EFFICACY OF DIABETIC CARE IN ONE PRIMARY CARE UNIT : CHATAPHADUNG COMMUNITY MEDICAL UNIT

WANAPORN WATTANAKOOL

A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF PRIMARY HEALTH CARE MANAGEMENT
FACULTY OF GRADUATE STUDIES
MAHIDOL UNIVERSITY
2016

Thesis
entitled

EFFICACY OF DIABETIC CARE IN ONE PRIMARY CARE UNIT : CHATAPHADUNG COMMUNITY MEDICAL UNIT

.....

Ms. Wanaporn Wattanakool
Candidate

Bang-on Thepthien
.....

Lect.Bang-On Thepthien,
Ph.D.(Behavioral Science)
Major advisor

.....

Assist. Prof.Jutatip Sillabutra,
Ph.D.(Mathematics)
Co-advisor

.....

Prof. Patcharee Lertrit,
M.D., Ph.D. (Biochemistry)
Dean
Faculty of Graduate Studies
Mahidol University

Aroonsri Mongkolchati
.....

Assist. Prof. Aroonsri MongkolChati,
Ph.D. (Public Health)
Program Director
Master of Primary Health Care Management
ASEAN Institute for Health Development
Mahidol University

Thesis
entitled

EFFICACY OF DIABETIC CARE IN ONE PRIMARY CARE UNIT : CHATAPHADUNG COMMUNITY MEDICAL UNIT

was submitted to the Faculty of Graduate Studies, Mahidol University
for the degree of Master of Primary Health Care Management
on
December 15, 2016

.....
Ms. Wanaporn Wattanakool
Candidate

.....
Lect.Supattra Srivanichakorn,
M.D.,
Dip.Thai Board of Epidemiological
Chair

.....
Assist. Prof.Jutatip Sillabutra,
Ph.D.(Mathematics)
Member

.....
Lect.Bang-On Thepthien,
Ph.D.(Behavioral Science)
Member

.....
Prof. Patcharee Lertrit,
M.D., Ph.D. (Biochemistry)
Dean
Faculty of Graduate Studies
Mahidol University

.....
Prof. Supa Pengpid,
Dr.P.H.
Director
ASEAN Institute for Health Development
Mahidol University

ACKNOWLEDGEMENTS

I would first like to thank my thesis advisor Dr.Bang-on Thepthian of the Asean Institute for Health Development at Mahidol University. Dr.Bang-on Thepthian was always open whenever I ran into a trouble spot or had a question about my research or writing. She consistently allowed this paper to be my own work, but steered me in the right direction whenever she thought I needed it.

Besides my advisor, I would like to thank the rest of my thesis committee: Dr.Supattra Srivanichakorn and Dr.Jutatip Sillabutra for their insightful comments and kindness, but also for the questions which incented me to widen my research from various perspectives.

I would also like to acknowledge Mr.Ronnayuth Chadpudsa, Mrs. Pranomgorn Pahanit and Mrs.Aram Suwanno for their patience to searching and collecting data for this research, and all staff of Chataphadung Community Medical Unit and Social Medicine Department of Khon Kaen Hospital for their giving and helping. They always support me anyway that I needed.

Last but not the least, I would like to thank my family: my mother and to my partner for supporting me spiritually throughout the writing process of this thesis and my life in general.

Wanaporn Wattanakool

THE EFFICACY OF DIABETIC CARE IN ONE PRIMARY CARE UNIT IN CHATAPHADUNG COMMUNITY MEDICAL UNIT

WANAPORN WATTANAKOOL 5537737 ADPM/M

M.P.H.M.

THESIS ADVISORY COMMITTEE : BANG-ON RHEEPTHIAN, Ph.D., DR.SUPATRA SRIVANICHAKORN,M.D., JUTATIP SILLABUTRA, Ph.D.

ABSTRACT

Chataphadung Community Medical Unit (CCMU) has been developing the holistic health care systems. The efficacy and the quality of care should be evaluated.The objective of this study was to measure efficacy and quality of holistic health care systems A retrospective cohort study was conducted. The data of diabetic patients who visited the CMU continuously from October 2011 to September 2015 were collected. The number of patients receiving blood examinations and the proportion of those receiving an annual examination of eye and foot were used to measure as efficacy and quality of holistic health care. The results showed that the prevalence of diabetes diagnosed was 0.53 in 2015. In 2014, it was found 32% of diabetic patients with less than 7% of HbA1C but only 19% of those in 2015. Twenty-six percent of the patients with acceptable LDL level (less than 100 mg/dl) and 43% of those with good eGFR (more than 90ml/min) were identified in 2015. The rate of eye examination was low and the results were unreliable. It is likely that the efficacy and quality of care of CCMU are inadequate. It needs better clinical care and assessment as indicated.

KEY WORDS: COMMUNITY MEDICAL UNIT / EFFICACY / DIABETES MELLITUS

71 pages

ประสิทธิผลการดูแลเบาหวานในหน่วยบริการปฐมภูมิ : ศูนย์แพทย์ชุมชนชาตะผดุง

THE EFFICACY OF DIABETIC CARE IN ONE PRIMARY CARE UNIT IN CHATAPHADUNG COMMUNITY MEDICAL UNIT

วนาพร วัฒนกูล 5537737 ADPM/M

สม.ม.

คณะกรรมการที่ปรึกษาวิทยานิพนธ์: บังอร เทพเทียน, Ph.D., สุพัตรา ศรีวนิชชากร,
จุฑาทิพย์ ศีลบุตร,Ph.D.

บทคัดย่อ

ศูนย์แพทย์ชุมชนชาตะผดุง มีระบบการดูแลผู้ป่วยเบาหวานอย่างเป็นองค์รวมและมีการพัฒนาระบบงานมาอย่างต่อเนื่อง อย่างไรก็ตาม ยังไม่มีการประเมินประสิทธิผลและคุณภาพการดูแลรักษาในระยะยาว จึงเป็นที่มาของงานวิจัยนี้ วิธีการวิจัย เป็นการสืบค้นข้อมูลย้อนหลัง โดยเก็บข้อมูลผู้ป่วยเบาหวานที่มีภูมิลำเนาอยู่ในเขตให้บริการของศูนย์แพทย์ชาตะผดุง เลือกเฉพาะผู้ป่วยที่มารับบริการที่ศูนย์อย่างอย่างต่อเนื่องทุกปีเป็นระยะเวลา 5 ปี ในช่วงปีงบประมาณ พ.ศ. 2553-2558 เก็บข้อมูลเกี่ยวกับลักษณะประชากร ผลการตรวจทางห้องปฏิบัติการและการตรวจหาภาวะแทรกซ้อนต่างๆของเบาหวานในแต่ละปี ผลการวิจัยพบว่า มีผู้ป่วยที่มารับบริการต่อเนื่องตลอด 5 ปีจำนวน 223 ราย ในแต่ละปีมีจำนวนผู้ป่วยที่มารับบริการที่ศูนย์แพทย์ชาตะผดุงมีเพิ่มขึ้นอย่างต่อเนื่องโดยมีผู้ป่วยรายเก่าสะสมมากขึ้น การให้บริการออกตรวจคัดกรองโรคเบาหวานในชุมชนทำได้น้อย อัตราความชุกของผู้ป่วยเบาหวานที่ถูกวินิจฉัยได้ในปี 2558 คือ 0.53 ในปี พ.ศ. 2557 มีผู้ป่วยที่มีระดับน้ำตาลสะสมในเลือด (HbA1c) ต่ำกว่า 7% ร้อยละ 32 ส่วนในปี พ.ศ. 2558 มีผู้ป่วยที่มีระดับน้ำตาลสะสมในเลือดต่ำกว่า 7% ร้อยละ 19 ระดับไขมันแอลดีแอลอยู่ในระดับที่ดี (ต่ำกว่า 100 มก./ดล.) ร้อยละ 26 และมีผู้ป่วยร้อยละ 43 ที่มีระดับการทำงานของไตปกติ (eGFR มากกว่า 90 มล./นาที) อัตราผู้ป่วยที่ได้รับการตรวจตาและเท้า อยู่ในระดับค่อนข้างต่ำและผลการตรวจยังไม่แน่นอนนัก

โดยสรุป ประสิทธิผลและคุณภาพการให้บริการผู้ป่วยเบาหวานของศูนย์แพทย์ชาตะผดุงอยู่ในระดับต่ำกว่าเกณฑ์และควรได้รับการพัฒนาให้ดีมากขึ้น

71 หน้า

CONTENTS

CONTENTS (cont.)

LIST OF TABLES

LIST OF TABLES (cont.)

LIST OF FIGURES

LIST OF GRAPHS

LIST OF ABBREVIATIONS

MOPH	Ministry of Public Health
THPH	Tambon Health Promotion Hospital
OPD	Out-patient department
CCMU	Chataphadung Community edical Unit
PCU	Primary Care Unit
NCD	Non-Communicable Disease
VHV	Village Health Volunteer

CHAPTER I
INTRODUCTION

Background and Importance of the Problem

Around the world, diabetes is increasing in incidence and prevalence. It is projected that, by 2025, the diabetes caseload will increase to over 5% of the world's population (300 million persons), from the level of 4% (135 million persons) in 1995 (1). The trend in Thailand is no different, as cases of diabetes are increasing at the same rate (2) (3). This is creating a mounting burden on the Thai health care system. In Khon Kaen Province in northeast Thailand, out-patient visits for non-communicable disease (NCD) are often related to diabetes mellitus and hypertension (4).

In 2006, the Ministry of Public Health (MOPH) launched a three-year project to improve services and develop referral networks to reduce crowding in large hospitals. Initially, 13 hospitals participated in the project. Then, in 2009, Khon Kaen hospital joined the project. The project strategy (5) includes education and skills building in the general population on health maintenance, systems reform, and increasing efficiency of the hospital and other facilities in the referral network. The following are more details of the project strategy:

- Identify the key factors behind crowding in the out-patient department (OPD)
- Improve services in the OPD
- Establish community health centers in municipal areas in proportion to the resident population
- Increase the efficiency of services at the health center and other outlets in the network
- Improve the referral system.
- Improve understanding among the general population on efficient use of the health care system, and increase health service options in the community by strengthening links between the hospital, community health outlets and health

volunteers.

Ultimately, the goal is to enable community residents to be as self-sufficient as possible for NCD prevention, care and management. The near-term goal is to reduce the rate of increase in OPD cases, improve convenience and quality of service, reduce incidence of disease, reduce non-essential OPD visits, and create a more even distribution of cases at various outlets (6).

Khon Kaen regional hospital is the largest of its kind in northeast Thailand and is classified as an Advanced-Level Referral Hospital, a Subspecialty-Level Referral Hospital and a Center of Excellence for trauma, cancer, cardio-vascular disease, and neonatal care. The hospital has 867 beds. In addition to tertiary care, Khon Kaen Hospital also provides primary and secondary care. Its catchment area covers the 16 sub-districts of Muang District with a resident population of 335,000 persons. There are 29 primary care units (PCU) it its referral network, including four urban community care outlets, 22 Tambon Health Promotion Hospitals (THPH), and three community health outposts. The four urban care outlets are distributed in each quadrant of Khon Kaen City, and are staffed with physicians, family medicine specialists, and a pharmacist. The outlets provide treatment, counseling and receive referrals from the THPH.

In the network, there are family nursing practitioners and multi-disciplinary staff with a complete set of clinical equipment and supplies. There are labs for diagnosis at the community level to speed diagnosis and treatment. The physicians in the four urban care outlets conduct outreach visits to see cases with chronic illness and other health problems, and conduct home visits in conjunction with THPH staff. Most of the cases have chronic NCD. In 2011, there were 9,384 cases of hypertension and 6,164 cases of diabetes in the network. Annual incidence of chronic disease was nearly 5%. The caseload of the OPD of Khon Kaen Hospital is increasing at the rate of over 5% per year (4). Thus, the current effort is to steer more patients to PCU. On May 1, 2012, Khon Kaen Hospital discontinued its OPD general medicine clinic in an effort to encourage patients to seek care at their local PCU.

The Chataphadung Community Medical Unit (CCMU) is one of the four urban clinical care outlets and has a catchment population of 17,605 persons. The unit had 498 registered cases of diabetes (at the end of 2014) and conducts health

promotion, disease prevention, treatment and rehabilitation. The unit has a case monitoring and follow-up system, and screening procedures for complications of NCD. The unit is constantly trying to improve services and produces regular reports to document progress toward indicator targets. Yet, there has not been an independent assessment of the outcomes and impact of the unit's services and, thus, this research project was conceived to address that gap.

This research assesses the efficacy of the diabetes case management system and the quality of services of the CCMU. Data were collected from the unit's database (e.g., blood sugar and cholesterol levels, kidney function, etc.) over a five-year period. Quality was assessed by examining coverage, accessibility and continuity of services.

Objectives

1. To study the efficacy of diabetes case management by the CCMU during 2011-15.
2. To study the quality of diabetes case management by the CCMU.

Importance and Scope of the Research

This study is important to better understand the outcomes of Khon Kaen's effort to reduce caseload burdens and increase the importance of the PCU in an urban setting (i.e., the CCMU). The focus of this study is diabetes case management as a proxy for overall clinic performance. The results should help other PCU to benefit from the lessons learned in this case study, especially for the management of NCD.

Definition of Terms

Primary care service system: This refers to care at the point of first contact with the individual, family and/or community, the comprehensiveness of care, the continuity of care through all phases of disease, and the linkages with other

services and outlets in the referral network.

Tambon Health Promotion Hospital (THPH): The THPH is a PCU that is located outside the Khon Kaen municipal area and under the authority of the Muang District Health Office and the Khon Kaen Hospital. The THPH have from two to four clinics per month with physicians in attendance.

Community medical unit: These PCU are located within the Khon Kaen municipal area and are under the authority of the Khon Kaen Hospital. There is a physician in attendance every day. In this study, the outlet of interest is the CCMU.

Quality of care: The dimensions of quality in this study include accessibility to primary care, standards of treatment, and overall client satisfaction.

Efficacy: In this study, efficacy refers to outcomes of diabetes case management in comparison with targets and objectives.

