Variations in the performance of three public insurance schemes in Thailand

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Thesis submitted to the University of London
For the Degree of Doctor of Philosophy

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June 2009

ABSTRACT

International experience shows that achieving universal coverage has been an important way to ensure equity of access to health care and to protect people from bankruptcy due to severe illness. One common approach to universal coverage has been to expand public health insurance to cover all people in a country. In Thailand, universal coverage of health care in Thailand was achieved by expanding public insurance to the uninsured. Before universal coverage, there were two main public insurance schemes, the Civil Servant Medical Benefit Scheme (CSMBS) and the Social Security Scheme (SSS). Merging two other schemes targeted at lower income groups, (the low income card scheme and health card scheme), and adding the uninsured population, produced the Universal Coverage Scheme (UC), a third and much larger scheme. The three schemes differ in a number of ways including funding, payment of provider and benefit package. There has been considerable concern that these characteristics might affect the performance of the insurance schemes.

The aim of this study was to evaluate the three public health insurance schemes in terms of their performance in selected areas. The first objective was to assess and explain variation in performance in terms of utilization, length of stay (LOS), and early readmission. The second was to identify the quality of care provided in each insurance scheme using Diabetes Mellitus (DM) as a tracer of performance and examining LOS, early readmission, and various other indicators of quality of care. To answer the first objective, the Health and Welfare Survey 2005 was used to analyse utilization by scheme and national claims data were used to analyse LOS and early readmission of DM patients. To assess quality of care in detail, primary quantitative and qualitative data were collected on DM patients and providers in Samutsakhon province.

The study indicates that the type of insurance scheme influences performance. The utilization review found that SSS members had a higher probability of using ambulatory services but a lower probability of being hospitalized. CSMBS members had a higher probability of being hospitalized. Members of the UC scheme had shorter LOS than CSMBS members and a higher probability of readmission relative to both SSS and CSMBS members.

The empirical study found that CSMBS members were more likely to receive care consistent with standard guidelines. However, intermediate outcomes such as fasting plasma glucose, and Haemoglobin A1C level, were not as good as might be expected possibly due to the effects of other factors such as body mass index and patient behaviour. The qualitative study found that different patient groups had different expectations and perceptions of quality of service and that the insurance scheme and hospital policy influenced provider behaviour.

The study demonstrates that, despite universal coverage, patients covered by different insurance schemes experienced variation in quantity and quality of care. Countries moving toward universal coverage should pay particular attention to the features of the insurance scheme design, especially with respect to management, organization, provider payment and the benefit package, as these features influence the performance of the scheme and the ability to achieve health system goals.

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ABBREVIATIONS

ACE	Angiotensin converting enzyme
ADA	American Diabetes Association
AN	Admission number
BMI	Body mass index
BP	Blood pressure
BUN	Blood Urea Nitrogen
CABG	Coronary artery bypass graft
CHI	Central Office for Healthcare Information
CMS	Centers for Medicare & Medicaid Services
COPD	Chronic obstructive pulmonary disease
COX2	Cyclooxygenase 2
CPG	Clinical Practice Guideline
Cr	Serum Creatinine
CSMBS	Civil Servant Medical Benefit Scheme
CUP	Contracting unit for primary care
CVA	Cerebrovascular accident
DM	Diabetes Mellitus
DQIP	Diabetes Quality Improvement Project
DRGs	Diagnosis related groups
FI	Farmers' insurance
FPG	Fasting Plasma Glucose
GDP	Gross domestic product
GEI	Government employees insurance
GIS	Government insurance scheme
GP	General Practitioner
HbA1C	Glycosylated haemoglobin
HDL	High density lipoprotein
HEDIS	Health Plan Employer Data and Information Set
HIV	Human immunodeficiency virus
HMO	Health Maintenance Organisation
HN	Hospital number
HSRI	Health System Research Institute
HT	Hypertension
HWS	Health and Welfare Survey
ICC	Intraclass correlation
ICD-10	International Classification of Disease 10^{th} version
IDDM	Insulin dependent Diabetes Mellitus
IP	Inpatient
LDL	Low density lipoprotein
LI	Labour insurance
LIS	Labour insurance scheme

