related authorities were carried out to explore the essential elements of an occupational health services model in Thai primary care units. Summarizing content analysis was used to analyze qualitative data.

In light of the development of occupational health services delivery in Thai primary care units, the findings revealed that developing occupational health services delivery in Thai primary care units was launched approximately in 2003 due to the increase of health and safety concerns on informal workers. Financial support for occupational health services came from various organizations. Although the Ministry of Public Health still has not had an apparent policy regarding occupational health services yet, several projects were performed in supporting the establishment of occupational health services delivery in primary care units. The common projects offered to primary care units included 1) enhancement of occupational health competency of staff in primary care units, 2) development of management strategies to deliver occupational health services, 3) emphases of collaboration with all the stakeholders, and 4) allocation of additional budget and/or advice on financial resources. Approximately, 89 primary care units in 18 provinces nationwide engaged on those projects. However, the occupational health services were inadequately implemented and mostly limited to agricultural workers. Some primary care units also have not delivered occupational health services yet.

On the point of appropriate elements of occupational health services model in Thai primary care units, the findings showed 15 elements in five themes consistent with the Rogers' model of occupational health programs and services. The functional elements of occupational health services model in Thai primary

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care units included 1) *inputs:* occupational health competencies of public health personnel, adequate personnel, occupational health profiles, operational resources, and occupational health unit goals, 2) *throughputs:* proper management to operate occupational health services delivery; training, continuing education, and research of public health personnel; and collaborative network building, 3) *occupational health services:* outreach and on-site occupational health services, 4) *outputs:* number of activities performed as outreach and on-site occupational health services, existing health and safety hazards of worksites/enterprises, and workers who are at risk; and prevalence of workers' health problems, and 5) *feedback:* trends of occupational health problems, satisfaction of employees/employers, and evaluation of occupational health services delivery.

1.2 Phase II: Quantitative Methods

The quantitative findings revealed the general profile of the sample with male and female staff working in primary care units nearly equal (51% and 49%, respectively). The majority of the sample were 40-49 years (44.5%), completed bachelor degree (79.0%), had 1-9 years experience (61%), were Public Health Administration Officers (42.3%), as well as worked in primary care units that had a staff of 1-3 persons, responsible population less than 5,000 (49.6%), and the existence of enterprises in their responsible area (50.9%).

The exploratory factor analysis was statistically evident that there were 24 important elements of occupational health services delivery model in Thai primary care units, including 8, 6, 4, 3, and 3 elements of system inputs, throughputs, occupational health services, outputs, and feedback, respectively. The eight components of system inputs were composed of knowledge and understanding about occupational health services of personnel; skills about health screening, disease diagnosis, and treatment in occupational health services delivery of personnel; capability in evaluating occupational health services delivery; adequate personnel; basic information about occupational health; statistical reports of occupational health services delivery; operational resources; and occupational health unit goals. The six components of system throughputs included organizing record, register, and report systems of occupational health services delivery;

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training, continuing education, and research of public health personnel; communication about occupational health services to clients; cooperation with other authorities involved in occupational health services; collaborative network building; and receiving additional support. The four components of occupational health services consisted of outreach occupational health services regarding work conditions and environments; outreach occupational health services regarding employee health, on-site occupational health services for employees in primary care units, and reporting occupational diseases and injuries. The system outputs included the number of outreach occupational health services conducted in the community, number of on-site occupational health services delivered to employees in primary care units, and number of research documents related to occupational health services. The feedback was concerned with trends of occupational health problems, satisfaction of employees/employers, and evaluation of occupational health services delivery.

With the cut-off point of 70%, a majority of respondents had actual total scores of inputs, throughputs, occupational health services, outputs, and feedback at low levels, which revealed the need for improvement. Of the total 24 components in five main concepts of the occupational health services model, a majority of respondents revealed that 19 components had scores at low levels, indicating the need to be improved. These 19 components included a) four components of inputs (i.e., capability in evaluation of occupational health services delivery; statistical reports of occupational health services delivery; operational resources; and occupational health unit goals), b) six components of throughputs (i.e., organizing record, register, and report systems of occupational health services delivery; training, continuing education, and research of public health personnel; give information to clients; cooperation with other authorities involved in occupational health services; collaborative network building; and receiving additional support), c) four components of occupational health services (i.e., outreach occupational health services regarding work conditions and environments; outreach occupational health services regarding employee health; on-site occupational health services for employees in primary care units; and

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reporting occupational diseases and injuries), d) two components of outputs (i.e., the number of outreach occupational health services conducted in the community; and number of on-site occupational health services delivered to employees in primary care units), and e) three components of feedback (i.e., trends of occupational health problems; satisfaction of employees/employers; and evaluation of occupational health services delivery).

The structural model fit was assessed and model modifications were done based on a set fit index. The result showed the structural model had an adequate fit with reality as represented by the sample data (χ^2=424.56, df=176, p-value<.001, CFT=.99, GFI=.92, RMSEA= .05). It indicated that the causal model of this study was sufficient valid reliable enough to explain the phenomenon of system inputs, system throughputs, occupational health services, system outputs, and feedback of the occupational health services delivery model in Thai primary care units.

2. Implications of Findings

The findings of this sequential mixed methods research provide implications to public health professionals working in practical, academic, and administrative fields. Key factors in the five main themes could be reinforced to modify the occupational health services model for the further improvement and development in primary care units as follows:

2.1 The findings from in-depth interviews revealed several efforts in supporting the delivery of occupational health services in Thai primary care units by important agencies under the Ministry of Public Health. The results evidence the possibility to establish occupational health services delivery in Thai primary care units and suggest that the development of occupational health services delivery in primary care units should be further extended to other primary care units nationwide. Such development of occupational health services delivery in primary care units should include enhancement of occupational health competency of personnel, development of management strategies to deliver occupational health services, emphases on communication with all the stakeholders both inside and

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outside the Ministry of Public Health, and allocation of additional funds and/or advice on financial resources.

2.2 The results of focus group discussions formed the basis for understanding stakeholders' perceptions and expectations in an effort to integrate occupational health services in Thai primary care units, suggesting 15 crucial elements that had to deal with establishing occupational health services delivery in Thai primary care units. The findings support the fact that occupational health services need to be comprehensive not only to avoid duplication of effort and competition among different units or responsibilities but also to be attractive to both management and workers as well as to preserve, protect and improve the health of the workforce. The research findings convince stakeholders that they all are key persons and could take part in the success of occupational health services delivery in Thai primary care units, and give more support to the possibility of integrating occupational health services in Thai primary care units.

2.3 This theory-linked research contributes to Rogers' model development in that it extends the body of knowledge within Rogers' model by expanding the generalization of Rogers' model relying on the industrial sector to the community setting. The findings suggest that the application of Rogers' model would be valuable in other efforts to delivery occupational health services in primary care settings.

2.4 A major contribution of this study is the presentation of a causal model of occupational health services delivery in Thai primary care units. This model could serve as a prototype based on a theoretical framework for the assessment of occupational health services delivery in Thai primary care units. It offers public health professionals opportunities for improvements, modifications, and developments of the system required to strengthen occupational health services delivery.

An assessment of occupational health services performance completely conducted in this study showed that occupational health services delivery in Thai primary care units still encounters several difficulties. Using the structural equation modeling technique, the system inputs and system throughputs

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were found as two key predictors in a causal model of occupational health services delivery. However, 10 components of system inputs and system throughputs had scores at a low level indicating the need to be improved. The results provide public health professionals simpler ways to improve and develop occupational health services delivery by addressing ten problematic components as follows:

2.4.1 Implication for Policy Makers

Official organization policies on occupational health services delivery should be advocated by policy makers at national, regional, provincial, and local levels. Having appropriate policies would strengthen occupational health services delivery in Thai primary care units by affecting the enrichment of system inputs, including determining occupational health unit goals, supporting needed operational resources and personnel, and preparing statistical reports of occupational health services delivery.

2.4.2 Implication for Public Health Personnel in Academic Fields

The findings suggest that the enhancement of personnel capability as related to evaluating of occupational health services delivery and training, continuing education, and research of public health personnel are needed. Education regarding occupational health should be offered to public health personnel in various methods (e.g., in formal, in-service, or on the job training).

Recognizing that nurses and public health personnel working in primary care units are unfamiliar with occupational health services; occupational health training within interdisciplinary framework should be conducted to enhance staff competency to deliver effective occupational health services. The first prioritized topic should be evaluation of occupational health services delivery, including details about gathering, analyzing, and evaluating outputs of occupational health services delivery; assessing feasible strategies for developing occupational health services delivery; writing plans for occupational health services delivery such as health prevention/promotion programs for workers (Table 13, Appendix F).

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2.4.3 Implication for Public Health Personnel in Administrative Fields

The administrator at provincial/district levels or head of primary care units should provide consultation and support training, continuing education, and research in relation to occupational health services of public health personnel.