Prevalence (8): This is the total number of persons with disease divided by the total population at a given point in time. In this study, the focus is on prevalence of diabetes among the total catchment population of the CCMU.

Incidence: This is the number of new cases of diabetes as a proportion of the total population at a given point in time.

Mortality refers to patient death.

Morbidity refers to patient illness.

Research hypotheses

1.Diabetes cases increased during 2011-15;

2.The changes and improvement in the primary care system had an impact on efficacy and quality of diabetes case management.

Conceptual framework

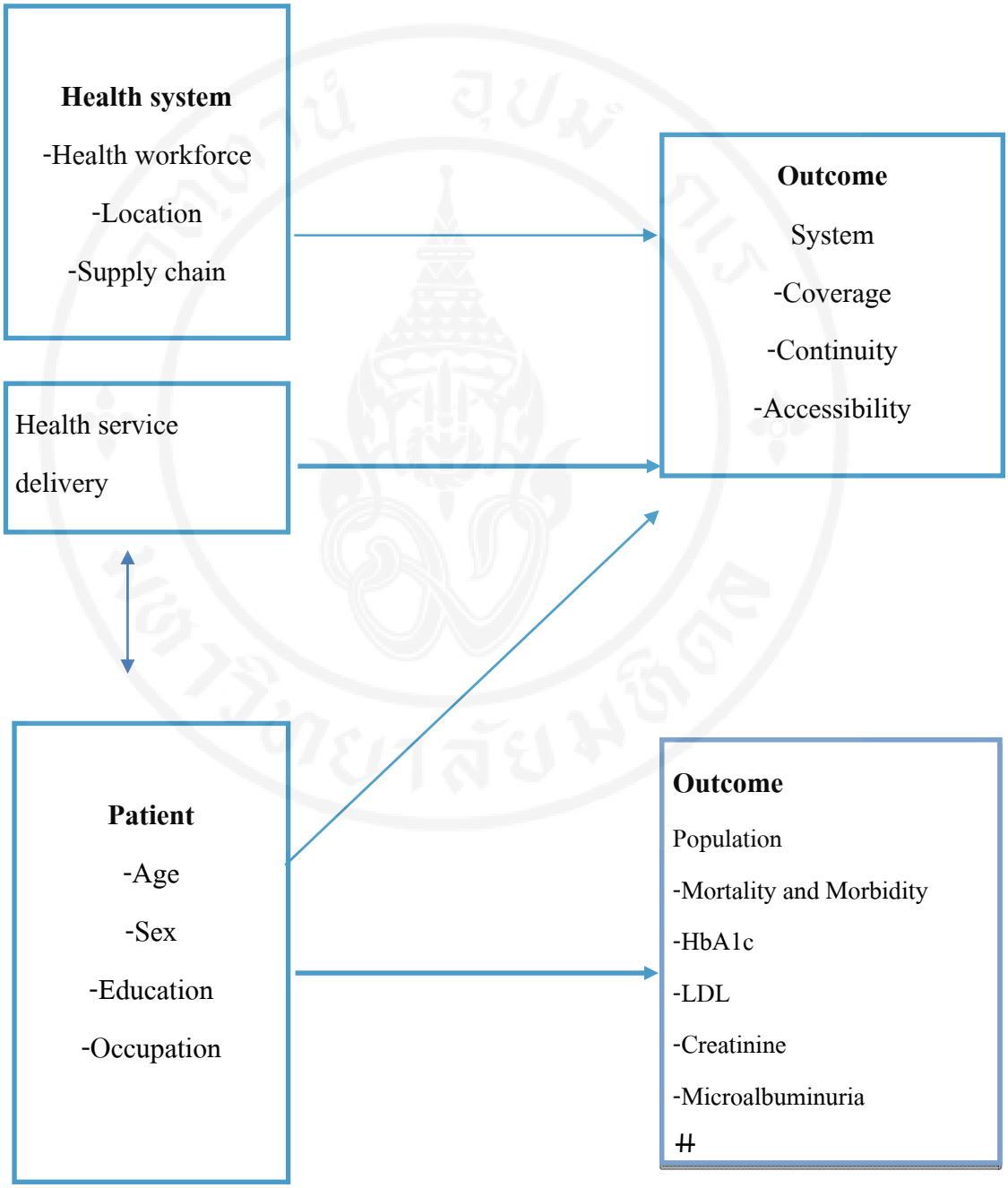


Figure 1.1 Conceptual framework

CHAPTER II
REVIEW OF RELATED LITERATURE

This chapter is divided in the following sections:

1. Concepts of the health service system
2. Monitoring and evaluation (M&E) of health services
3. Concepts of primary care services and Khon Kaen Hospital primary care
4. Quality assessments of diabetic care in the primary care setting
5. Diabetes
6. Related research

Concepts of the health service system

The WHO has defined six building blocks of health systems management (9), (10), (12) including service provision, personnel, information system, access to essential medicines, finance, and good governance (Figure 1). The goals of these building blocks include improved health, responsiveness, social/financial risk protection and greater efficiency.

Details of the health system framework's six building blocks are as follows:

1. Health service delivery refers to health promotion, disease prevention, treatment and rehabilitation. Services are of standard quality, safe, and meet clinical and health rights. The system attempts to strengthen the PCU with efficiency up and down the system.

2. Health human resources denotes adequate number of personnel who are knowledgeable, with an appropriate array of skills to meet the needs of the population.

3. The health information system refers to the timeliness and distribution

of data that is relevant to the illness or health condition, prognosis and achievement of indicator targets for quality and ethical service.

4. Access to essential medicines includes clinical supplies, vaccines, diagnostics and standard equipment that is safe and properly transported and used.

5. The health finance system includes the health insurance system and coverage, reduced costs of the government and clients, resource mobilization, procurement, and financial management that is ethical and efficient.

6. Leadership and good governance encompasses oversight to ensure ethical implementation that is transparent, auditable, in accordance with policy, strategy and plans to address the priority health problems and forecast care needs in the future.

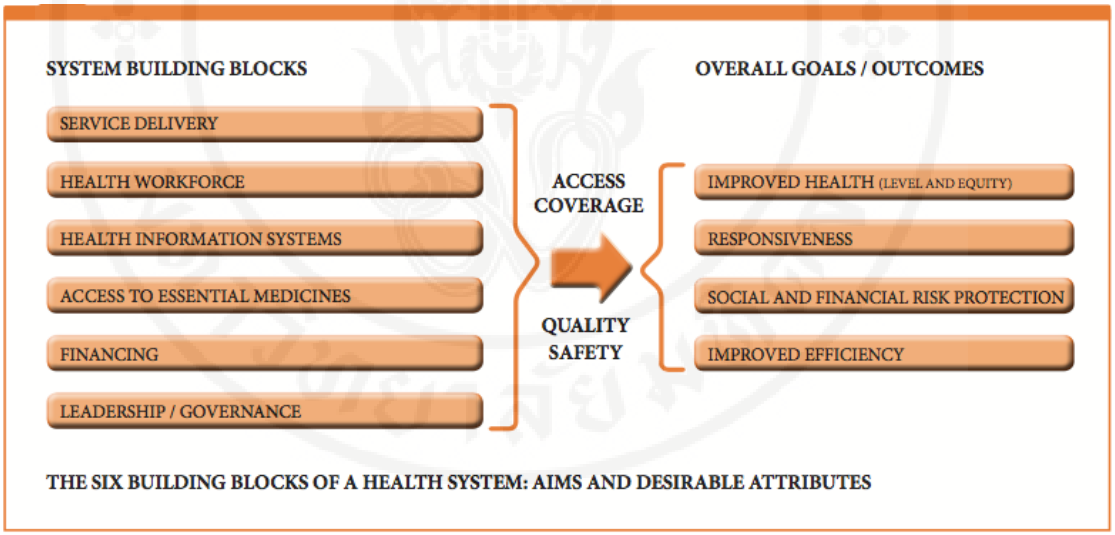


Figure 2.1 The WHO Health Systems Framework

Source: (12)

Monitoring and Evaluation of health services

The framework for Monitoring and Evaluation (M&E) of the building blocks (12) is depicted in Figure 2. Inputs include Leadership/Governance and Financing. Inputs and processes include infrastructure, health workforce, supply chain, and information. Outputs include project plans, interventions, access, service readiness, quality and safety. Outcomes include coverage of the interventions,

prevalence of health risk behavior and related factors. Impact denotes improved health status of the population, equity of services, social protections, financial risk management, responsiveness and efficiency.

WHO has offered recommendations of tools to use for M&E of the Building Block Framework (10) at different levels, as follows:

- For inputs, WHO recommends use of a financial tracking system, national health account, health database and records, human resource tracking, infrastructure assessment, supply chain and information management.- Facility assessments are useful for process monitoring.

- Outputs, outcomes and impact can be tracked using the clinical reporting system, and assessments of service readiness, quality, coverage and health status.

- Outcomes and impact can be measured using population–based surveys to measure coverage, health status, equity, risk protection, responsiveness and civil registration in addition to the health service delivery assessment.

Key characteristics of good service delivery include the following:

- Comprehensiveness
- Accessibility
- Coverage
- Continuity
- Quality
- Person-centeredness
- Coordination
- Accountability and efficiency

M&E tools also include the routine health facility report system, health facility census and health facility survey.

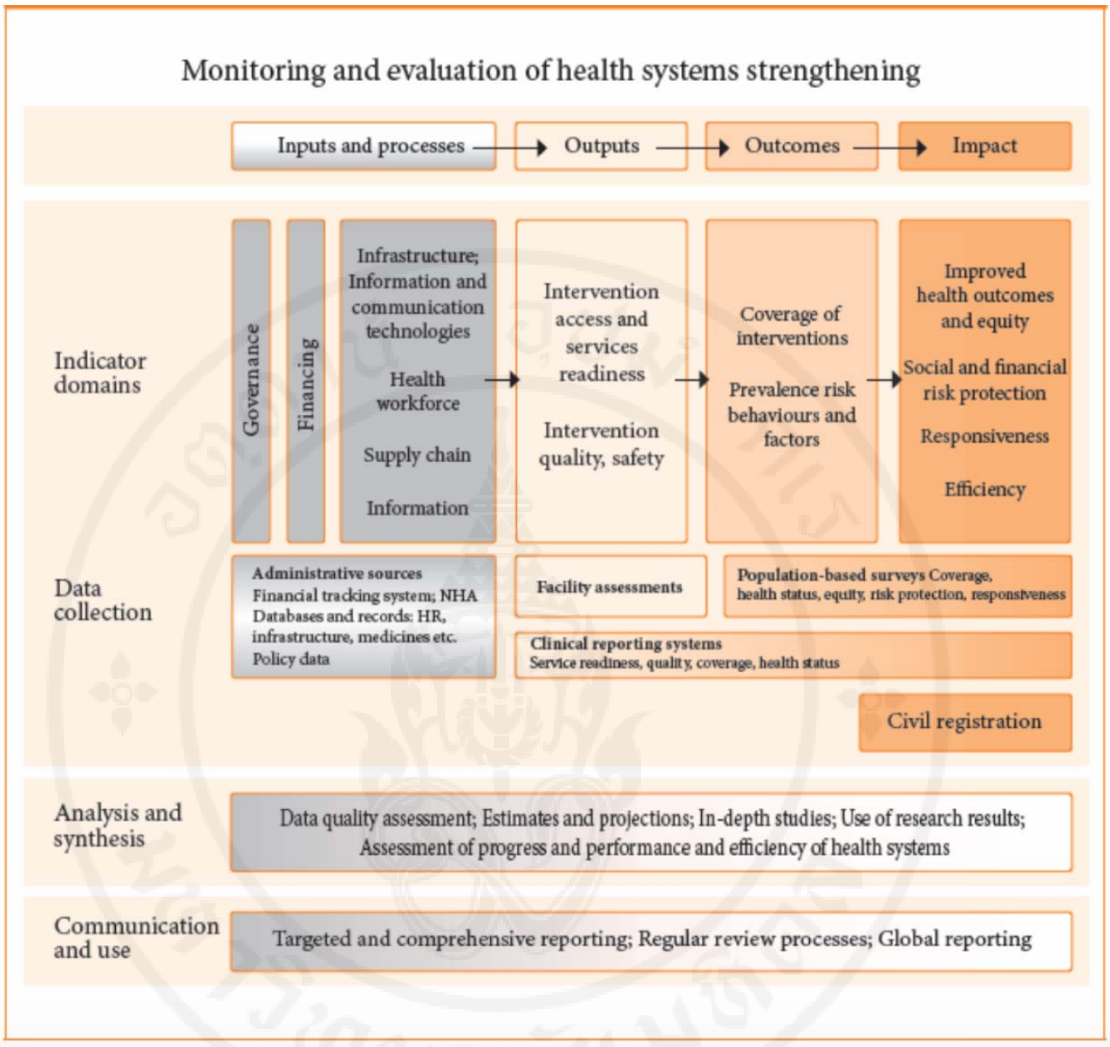


Figure 2.2 Monitoring and Evaluation of Health Systems Strengthening
Source: (12)

Concepts of primary care services and Khon Kaen Hospital primary care

In 2010, the WHO issued a report entitled: "The World Health Report for 2008: Primary health care now more than ever" (11). This report gave more importance to primary health care (PHC) than ever before because, in the view of WHO, globalization was worsening the condition of important segments of the world's population. Access to services for the lower-income seemed to be declining and inequities in the health system were widening. In all segments of the population

chronic NCD were becoming more prevalent, and new epidemics were emerging without warning. Global climate change was also exacerbating health of vulnerable populations. Thus, PHC was seen as an important tool to redress some of these problems and negative trends.

Meaning and importance of PHC

The 1978 Declaration of Alma-Ata was the first statement referring to PHC as place of initial contact for an individual, family or community with the health care system. Care in the PHC context has a broader meaning than just clinical or medical care. PHC encompasses holistic care which also addresses social well-being, and a supportive family and community. The best PHC is one that is available in the home community and where there is patient-centered care. Quality care should be comprehensive, continuous, and health promoting, not just curative care.