LOS	Length of stay
LSHTM	London School of Hygiene and Tropical Medicine
MOPH	Ministry of Public Health
NCQA	National Committee for Quality Assurance
NHI	National Health Insurance
NHS	National Health Service
NHSO	National Health Security Office
NIDDM	Non insulin dependent Diabetes Mellitus
NSAID	Non-steroidal anti-inflammatory drug
NSO	National Statistical Office (Thailand)
OP	Outpatient
OR	Odds ratio
PCU	Primary care unit
PPO	Preferred Provider Organisation
PPS	Prospective payment system
RAND	Research and Development
RBRV	Resource-based relative value
RBRVS	Resource-based relative value scale
SCHIP	State Children's Health Insurance Program
SD	Standard deviation
SSO	Social Security Office
SSS	Social Security Scheme
UC	Universal Coverage
UK	United Kingdom
URI	Upper respiratory tract infection
US	United States
WHO	World Health Organisation

ACKNOWLEDGEMENTS

Upon completion of this thesis, there are certain people to whom I would like to express my deep gratitude. I would like to thank my supervisor, Professor Anne Mills, for her professional, generous, and supportive mentoring. I am very fortunate to have had an opportunity to work and learn from her.

To study at the London School of Hygiene and Tropical Medicine, I received a lot of support from my office (NHSO), Dr. Winai Sawasdiworn, Dr.Pongpisut Jongudomsuk, Dr. Viroj Tangcharoennsathien and European Union (EU) to support funding to live here. The teams of EU in Thailand include Ae, Kong, Dr. Yongyuth Pongsuparp who always supported administrative tasks for me and very warm support from my best colleagues Dr. Jiruth Sriratanaban, Dr.Santawat Asawaruangchai, and Dr.Krit Ponpirun.

When I came back to Thailand to collect data, many people helped me to finish it smoothly. I would like to thank Dr. Veerasak Jongsuwiwatwong, Edward McNeil, and Suteemate Wechgama for their help in data management and ideas for analysis. Pim, Noom, and Wan were the best assistants when I was in Thailand. Dr. Samrit Srithamrongsawat provided space in his office and budget for data collection and always gave me a time to consult about my thesis. Furthermore, I would like to thank people who were involved in providing data for this study: directors of hospitals in Samutsakhon including Samutsakhon, Banpaw, Kratumban, Srivichai3, and Mahachai2 and their teams, Dr. Wichai Aekprakorn for helping me in analysis of Health Examination Survey data, and Dr. Suchart Soranasathaporn of the Central Office for Health Information who provided CSMBS data and SSO for SSS data.

Living in UK and enjoying life I would like to thank all of my friend and colleagues here who help me with everything, Dr.Sirinart Thongsiri, Sirinya Poolkerd, Saowaluk Hunnangkul, Nareerat Pudpong, Dr. Phusit Prakongsai, Walaiporn Patcharanarumol and special thanks to my colleagues for helping me in thesis proof reading including Yoel Lubell, Sarah Alkenbrack, Francisco Pozo-Martin, Amirhossein Takian.

I would like to thank my family who have stood by me through the PhD study period in the U.K. Without them, I might not have had the motivation to study, particularly my wife Noppakun and my children Gear and Kuku.

Upon my last word, I would like to dedicate this thesis to my parents who always supported me with their heart and Dr. Sanguan Nittayarumpong who supported me and gave me a chance to study for a PhD at the London School of Hygiene and Tropical Medicine.

DECLARATION OF CANDIDATE'S ROLE IN THE RESEARCH INVESTIGATION

The research investigation reported in this thesis was conceptualized, analyzed and written up by myself while I was a PhD student at the London School of Hygiene and Tropical Medicine.