2.4.4 Implication for Public Health Personnel in Practice Fields

To improve and develop occupational health services delivery in Thai primary care units, public health personnel should organize systems for recording, registering, and reporting occupational health services delivery; communicate about occupational health services to clients; cooperate with other authorities involved in occupational health services; strengthen collaborative network building; and negotiate additional support.

2.4.5 Implication for Public Health Nurses

Public health nurses could be key persons in dealing with those difficulties encountered (10 problematic elements of system inputs and system throughputs). Public health nurses should realize what the occupational health problems of working population and be leaders in improving and changing health care activities or seeking additional resources to help increase appropriate occupational health services delivery to cover all the working population. Public health nurses should act as mediators among employees, employers, health care providers, and other related authorities both in private and governmental agencies to facilitate communication, cooperation, and collaboration processes for occupational health services delivery to cover neighboring working populations. By sharing resources such as funding, staff, equipment, and programs or methods, communities can strengthen their ability to address occupational health problems. Also, public health nurses should present the consequences of inadequate or ineffective occupational health services delivery to policy makers especially health hazards and health outcomes of workers.

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3. Recommendations for Further Studies

3.1 Further studies are needed to be conducted in different contexts (e.g., study in other developing countries or with different occupational health services model) to examine whether Rogers' model is valid. Also, further research is desired to discover other emerging variables based on Rogers' model. The results of such studies not only create occupational health services models in primary care settings and extend the body of knowledge within Rogers' model but also increase generalization of Rogers' model.

3.2 Since the study employed the cross-sectional design in the second phase, the causal model of this study provided limited support for the Rogers' model (i.e., two paths of feedback loop did not exist in this study due to the research design). Further studies with appropriate research design (i.e., experiment or longitudinal study) are needed to eliminate the limitation found in this study by adding those two feedback loops, the path from occupational health services back to the system throughputs and the path from system feedback back to system inputs.

3.3 The comparisons of the overall fit between the structural model and the measurement model showing a difference of two χ^2 was 64.34 with a difference in degrees of freedom of 9 suggest that possible alternative models based on Rogers' model exist. The results suggest further studies with different hypothetical structural relationships (i.e., adding more dependent relationships among the five domains such as the addition of the path from system inputs to system outputs and/or feedback) or different measurement models (i.e., including more or excluding some elements in each domain depending on modification indices of measurement model).

3.4 Although the research instruments including the SIAS, STAS, OHSAS, SOAS, and FAS would benefit the assessment of occupational health services performance in Thai primary care units, further studies are still required to assess criterion-related validity (i.e., confirm whether construct validity is at an acceptable level). Also, further studies are desirable to develop a standard criterion

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in judging how effective system inputs, throughputs, occupational health services, outputs, and feedback of Thai primary care units could be.

3.5 Further studies are also needed to design, implement, and/or evaluate appropriate interventions in improvements and developments of problematic elements in system inputs and system throughputs discovered using experiment study or action research.

3.6 With the sequential mixed methods research, tool development processes complementarily combining qualitative and quantitative methods based on a practical- and theoretical-based approach, provide a clear, detailed, and precise occupational health services model in Thai primary care units. The results support a major advantage of mixed methods research in that it has the capacity to answer both exploratory and confirmatory questions in the same study that other methodologies cannot. Although disadvantage of mixed methods research include the time and effort required as well as financial consideration, the findings suggest that in conducting research the mixed methods research should be considered as an alternative choice to design further studies.

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APPENDIX A
IN-DEPTH INTERVIEW GUIDE

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APPENDIX A
IN-DEPTH INTERVIEW GUIDE

Introduction

Hello. I am Yuwadee Wittaypun. I appreciate your taking some of your time to participate in this in-depth interview as part of this research. We will be leading today's discussion about the situation of occupational health services in the Thai primary care setting.

Purpose of Interview

The intent of this in-depth interview as a part of initial phase of research is to gain an understanding about the situation of delivering occupational health services both in primary care units and health centers in order to explore the essential elements of occupational health services delivery model proposed or expected in Thai primary care units and health centers from the perspectives of nurses and public health personnel, employees, employers, and other related authorities. What you know is important for further development of delivering occupational health services in primary care unit and health centers.

Tape Recording and Confidentiality

Before we get started, I want to remind you that we will be taking notes and tape recording the session because we do not want to miss any of your comments. As you know everything is confidential. Although we will be on a first name basis today, we will not use your real name in our report. That means your name will be deleted or changed to a letter format during tape transcription. Also, the information you provide today will be collected with that of others, and only summary reports will be written. You can be assured of complete confidentiality. No one will be able to link your name back to what you said, and only I will transcribe those tapes and keep all information including consent forms.

Consent Forms

At this point, I would like to collect your signed consent forms. Do you have any questions about these forms before I collect it? (After collecting the consent forms, the participant will be told that the tape recorder will be started.)

Timing and Appreciation

I expect to be here until _____. I appreciate you taking this time for this discussion so I want to make sure we end on time. At about _____ (5 minutes before the end of time), I will end the discussion. To show my appreciation for what you give me and for your time, I have a token that I will give you at the end of the session. Are there any questions before we get started?

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In-depth Interview Questions

- **Development of Delivering Occupational Health Services in Thai Primary Care Units**
  1. What is the background and significance of the efforts to establish occupational health services?
  2. What are activities/plans/projects designed to be done?
  3. What are the objectives of those activities/plans/projects/programs?
  4. What/Where/When/How were activities/plans/projects/programs undertaken until now?
  5. What/How were the results of those activities/plans/projects/programs undertaken?
  6. Were those outcomes congruent with the objectives?
  7. Did those activities/plans/projects/ programs have any problem directly/indirectly/obviously/ambiguously?
  8. What/Why/How were the problems of those activities/plans/projects/ programs?
  9. Were those problems solved?
  10. What/How were the methods of solutions?
  11. What/How were the outcomes of those solutions?
  12. What/How further activities/plans/projects/programs should be?
  13. Is there anything else you would like to tell me about delivering occupational health services in primary care units or health centers?

- **Asking for the List of Key Persons for Focus Group Discussion**
  1. Would you mind giving me a list of key persons for focus group discussion aiming to know the important elements of occupational health services delivery model existing or expected to be?
  2. Is there anyone else you would like to tell me as a key person?
  3. Which primary care units can not deliver occupational health services?
  4. Who are the key informants in those primary care units?

Giving a Token

Thank for participating in this in-depth interview. The information you have provided will be combined with that of others to reveal the situation of occupational health services delivery model development, and summary reports will be written. (Give participant a token.)

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APPENDIX B
FOCUS GROUP PROTOCOL

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APPENDIX B
FOCUS GROUP PROTOCOL

1. Focus Group Preparation

Date of focus group	
Focus group number	

Materials Needed

- ❒ Approximately 8 chairs arranged in a circle
- ❒ Table to arrange snacks
- ❒ Snacks for about 8 people (remember ice, utensils, cups, napkins, plates)
- ❒ 8 nametags
- ❒ 8 thick blue magic markers to write on name tags and note cards
- ❒ 8 pens
- ❒ Digital voice recorder
- ❒ 1 roll fix tape
- ❒ 12 Participant Consent Forms (one to be signed and collected, the other to leave with participant)
- ❒ 1 piece of 24 x 36-inch board
- ❒ Pad and pen for taking note
- ❒ Clock
- ❒ 6 tokens
- ❒ About 100 pieces 3x5 inch note cards
- ❒ Focus group agenda

Focus Group Site Preparation (15 minutes)

1. Arrange chairs in circular formation for participants and facilitator.
2. Setup snacks for at least 8 people.
3. Have name tags and thick blue magic markers available for people to write their first names only.
4. Have consent forms and pens ready.
5. Test digital voice recorder and place in center of the circle.
6. Warmly greet focus group participants as they enter the room. Encourage them to take some snacks.
7. Give each person two copies of a consent form to read over. Ask them to sign one copy of the form before the discussion begins and to keep the other one to take home with them. This form has focus group study contact information should they need it in the future. Make yourself available to summarize/read the form to someone who needs help.
8. Ask participants to turn off cell phones.

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9. Inform participants where bathrooms are and encourage their use before the focus group gets started.

2. Focus Group Conduct

2.1 Introduction, Ground Rules, and Icebreaker (15 minutes)

2.1.1 Introduction (3-4 minutes)

Welcome and Overview of Session

Hello everybody. My name is Yuwadee Wittaypun. I appreciate you taking some of your time to participate in this focus group as part of this research. I will be leading today's discussion about how occupational health services are to be delivered in primary care setting and what should be done to doing so.