Primary care at the Khon Kaen Hospital (7)

Khon Kaen Hospital is one of the hospitals in the pilot project of the MOPH and NHSO to reduce crowding in Thai hospitals. Khon Kaen Hospital already has primary care service through its network of four urban care clinics in the four quadrants of Khon Kaen City. Two or three family medicine physicians are on staff each day to provide treatment, counseling and receive referrals from the THPH. There is also a family nurse practitioner and pharmacist, among other personnel. There is adequate equipment and supplies for routine care, and a laboratory for diagnosis. Each urban care clinic has three to seven THPH and community health outposts in its network. Physicians from the four centers visit the THPH and community outposts two to four times per month as a mobile outreach service.

The strategy to prepare the four urban care clinics to play a bigger role in primary care (starting on May 1, 2012) includes four sub-strategies with additional details following:

1. Provide quality PHC
2. Provide a uniform standard of PHC, efficiently
3. Encourage participation of and strengthen other network members
4. Become a learning center based on principles of good governance

Provide quality PHC

The consultation system development plan views the four urban care outlets as a central node for counseling, either through face-to-face interactions or distance consultation by phone or on-line technology such as Skype, Line, and/or Facebook. The four urban clinics are the first point of referral for uncomplicated cases. Each clinic applies Clinical Practice Guidelines (CPG) for managing cases of diabetes, hypertension and animal bites. The clinics receive and transmit data through the network's information exchange system. The initial strengthening of the PHC system focused on two urban clinics: Prachasamosorn and Wat Nong Waeng. These clinics added physicians, nurse practitioners and other support personnel, and expanded hours of service of 8 a.m. to 8 p.m. on weekdays and 8 a.m. to 4 p.m. on weekends and holidays. These clinics were also supplied with additional medicines and clinical equipment. The clinic's interior and exterior were remodeled to be more inviting to clients and inspire confidence in the clinic.

The Prachasamosorn Clinic established a 'community laboratory' with two medical technologists and a specimens liaison officer on staff. The clinic serves as a reference lab for other outlets in the network. Results of the diagnosis are sent instantly (electronically) to the PHC outlet to speed follow-up. The clinics also revamped their system of managing inventory of supplies and equipment, and aligned its pharmaceutical records and coding system with the Khon Kaen Hospital system and added medicinal herbs and traditional medicines to its inventory. The clinics also launched a system of supervision and follow-up, and consolidates data from service statistics into monthly progress reports which are shared (electronically) with outlets in the network and Khon Kaen Hospital. The report also includes lab activities and data on dispensing of medicines. Referral data are compiled using the i-Refer software, and there is a system for tracking the history of patient care at the hospital (through the District Health Office and Khon Kaen Hospital).

Staff of the clinics received in-service training on professional standards, and the clinic staffing was upgraded to comply with the standard for the Primary Care Award (PCA) and as defined by the National Health Security Office (NHSO).Provide a uniform standard of PHC, efficiently.This strategy involved a restructuring of the network committee (i.e., board) to improve flexibility, reduce duplication, and appoint

an adjunct consultative committee with members who have expertise in finance, management, clinical care, etc. Other systems were improved under this strategy including procurement and delivery, stock and inventory management, and the data information system. The network committee started meeting monthly, at a minimum.

Encourage participation of and strengthen other network members

Under this strategy, there were public forums on developing community plans for and by the target communities themselves. Peer leaders and volunteers were recruited, and a surveillance network was established to promote safety, reduce disease, and reduce risk of chronic NCD (e.g., diabetes and hypertension). The local administrative organizations (LAO) also participated in health management and support in their areas of jurisdiction. Participating communities set up local groups to reduce accidents and address problems of drug addiction, and create a support network for female sex workers.

Become a learning center based on principles of good governance

This strategy envisions the urban health care outlets as centers of learning in family medicine. This entails creating learning activities and defining principles and concepts of implementation. Staff in the network receive regular refresher training in these concepts.

Model of quality primary care for chronic NCD

Khon Kaen Hospital has revised and upgraded PHC in the network which shifts the focus to "health creation" rather than "health correction". Individuals, families and the community participate actively in monitoring and managing their own health. The population is educated on the risk factors for NCD and how to minimize those risks. There are both static and outreach services with a dynamic system of consultation, referral and mutually-reinforcing interaction, as described next.

1. Identifying persons at elevated risk and diagnosing new cases of diabetes.

The Khon Kaen Hospital network attempts to identify everyone at risk of diabetes and detect new cases as early as possible to improve treatment outcomes. There is direct screening of persons age 15 years or older, including the following steps:

1.1 The network selects persons age 15 years or older from the household registration system and conducts screening for diabetes by age group: 15-34 years, 35-59 years and those age 60 years or older. Initial screening for risk among those age 15-34 is conducted in the following steps:

• Screening for history of diabetes in the father or mother

• Screening for overweight and obesity (waist $\geq$ 90 cm. in males or $\geq$ 80 cm. in females) and/or BMI $\geq$ 25 kg./m.^{2}

• Blood pressure $\geq$ 140/90 mm.Hg or history of hypertension or taking anti-hypertensive medication

• Dark areas around the neck and underarm

If a person has all of these risk factors then their blood glucose is tested using a finger prick method (Fasting Capillary Glucose - FCG) or Fasting Plasma Glucose (FPG).

There are five risk factors for those age 35-59 years:

• Screening for history of diabetes in the father or mother

• Screening for overweight and obesity (waist $\geq$ 90 cm. in males or $\geq$ 80 cm. in females) and/or BMI $\geq$ 25 kg./m.2

• Blood pressure $\geq$ 140/90 mm.Hg or history of hypertension or taking anti-hypertensive medication

• History of Triglyceride $\geq$ 250 mg/dL or HDL cholesterol < 35 mg/dL

• History of high blood glucose (post-fasting) of 100-125 mg/dL or history of an oral glucose tolerance test (OGTT) = 140-199 mg/dL

A person who has any one of these five factors needs confirmatory diagnosis.

Persons age 60 years or older have testing for blood sugar at least once a year.

1.2 Persons may be preliminarily screened by question and answer check-list and this can be done by a village health volunteer (VHV) under the supervision of a trained health professional in the nearest PCU.

1.3 Persons diagnosed with risk of diabetes receive counseling for behavior change using the seven-color code system of the Khon Kaen Hospital PHC protocol, as follows:

- White color code: Normal persons, i.e., those without any risk factors for diabetes and post-fast (at least eight hours since last meal) blood glucose < 100 mg/dl;
- Light green: Persons with slight risk of diabetes, i.e., blood glucose (post-fasting) of 100-125 mg/dL;for persons with clear symptoms of diabetes, e.g., abnormal urine, frequent hunger and consumption of water, weight loss, and eating until full but still losing weight, among other indicators, the following color code is used:
- Dark green: blood glucose (post-fasting) of 100-125 mg/dL and taking medicine to control symptoms;
- Yellow: blood glucose (post-fasting) of 125 – 154 mg/dL and HbA1c < 7%;
- Orange: blood glucose (post-fasting) of 155 – 182 mg/dL and HbA1c of 7 – 7.9%;
- Red: blood glucose (post-fasting) of 183 mg/dL and HbA1c >8 % but without symptoms of complications of diabetes;
- Black: Severe diabetes with inability to control blood glucose, and displaying symptoms of complications such as heart disease, stroke, kidney failure, blindness, and chronic sores on the finger and toe tips.

1.4 Results of screening are reported using the JHCIS software of the Khon Kaen PHC system.

2. Referral of persons at risk

This refers to referral of persons who have risk of diabetes (suspected new case) based on the screening, to a site for confirmation testing by a physician and registering as a new case (if confirmed). Next, the clinical team and patient jointly develop a treatment plan. The results of the testing and treatment plan are shared with the PCU network nearest the patient's home. Client follow-up is initiated by mail, phone or on-line channels.

3. Care and treatment for diabetes

- New cases are entered into the PCU registry for diabetes.
- Cases are examined as appropriate by a physician or nurse practitioner.
- There is periodic assessment for associated complications and behavior change and self-management to reduce risk of these.
- Communication and warning if there is a symptom that needs immediate investigation by a health professional.
- Follow-up of results of prevention and care activities, among those who are or are not taking medication to control disease.
- Examination of the eyes, kidneys, feet, heart and vascular system for symptoms of complications and prevention.
- Care and referral for cases with complications.
- Cross-referral for on-going care and monitoring according to the treatment plan by the most local PCU.
- Home visiting by a multi-disciplinary team.
- Development and use of clinical practice guidelines.
- Establish a coordination system for consultation with physicians and experts between the PCU and attending hospital.

4. Links with community services

There is a need to identify resources and mechanisms in the home community to ensure that the diabetes patient lives in an understanding and health-promoting environment. The community should be mobilized to reduce risk of diabetes (and other prevalent NCD) for every resident, regardless of current disease

status. The local VHV can be especially important in this effort. Cases and persons at risk of diabetes can learn how to monitor their own blood glucose level. There can be support groups to help these persons monitor and motivate each other. These groups can be linked with groups in other communities to create a network of family health monitors.

5. Supporting self-care and monitoring for diabetes patients

Khon Kaen is promoting the active involvement of the diabetes cases themselves to monitor and manage their disease to the greatest extent possible. This includes having a system of continuous monitoring of health status, a warning system, an appointment system, and home visits, with feedback of clinical data from the PCU to the patient and their family. Based on this information, the patient and care team can implement changes in behavior or medicines as appropriate. The self-care approach is comprehensive and covers physical, psycho-social, and emotional care. Family members can also be actively involved with the patient in case management.

Quality assessments of diabetic care in the primary care setting

Evaluation of quality diabetic care in the PCU needs to consider the following dimensions:

- Incidence of diabetes
- Process of care
- Incidence of complications
- Short-term outcomes
- Long-term outcomes

Table 2.1 Indicators to assess the process of care (19)

Level of ascertainment	Incidence of persons receiving a diagnosis compared to the hypothesized level of incidence of diabetes
Annual review coverage	Percent of persons with annual health exams which measure the following: - Body mass index (BMI) - Nutrition - Smoking - Microalbuminuria - Blood pressure - HbA1c level - Serum creatinine - Serum lipid - Retina examination - Foot examination
Patient satisfaction	Using questionnaires to assess patient satisfaction

Table 2.2 Indicators of treatment outcome

Quality of life	Knowledge and happiness assessment of diabetic patient by questionnaire or interview
Blood sugar level	Percentage of patient with HbA1c < 7.4%
Incidence risk of cardiovascular diseases	Rate of patients with - smoking - BMI > 25 kg/m2 - Blood pressure level (140/80 mmHg) - Serum cholesterol level (200 mg/dl) - Serum LDL level - Serum triglyceride level
Micro vascular complications	- Proteinuria/Microalbuminuria - Diabetic retinopathy with laser therapy - Background and sight-threatening retinopathy - Absent foot pulses - Decreasing vibration sense - Decreasing pin-prick sense - Foot ulceration
Middle outcome	- Angina - Claudication - Symptomatic neuropathy - Erectile dysfunction
Long term outcome	- Myocardial infarction - Stroke - Visual impairment - Severe visual impairment - End stage renal failure - Amputation

Diabetes mellitus

Diabetes is the most common disease of the endocrine system. Diabetes can be manifest by lack of insulin (Type 1) or lack of adequate bodily production of insulin (Type 2). The general manifestation is an inability of the body to regulate insulin. Blood glucose is a source of energy for action. However, the diabetic cannot make optimal use of insulin and, thus, a variety of adverse consequences may be observed (14)(18).

Type of diabetes mellitus

1.Type 1 diabetes mellitus

Type 1 diabetes is found in about 5 to 10% of all types of diabetes. This results from destruction of beta cells in the pancreas. This results in inability of the pancreas to produce insulin.

2. Type 2 diabetes mellitus

Type 2 diabetes accounts for 90 to 95% of all cases of diabetes. This results from insulin tolerance in conjunction with impairment of the insulin production process.

3. Other specific types

Other types of diabetes may result from genetic disorder

4. Gestational diabetes mellitus

Gestational diabetes mellitus is diabetes during pregnancy. This type is diagnosed using the glucose tolerance test during pregnancy and usually resolves naturally in the post-partum period.

Table 2.3 Symptoms of diabetes

	Type 1	Type 2
Cause	Auto-immune malfunction or destruction of beta cells which inhibit production of insulin by the pancreas	Genetic disorder of environmental factor which cause insulin tolerance in conjunction with impaired ability of the pancreas to produce insulin
Symptoms	Sudden, severe metabolic acidosis, associated with congestion of ketone compounds. This can be rapidly diagnosed and is found in persons under age 20 who are usually not overweight	Unclear symptoms with no obvious indication of duration of disease. There could be complications of the vascular and nervous systems. This is more common in persons over age 45 years and overweight/obese
Treatment	Only treat with insulin; there could be low insulin levels	Adjustment of diet and exercise can ameliorate symptoms and can help with prevention. Most cases need medication to reduce sugar levels while some may need insulin.

Table 2.4 Screening for diabetes mellitus

There should be screening of persons age 45 years or older. Younger persons who have the following symptoms should be suspected for diabetes:
• Direct relative who has/had diabetes • Physical inactivity • Genetic disposition for diabetes • History of delivering an infant of 4 kg or more or history of diabetes during pregnancy • Hypertension • HDL cholesterol=< 35 mg/dl or triglyceride >=250 mg/dl • Polycystic ovary syndrome • Impaired glucose tolerance • History of cardiovascular diseases

Diagnosis

Table 2.5 Diabetes diagnosis criteria

Group	Fasting plasma glucose (mg/dl)	2-Hour plasma glucose(mg/dl)	Casual plasma glucose (mg/dl)
Normal	< 100	< 140	-
Impaired fasting glucose(IFG)	100-125	140-199	-
Diabetes mellitus	>=126	>=200	>200 with diabetic symptoms

Progression of disease and prognosis

Type 2 diabetes is a chronic condition which slowly worsens without treatment due to the erosion of the beta cells of the pancreas. Thus, case management involves medication to progressively reduce the blood sugar. Without treatment, there is risk of adverse vascular events. For patients diagnosed after age 40 years, the long-term survival declines to 12 years and quality of life declines to 20 years.

Treatment

The general goal of treatment of diabetes is to keep the blood sugar level as low as possible while minimizing the occurrence of complications.

Table 2.6 Goal of treatment

	Normal	**ADA* target**
Glycemic control		
HbA1c (%)	< 5.8	<7.0
Blood sugar level		
pre prandial (mg/dL)	< 100	70-130
post prandial (mg/dL)	< 140	<180
Blood pressure (mmHg)	< 120/80	<130/80
Lipid (mg/dL)		
LDL	<130	<100
Triglycerides	<150	<150
HDL	>40	>40

*ADA= American Diabetes Association

Type of treatment

1. Lifestyle modification

1.1 Lifestyle change

Every case of diabetes needs to implement lifestyle changes by improving their diet, controlling their weight, and increasing physical exercise. Medication for treating diabetes mellitus, hypertension and dyslipidemia is no substitute for the behavior modifications cited above.

Table 2.7 Nutritional recommendations for diabetes

Food composition	**Recommendation**
Total fat	25-35% of total calories
Saturated fat	<7% of total calories
Polyunsatulated fat	up to 10% of total calories
Monounsatulated fat	up to 20% of total calories
Carbohydrates	40-50% of total calories
Fiber	25-40 gm/d
Protein	15-20% of total calories
Cholesterol	< 200 mg/d
Total calories	Sufficient to desirable body weight

1.2 Physical exercise

All cases of diabetes are recommended to engage in moderate-intensity aerobic physical activity (i.e., 50 – 70% of heart capacity) for 150 minutes per week and three times per week. There should not be more than two consecutive days without this form of exercise. Regular exercise of this nature is a key factor in helping to control blood sugar levels and reducing risk of cardio-vascular complications of diabetes.

1.3 Weight control

Weight control helps to control blood pressure, triglyceride, LDL, HDL, blood glucose and HbA1c levels, as well as preventing diabetes itself. Weight control is only possible with a combination of nutrition and exercise. The goal is a BMI of 21 kg/m^2 to 25 kg/m^2 and waist circumference below 102 cm for males and 88 cm for females.

2. Medications

Table 2.8 Diabetic medications

Group	**Name**	**Mechanism of action**
Thiazolidinediones (TZD)	Rosiglitazone	Increased insulin sensitivity; preservation of beta cell function; deceased hepatic glucose output
Biguanides	Metformin	Deceased hepatic glucose output
Alpha-glucosidase inhibitors	Acarbose	Delayed GI absorption of carbohydrates; increased incretin production
Insulin secretagogues	Chlorpropamide Glipizide Glyburide Glimepiride	Increased insulin release
Dipeptidyl peptidase-4 (DPP) inhibitors	Sitagliptin	Increased GLP-1 level; augmentation of glucose stimulated insulin release and suppression of glucagon production; preservation of beta cell function

3. Insulin therapy

Insulin therapy is introduced if the patient cannot control their blood sugar by other means. Insulin can be used in isolation or in combination with Metformin. The insulin dosage should be tailored to the needs and lifestyle of the patient since the phamacokinetics will vary from person to person and type of insulin. Fast-acting insulin should be given at dinner time, whereas slow-acting insulin should be given at bedtime. For cases with high blood sugar, insulin injections are needed at least twice a day, and the preference is for fast-acting insulin prior to meals and/or in combination with mixed-release or insulin with a medium speed of action.

Complications of diabetes

An important complication of diabetes is deterioration of the arterial walls and capillaries, which can progress to cardio-vascular disease, stroke, impaired kidney function, retinal erosion, and peripheral nerve decay. Strict control of blood sugar can help to mitigate or prevention these complications.

Related research

The Bureau of Research and Community Development conducted a case study to identify factors which affect establishment of a community clinic (13). The researchers found that having a good understanding of PHC and appreciating the value of integrated services were more important determinants than having clinical care in the community. PHC should be standard quality, continuous, and be linked with a supportive network. Family medicine which is client-centered and holistic will have the best results.

Factors related to quality care of diabetes patients in the PHC setting

A study in the UK (21) found that key indicators of care include the time spent with the attending physician, the size of the PHC facility, economic level of the catchment area, and the unity of the clinical team. More time with the attending physician was associated with improve care outcomes. A smaller PHC facility was seen as more convenient; this is offset by the fact that a larger PHC facility could provide a broader range of care, and that is important for the diabetic since the disease can have complications which need to be addressed by a multi-disciplinary team.

Clients of PHC outlets located in lower socio-economic neighborhoods tend to have less diabetes-prevention behavior than facilities in higher socio-economic areas. Greater unity of the clinical team translates into higher quality care, greater access and continuity of services, and higher client satisfaction (19). These findings are consistent with those of Campbell who found that when the PHC staff have positive relationships with each other, and if the facility is larger in size, then diabetes treatment outcomes will be better (21). Mikko (23) conducted a comparative study of PHCs: One type had less medical equipment/supplies and a general practitioner as the attending physician. The other type had a diabetes specialist as the attending physician and more clinical equipment/supplies. Clients who had Type 1 diabetes were more satisfied with the second type of outlet (with a diabetes specialist). Clients with Type 2 diabetes had similar treatment outcomes and costs in both types of outlets.

An evaluative research study was conducted in Thailand on treatment outcomes of diabetics in the PHC setting (17). The research found that there was wide variation in quality of care across areas and facilities. Most of the services were passive and static (not outreach) and staff did not have the optimal levels of knowledge for effective diabetes case management. Most of the activity consisted of screening and case follow-up. There was little emphasis on behavior modification. Only 38% of the caseload had HbA1c <7%. These findings are similar to a study by Benjaporn Kriangkraipet (15) who found that 35-43% of diabetes patients seen by a community clinic had HbA1c<7%. A study in Italy by Modesti (25) found that only 49% of cases could effectively control HbA1c and only a minority had healthy levels of blood cholesterol. Another study in Thailand by Supatra Sriwanitchakorn (17) found that 10 to 19% of cases had high levels of cholesterol, 31-50% started to show abnormal kidney function Microalbuminuria, and 2 to 30% had high serum creatinine. Those cases with at least five years of disease had greater prevalence of abnormal metabolic function, consistent with the progression of lack of adequate diabetes case management. A pervasive problem seems to be lack of proper nutritional behavior of the diabetics, and less knowledge of the practitioners on clinical care for diabetes. That said, better knowledge about diabetes is associated with better quality of life. This research suggested indicators of evaluation of care outlets including teamwork of the staff, outreach for screening, proportion of the caseload who is overweight, smoke,

or have HbA1c<7%, level of knowledge of the diabetics on health promoting behavior, and client satisfaction with the service.

Recommendations for improving diabetes case management in the PHC setting (24) include design and management of services, as follows: Access to the PHC outlet should be convenient (e.g., community-based). Services should be available for all types of clients, including those at-risk of diabetes, those with diabetes and the 'normal' population. There should be screening for risk factors and diabetes itself. There should be programs for diabetes prevention such as exercise groups, and there should be a clear referral network.

Studies of quality of care for diabetes in Europe have recommended that evaluation of those services should focus on five areas: Control of glycaemia; early detection of glycemic complications, treatment of glycemic complications, assessment of cardiovascular diseases, and quality of life (22). A study of the effectiveness of the chronic care model (16) found that the preferred model has six components: (1) Self-management; (2) Model of services; (3) Data collection system; (4) Support for decision-making; (5) Health system; and (6) Community support. Other factors include feedback system for mutual support, clear communication, having leadership support and sustainability, and support from family members of the patient.

CHAPTER III
RESEARCH METHODOLOGY

Design of the research

This research had the objective to study the efficacy of Type 2 diabetes case management of the CCMU in Muang District, Khon Kaen Province. This was a retrospective cohort study to analyze treatment outcomes of the CCMU diabetes caseload during a five-year period. Secondary data were collected from patient records and processed using computer software. In addition, primary data were collected by interviews with CCMU staff.

Context of the study

The CCMU is PHC outlet under management of the Social Medicine Department of Khon Kaen Hospital. The CCMU first opened on August 1, 2003 and moved to its present location on February 1, 2006. The CCMU is centrally located for the catchment population it serves, and public transportation passes by the road adjacent to the clinic. The clinic is only five minutes (by car) from Khon Kaen Hospital. The CCMU offers comprehensive and integrated continuum of care, from the clinic to the home, family and community. The clinic provides both static and outreach services.

The CCMU has a catchment population of 19,097 persons living in 4,785 households in 12 neighborhoods of Khon Kaen City. The housing pattern is densely settled. There are three schools and four monasteries in the catchment area. The CCMU has two family medicine physicians, and a team of nurses. The clinic provides health promotion and dental care, and has a pharmaceutical unit in-house. The clinic is open at least 56 hours per week, and this complies with the NHSO standard for PHC clinics. There is a modern data storage and information processing system. The CCMU has the full set of equipment and supplies for the services it provides. Most of

the cases of NCD who are served by the CCMU are hypertensives and diabetics. The CCMU staff have a regular schedule for community outreach to provide health education and information on prevention of NCD, screening for NCD, new case finding, and home visits to registered cases. The CCMU provides clinic-based care for NCD every working day and makes an appointment date system by community-based so neighborhoods in the same community visit the clinic visits on the same day to improve convenience and shared travel. The clinic procedure for new cases involves a finger prick to check blood sugar, blood pressure measurement, history taking, and registration. New cases receive counseling on health maintenance. Next is a physical examination by the attending physician. The last step is prescription of medicine (if needed) and dispensing. Clients are given an appointment for follow-up visit and/or referral to the hospital for specialized care.

All NCD cases are examined and tested for complications at least once a year. All diabetics are screened for HbA1c, Creatinine, LDL and Microalbuminuria. Screening and examinations are tailored to the type of NCD and severity of symptoms. Patients are screened and treated for kidney malfunction, and examined for retinal deterioration at least once a year. The feet and extremities of diabetic cases are examined at least once a year.

Sample population

For this research, the sample population consists of Type 2 diabetes cases who are registered with the CCMU and who have visited the clinic at least once a year during the period from October 1, 2010 to September 30, 2015.

Inclusion criteria

- Case of diabetes without insulin dependence
- Case of diabetes who has been seen by the CCMU at least once a year

Exclusion criteria

- Lack of baseline data (e.g., date of birth, sex).

Data collection

Secondary data were collected from the Java Health Center information System (JHCIS program) of the MOPH, and specific to the PHC system of Khon Kaen Hospital. Data include patient characteristics, treatment, examination for complications and laboratory diagnostic results. Data were tabulated using the Navicat Premium for MySQL software. Patient data include values for HbA1c, LDL, Creatinine, eGFR, and Microalbuminuria, among other indices. Data were cross-checked between the JHCIS and patient charts at both the CCMU and Khon Kaen Hospital to ensure completeness, compliance with the inclusion criteria, and collection of data on treatment of complications and patient mortality. Data on eye and foot examination were accessed at the Social Medicine Department since these data are not in the JHCIS.

For the level of ascertainment, the author calculated the rate of prevalence of expected diabetes and prevalence of diagnosed diabetes. Data on client satisfaction were obtained from annual progress reports of the Social Medicine Department (which consolidates the experience of clients for any purpose of visit, not just diabetes). Because this was a retrospective study of recorded client data, it is possible that there is missing data for a certain number of clients. To address this, the authored interviewed five staff of the CCMU including the past and present chief officers, pasty and present NCD nurses, and the person responsible for data recording and processing. Secondary data were collected during January to March, 2016, while the interviews were conduct during November 2016.

Data analysis

Data were processed using descriptive statistics for the following general characteristics: sex, age, occupation, right to treatment, education, and other chronic illness. The author also calculated prevalence of diabetes, rates of laboratory assessment, prevalence of complications, rates of standard quality of examinations, and prevalence of severe complications.

CHAPTER IV
RESULTS

This research had the objective to study quality of services of the Chatapadung Community Medical Unit (CCMU), using indicators for data available in the existing databases, including coverage, access, and continuity of service utilization. The software program JHCIS was used to mine the CCMU and Khon Kaen Hospital databases. Additional data came for summary progress reports and other related documentation. Primary data were collected by interview with current and former staff. The second objective of the research was to study the efficacy of the services for diabetes case management at primary care units (PCU) in the Khon Kaen Hospital network. The time frame for data was the five years from 2011-15. This was a retrospective cohort study.

CCMU services for diabetes patients

Interviews were conducted with the following:

- Former head of the CCMU
- Current head of the CCMU
- Former nurse responsible for chronic illness/condition in the CCMU
- Current nurse responsible for chronic illness/condition in the CCMU
- Technical health specialist in the CCMU

The CCMU is located in the Non Than Community of Khon Kaen City, about two kilometers from Khon Kaen Hospital. The CCMU facility is part of the Non Than School complex, and access is convenient for both vehicles and pedestrians. Chronic illness/condition case management at the CCMU is in accordance with the guidelines of the Community Medicine Department, and the CCMU implements a strategy of comprehensive and holistic care, with links to the home community of clients. Cases can come to the CCMU any day of the week. Thus, there is no day set aside for diabetes cases. However, each day of the week is dedicated to serving clients

from one of the communities in the catchment area, in order to increase convenience, familiarity and ride sharing by clients.

All diabetes cases have their blood sugar level measured, and other clients are screened for diabetes at least once a year. New CCMU clients receive a history taking and general health and behavior assessment as a basis for grouping them into risk categories. Higher-risk cases receive urgent intervention. A family medicine physician attends to each case, and nurse practitioners are part of the clinical team. Appointments are made for home visits. The CCMU pharmacist dispenses medicines before the client leaves the CCMU. Diabetes cases are screened for complications of the disease by conducting annual testing (e.g., blood, feet, eyes) by the clinical team(Figure 4).

The Community Medicine Department produced the Clinical Practice Guidelines for Diabetes Mellitus in Primary Care in 2006, and that is still in use and up-dated as appropriate. The CCMU receives budget and clinical supplies from the Khon Kaen Hospital and reports no shortages in the five years of the study. One distinction of the CCMU is the relatively large number of the population in its catchment area (24,000), and this results a higher population : provider ratio than the other three units in Khon Kaen City. In 2011, the CCMU had only four nurses on staff and, at times, they were overloaded with work. Some staffing adjustments were made to ease the work burden but, as of 2013-14, the ratio of nurses to population was 1 : 3,500 – 4,000 which is more than the recommended standard of one nurse per 2,500 population. One strategy to address this imbalance is to mobilize the communities themselves to play a bigger role in NCD prevention, control and management. The CCMU launched a project for diabetes case management with involvement of the local village health volunteers (VHV) as key players (Figure 5).