Demonstration Research Background

I would like to start by briefly talking about policy and Practical Guideline of Occupational Health Services of Health Facilities including Primary Care Units edited by the Bureau of Occupational and Environment Diseases. As you probably know, the Occupational Health Development Committee initiated this Practical Guideline in 2002, and recently the Bureau of Occupational and Environment Diseases has revised the practical guideline by adding evaluation criteria in each practical guideline and an index in order to more easily implement it. You may examine more details in a copy of Practical Guideline of occupational health services as sent to you with a cover letter. However, it will be distributed to you again.

Purpose of the Focus Group

The intent of this focus group as an initial phase of research is to gain an understanding about delivering occupational health services both in primary care units and health centers of nurses and other public health personnel, employees, employers, and other related authorities in order to examine a causal model of occupational health services delivery. What you think is important for possibly delivering occupational health services in primary care unit and health centers will be addressed. In particular, we will be talking about:

1. What are your perceptions about the delivering occupational health services in primary care units?
2. What do you think are the characteristics of occupational health services in primary care units? And,
3. What are the significant factors contributing to delivering occupational health services in primary care units?

We are going to use what we learn from you today and from the other three focus groups of health care providers in primary care units and health centers to develop a questionnaire for a national survey on this topic in the second phase of this research. Data derived will be used to develop a model of occupational health services delivery in primary care units and health centers.

Roles of Moderator and Participants

Our focus group discussion is going to last about an hour and half. Focus groups are different from workshops or classes. Once we get started, I

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am going to ask you questions and ask you to share your thoughts and opinions. You will do most of the talking. I will be doing a lot of the listening. Remember we want to learn from you. Around 20 minutes before ending this focus group, we will let you write down all discussion features on note cards, and arrange them with your personal opinion to determine what the characteristics of occupational health services are and what factors influence it. All note cards written will be destroyed at the end of study.

2.1.2 Ground Rules (6-7 Minutes)

No "Right" or "Wrong" Answers and Participation

I will be asking you several questions about occupational health services in primary care units over the next hour. I want to assure you that there are no "right" or "wrong" answers but rather different points of view. Please feel free to share your point of view, even if it is different from what others have said. You can disagree with each other, and you can change your mind. There will be no repercussions concerning any arguable issues raised. I would like you to feel comfortable saying what you really think and how you really feel. In fact, it is really important for us to hear all the different points of view in the room. If you want to follow-up on something someone said, or if you want to agree or disagree, or give an example, feel free to do that without waiting to be called on. Do not feel like you have to respond to me all the time. Feel free to interact with one another about these questions. We want everyone to have a chance to share ideas. We may need to interrupt or call on people to make sure this happens. Please do not feel offended if we do this. Also you do not have to answer any question that makes you feel uncomfortable or you can leave the focus group at any time if you wish.

Tape Recording and Confidentiality

Before we get started, I want to remind you that we will be taking notes and tape recording the session because we do not want to miss any of your comments. As you know everything is confidential. Although we will be on a first name basis today, we will not use your real names in our report. That means your name will be deleted or changed to a letter format during tape transcription. For example, participant A will be used instead of real name. Also, the information you provide today will be collected with that of other three focus groups, and only summary reports will be written. You can be assured of complete confidentiality. No one will be able to link your name back to what you said, and only I will transcribe those tapes and keep all information including consent forms.

Consent Forms

At this point, I would like to collect everyone's signed consent forms. Does anyone have any questions about these forms before we collect them? After collecting the consent forms, the group will be told that tape recorder will be started.

Timing and Appreciation

We expect to be here until _____. We appreciate you taking this time with us so we want to make sure we end on time. I will be watching the clock and may need to break off the discussion at times to be sure we have time to discuss all topics.

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At about _____ (5 minutes before the end of our time together), we will end the focus group. To show our appreciation for what you teach us and for your time, we have 6 tokens that we will give to each of you at the end of the session.

2.1.3 Icebreaker (5 Minutes)

Let us begin. We have asked you to wear a name tag with your first name on it to help us remember each others' names. Let us go around the room and introduce ourselves. Please give your first name, tell us number of years working in primary care unit or health center, and just for fun, tell us what your favorite food and recreation are.

Are there any questions before we get started?

2.2 Focus Group Questions (90 minutes)

Introductory Question

As you know, we are trying to learn about delivering occupational health services in primary care unit from all of you as a key person to make this effort possible. During our discussion, my research assistant will help write down both the questions and the comments on a flip chart for all to see in later reviewing. Also, you can both write down your comments on note cards distributed and express out loud to share with the entire group. (Give each participant note cards and a thick blue magic marker.)

When you hear the words occupational health services, what is your understanding of occupational health services in primary care units and health centers?

Main Questions

Before we continue the discussion, a copy of the Practical Guideline of Occupational Health Services edited by the Bureau of Occupational and Environment Disease would be distributed to you all. We will take a look this Practical Guideline together and please share your opinions on occupational health issues you faced.

1. On page number____ you can see the definition of occupational health, and scope of occupational health practices. According to this information,
   a. What should the goal of occupational health services be in your opinion?
   b. What characteristics of occupational health services should be targeted in primary care units and health centers?
2. On page number ____ to _____, you can see goal, role, functions, and guideline of delivering occupational and health services in primary care units and health centers. In part of services on page____, which services have you found practicable/suitable, and impracticable/unsuitable to implement in primary care units and health centers? Why? What are reasons for that answer in each service?
   a. Which services do you think are practicable or suitable to delivery in primary care units and health centers?
   b. What else should be included to meet the goal of occupational health services in primary care units and health centers?
3. Have you performed occupational health services mentioned on page____ so far?

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a. What routine health care services both active and passive in primary care units and health centers do you consider as occupational health services?
b. Who are involved in occupational health cases?
c. How often are you confronted with clients having occupational health problems? (e.g., in the past six month how often were occupational injuries recorded?)
d. How are clients with occupation health problems managed?
e. Do you ask clients about their occupations?
f. Do you record the occupations of clients in your records?
g. Do you know the occupational health problems of clients in your responsible area?
h. What is your opinion to improve caring for clients with occupational health problems?

4. On page number ____ to _____, you can see a table of practical guideline of delivering occupational health services of primary care units and health centers. The last column of the table illustrates evaluation criteria. You can use these criteria as a guide for assessing and comparing your organizations with regard to occupational health services as required by practical guideline. Which evaluation criteria have you found applicable to implement or that your organization can perform such activities as required? Which evaluation criteria have you found inapplicable to implement or your organization cannot perform activities as required? Why? What are reasons for each answer in each criterion?
   a. Which items do you think are applicable?
   b. Which items do you think are inapplicable?
   c. What else should be included/excluded?
   d. How can your organizations perform activities as required by this practical guideline to assure quality of occupational and health services delivery?
5. What do you think it is necessary or that you need to be able to deliver such occupational health services in primary care units and health centers?
   a. What are the current barriers/difficulties to addressing occupational health services?
      1) What further other barriers/difficulties should be considered and changed to be able to deliver occupational health services in primary care units and health centers?
      2) How could these barriers/difficulties be improved/changed to be better to deliver occupational health services in primary care units and health centers?
   b. What are the factors for achieving the delivering occupational health services in primary care units and health centers?
      1) What are your opinions about the policy of delivering occupational health services in primary care units and health centers?
      2) How do you know your target population for delivering occupational health services?
      3) How are occupational health services to be integrated in health care services of primary care units and health centers?

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4) What is the major risk of occupational health problems of your clients?
5) How can you help improve worker health/safety and working conditions?

c. Are any other points/issues needed to be changed to deliver occupational health services in primary care units and health centers directly, and indirectly?

6. Of these above mentioned characteristics for delivering occupational health services in primary care units and health centers, what are undesirable and desirable results?
   a. How can you decrease undesirable and increase desirable results?
   b. What do you need additionally in order to obtain desirable results and eliminate undesirable results affecting primary care units and health centers?

Wrap-up Questions

Recall that this study is based on a system approach; we are now in the process of developing categories, and we want to be certain that we have included all categories that are important in five main concepts, including system inputs, throughputs, occupational health services, outputs, and feedback. (Ask each participant to identify on a note card their view on three to five more important characteristics of occupational health services in primary care units, as well as factors influencing or in response to deliver occupational health services in primary care units, directly or indirectly, relating to those five main concepts earlier emphasized for a system approach. Give them a few minutes to do so and then ask the participants to share their responses orally within the group. As the participants discuss their ideas, their note cards will be transferred and taped onto a 24x36 inch board. The moderator will group similar suggestions together and indicate a name for each category. The moderator then moves from category to category, asking for additional categories that will apply to each main concept.)

Is there anything else you would like to discuss about delivering occupational health services in primary care units or health centers? Notes cards will be destroyed at the conclusion of the study.

Giving Tokens

(Thank the group for participating in this focus group.) The information you provide will be combined with that of other focus groups to develop a questionnaire, and summary reports will be written. After the questionnaire is developed, some of you will be asked to comment on the content of the questionnaire by capturing the essence of the focus group topic. (Give each participant a token.)

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MAIN QUESTIONS FOR WORKERS' FOCUS GROUP

1. What are your occupational health problems attending primary care units/health centers?
   a. Did those problems occur only with you or others as well such as your friends in worksites or your families?
   b. Where did the occupational health problems happen?
   c. How did the occupational health problems turn out?
   d. How often did occupational health problems occur?
   e. When was the last time of your occupational health problems?
   f. What were the causes of occupational health problems?
   g. What was the most important cause of problems?
2. How did you treat your occupational health problems?
   a. Did you go to health care facilities?
   c. Where did you go?
   d. How were the outcomes of treatments?
   e. Were you satisfied?
   f. What other things of health care did you think you could have received?
   g. Who (your employers/families/friends in workplaces) were involved in solving your illnesses/injuries?
   h. How about your employers/families/friends in workplaces about solving your health problems?
3. What were the consequences of your occupational health problems?
   a. Did you lose money/time of work/partial (limb)s?
   b. What were impacts on you/ your employers/families/friends in workplaces due to those consequences of your occupational health problems?
4. Did you have any actions (prevention/protection/treatment/rehabilitation) related to dealing with occupational health problems?
   a. Whom did you cooperate with for dealing with occupational health problems?
   b. How about its goals/procedures/outcomes/evaluations?
5. At present, what are your opinions or needs about occupational health problems?
   a. Do you know about potential hazards in working procedures/environment?
   b. Do you have any other basic health problems?
   c. What are your concerns about your health and work?
   d. Do your health problems have negative influences on your work?
   e. What are potential hazard in working procedures/environment affecting your safety and health?
   f. How should occupational health problems be managed?
   g. Who should be engaged in dealing with occupational health problems as you mentioned? (employers, workers, health care provider, others related)
   h. What should be their roles/functions?

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i. What are your ideas regarding prevention/protection/treatment/ rehabilitation of occupational health problems?
j. How are about its goals/procedures/outcomes/evaluations?
k. How should services related to prevention/protection/treatment/ rehabilitation of health care provider in primary care units/health centers be according to your opinion or your needs regarding occupational health problems?
l. What services do you need additionally for safety and health in working both in worksites and primary care units/health centers?
m. What are your ideas in supporting/cooperating with the implementation of health care providers in primary care units/health centers according to your opinion or your needs regarding occupational health problems?

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MAIN QUESTIONS
FOR EMPLOYERS' FOCUS GROUP

1. What are workers' occupational health problems in your business?
   a. What were the magnitudes of workers' occupational health problems?
   b. How did the occupational health problems turn out?
   c. How often did occupational health problems occur?
   d. When was the last time of occupational health problems in your workplace?
   e. What were the causes of occupational health problems?
   f. What was the most important cause of problems?
2. How did you treat your workers having occupational health problems?
   a. Did he/she attend health care facilities?
   b. Where did he/she go?
   c. How were the outcomes of treatments of your workers?
   d. Were you satisfied?
   e. What other things of health care did you think your workers could have received?
   f. Who (you/workers' family/other employees in workplaces) were involved in solving your workers' illnesses/injuries?
   g. How about you/ workers' families/other employees in workplaces about solving workers' health problems?
3. What were the consequences of workers' occupational health problems?
   a. Did you/he/she lose money/time of work/partial limb(s)?
   b. What were impacts on your business/ workers' families/ other employees in workplaces due to those consequences of your workers' health problems?
4. Did you have any actions (prevention/protection/treatment/rehabilitation) related to dealing with occupational health problems?
   a. Whom did you cooperate with for dealing with occupational health problems?
   b. How about its goals/procedures/outcomes/evaluations?
5. At present, what are your opinions or needs about occupational health problems?
   a. Do you know about potential hazards in working procedures/environment in your companies?
   b. Do you know about workers' basic health problems?
   c. What are your concerns about workers' health and work?
   d. What are potential hazard in work procedures/environment affecting workers' safety and health?
   e. How should occupational health problems be managed?
   f. How are your ideas related preventions/protection/treatment/rehabilitation of occupational health problems?
   g. Who should be engaged in dealing with occupational health problems as you mentioned? (employers, workers, health care provider, others related)

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h. What should be their roles/functions of them?
i. What are about its goals/procedures/outcomes/evaluations?
j. How should services of health care providers in primary care units/health centers be according to your opinion or your needs regarding occupational health problems?
k. What services do you need additionally for worker safety and health in working both in your worksite and primary care units/health centers?
l. What are your ideas in supporting /cooperating with the implementation of health care providers in primary care units/health centers according to your opinion or your needs regarding occupational health problems?

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MAIN QUESTIONS FOR RELATED AUTHORITIES' FOCUS GROUP

1. What are the workers' occupational health problems in your communities that you are aware of?
   a. What were the magnitudes of workers' occupational health problems?
   b. How did the occupational health problems turn out?
   c. How often did occupational health problems occur?
   d. When was the last time of occupational health problems in your workplace?
   e. What were the causes of occupational health problems?
   f. What was the most important cause of problems?
3. How did workers treat their occupational health problems as you knew?
   a. Did he/she attend health care facilities?
   b. Where did he/she go?
   c. How were the outcomes of treatments of workers?
   d. Did the outcomes satisfy them?
   e. What other things of health care did you think workers could have received?
   f. Who (you/workers' families/other employees in workplaces) were involved in solving workers' illnesses/injuries?
   g. How about you/ workers' families/other employees in workplaces about solving workers' health problems?
4. What were the consequences of workers' occupational health problems that you knew?
   a. Did you/he/she lose money/time of work/partial limb(s)?
   b. What were impacts on those businesses/ workers' families/ other employees in workplaces due to those consequences of workers' health problems?
5. Did you have any actions (preventions/protection/treatment/rehabilitation) related to dealing with occupational health problems?
   a. Whom did you cooperate with for dealing with occupational health problems?
   b. How about its goals/procedures/outcomes/evaluations?
6. At present, what are your opinions or needs about occupational health problems in communities?
   a. Do you know about potential hazards in work procedures/environment in communities?
   b. Do you know about workers' basic health problems?
   c. What are your concerns about workers' health and work?
   d. What are potential hazards in work procedures/environment affecting worker safety and health?
   e. How should occupational health problems be managed?

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f. Who should be engaged in dealing with occupational health problems in communities as you mentioned? (employers, workers, health care provider, others related)
g. What should be their roles/functions?
h. What are your ideas related to preventions/protection/treatment/ rehabilitation of occupational health problems in communities?
i. How about its goals/procedures/outcomes/evaluations?
j. How should services of health care providers in primary care units/health centers be according to your opinion or your needs regarding occupational health problems in communities?
k. What services do you need additionally for worker safety and health in working both in communities and primary care units/health centers?
l. What are your ideas in supporting/cooperating with the implementation of health care providers in primary care units/health centers according to your opinion or your needs regarding occupational health problems?

7. According to some parts of Practical Guideline of occupational health services in Primary Care Units and Health Centers that my research assistant is going to distribute to you, on page number ____ to _____, you can see a table of practical guidelines of delivering occupational health services of primary care units and health centers.
   a. Which evaluation criteria have you found applicable to implement in primary care units and health centers?
   b. Which evaluation criteria have you found inapplicable to implement? Why? What are reasons for each answer in each criterion?
   c. Which items do you think are applicable?
   d. Which items do you think are inapplicable?
   e. What else should be included/excluded?
   f. How can your organizations/role/functions perform activities to support to/cooperate with primary care units and health centers to be able to conduct activities as required by this practical guideline to assure quality of occupational and health services delivery?

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APPENDIX C
RESEARCH INSTRUMENTS

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APPENDIX C
RESEARCH INSTRUMENTS

Instructions

1. This questionnaire is divided into 2 parts as follows:

   Part I: General Information Assessment Scale (GIAS)
   The first section of the questionnaire comprises 12 items of both close- and open-ended questions about general information and recommendations related to occupational health services delivery in primary care units.

   Part II: Occupational Health Services Assessment Instrument (OHSAI)
   The second section of the questionnaire is the Occupational Health Services Delivery Assessment Instrument. It is a four-point Likert scale with the response options ranging from truly met, high partially met, low partially met, and fairly met. The Occupational Health Services Delivery Assessment Instrument comprises 24 main items of five subscales listed below.
   1) System Input Assessment Scale (8 main items),
   2) System Throughput Assessment Scale (6 main items),
   3) Occupational Health Services Assessment Scale (4 main items),
   4) Outputs Assessment Scale (3 main items), and
   5) Feedback Assessment Scale (3 main items).

2. Requirements for eligibility. Responders must:
   2.1 Be public health personnel working in a primary care unit/health center surveyed.
   2.2 Have worked in a primary care unit surveyed at least a year.
   2.3 Be a person responsible for occupational health or environmental health.