That project also built capacity of the diabetes cases themselves to monitor their own health status and report progress to the VHV. The project was expanded to include community-based screening for complications of diabetes, hypertension, cervical cancer and breast cancer. The project included behavior modification activities for risk groups and those with symptoms of diabetes and hypertension.

The general strategy of the CCMU and related projects is health promotion and maintenance, and prevention of complications. The goal is to educate the

catchment population about NCD and how to care for themselves by themselves. The CCMU arranges support group meetings of residents to share knowledge and experience. However, given the fact that there is a diverse level of knowledge among the population it is hard to tailor the sessions by type of need. Also, many of the participants are elderly and cannot easily travel to the CCMU for each group session.

Initially, the NCD screening program of the CCMU recruited fewer participants than they had projected. Also, it was hard to recruit new persons into screening events (i.e., who had not been screened before). The CCMU outreach team tried to increase uptake of screening by arranging mobile clinic visits to the communities outside routine working hours. Also, VHV were mobilized to recruit new participants for screening. Even the CCMU physicians helped with the outreach by knocking on doors to persuade hold-outs to be screened. However, this effort still did not boost coverage as expected. Another obstacle is the urban lifestyle, in which people tend to live more independent lives, and run many errands on a given day. The result is that health status takes lower priority than these day-to-day errands.

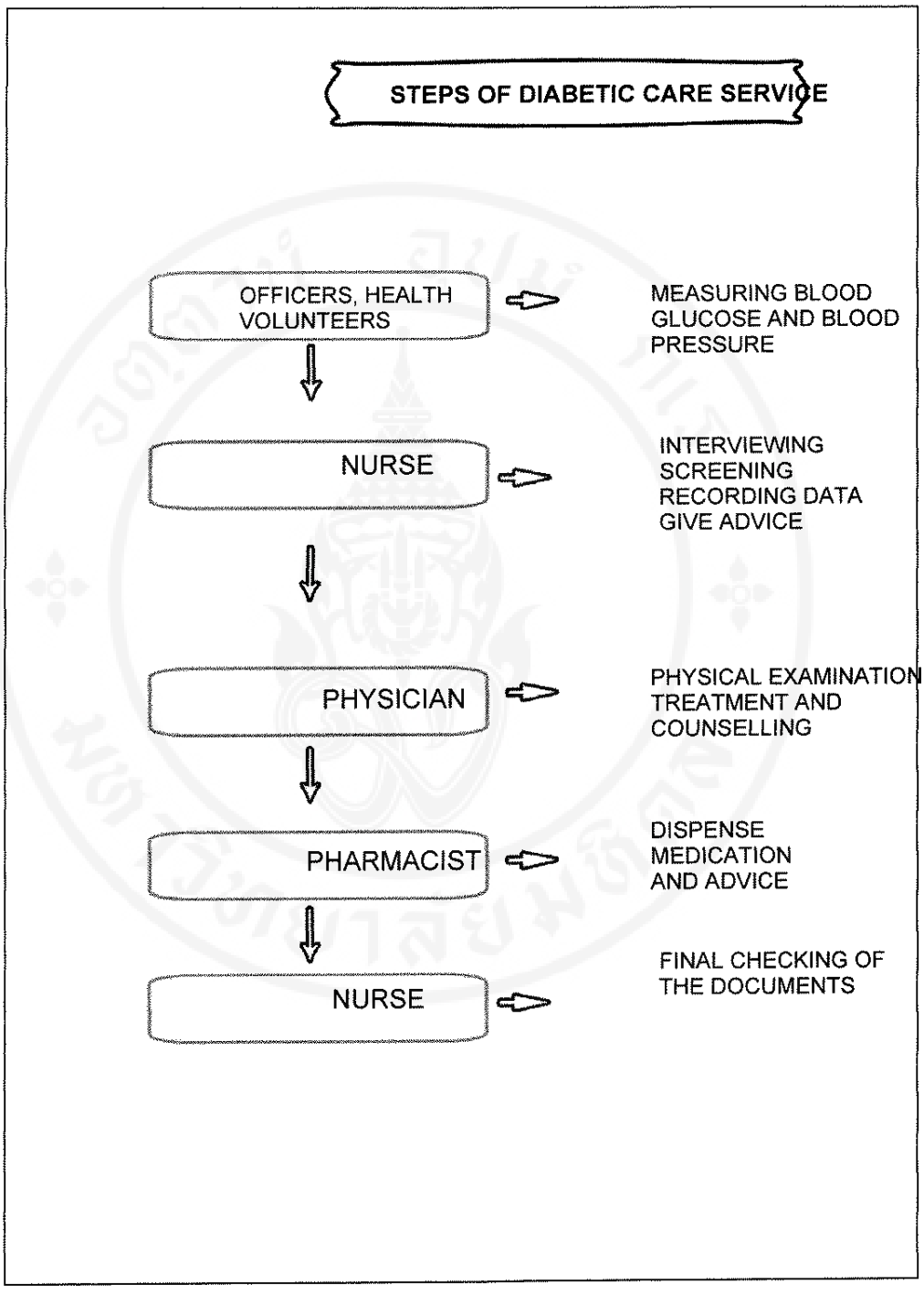


Figure 4.1 Steps of diabetic care service by the CCMU

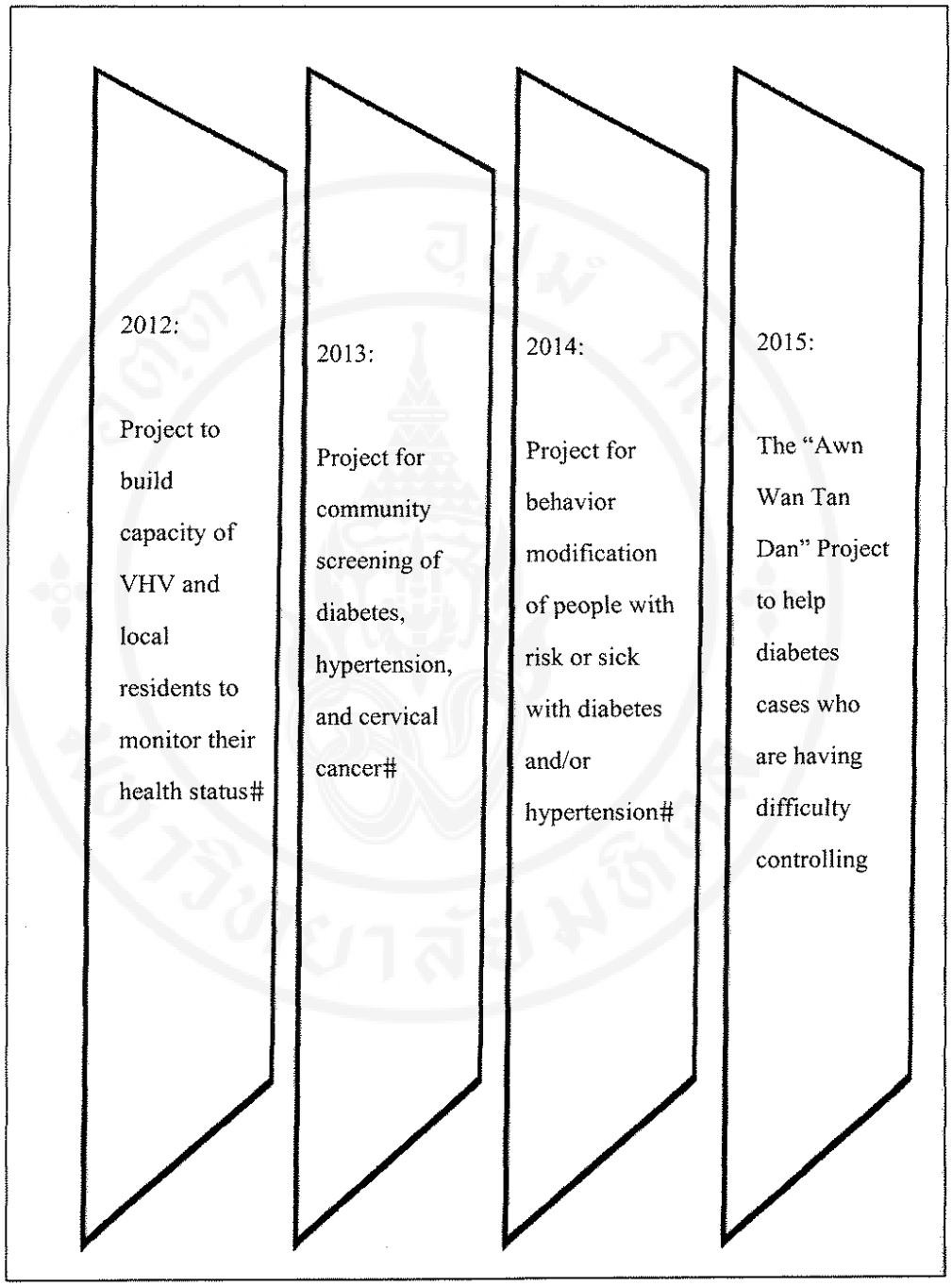


Figure 4.2 Projects on diabetes care during 2012-15

CCMU data on quality of care

Staffing

The CCMU has two family medicine physicians who take turns seeing clients. The CCMU is open Monday to Friday during routine government service hours. The CCMU offers over-time sessions (4 – 6 p.m.) and half-day clinics on Saturday and Sunday. In addition, to the MDs, there is a dentist who is staff of the Khon Kaen Hospital and visits the CCMU every weekday except Wednesday. The pharmacist is at the CCMU during 8 – 12 noon. The CCMU staff conduct outreach to the four THPH in its catchment area twice to four times per month. As noted, the nurse-population ratio is below standard, but the staffing ratio for physicians, dentists and pharmacists meets the standard.

Table 4.1 Number of personnel and ratio to the catchment population of CCMU: 2011-2015

	2011		2012		2013		2014		2015	
Population	23,969	Ratio	16,799	Ratio	16,679	Ratio	17,605	Ratio	17,405	Ratio
Doctor	2	11,984	2	8,399	2	8,340	2	8,802	2	8,702
Dentist	1	23,969	1	16,799	1	16,679	1	17,605	1	17,405
Pharmacist	1	23,969	1	16,799	1	16,679	1	17,605	1	17,405
Nurse	5	4,793	4	4,199	4	4,169	5	3,521	7	2,486
Pubic health	1	23,969	1	16,799	1	16,679	1	17,605	1	17,405
Dental Worker	1	23,969	1	16,799	1	16,679	1	17,605	1	17,405
Others*	5		5		5		5		4	
Total	15		15		15		16		17	

*Others= patient helper, data record officer and public health worker

Catchment area population, number of patients (all conditions) and number of diabetes cases

The data in Table 4.2, show the rather large CCMU catchment population for 2011. The total had increased by 2014 due to some realignment of the communities in the catchment area. CCMU caseloads increased steadily during the period of study. Client visits nearly doubled from 17,771 in 2011 to 31,652 in 2015. The CCMU also received clients from outside its catchment area, and that number also increased during the five years. Patient visits for diabetes in 2011 were 959, and this number tripled to 2,976 by 2015.

Table 4.2 Total population in the catchment area, total number of all patients and diabetes patients during 2011-2015

	2011	**2012**	**2013**	**2014**	**2015**
Total population (person)	23,969	16,799	16,679	17,605	17,405
Total number of patients visiting (time/year)	20,045	23,847	27,210	33,610	34,511
-Patients from the catchment area	17,771	21,484	24,968	30,781	31,652
-Patients from outside the catchment area	2,274	2,363	2,242	2,829	2,859
Total diabetic patients* (person)	417	377	512	411	492
Number of diabetic patient visiting (time/year)	959	1,765	2,034	2,601	2,976

*Total diabetic patients including diabetic patients who live outside the catchment area of the CCMU

In 2015, the CCMU staff conducted a survey of the catchment area population to detect cases of diabetes. The survey identified 556 diabetics; of these 490 (88.1%) were being seen at the CCMU, while 66 cases were going to other outlets.

1.3 Screening and prevalence of diabetes

Each year, the staff of the CCMU implement an outreach screening program among the population age 15 years or older to detect new cases of diabetes. The screening begins with an oral question/answer exchange; if the person is age over 35 years, then a finger-prick sample of blood is taken for testing with a blood glucose meter. Persons with results of over 126mg% (fasting) and over 200mg% (non-fasting) are considered at risk of diabetes. These persons are advised to have a second blood test at the CCMU to confirm the results.

Table 4.3 Number of persons screened for diabetes, risk group and newly-diagnosed cases

	2012	**2013**	**2014**	**2015**
Number of cases screened	3,090 (21.6%)	3,407 (23.5%)	4,045 (25.9%)	955* (9.4%)
Target population (age > 15 years)	14,269	14,493	15,591	10,173* (age > 35yr)
Risk group number	143	38	46	48
Newly diagnosed	20	10	16	11

population at risk for diabetes; FBS >=126mg% or Random blood sugar >= 200 mg% at the first time of blood sampling for screening test

*Screened population is above 35 years old.

Data in Table 4.3 show the number of persons screened by year is much lower than the standard target of 90%. Interviews with staff and other related data (30) indicate that some of the obstacles to higher coverage of screening include tardy planning and difficulty of locating people who spend most of the day outside the home and community. Based on the CCMU community survey and application of the level of ascertainment analysis, the prevalence rate of diagnosed diabetes in the catchment area population is 0.53.

$$\text{Level of ascertain of the prevalence of diabetes} = \frac{\text{Prevalence of diagnosed diabetes}}{\text{Prevalence of expected diabetes}}$$

Prevalence of diagnosed diabetes of the year 2015 = 556 cases

The 4th National Survey of the Health of the Thai Population (using physical exam) 2008-9, found that the prevalence of diabetes for the population age over 15 years was 6.9%

CCMU catchment area population in 2015 age over 15 years = 15,191 persons

Calculate prevalence of expected diabetes (6.9/100 x 15,191) = 1,048 cases

Prevalence rate of diagnosed diabetes = 556/1,048 = 0.53

1.4 Satisfaction with services

Data on CCMU client satisfaction was extracted from forms distributed to a 10% sample of clients in the time period of the study (see appendix). Overall, client satisfaction is high (i.e., over 90%).