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Part I General Information Assessment Scale (GIAS)

Instruction **Please fill data in the blank or mark the symbol of ✓ in ❒ in front of each answer that best corresponds to you/other staff in the primary care unit.**

1. What is your gender?
   ❒ 1. Male ❒ 2. Female

2. How old are you? (Please identify) I am……..year old.

3. What is your education level? (Please identify)

Degree	Curriculum	Major	Year of graduate
Diploma/Certificate			
Bachelor degree			
Master degree			
Others……			

4. What is your office?
   ❒ 1. Primary Care Unit (Please identify its name)
   ……..……..
   ❒ 2. Health Center (Please identify its name)
   ……..…….
   What is its address?
   Address……..……..……..……
   ……..……
   ……..……..……..…
   ……..……..……..……
   ……..……..……..……..……
   What is your Contacting Unit of Primary Care? (Please identify its name)
   ……..……..……..……..……

5. How long have you worked here?
   I have worked here for ……..years and……months.
   Do you have experience in working in other primary care units/health centers?
   ❒ 1. No
   ❒ 2. Yes (Please identify)
   The number of primary care units/health centers I have experience in working is …….., and used to work in those for…….years.

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6. What is your current position in a primary care unit/health center?
   - ❒ 1. Health Administration Officer
   - ❒ 2. Community Health Officer
   - ❒ 3. Technical Nurse
   - ❒ 4. Professional Nurse
   - ❒ 5. Public Health Technical Officer
   - ❒ 6. Other (Please identify)

7. Are you a primary care unit/health center head?
   - ❒ 1. Yes
   - ❒ 2. No

8. How many staff are in your primary care unit/health center?
   8.1 There are ……..……..full time personnel as follows:
   - ❒ 8.1.1 Health Administration Officers (……persons)
   - ❒ 8.1.2 Community Health Officers (……persons)
   - ❒ 8.1.3 Technical Nurses (……persons)
   - ❒ 8.1.4 Professional Nurses (……persons)
   - ❒ 8.1.5 Public Health Technical Officers (……persons)
   - ❒ 8.1.6 Others
     - 8.1.6.1 (Please identify) ……..……..(……persons)
     - 8.1.6.2 (Please identify) ……..……..(……persons)
     - 8.1.6.3 (Please identify) ……..……..(……persons)

   8.2 There are ……..……..employees as follows:
   - 8.2.1 (Please identify) ……..…… (……persons)
   - 8.2.2 (Please identify) ……..…… (……persons)
   - 8.2.3 (Please identify) ……..…… (……persons)

   8.3 There are ……..……..part time personnel as follows:
   - 8.3.1 (Please identify) ……..…… (……persons)
   - 8.3.2 (Please identify) ……..…… (……persons)
   - 8.3.3 (Please identify) ……..…… (……persons)

9. How many people/villages are in your responsible area?
   The number of people is ……., and
   The number of villages is ….……...

10. Are there enterprises in your responsible area?
    - ❒ 1. No
    - ❒ 2. Yes (Please identify) There are……enterprises.

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11. Are there occupational health services in your office?
    - ❒ 1. No
    - ❒ 2. Not sure
    - ❒ 3. Yes
        - 11.1 If so, please identify what year it began……..……
        - 11.2. Who initiates occupational health services in your primary care unit/health center?
            - ❒ 1. Head of primary care unit/health center
            - ❒ 2. Other personnel in primary care unit/health center
            - ❒ 3. District/Sub-district Public Health Officer
            - ❒ 4. Provincial Public Health Officer
            - ❒ 5. Staff of Contacting Units for Primary Care
            - ❒ 6. Occupational health services were launched as part of pilot project/research of external organizations.
            - ❒ 7. Not sure
            - ❒ 8. Other. (Please identify) ……..……

12. Have you ever received trainings, field visits, and/or continuing education about occupational health?
    - ❒ 1. No
    - ❒ 2. Yes (Please identify in a table below)

Topics/Subjects	Days attended	Year	Produced By Institutions

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13. Comments and Recommendations Related to Occupational Health Services Delivery.

What would you like to comment and recommend about occupational health services delivery? Please describe your opinion in each section as follows:

1. System inputs

……
……

2. System throughputs

……
……

3. Occupational health services

……
……

4. System throughputs

……
……

5. Feedback

……
……

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Part II Occupational Health Services Assessment Instrument (OHSAI)

Instruction Please indicate by marking a sign of ✓in the blank after each question to show which response best corresponds to the activity in the past three years until present of your primary care unit/health center. The response options are described below.

Yes — During the past three years until present, greater than 75 percent of the activity described within the question is met within your primary care unit.

High Partially — During the past three years until present, greater than 50 percent, but no more than 75 percent of the activity described within the question is met within your primary care unit.

Low Partially — During the past three years until present, greater than 25 percent, but no more than 50 percent of the activity described within the question is met within your primary care unit.

No — During the past three years until present, no more than 25 percent of the activity described within the question is met within your primary care unit.

No.	Items	Yes	High Partially	Low Partially	No
I. System Inputs Assessment Scale					
1.	**Knowledge and understanding about occupational health services of personnel. Could you or other public health personnel in your primary care unit describe:**				
	1.1 Scope of occupational health?				
	1.2 Aims of occupational health?				
	1.3 Occupational health hazards in work conditions and environment?				
	1.4 Occupational health and safety risks of employees?				
….	……				
….	……				
….	……				
24.	**Evaluation of occupational health services delivery. Are you or other public health personnel assessed about delivering occupational health services by:**				
	24.1 Staff of contacting units for primary care unit?				
	24.2 Staff of district/sub-district public health office?				
	24.3 Staff of provincial public health office?				
	24.4 Staff of other organizations involved in supporting occupational health services delivery?				
	24.5 Making comparison with policies/goals/ indicators of related organizations?				

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APPENDIX D
LIST OF EXPERTS

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APPENDIX D
LIST OF EXPERTS

The eight experts validating the content of the research instrument were listed by name, education, position, and institute as follows:

1. Dr. Chuntana Phadungthod
   M.D., M.P.H. (Occupational Health), Dr.PH. (Occupational Health)
   Occupational Health Physician 8
   Bureau of Occupational and Environmental Disease, Amphur Muang, Nonthaburi
2. Soisuda Kesornthong
   B.Sc.(Public Health), M.Sc. (Occupational Health and Safety), Ph.D. (Occupational Health)
   Public Health Technical Officer
   Bureau of Occupational and Environmental Disease, Amphur Muang, Nonthaburi
3. Simalak Dithisawatwet
   B.Sc. (Public Health), B.P.H. (Occupational Health and Environment), M.Sc. (Biostatistics)
   Public Health Technical Officer 8
   The Sixth Office of Disease Prevention and Control, Amphur Muang, Khon Kaen
4. Chutsiri Pisitkul
   B.Sc. (Public Health)
   Public Health Technical Officer 7
   Phayoa Provincial Public Health Office, Amphur Muang, Phayoa
5. Suvit Innamma
   B.P.H. (Public Health), M.P.H. (Public Health)
   Public Health Technical Officer 7
   Ban Meng Primary Care Unit, Amphur Nong Ruea, Khon Kaen
6. Aumphaporn Karinchai
   B.Sc. (Health Education), B.Sc. (Nursing & Midwifery)
   Professional Nurse 7
   Ban Tom Primary Care Unit, Amphur Muang, Phayoa
7. Arnon Vutthanakorakul,
   B.P.H (Public Health), M.P.H. (Public Health)
   Chaloem Phra Kiat Analyo Primary Care Unit, Amphur Muang, Phayoa
8. Utumporn Thung-Oon
   B.Sc. (Nursing & Midwifery)
   Professional Nurse 7
   Phu Sang Primary Care Unit, Amphur Phu Sang, Phayao

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APPENDIX E
DOCUMENTARY PROOF OF ETHICAL CLEARANCE

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APPENDIX E
DOCUMENTARY PROOF OF ETHICAL CLEARANCE

No. MU 2006-211

Documentary Proof of Ethical Clearance
The Committee on Human Rights Related to Human Experimentation
Mahidol University, Bangkok

Title of Project: A Causal Model of Occupational Health Service Delivery in Thai Primary Care Units
(Thesis for Ph.D.)

Principle Investigator: Mrs. Yuwadee Wittayapun

Name of Institution: Faculty of Public Health

Approved by the Committee on Human Rights Related to Human Experimentation

Signature of Chairman: .....
(Professor Dr.Srisin Khusmith)

Signature of Head of the Institute: for .....
(Professor Dr.Pornchai Matangkasombut)

Date of Approval: 17 NOV 2006

Date of Expiration: 16 FEB 2008

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APPENDIX F
DATA ANALYSIS

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APPENDIX F
DATA ANALYSIS

1. Covariance Matrix

Covariance Matrix

	THROUG1T	THROUG2T	THROUG3	THROUG4T	THROUG5T	THROUG6T
THROUG1T	0.23					
THROUG2T	0.13	0.25				
THROUG3	0.64	0.66	5.64			
THROUG4T	-0.01	-0.01	-0.06	0.00		
THROUG5T	-0.01	-0.01	-0.06	0.00	0.00	
THROUG6T	-0.01	-0.01	-0.05	0.00	0.00	0.00
OHS1T	0.05	0.04	0.24	0.00	0.00	0.00
OHS2	0.56	0.46	3.24	-0.05	-0.05	-0.05
OHS3	1.83	1.47	8.47	-0.13	-0.12	-0.12
OHS4T	0.04	0.04	0.19	0.00	0.00	0.00
OUTPUT1	0.82	0.72	4.21	-0.06	-0.07	-0.06
OUTPUT2T	-0.01	-0.01	-0.05	0.00	0.00	0.00
OUTPUT3	1.14	0.84	5.36	-0.08	-0.09	-0.08
FEEDBA1	0.82	0.59	3.64	-0.06	-0.06	-0.06
FEEDBA2T	0.14	0.11	0.59	-0.01	-0.01	-0.01
FEEDBA3T	-0.01	-0.01	-0.06	0.00	0.00	0.00
INPUT1	0.27	0.31	1.37	-0.02	-0.01	-0.02
INPUT2	0.73	0.61	3.08	-0.03	-0.03	-0.04
INPUT3	0.30	0.45	1.50	-0.04	-0.04	-0.04
INPUT4	0.34	0.29	1.52	-0.02	-0.02	-0.02
INPUT5	0.26	0.24	1.16	-0.01	-0.01	-0.01
INPUT6	1.36	1.06	6.68	-0.15	-0.14	-0.12
INPUT7T	0.16	0.11	0.70	-0.02	-0.02	-0.01
INPUT8	1.08	0.95	5.00	-0.11	-0.11	-0.08

Covariance Matrix

	OHS1T	OHS2	OHS3	OHS4T	OUTPUT1	OUTPUT2T
OHS1T	0.03					
OHS2	0.27	6.34				
OHS3	0.65	12.27	58.54			
OHS4T	0.02	0.21	0.87	0.04		
OUTPUT1	0.35	4.58	15.11	0.30	10.59	
OUTPUT2T	-0.01	-0.06	-0.19	-0.01	-0.12	0.00
OUTPUT3	0.46	7.89	25.87	0.55	11.29	-0.17
FEEDBA1	0.32	4.54	15.48	0.37	7.27	-0.10
FEEDBA2T	0.06	0.68	2.08	0.06	1.05	-0.02
FEEDBA3T	-0.01	-0.07	-0.20	0.00	-0.09	0.00
INPUT1	0.10	1.34	5.82	0.09	2.56	-0.03
INPUT2	0.21	3.86	14.62	0.19	5.52	-0.06
INPUT3	0.14	1.35	5.05	0.10	2.78	-0.04
INPUT4	0.11	1.37	5.02	0.10	2.77	-0.03
INPUT5	0.08	1.33	5.13	0.07	2.09	-0.01
INPUT6	0.53	6.89	17.62	0.44	8.77	-0.15
INPUT7T	0.05	0.71	1.75	0.05	0.87	-0.01
INPUT8	0.31	3.85	11.90	0.28	5.88	-0.10

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Covariance Matrix

	OUTPUT3	FEEDBA1	FEEDBA2T	FEEDBA3T	INPUT1	INPUT2
OUTPUT3	26.44					
FEEDBA1	12.83	12.37				
FEEDBA2T	1.72	1.33	0.34			
FEEDBA3T	-0.14	-0.09	-0.02	0.00		
INPUT1	3.87	2.71	0.31	-0.02	5.55	
INPUT2	10.76	6.75	0.81	-0.07	4.45	16.44
INPUT3	2.86	2.12	0.45	-0.04	1.42	3.15
INPUT4	4.12	2.91	0.42	-0.03	2.41	4.57
INPUT5	3.78	2.14	0.25	-0.01	1.10	2.65
INPUT6	13.57	9.60	1.84	-0.14	3.32	8.97
INPUT7T	1.42	0.90	0.17	-0.01	0.28	0.79
INPUT8	8.42	5.65	1.11	-0.12	2.15	6.76

Covariance Matrix

	INPUT3	INPUT4	INPUT5	INPUT6	INPUT7T	INPUT8
INPUT3	7.44					
INPUT4	1.89	4.20				
INPUT5	1.24	1.54	4.45			
INPUT6	4.77	5.26	3.22	28.48		
INPUT7T	0.42	0.43	0.22	1.88	0.28	
INPUT8	3.52	3.00	1.69	12.55	1.24	19.40

2. Parameter Specifications

LAMBDA-Y

	throughp	OHS	Output	feedback
THROUG1T	0	0	0	0
THROUG2T	1	0	0	0
THROUG3	2	0	0	0
THROUG4T	3	0	0	0
THROUG5T	4	0	0	0
THROUG6T	5	0	0	0
OHS1T	0	0	0	0
OHS2	0	6	0	0
OHS3	0	7	0	0
OHS4T	0	8	0	0
OUTPUT1	0	0	0	0
OUTPUT2T	0	0	9	0
OUTPUT3	0	0	10	0
FEEDBA1	0	0	0	0
FEEDBA2T	0	0	0	11
FEEDBA3T	0	0	0	12

LAMBDA-X

	input
INPUT1	13
INPUT2	14
INPUT3	15
INPUT4	16
INPUT5	17
INPUT6	18
INPUT7T	19
INPUT8	20

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BETA

	throughp	OHS	Output	feedback
throughp	0	0	0	0
OHS	21	0	0	0
Output	0	22	0	0
feedback	0	0	23	0

GAMMA

	input
throughp	24
OHS	0
Output	0
feedback	0

PSI

throughp	OHS	Output	feedback
25	26	27	28

THETA-EPS

THROUG1T	THROUG2T	THROUG3	THROUG4T	THROUG5T	THROUG6T
29	30	31	32	33	34

THETA-EPS

OHS1T	OHS2	OHS3	OHS4T	OUTPUT1	OUTPUT2T
35	36	37	38	39	40

THETA-EPS

OUTPUT3	FEEDBA1	FEEDBA2T	FEEDBA3T
41	42	43	44

THETA-DELTA

INPUT1	INPUT2	INPUT3	INPUT4	INPUT5	INPUT6
45	46	47	48	49	50

THETA-DELTA

INPUT7T	INPUT8
51	52

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3. Testing Important Statistical Assumptions

3.1 Normality

Of the 24 observed variables, only 6 variables showed statistical significance of normal distribution in the overall normality test at a significant level of .001. There were 11 variables that had markedly nonnormal distributions with high Z-score skewness at a .001 significant level as shown in Table 11. These 11 variables were then transformed by taking the square root, logarithms, and inverse of the variables. The Z-score skewness of ten transformed variables was improved to a more acceptable level except for the variable, cooperation with other authorities involved in occupational health services.

Table 11 Z-score Skewness of Observed Variables before and after Transformed (n=403)

Observed Variables	Z-score Skewness	
	Before Transformed	After Transformed
1. Operational Resources	3.97***	1.62
2. Organizing Record, Register, and Report Systems of Occupational Health Services Delivery	2.94***	0.10
3. Training, Continuing Education, and Research of Public Health Personnel	3.52***	0.68
4. Cooperation with Other Authorities Involved in Occupational Health Services	7.73***	-3.28***
5. Collaborative Network Building	6.78***	-2.61
6. Receiving Additional Support	5.76***	1.19
7. Outreach Occupational Health Services Regarding Work Conditions and Environments	4.41***	-0.15
8. Reporting Occupational Diseases and Injuries	3.89***	-0.12
9. Number of On-site Occupational Health Services Delivered to Employees in Primary Care Units	5.92***	0.75
10. Satisfaction of Employees/Employers	3.32***	1.11
11. Evaluation of Occupational Health Services Delivery	4.81***	1.78

Note: ***p-value ≤.001

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Basically, to minimize the problems of deviations from normality, the study requires 15 respondents for each parameter estimated in the model. However, recall that the sample size suggested for using maximum likelihood estimation technique ranges from 150 to 400 subjects (Hair et al., 2006). Based on these two rules, the sample size of 403 in this study seemed to be a proper compromise. Also, transformed variables showed sufficient remedies for further analysis.

3.2 Linearity and Multicollinearity

The common way by running a multiple regression analysis was utilized to assess linearity and multicollinearity of variables. With this procedure, inputs, throughputs, occupational health services, and output were considered to be independent variables influencing feedback or dependent variables.