Table 4.4 Patients' satisfaction with CCMU services

	2011	**2012**	**2013**	**2014**	**2015**
score (total 100)	89.5	89.5	90.7	93.2	93.8

1.5 Medicines and clinical supplies

The Pharmacists Work Cluster of the Khon Kaen Hospital deploys pharmacists to assist PCU in the network. These staff help manage the supply of medicines and clinical supplies. They educate staff of the PCU on use of medicines and stock control. The clinical team and pharmacist meet annually to consider costs of medicines and make changes to their inventory of drugs. The CCMU has an adequate supply of drugs (i.e., no stock-outs) and the cost of medicines used in 2014 was 1,727,769 baht. In 2015, the total value increased to 1,970,739 baht. The budget ceiling for PCU medicines was increased from 1.6 to 2.6 million baht in 2016 (27).

1.6 Characteristics of diabetes cases seen at the CCMU

Table 4.5 Demographic data of diabetic patients in the CCMU catchment area during 2011-2015

		2011	**2012**	**2013**	**2014**	**2015**
Sex	Male	87 (36.7)	109 (37.1)	129 (39.9)	145 (39.6)	158 (40.1)
	Female	150 (63.2)	185 (62.9)	194 (60.0)	221 (60.4)	236 (59.8)
Age by average (SD, min, max)		60.9 (10.4,31,85)	61.8 (11.1,29,91)	62.2 (11.4,30,92)	62.4 (11.2,31,93)	63.4 (11.4,32,94)
	<40 years	9 (3.8)	10 (3.3)	8 (2.4)	7 (1.9)	7 (1.7)
	40-49	24 (10.1)	31 (10.5)	36 (11.1)	43 (11.7)	43 (10.9)
	50-59	71 (29.9)	73 (24.8)	81 (25.0)	92 (25.1)	88 (22.3)
	60-69	85 (35.8)	108 (36.7)	108 (33.4)	119 (35.5)	131 (33.2)
	>70 years	48 (20.2)	72 (24.5)	100 (27.8)	105 (28.6)	125 (31.7)

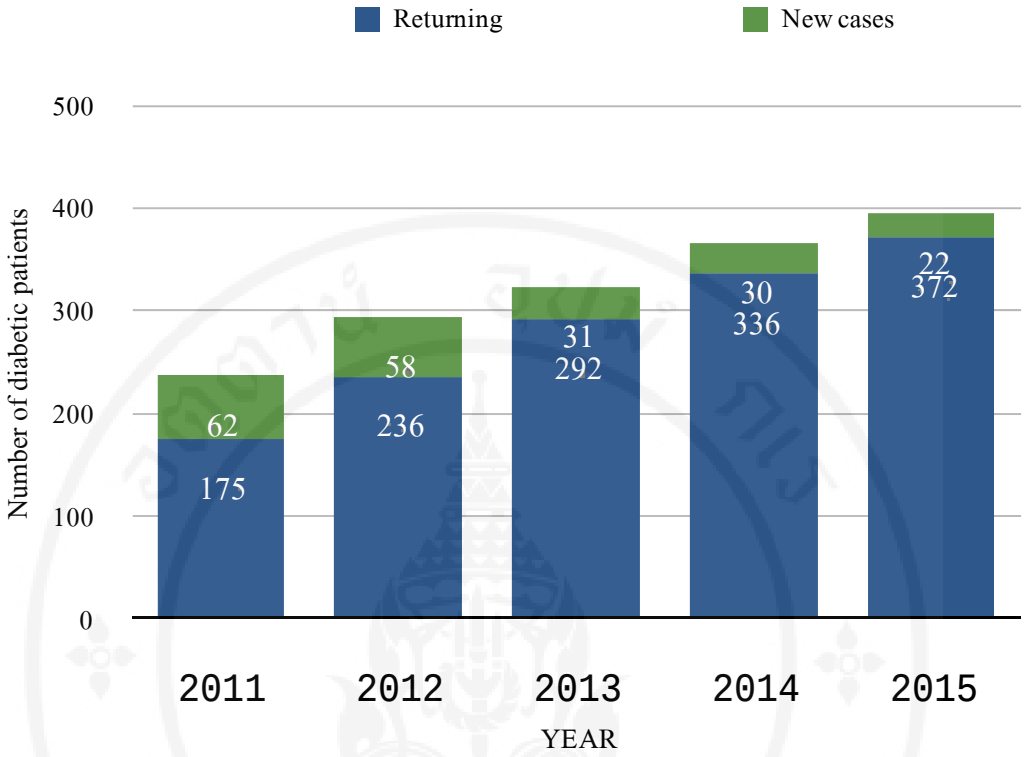
Table 4.5 Demographic data of diabetic patients in the CCMU catchment area during 2011-2015 (cont.)

		2011	2012	2013	2014	2015
Marital Status	Married	160 (67.5)	190 (64.6)	211 (65.3)	234 (63.9)	254 (64.4)
	Widowed	53 (22.3)	68 (23.1)	69 (21.3)	73 (19.9)	75 (19.2)
	Single	15 (6.3)	23 (7.8)	29 (8.9)	37 (10.1)	41 (10.4)
	Divorced	8 (2.9)	11 (3.7)	11 (3.4)	18 (4.9)	19 (4.8)
	Unknown	1 (0.4)	2 (0.6)	3 (0.9)	4 (1.0)	5 (1.2)
Health insurance coverage	Universal coverage program	157 (66.2)	196 (66.6)	206 (63.7)	238 (65.0)	255 (64.7)
	Government civil servant	73 (30.8)	87 (29.5)	99 (30.6)	107 (29.2)	117 (29.6)
	Social welfare	7 (2.9)	11 (3.7)	18 (5.5)	21 (5.7)	22 (5.5)
Educations	Primary school	169 (71.3)	211 (71.7)	222 (68.7)	253 (69.1)	265 (67.2)
	Secondary school	28 (11.8)	39 (13.2)	48 (14.8)	53 (14.5)	58 (14.7)
	Diploma	8 (3.3)	8 (2.7)	9 (2.7)	11 (3.0)	14 (3.5)
	Bachelors degree	10 (4.2)	11 (3.7)	13 (4.0)	17 (4.6)	19 (4.8)
	Above a bachelors degree	1 (0.4)	1 (0.3)	2 (0.6)	2 (0.5)	4 (1.0)
	Unknown	21 (8.8)	24 (8.1)	29 (8.9)	30 (8.2)	33 (8.3)
	No formal education	-	-	-	-	1 (0.2)

Table 4.5 Demographic data of diabetic patients in the CCMU catchment area during 2011-2015 (cont.)

		2011	2012	2013	2014	2015
Occupations	Homemaker	74 (31.2)	90 (30.6)	92 (28.4)	104 (28.4)	108 (27.4)
	Laborer	56 (23.6)	71 (24.1)	79 (24.4)	95 (25.9)	101 (25.6)
	Merchant	64 (27.0)	80 (27.2)	87 (26.9)	98 (26.7)	106 (26.9)
	Unknown	18 (7.5)	24 (8.2)	28 (8.6)	30 (8.2)	34 (8.6)
	Government civil servant	9 (3.7)	11 (3.7)	19 (5.8)	20 (5.4)	23 (5.8)
	Retiree	16 (6.7)	18 (6.1)	18 (5.5)	19 (5.1)	22 (5.5)
Total		237	294	323	366	394

The number of diabetics seen by the CCMU has increased steadily from 237 in 2011 to 394 in 2015 (66%). Most (60-63%) of cases are female, mean age of 60 years (increasing each year), most (64-68%) are married and 65-66% use the universal health insurance plan for coverage. Fully 67-71% completed primary education and were/are employed in wage labor, homemaker or sales (80-82%).



Graph 4.1 Number of new and returning diabetic patients during 2011-2015

Diabetes cases seen at the CCMU can be classified as new and returning (Graph 1). A new client is one who has not registered at the CCMU in the current year. During the five years of the study, the number of new patients declined while cumulative cases (new and returning) increased. This implies good retention of the caseload.

On the other hand, there were 35 diabetes cases who never returned or attended the CCMU irregularly (i.e., not according to appointment). These cases were male and female, with average age of 60 years (Table 4.6). In 2015, 31 cases received HbA1c testing result of average HbA1c = 8.7% and only 6 cases had HbA1c <7%.

Table 4.6 Characteristics of population with irregular treatment visits (2011-2016)

		Number	Percent
Sex	Female	18	51.4
	Male	17	48.6
Age (years)	Average	59.89	
	<50	6	17.1
	50-59	13	37.1
	60-69	9	25.7
	>70	7	20.0
Status	Married	24	68.6
	Widowed	5	14.3
	Single	2	5.7
	Divorced	4	11.4
Health insurance coverage	Universal coverage program	20	57.1
	Government civil servant	9	25.7
	Social welfare	6	17.1
Education	Primary school	22	62.8
	Secondary school	7	20.0
	Diploma	2	5.7
	Unknown	4	11.4

Table 4.6 Characteristics of population with irregular treatment visits (2011-2016) (cont.)

		Number	Percent
Occupation	Homemaker	7	20.0
	Laborer	14	40.0
	Merchant	8	22.8
	Retiree	6	17.1
Total		35	

1.6 Number of diabetes cases who received an eye and foot examination

Table 4.7 Number of patients receiving eye and foot examination

	2012	2013	2014	2015
Number of diabetic patients*	460	503	411	430
Number of patients receiving eye examination (%)	79 (17.2)	174 (34.6)	127 (30.9)	213(49.5)
Abnormality of eyes (%)	25 (31.6)	0	60 (47.2)	NA
Number of patients receiving foot examination (%)	205 (44.6)	282 (56.1)	363 (47.2)	361(83.9)
Foot abnormality (%)	2 (1.0)	8 (2.8)	8 (2.2)	1 (0.3)

*Source of data: NCD 29F of the Community Medicine Department: diabetes and diabetes + hypertension cases in the CCMU catchment area.

NA= Not available

Diabetes clients who received eye examinations increased from 17.2% in 2012 to 49.5% in 2015. Of these, in 2012, 31.6% of examinations revealed abnormal results and this increased to 47.2% in 2014. Foot examinations for diabetics increased from 44.6% in 2012 to 83.9% of clients in 2015. Abnormalities were found in less than 3% of examinations.

2. Diabetes cases coming regularly for service during the five years

2.1 Characteristics of the population

Table 4.8 Demographic data of the target population

		Number	**%**
Sex	Male	83	37.2
	Female	140	62.8
Mean age (SD, min,	65 (10.0, 35, 89)		
Age (years)	<40 years	2	0.8
	40-49	11	4.9
	50-59	44	19.7
	60-69	87	39.0
	>70 years	79	35.4
Marital Status	Married	149	66.8
	Widowed	52	23.3
	Single	13	5.8
	Divorced	8	3.5
	Unknown	1	0.4
Health insurance	Universal	147	65.9
	Government	70	31.3
	Social welfare	6	2.6

Table 4.8 Demographic data of the target population (cont.)

		Number	%
Education	Primary school	161	72.1
	Secondary school	25	11.2
	Diploma	7	3.1
	Bachelors degree	10	4.5
	Above bachelors	1	0.4
	Unknown	19	8.5
Occupation	Homemaker	72	32.2
	Merchant	59	26.4
	Laborer	51	22.8
	Unknown	17	7.6
	Government civil servant	9	4.0
	Retiree	15	6.7
Other diseases	Hypertension	204	91.5
	Dyslipidemia	86	38.5
	Chronic kidney disease	25	11.2
	Gout	5	2.2
	Cerebrovascular disease	4	1.8
	Asthma	3	1.3

Table 4.8 Demographic data of the target population (cont.)

		Number	%
Other diseases	Coronary artery disease	2	0.9
	Anemia	2	0.9
	Thyroid disease	2	0.9
	Benign prostate hyperplasia	1	0.4
	Hyperuricemia	1	0.4
Total diabetic patients (cases/year)		223	

A total of 223 diabetes cases who came regularly for care at the CCMU (i.e., the target population of the study). Of these, 37.2% were male, mean age of 65 years, two-thirds were married and used the universal health insurance scheme for coverage, while 72.1% had completed primary school, and 32.2%, 26.4%, and 22.8% were homemakers, merchants or wage laborers, respectively.

Of the 223 cases diabetes:

95 cases had diabetes with hypertension

65 cases had diabetes with hypertension and dyslipidemia

24 cases had diabetes with hypertension and 1other disease

19 cases had diabetes with hypertension and 2 other diseases.

2.2 Number of patients tested for HbA1c

Table 4.9 Number of cases with HbA1c examination

	2011	**2012**	**2013**	**2014**	**2015**
No. of patients (%)	15 (6.7)	37 (16.5)	26 (11.6)	198 (88.7)	197 (88.3)
HbA1c level Median (95%CI)	8.4 (6.7-8.8)	8.9 (8.0-9.5)	8.6 (7.8-9.7)	8.1 (7.6-8.4)	8.3 (8.0-8.7)
Number of patients achieving target HbA1c < 7% (%)	2 (13.3)	3 (8.1)	4 (15.3)	63 (31.8)	37 (18.7)

Of the 223 diabetics at the CCMU, only 7% to 16% had testing for HbA1c during 2011-2013, but this increased to 89% in 2014-5. The median level of HbA1c was 8.3 - 8.9%, which is over the standard of <7%. Only 32% in 2014 and 19% in 2015 had standard levels of HbA1c.