3.2.1 Linearity

As shown in Table 12, the correlation matrix among variables existed from multiple regression analysis showed a correlation coefficient between each of the four variables, including inputs, throughputs, occupational health services, and output, and feedback of .61, .49, .62, and .75, respectively. These correlation coefficients were significantly higher than .5 at the significant level of .001, indicating adequate linear relationships between independent and dependent variables.

Table 12 Correlation Matrix among Variables

Variable	Inputs	Throughputs	Occupational Health Services	Outputs	Feedback
Inputs	1.00				
Throughputs	.61***	1.00			
Occupational Health Services	.59***	.57***	1.00		
Outputs	.65***	.56***	.73***	1.00	
Feedback	.61***	.49***	.62***	.75***	1.00

Note: ***p-value <.001

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3.2.2 Multicollinearity

Both tolerance and variance inflation factors (VIF) were considered to examine multicolinearity from multiple regression analysis. Because tolerance value is the amount of a variable unexplained by the other independent variables, its value should be high. The VIF is calculated by taking the inverse of the tolerance value. With a tolerance value below .19 (or above a VIF of 5.3), the variables would have problems with mulitcolinearity (Hair et al., 2006). In this study, tolerance of predictors ranged from .44-.69; VIF, 1.72-2.30, indicating a non existing multicollinearity problem.

3.3 Normality of the Error Term

The normality of the error term of the variate was checked using a visual examination of the normal probability plots of the residuals. As shown in Figure 8, the values fell along the diagonal representing a normal distribution, indicating that the variate met the assumption of normality well.

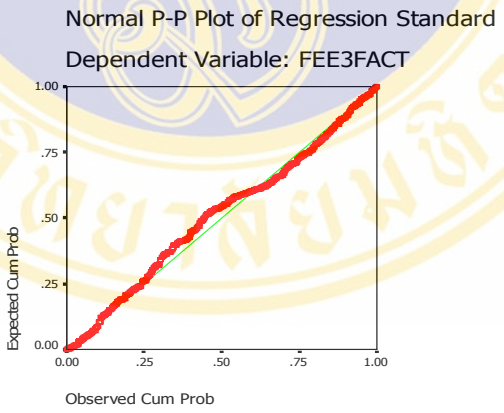

Figure 8 Normal Probability Plots of the Residuals

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4. Percentage of Respondents Classified by Observed Variables

Table 13 Percentage of Respondents Classified by Observed Variables (n=403)

No.	Observed Variables - Items	Percentage of Respondents			
		Yes	High Partially	Low Partially	No
1.	**Knowledge and understanding about occupational health services (OHSs) of Personnel**				
	1.1 Scope of occupational health.	9.7	50.4	36.2	3.7
	1.2 Aims of occupational health.	12.7	56.6	28.5	2.2
	1.3 Occupational health hazards in work conditions and environment.	20.6	61.0	16.9	1.5
	1.4 Occupational health and safety risks of employees.	23.1	61.3	14.4	1.2
2.	**Skills about health screening, disease diagnosis, and treatment in occupational health services delivery of personnel**				
	2.1 Screen employee health for:	22.3	58.8	16.9	2.0
	- General diseases.				
	- Occupational injuries.	18.1	57.3	20.8	3.7
	- Occupational diseases.	13.2	51.6	30.8	4.5
	2.2 Diagnose:	19.4	62.0	16.1	2.5
	- General diseases.				
	- Occupational injuries.	17.1	62.3	17.4	3.2
	- Occupational diseases.	13.2	53.8	29.0	4.0
	2.3 Basically treat employees who were sick or injured.	29.3	61.0	8.7	1.0
3.	**Personnel capability in evaluating occupational health services delivery**				
	3.1 Gather, analyze, and evaluate outputs of occupational health services delivery.	10.2	46.4	36.7	6.7
	3.2 Assess feasible strategies for improving and developing occupational health services delivery.	10.9	47.1	36.2	5.7
	3.3 Write plans/projects/programs of occupational health services delivery such as a health promotion program.	13.2	47.4	34.0	5.5
4.	**Adequate personnel**				
	4.1 The number of public health personnel is equal to or more than the standard number of public health personnel in a primary care unit identified by the Ministry of Public Health.	8.4	18.4	37.7	35.5
	4.2 The number of public health personnel aids to partially support for establishing occupational health services delivery.	5.7	34.7	44.9	14.6
	4.3 Types of public health personnel such as nurses or public health workers are consistent or more diverse than the standard types of public health personnel in a primary care unit identified by the Ministry of Public Health.	10.4	27.8	35.7	26.1
	4.4 Types of public health personnel aid to partially support for establishing occupational health services delivery.	8.2	39.5	40.4	11.9

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Table 13 Percentage of Respondents Classified by Observed Variables (n=403) (Continued)

No.	Observed Variables - Items	Percentage of Respondents			
		Yes	High Partially	Low Partially	No
5.	**Basic information about occupational health**				
	Having information of:				
	5.1 The number of workforce in responsible area.	34.0	50.4	13.4	2.2
	5.2 Occupational categories of workers in responsible area.	26.1	47.4	22.3	4.2
	5.3 The number of occupational groups, organizations, and enterprises in responsible area.	26.1	49.9	21.1	3.0
6.	**Statistical reports of occupational health services delivery**				
	Having statistical reports of**:**				
	6.1 Abnormal health discovered from health screening.	6.2	30.3	42.2	21.3
	6.2 Work conditions and environments discovered from walk-through surveys including health hazards.	3.5	18.9	47.6	30.0
	6.3 Accidents/disasters of occupational groups, organizations, and enterprises visited/occurred.	2.0	16.6	49.9	31.5
	6.4 Target or high-risk groups of workers, organizations, or enterprises to deliver occupational health services.	3.2	26.3	43.9	26.6
	6.5 Occupational health services plans/projects/programs done completely.	4.2	26.3	41.7	27.8
	6.6 Satisfaction degree with occupational health services delivery of employees, employers, and/or organizations.	3.5	17.6	38.2	40.7
	6.7 Those statistical reports were highlighted with charts/ graphs to show crucial occupational health issues.	1.5	14.9	42.7	40.9
	6.8 Those statistic reports were usually updated.	2.7	20.3	43.9	33.0
7.	**Operational resources**				
	Having:				
	7.1 Forms for walk-through surveys.	2.5	13.4	37.2	46.9
	7.2 Forms for basic health screening.	6.5	19.1	34.7	39.7
	7.3 Equipment/arrangements for recording work history and health hazard exposure.	6.2	26.3	31.0	36.5
	7.4 Equipment/arrangements for registering services offered to employees.	3.5	17.4	32.8	46.4
8.	**Occupational health unit goals**				
	Having:				
	8.1 Goals/indicators of occupational health services delivery determined by the District/Sub-district Public Health Office.	8.9	29.8	40.7	20.6
	8.2 Goals/indicators of occupational health services delivery determined by the Contacting Units for Primary Care.	7.4	28.8	43.7	20.1
	8.3 Goals/indicators of occupational health services delivery determined by other organizations involved in supporting occupational health services delivery.	4.7	23.1	43.2	29.0

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Table 13 Percentage of Respondents Classified by Observed Variables (n=403) (Continued)

No.	Observed Variables - Items	Percentage of Respondents			
		Yes	High Partially	Low Partially	No
	8.4 Goals/indicators of occupational health services delivery determined by head of your primary care unit/health center.	5.2	29.0	41.2	24.6
	8.5 Goals/indicators of occupational health services delivery determined by other staff in your primary care unit/health center.	4.7	21.3	45.9	28.0
	8.6 Written documents of goals/indicators of occupational health services delivery of your primary care unit such as existing in a long-term plan.	4.2	17.9	40.9	37.0
9.	**Organizing record, register, and report systems of occupational health services delivery**				
	Having:				
	9.1 Meeting/informing/managing about record work history of and health hazard exposure of employees in Family Folders or other related.	8.2	26.6	41.2	24.1
	9.2 Meeting/informing/managing register systems of services offered to employees.	4.0	20.3	40.7	35.0
	9.3 Meeting/informing/managing report systems of occupational diseases/injuries.	5.0	23.8	41.4	29.8
10.	**Training, continuing education, and research of public health personnel**				
	There are				
	10.1 Need assessments of trainings, field visits, continuing educations, and/or research presentation about occupational health of public health personnel.	9.9	25.6	37.7	26.8
	10.2 Staff who received trainings, field visits, and/or continuing education in relation to occupational health.	9.4	22.8	34.2	33.5
	10.3 Support/encouragement given to public health personnel to conduct occupational health research or other related.	6.9	22.3	37.5	33.3
11.	**Communication about occupational health services to clients**				
	Having:				
	11.1 Informing/negotiating with agricultural workers.	5.7	26.8	38.0	29.5
	11.2 Informing/negotiating with delegates of occupational groups.	3.0	24.8	36.7	35.5
	11.3 Informing/negotiating with community leaders.	13.4	36.7	32.3	17.6
12.	**Cooperation with other authorities involved in occupational health services**				
	Having:				
	12.1 Cooperation with representatives of municipality office.	1.2	9.7	31.3	57.8
	12.2 Cooperation with representatives of provincial social security office	0.5	9.4	30.5	59.6
	12.3 Cooperation with representatives of provincial labor protection and welfare office.	0.2	6.5	31.3	62.0