Table 4.10 Characteristics of patients with HbA1c examination during 2014-2015

	No.	**Sex**	**Age**	**HbA1c average level 2014**	**HbA1c average level 2015**
Gr1 2014, 2015 good	29 (16.6%)	M 9 F 20	67.55 (10.02, 41,87)*	6.22 (0.44, 4.9,6.8)	6.42 (0.54, 5.0,7.0)
Gr2 2014 good 2015 poor	27 (15.5%)	M 12 F 15	63.70 (9.78, 41,70)	6.44 (0.35, 5.7,7.0)	8.70 (1.50, 7.1,11.6)
Gr3 2014 poor 2015 good	15 (8.6%)	M 1 F 14	66.87 (11.26, 43,84)	8.76 (1.72, 7.1,13.5)	6.80 (0.41, 5.7,7.0)
Gr4 2014 ,2015 poor	103 (59%)	M 38 F 65	65.34 (9.64, 39,87)	9.28 (1.60, 7.1,13.4)	9.54 (1.60, 7.1,15.0)
Total	174				

*Number in parenthesis are SD,min,max

For the years 2014-15, 174 cases had testing for HbA1c each year. These can be divided into those with standard acceptable HbA1c (<=7%) and those with abnormal HbA1c (over 7%). These can be further divided into four groups: Normal in both years, normal in 2014/abnormal in 2015, abnormal in 2014/normal in 2015, and abnormal in both years. Older women tended to cluster in the abnormal group for both years (59%) with mean HbA1c of 9.3% in 2014 and 9.5% in 2015.

2.3 Number of cases receiving LDL testing

Table 4.11 Number of cases with LDL examination

	2011	**2012**	**2013**	**2014**	**2015**
No. of patients (%)	101 (45.3)	72 (32.3)	183 (82.0)	203 (91.0)	198 (88.7)
LDL level **Median** (95%CI)	121.8 (116.6-131.6)	112.5 (99.0-123.7)	117.5 (108.6-122.3)	129.0 (121.6-136.0)	118.0 (113.0-125.2)
Number of patients achieving target LDL < 100 (%)	28 (27.7)	29 (40.3)	65 (35.5)	50 (24.6)	52 (26.2)

In 2011-12, less than half the diabetes caseload had an LDL check-up. But the proportion increased in 2013-15. The levels of LDL were rather high at 112-129 mg/dL (which is above the healthy standard of <100). Only 25-40% of cases had healthy LDL and, in 2014, when 90% of the caseload was checked, only one-fourth had a healthy LDL level.

Table 4.12 Characteristics of patients with LDL examination during 2013-2015

	No	**Sex**	**Age**	**LDL 2013**	**LDL 2014**	**LDL 2015**
Gr1 2013-2015 good	11 (7.2%)	M 6 F 5	64.2 (7.8,49,76)*	71.07 (24.4,13,99)	82.18 (14.1,59,97)	76.45 (10.98,63,96)
Gr2 2015 poor	37 (24.2%)	M 18 F 19	64.5 (11.1,39,87)	90.65 (21.8,41,146)	112.81 (32.7,34,174)	130.03 (22.4,104,210)
Gr3 2015 good	33 (21.5%)	M 12 F 21	66.18 (10.2,41,84)	111.73 (42.1,24,234)	119.36 (32.5,68,211)	86.82 (13.4,44,99)
Gr4 2013-2015 poor	72 (47.0%)	M 17 F 55	66.08 (10.4,41,84)	138.83 (28.4,100,221)	148.58 (27.4,103,217)	142.68 (32.6,100,236)
Total	153					

*Number in parenthesis are SD,min,max

Most cases receiving checks of their LDL in 2013, 2014 and 2015 were female (65.3%) with mean age of 66 years. Only 7.2% had healthy LDL and the average for the group was 71-82 mg/dL.In the other hand, 47% of patients had high LDL with the average LDL was 138-148 mg/dL.

2.4 Number of cases tested for Creatinine

Table 4.13 Number of cases receiving a Creatinine examination

	2011	**2012**	**2013**	**2014**	**2015**
No of patients (%)	106 (47.5)	95 (42.6)	187 (83.8)	201 (90.1)	200 (89.6)
Creatinine level Median (95%CI)	0.80 (0.80-0.90)	0.90 (0.90-1.00)	0.80 (0.80-0.90)	0.80 (0.80-0.90)	0.81 (0.76-0.86)
No of patients eGFR* above 90 mL/min					83 (41.5)

*Estimated Glomerular Filtration Rate

Examination of Creatinine increased at the CCMU during 2013-15 (from 84% to 90% of diabetics). Less than half had received screening in 2011-12. Over time, the Khon Kaen Hospital upgraded its protocol for Creatinine screening, and introduced the use of the Estimated Glomerular Filtration Rate (eGFR) measurement. The eGFR is a proxy for kidney function and is a better reflection of kidney health than the Creatinine test alone. The CCMU diabetes caseload can be classified into the following five groups:

Stage 1 GFR above 90 mL/min or normal kidney function

Stage 2 GFR 60-89 mL/min

Stage 3 GFR 30-59 mL/min

Stage 4 GFR 15-29 mL/min

Stage 5 GFR below 15 mL/min or end-stage renal disease

In 2015, the CCMU service statistics show that 192 cases had eGFR scores. Of these, 83 (43%) were in Stage 1, while 63, 40, 5 and 1 were in Stages 2, 3, 4 and 5, respectively.

2.5 Number of cases receiving Microalbuminuria testing

Table 4.14 Number of cases receiving the urine microalbumin examination

			2011	2012	2013	2014**	2015
Number of cases (%)			2 (0.9)	20 (8.9)	101 (45.2)	202 (90.5)	199 (89.2)
Micro albumin level	Automate test Median (95% CI)			28 (12.0-85.6)	27 (19.0-36.0)	35.5 (26.6-81.4)	-
	Strip test (mcg/ml)	0				118	118
		20				60	78
		50				0	1
		100				0	2
Number of cases achieving target <30 mcg/ml (%)				10 (50.0)	53 (52.4)	187 (92.5)	196 (98.4)

**Changing the method of the urine microalbumin examination during the year 2014. 24 cases received automate test and 178 cases had the strip test. The strip test has 4 scales; 0 means negative, 20 mg/L, 50 mg/L and 100 mg/L.

Microalbuminuria is an examination to measure the albumin protein level in the urine. A healthy result is no protein detected. If the score is over

30 mcg/ml that indicates abnormal kidney function as a complication of diabetes. The proportion of diabetics receiving this exam increased dramatically, form 1% in 2011, to 9% in 2012, 45% in 2013, and 90% in 2014-15. In 2014, the laboratory procedures for this test were modified, switching from the Automate machine, to the strip test (to reduce cost). This change also caused a change in the results for level of protein in the urine, from a discrete number to a four-tiered scale of 0, 20, 50 and 100 mcg/ml.

2.6 Severe complications from diabetes

As of April 21, 2016, in this population of 223 diabetics, nine (4%) had severe complications, with the following symptoms: Six cases had cerebral infarction, intracerebral haemorrhage, transient ischemic attack and/or stroke. Five had congestive heart failure (CHF), or myocardial infarction (MI). There was one case of chronic renal failure (CRF).

Table 4.15 Diagnosis and date of admission of the diabetic patients

No	Name	Sex	Birth year	Admit date	Diagnosis
1	Y.D.	Male	1933	25-6-2013	Transient ischemic attack
2	P.K.	Female	1934	17-11-2014	Intracerebral hemorrhage
3	U.K.	Male	1955	1-2-2015	CHF ,Cerebral infarction
4	P.B.	Female	1942	16-2-2015	CHF
5	L.D.	Female	1931	1-4-2015	MI
6	B.S.	Male	1941	11-4-2015	Stroke
7	P.N.	Female	1935	11-2-2016 12-3-2016	CHF CHF
8	T.S.	Male	1946	1-4-2016	Stroke
9	S.S.	Female	1934	4-8-2015 29-2-2016 11-3-2016	CRF Stroke MI, CHF

CHAPTER V
DISCUSSION OF FINDINGS

Findings

1. Quality of CCMU services

The number of client visits at the CCMU, for any cause and diabetes, increased each year during 2011-15. However, the CCMU is still well below the MOPH target of 90% of the population age over 15 years screened for diabetes (CCMU: 21-25% screened during 2012-14). In 2015, the screening criteria was changed to persons over 35 years and 9.3% screened.The prevalence rate of diagnosed diabetes was 0.53 in 2015. Corresponding to the IDF Diabetes Atlas (31) estimates that under half the population in the world who have diabetes do not know it.

In 2011, the number of diabetic patient visits to the CCMU was 959 (includes repeat visits for a single person). This number increased steadily and, by 2015, reached nearly 3,000 client visits. Over time, the characteristics of the diabetes cases has not changed much. A majority are female, mean age is 60 years, about two-thirds are married, use the universal health insurance scheme, and have only primary education, while 80% work/worked as homemakers or merchants. New cases have declined over the five years, while cumulative caseload has increased. This indicates good retention of cases by the CCMU. The attraction of the CCMU is proximity to the catchment population and the presence of a physician on duty every day. The CCMU also has good stock management of medicines and supplies. There is a lab on-site and this speeds diagnosis and informing clients of results. The CCMU is conveniently accessible by foot or vehicle. Overall client satisfaction with services is high.

Coverage of screening for diabetes complications of the eyes and feet is increasing. In 2015, nearly half of diabetics received eye screening and 84% received foot screening. Foot screening found that less than 3% had any diabetes-related

problems. A national survey of diabetic Thais in 2012 (26) found that two-thirds had annual examinations of the retina and foot. Less than 5% had sores on the feet (attributable to diabetes). Retinal examination is logistically more difficult than the foot exam since special equipment for the exam is shared among clinics. By contrast, microfilament examination of the feet does not require special equipment and can be done by each member of the clinical team.

2. Diabetes patients who regularly visit the CCMU

Testing for HbA1c among regular diabetic clients of the CCMU increased to nearly 90% in 2015. However, clients with healthy levels of this marker were only 32% in 2014, and 19% in 2015. The MOPH has a policy to intensify screening using the HbA1c, Creatinine, LDL, and Microalbuminuria markers, and this is reflected in increased coverage of CCMU clients (up to 89%). However, healthy levels of these markers was not optimal, ranging from only 26% (LDL) to 43% (eGFR) of cases.

In 2014, examination of microalbuminuria changed from using the Automate machine to the strip test to economize on budget. Normal levels of microalbuminuria are under 30 mcg/ml, and nearly all the diabetics at the CCMU had normal levels in 2014-15. However, this is not plausible given the other markers and, thus, quality of the strip test results is under question. When using the Automate machine only half the diabetes caseload had healthy levels of microalbuminuria. Further, other markers of kidney function show that many of the CCMU diabetes cases have problems. Complications of diabetes requiring hospitalization at the Khon Kaen Hospital only affected 4% of the CCMU caseload during the five years of the study. However, this is probably an underestimate since some cases might have gone to another facility for in-patient care. That said, Khon Kaen Hospital is convenient and high quality, so it should be the first choice of CCMU clients.

The national study (26) of diabetics found that 35.6% of cases had HbA1c < 7, and 43.7% LDL< 100 mg/dL. Over half (57.4%) had at least one examination of microalbuminuria per year, and 65.9% had at least one eye exam per year, while 66.1% had at least one foot exam per year. The CCMU clinic has not achieved the national levels of screening for its catchment population.

Analysis of findings

Overall, the outcomes of diabetes case management by the CCMU, when compared to the national performance, needs improvement. That said, coverage of screening and care by the CCMU has increased significantly over the five years of this study. The CCMU has the same number of staff as it did when it first opened, despite its increased caseload of NCD patients. This could be the result of policies of the MOPH and NHSO to promote more community-based care and self-monitoring in home setting. Outreach and networking by the CCMU has increased over time. Screening for complications of diabetes has increased, though some diagnostics may need better quality control. Diabetics who can effectively control their blood sugar is only 30% of the CCMU caseload. The clinical team needs to give higher priority to health maintenance than curative care. However, health promotion is time-consuming and long-term, and requires full-time staff to focus on behavior change which is notoriously difficult for people with ingrained habits. A study by Aram Suwano in 2014 looked at knowledge, behavior and self-care by diabetes patients at the CCMU and found that only 47.8% had good knowledge about diabetes, and only 59.2% had health promoting behaviors.

While some of the increase in caseload of diabetics at the CCMU could be due to the effects of Thai lifestyle changes in the past several decades, increased case finding is also contributing to the increase. Another factor is the transfer of some Khon Kaen Hospital cases to centers in the network, such as CCMU. In 2012, Khon Kaen Hospital closed its general examination service and referred clients to the PCU nearest their home. From this study, it is clear that there continues to be a strong need to improve the community clinical care units and the PHC system so that services are more efficient in accordance with the six building blocks of the WHO. In general, programs need to continue to shift from curative care to more disease prevention and health promotion.

Limitations of the research

The researcher was not able to access all the essential data of the CCMU and the Community Medicine Department on diabetes case management. This was

due to incomplete recording of data in the files and lack of detailed annual statistical reports. Thus, the data for this study come from multiple sources, and there may be inconsistencies among the different systems which contribute to undesirable variance in the data.

REFERENCES

1. King H. Global Burden of Diabetes, 1995–2025: Prevalence, numerical estimates, and projections. Diabetic care. 1998; 21:25.
2. Jiamjarusrungsi V. Type 2 diabetes care in primary care unit.18.
3. Srivanichakorn S. Over-crowding Problems in Hospitals. Journal of Health Systems Research. 2007;1:8.
4. Khon Kaen Hospital. Achievement of strategic planning of Khon Kaen Hospital 2012: Pen printing; 2012 June 2013. 201 p.
5. Chuanchom Pawatthanaya. Development of primary care network model for diabetic patients at Photharam hospital. 2010. 143 p.
6. Key content of the Hospital Development Project services. In: Department PH, editor. 2006. 3 p.
7. CUP board committee of Khon Kaen Hospital. Service systems development in the urban primary care setting, Fiscal Year 2012.
8. https://www.health.ny.gov/diseases/chronic/basicstat.htm.Access 12 October 2015
9. https://www.gotoknow.org/posts/514904. Access 28 November 2015
10. Chonlatis Urailetkkul. Review article: Health System Governance.24 p.http://hpc5.anamai.moph.go.th/director/data/aug2012/healthSystemGovernance.pdf
11. World Health Organisation. The world health report 2008 Primary health care - now more than ever: 2008.
12. World Health Organisation. Monitoring the building blocks of health systems: a handbook of indicators and their measurement strategies. Geneva: WHO Document Production Services, 2010.
13. Office of Research and Community Health Systems Development. Research on primary care services development. Community medical clinic. NHSO. Case study of 9 clinics; Capital costs of a primary care unit, case study of six provinces. 2010.

14. James H. O'Keefe,Jr. David S.Bell. Kathleen L.Wyne. Diabetes essentials fourth edition. Jones and Bartlett Publishers; 2009,191 p.
15. Benjaporn Kriangkrapet, Somsiri Pansaksiri. Comparison of efficacy of treatment of type 2 diabetes by community medical centers, community health outposts, and treatment outside the clinic setting in Saraburi. Thai Journal of primary care and family medicine 2011; 2(6):40-47.
16. Carol Davy, Jonathan Bleasel, et al. Effectiveness of chronic care models: opportunities for improving healthcare practice and health outcomes: a systematic review. 2015; BMC health services research; 15.
17. Supatra Srivanichakorn. The evaluation of diabetic care of primary care system. Journal of health systems. 2007; 1(1): 17-34.
18. Diabetes association of Thailand. Clinical practice guideline for diabetes 2014. 2014; 175 p.
19. Wiroj Jiamjarasrangsri, Vitool Loohsunthorn. Diabetes care in a primary care unit.Journal of health systems research: 2008; 2: 195-205.
20. Rury R. Holman, Andrew J. Farmer, et al. Three-Year Efficacy of Complex Insulin Regimens in Type 2 Diabetes. N Eng J Med 2009; 361:1736-47.
21. S M Campbell,, M Hann, J Hacker, C Burns, D Oliver, A Thapar, N Mead, D Gelb Safran, M O Roland. Identifying predictors of high quality care in English general practice: observational study. BMJ: 2001;323:784.
22. Johan Wens, Kristien Dirven, Chantal Mathieu, Dominique Paulus, Paul Van Royen. Quality indicators for type-2 diabetes care in practice guidelines: An example from six European countries. 2007; 1(1):17-23.
23. Mikko T Honkasalo, Miika Linna, Timo Sane, Atte Honkasalo and Outi Elonheimo. A comparative study of two various models of organising diabetes follow-up in public primary health care – the model influences the use of services, their quality and costs. BMC Health Services Research: 2014; 14:26.

24. Institution of research and development health system. Recommendation report for development of integrative diabetic care system in primary care: 2011. http://kb.hsri.or.th/dspace/handle/11228/3420.Access date 14 August 2015.

25. Modesti A1, Bartaloni R1, Bellagamba F1, Caglieri R1, Cenori K1, Ciampalini G1,et al. Health care delivery in type 2 diabetes. A survey in an Italian primary care practice.Prim Care Diabetes. 2015; 9(1): 9-14.

26. An Assessment on Quality of Care among Patients Diagnosed with Type 2 Diabetes and Hypertension Visiting Hospitals of Ministry of Public Health and Bangkok Metropolitan Administration in Thailand, 2012.

27. https://www.sites.google.com/site/Khon Kaen Hospitaldrugsystem/hna-hlak-home/taw-chi-wad-rabb-ya/kar-brihar-wechphanth/kar-brihar-wechphanth-pcu. Access 21 November 2016

28. Aram Suwanno. Perception and self-care behaviours of diabetic patients in the catchment area of Chataphadung medical contracting unit, Khon Kaen Hospital. Journal of Khon Kaen Health: 2014; 308

29. Ministry of Public Health. Human Resources Department. 2015. http://www.bro.moph.go.th/html/downloads/STRATEGY/file_meeting_ssj_kaoyai/08-human.pdf

30. Social medicine department, Khon Kaen Hospital. Service profile CMU Chataphadung 2015.

31. International Diabetes Federation. IDF diabetes atlas seventh edition. Brussels, Belgium. 2015. 143 p.

APPENDICES

APPENDIX A
SEMI-STRUCTURED INTERVIEW GUIDELINES

Name.....Surname.....

Position.....

Place.....

Interview

date.....

Work place.....

Interview questions

1. During the time you worked at the CCMU, describe the diabetes case management system. Including health promotion, screening, care, treatment, rehabilitation and home visits.
2. During 2011-15, how did the diabetes case management system change?
3. What impact did the 2012 policy to reduce crowding in hospitals have on diabetes care in the CCMU?
4. What obstacles or problems did the CCMU face in managing patient care?
5. What solutions did CCMU come up with to address the problems?
6. How were the outcomes of diabetes case management of the CCMU?

APPENDIX B

FORM FOR ASSESSING SATISFACTION WITH SERVICES

Age.....Occupation.....

Education.....

Marital status: single, married, widowed

Please mark the box for the answer which best describes your level of satisfaction

PCU (THPH)	Level of satisfaction				
	5	4	3	2	1
1.Good welcome, polite and smiling staff					
2. Dedicated to providing quality services					
3. Providing convenient and efficient services					
4. Services were during government work hours or the stated hours					
5. Services were in accordance with government standards					
6. Staff clearly explained the steps and procedures for the client					
7. The clients were able to conveniently communicate with the community health outlet					
8. Staff of the community health outlet showed responsibility and dedication to the job					
8. Level of satisfaction of staff performance					
10. The health center and community health outlet provided services as scheduled.					

Most = 5 high = 4 moderate = 3 Low = 2 least = 1

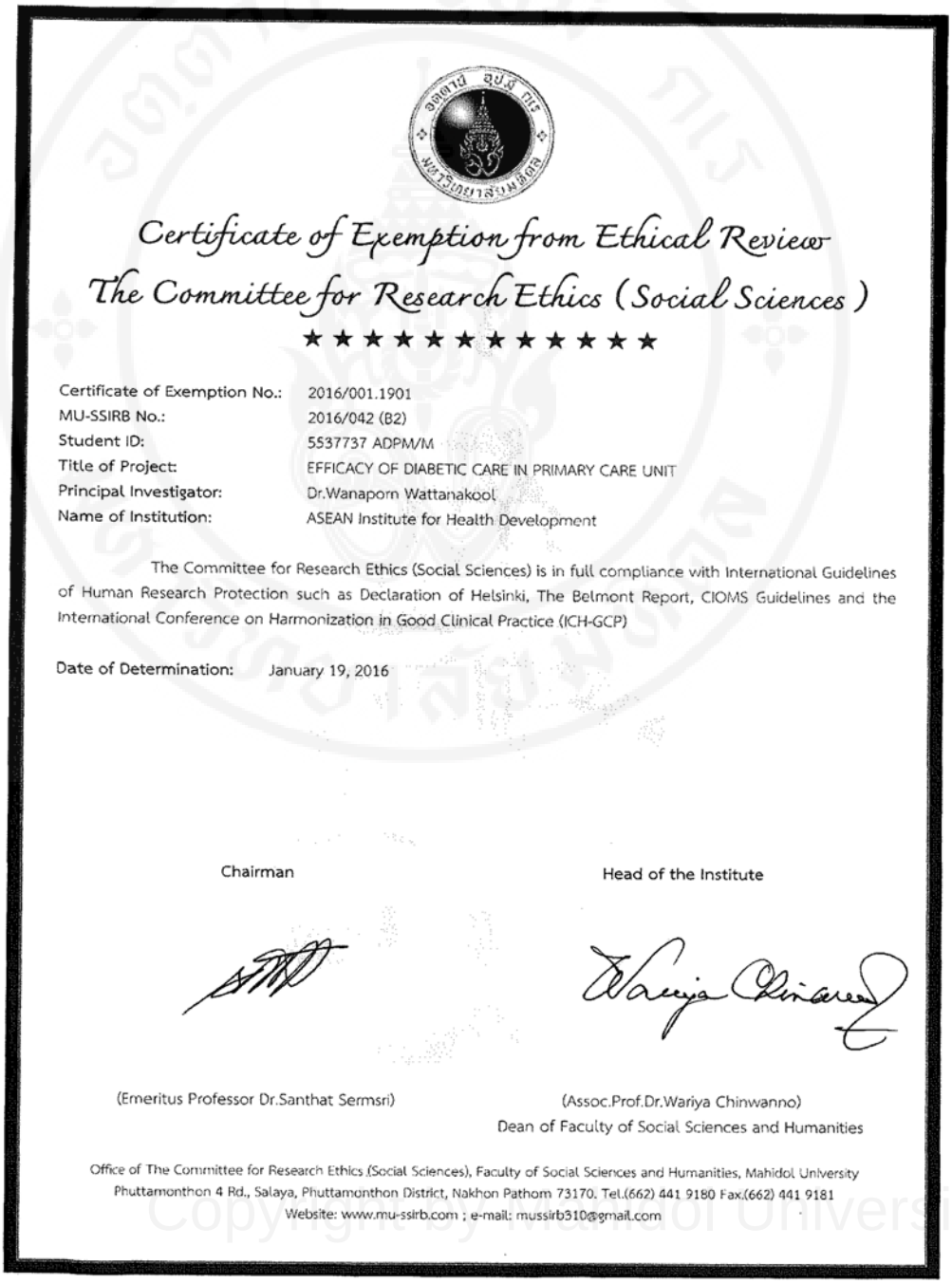
11. In your experience with this THPH, what suggestions do you have for improvement?

……
……
……

12. What other recommendations do you have to improve services of the THPH?

……
……
……

APPENDIX C
HUMAN SUBJECTS APPROVAL DOCUMENT



Certificate of Exemption from Ethical Review
The Committee for Research Ethics (Social Sciences)
★★★★★★★★★★★★

Certificate of Exemption No.:	2016/001.1901
MU-SSIRB No.:	2016/042 (B2)
Student ID:	5537737 ADPM/M
Title of Project:	EFFICACY OF DIABETIC CARE IN PRIMARY CARE UNIT
Principal Investigator:	Dr.Wanaporn Wattanakool
Name of Institution:	ASEAN Institute for Health Development

The Committee for Research Ethics (Social Sciences) is in full compliance with International Guidelines of Human Research Protection such as Declaration of Helsinki, The Belmont Report, CIOMS Guidelines and the International Conference on Harmonization in Good Clinical Practice (ICH-GCP)

Date of Determination: January 19, 2016

Chairman

(Emeritus Professor Dr.Santhat Sermsri)

Head of the Institute

(Assoc.Prof.Dr.Wariya Chinwanno)
Dean of Faculty of Social Sciences and Humanities

Office of The Committee for Research Ethics (Social Sciences), Faculty of Social Sciences and Humanities, Mahidol University
Phuttamonthon 4 Rd., Salaya, Phuttamonthon District, Nakhon Pathom 73170. Tel.(662) 441 9180 Fax.(662) 441 9181
Website: www.mu-ssirb.com ; e-mail: mussirb310@gmail.com

โครงการวิจัยนี้ได้รับการรับรองจริยธรรมการวิจัยในคนจากคณะกรรมการจริยธรรมการวิจัยในคน
สาขาสังคมศาสตร์ มหาวิทยาลัยมหิดล แล้ว

หากผู้วิจัยต้องการปรับเปลี่ยนรายละเอียดบางส่วนของโครงการวิจัย ขอให้ผู้วิจัยแจ้งมายังสำนักงานคณะกรรมการจริยธรรมฯ โดยกรอกแบบฟอร์ม "แบบขอปรับเปลี่ยนโครงร่างวิจัย (Protocol Amendment)" เพื่อขอรับการพิจารณารับรองก่อนเริ่มดำเนินการวิจัย เมื่อคณะกรรมการจริยธรรมฯ พิจารณารับรองแล้ว จะมีหนังสือตอบรับ (Acceptance Letter) แจ้งไปยังผู้วิจัย โดยระบุวันที่พิจารณารับรอง ผู้วิจัยจึงสามารถเริ่มดำเนินการวิจัยต่อไปได้

This research project had been certified by MU-SSIRB.

If the researcher wanted to amend some details of the research project, the researcher had to inform MU-SSIRB by completing the Protocol Amendment Form for consideration and certification before beginning doing the research. After considering and certifying, MU-SSIRB would send the researcher an acceptance letter with date of consideration and certification. After that, the researcher was able to begin doing the research.

Faculty of Graduate Studies

Mahidol University

It is Hereby Certified that

Name-Surname ..... Dr. **Wanaporn Wattanakool**..... Student ID.....**5537737**.....

Faculty/Institute/College..... **ASEAN Institute for Health Development (AIHD)**.....

Has attended the required classes on Ethics in Human Research

Course..... **ADPM 628 : Research Methodology : Principles of research ethics**.....

Faculty/Institute/College..... **ASEAN Institute for Health Development (AIHD), Mahidol University**.....

On.....**7 October 2013**.....(Date/Month/Year)

Signature..... Somsak Wongsawass

(Assistant Professor Somsak Wongsawass)

Course coordinator

Signature..... Orapin L.

(Lect. Dr.Orapin Laosee)

Lecturer

BIOGRAPHY

NAME	Wanaporn Wattanakool
DATE OF BIRTH	9 December 1973
PLACE OF BIRTH	Khon Kaen, Thailand
INSTITUTIONS ATTENDED	Khon Kaen University, 1990-1994 Bachelor of Science (Medical Technology) Chulalongkorn University, 1996-2000 Doctor of medicine Khon Kaen Hospital, 2002-2004 Diploma of Thai Board of Family Medicine Mahidol University, 2012-2016 Master of Public Health Program
RESEARCH GRANT	Supported by Social Medicine Department, Khon Kaen Hospital
HOME ADDRESS	52 Ruenjitr Road, Amphur Muang, Khon Kaen E-mail : Krataipaa@gmail.com
EMPLOYMENT ADDRESS	Social Medicine Department, Khon Kaen Hospital, Amphur Muang, Khon Kaen Tel. 043-336789 ext 1112
PUBLICATION	Original article Sirinart Tongsiri, Wanaporn Wattanakool, et al. Teaching Family Medicine in the Faculty of Medicine, Mahasarakham Uni versity: The Application of Transformative Learning Theory and Practice. Thammasat Medical Journal; 2015; 15 (3) : 416-425.

PRESENTATION

Poster presentation
AMEE Conference, Trondheim, Norway
25-29 August 2007.
Teaching holistic care in Primary care units

Oral presentation
19th Wonca Asia pacific Regional Conference, Jeju, South Korea 24-27 May 2012. The survey of Thai family physician curriculum.

#