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Table 13 Percentage of Respondents Classified by Observed Variables (n=403) (Continued)

No.	Observed Variables - Items	Percentage of Respondents			
		Yes	High Partially	Low Partially	No
	12.4 Cooperation with representatives of the provincial industry office.	0.5	6.0	26.1	67.5
13.	**Collaborative network building**				
	13.1 All stakeholders related form collaborative networks to support occupational health services delivery.	1.0	13.2	34.0	51.9
	13.2 There is an official name list of collaborative networks.	0.7	12.4	28.5	58.3
	13.3 Collaborative network have meeting plans.	0.5	11.7	29.0	58.8
	13.4 There are regular meetings of collaborative networks.	0.7	10.7	27.5	61.0
	13.5 There are meeting reports of collaborative networks.	1.0	10.2	28.3	60.5
14.	**Receiving additional support**				
	There are the supports received about:				
	14.1 Projects/programs proposed by	3.2	16.9	42.2	37.7
	- Primary care units.				
	- All stakeholders.	1.2	14.7	41.2	44.9
	- External organizations related.	2.0	7.7	35.7	54.6
	14.2 Working team.	0.7	9.7	34.7	54.8
	14.3 Budget.	1.2	8.9	33.0	56.8
	14.4 Forms of walk-through surveys.	1.5	11.4	35.7	51.4
15.	**Outreach occupational health services regarding work conditions and environments**				
	15.1 Conduct walk-through surveys at work site.	3.5	21.1	40.9	34.5
	15.2 Record the result of walk-through surveys.	2.7	18.4	39.7	39.2
	15.3 Inform employees, employers/enterprises, and other organizations relating the result of walk-through surveys.	2.0	16.1	36.5	45.4
	15.4 Advise preventive and control measures to employees, employers/enterprises, and other related organizations.	3.5	24.3	37.5	34.7
	15.5 Participate in correcting or improving work conditions and environments.	2.5	18.6	36.7	42.2
	15.6 Visit to follow up the corrected or improved work conditions and environments.	3.5	17.9	39.5	39.2
16.	**Outreach occupational health services regarding employee health**				
	16.1 Screen employee health.	7.7	30.8	34.7	26.8
	16.2 Ask employees about work history and health hazard exposure, and recognize the interaction between health and work, including the severity of diseases and work.	5.5	32.0	38.5	24.1
	16.3 Record the work history and health hazards exposure, and results of health screening such as record in Family Folders.	8.4	31.8	35.0	24.8

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Table 13 Percentage of Respondents Classified by Observed Variables (n=403) (Continued)

No.	Observed Variables - Items	Percentage of Respondents			
		Yes	High Partially	Low Partially	No
17.	**On-site occupational health services for employees in primary care units**				
17.1	Ask employees about work history and health hazard exposure, and recognize the interaction between health and work, including the severity of diseases and work.	11.2	36.7	34.0	18.1
17.2	Record the work history and health hazards exposure, and results of health screening such as record in the Family Folder.	14.4	36.2	33.0	16.4
17.3	Diagnose occupational disease such as pesticide poisoning, chemical contact dermatitis of employees who attend services in primary care units.	9.7	35.0	34.2	21.1
17.4	Diagnose occupational injuries of employees who attend services in primary care units.	10.7	31.0	36.5	21.8
17.5	Record the result of diagnosis of occupational diseases and injuries such as record in Family Folders.	11.2	31.8	33.3	23.8
17.6	Treat diseases/injuries for employees who attend services in primary care units.	19.9	43.7	23.3	13.2
17.7	Refer employees who attend services in primary care units to a higher degree of health care facility in case of appropriate investigation of occupational diseases.	19.4	37.0	27.5	16.1
17.8	Inform employees of the results of health screening and investigating.	11.9	36.2	27.8	24.1
17.9	Advise employees on changing health behaviors, work conditions and environments such as health promotion or health protection.	18.6	42.4	29.0	9.9
17.10	Inform other staff in primary care units of the name list of employees needed to be visited to follow up the changed health behaviors, work conditions and environments.	9.4	32.0	30.3	28.3
18.	**Reporting occupational diseases and injuries**				
18.1	Report occupational diseases and injuries with Form 506/2.	9.2	24.1	25.8	40.9
18.2	Report occupational diseases and injuries with special form for occupational diseases often found in community.	4.5	19.9	27.0	48.6
18.3	Report occupational diseases and injuries with computer system (e.g., ICD-10).	10.7	23.8	24.6	40.9
18.4	Report occupational diseases and injuries monthly.	10.4	22.6	24.1	42.9
19.	**Number of outreach occupational health services conducted in the community**				
	Describing:				
19.1	The number and types of worksite/ enterprises that were walk-through surveyed.	4.7	35.5	35.7	24.1
19.2	The problems of worksite/enterprises that have health and safety hazards existing in work conditions and environments.	6.2	35.0	37.0	21.8

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Table 13 Percentage of Respondents Classified by Observed Variables (n=403) (Continued)

No.	Observed Variables - Items	Percentage of Respondents			
		Yes	High Partially	Low Partially	No
	19.3 The numbers of employees who are at risk of health and safety or work under inappropriate work conditions and environments.	4.5	34.7	35.7	25.1
	19.4 The numbers of worksite/enterprises found health and safety hazards existing in work conditions and environments that were advised on preventive or control measures and visited to follow up.	5.2	30.5	40.9	23.3
20.	**Number of on-site occupational health services delivered to employees in primary care units**				
	Describing:				
	20.1 The number of employees who were screened for health.	11.7	35.2	33.0	20.1
	20.2 The prevalence of employees screened for health that found abnormal health.	11.7	34.5	32.0	21.8
	20.3 The number of employees who were investigated for health and diagnosed diseases.	10.7	38.0	32.8	18.6
	20.4 The prevalence of occupational diseases among employees who attended services.	8.7	32.8	34.2	24.3
	20.5 The prevalence of occupational injuries among employees who attended services.	8.7	35.0	34.0	22.3
	20.6 The prevalence of general diseases among employees who attended services.	12.2	40.9	29.8	17.1
21.	**Number of research documents related to occupational health services**				
	Describing:				
	21.1 The number of research documents of outreach occupational health services produced by staff in primary care unit.	5.0	16.1	29.8	49.1
	21.2 The number of research documents of outreach occupational health services produced by staff in primary care unit together with other organizations related.	5.2	18.1	28.8	47.9
	21.3 The number of research documents of on-site occupational health services produced by staff in primary care unit.	5.0	18.6	28.5	47.9
	21.4 The number of research documents of on-site occupational health services produced by staff in primary care unit together with other related organizations.	4.7	19.1	28.5	47.6
22.	**Trends of occupational health problems**				
	Describing:				
	22.1 The top five occupational diseases.	9.9	29.8	36.5	23.8
	22.2 The top five occupational injuries.	9.2	30.5	36.5	23.8
	22.3 Trends of occupational diseases/injuries.	6.7	29.8	38.2	25.3
	22.4 Trends of employees/enterprises that are important target groups of occupational health services.	6.5	29.0	39.2	25.3

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Table 13 Percentage of Respondents Classified by Observed Variables (n=403) (Continued)

No.	Observed Variables - Items	Percentage of Respondents			
		Yes	High Partially	Low Partially	No
23.	**Satisfaction of employees/employers**				
	Describing:				
	23.1 The proportion of employee satisfaction degree.	4.5	24.6	36.5	34.5
	23.2 The comments and/or recommendations of employees that need primary care units to be better improved or corrected.	2.0	23.1	37.7	37.2
	23.3 The proportion of employers/enterprises' satisfaction degree.	2.7	21.8	38.2	37.2
	23.4 The comments and/or recommendations of employers/enterprises that need primary care unit to be better improved or corrected.	2.5	20.8	38.7	38.0
24.	**Evaluation of occupational health services delivery**				
	You or other public health personnel are assessed about delivering occupational health services by:				
	24.1 Staff of contacting units for primary care unit.	2.5	20.1	34.2	43.2
	24.2 Staff of district/sub-district public health office.	3.7	21.3	34.5	40.4
	24.3 Staff of provincial public health office.	2.5	17.4	37.0	43.2
	24.4 Staff of other organizations involved in supporting occupational health services delivery.	2.2	16.1	30.5	51.1
	24.5 Making comparison with policies/goals/ indicators of related organizations.	2.5	16.4	33.7	47.4

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