Quantitative primary data collection from Diabetes Mellitus patients was done by myself with two assistants. Secondary data were cleaned and merged by myself. Qualitative data collection from patients and providers was done by myself with logistical support from the research assistants. The entire investigation as reported here is my own work, with support provided by my supervisor, Professor Anne Mills. Some advice and support came from Professor Nick Black and Kara Hanson.

Jadej Thammatacharee

I confirm the accuracy of the above statement.

Professor Anne Mills
Supervisor
1 July 2009

CHAPTER 1INTRODUCTION

1.1 Background

Public health insurance plays a major role in protecting people from the financial consequences of illness and providing access to health care. There are three major functions within health insurance: collection of revenues (sources of funds), pooling of funds and spreading risk across the population, and purchasing services from providers (Preker et al. 2001).

To achieve the public health insurance role, most countries have tended to expand public health insurance to cover the entire population. However, the degree of achievement of this expansion varies from country to country (Mills 1998). Because of market failure of insurance, it is generally considered that insurance should be compulsory because coverage less than 100% leaves some people uninsured and leads in turn to equity problems (Halvorson 2007). However, insurance coverage can create a problem of moral hazard which means an increase demand for medical care in response to insurance coverage (Zweifel and Manning 2000). One approach to reduce moral hazard is to include cost sharing from beneficiaries.

Universal coverage of health insurance can be viewed from two perspectives; breadth of coverage, determining the proportion of the population covered by insurance, and depth of coverage, which is the range of services available to people without out-of-pocket payment. The definition of depth of coverage is more controversial as it requires specification of the range of service packages which diffes from country to country, and regarding which there are many variations (Kutzin, 1998).

Most countries use a mix of sources to finance their public health insurance system. The most common sources are payroll tax and general tax. The progressivity of premiums or contributions collected by each source will inevitably determine the fairness of financial contributions. How providers are reimbursed is another major issue in designing health insurance. Several mechanisms can be used to pay service providers such as capitation, fee-for-service (FFS), per diem, global budget, salary,

bonus, and line item budget. Each payment method requires different levels of information and management capacity, with advantages and disadvantages in motivating service providers, and different implications for health care costs. Health insurance systems and their management also vary from country to country. Some countries have a single system with a single fund or multiple funds, while others have more than one system for different segments of their populations, for example for the formal and informal sectors.

1.2 Health insurance performance

Variations in system design and institutional arrangements inevitably affect the performance of health insurance. Performance of public health insurance can be measured in terms of achieving universal coverage and health system performance (Carrin and James 2005; Kutzin 2001). Performance of the health system can be assessed by multiple criteria such as population health outcomes, protection from financial risk, and satisfaction with process and result of care (Berman 2000). Scope of performance includes health gain, cost containment, health outcome, efficiency, quality, equity, access, choice, transparency, accountability, citizen participation, and provider satisfaction (Figueras et al. 2005). Some criteria are interrelated with others, for example, accessibility is related to both equity of service and related to utilization. Another example is that efficiency of resource use might relate to cost containment. There are several indicators used to evaluate health system performance. This study focuses on access to care in terms of utilization, efficient use of resources, and quality of service.

In terms of access, many countries have made a commitment to improve access to care especially for the poor, but evidence shows that there are inequalities in access to services in different dimensions such as income and geographical factors (Palmer 2007, Goddard and Smith 2001).

In terms of quality of care, although it varies enormously, it can be measured (McGlynn 2007). A common quality-oriented framework to evaluate performance is Donabedian's approach to quality measurement, consisting of structure, process, and outcome (Donabedian 1988; Handler et al. 2001). To assess quality of care, it is normal to use a disease or condition to be a tracer for study. This thesis used Diabetes

Mellitus (DM) as a tracer for three reasons: it is a chronic disease for which patients require regular follow up; it has clear criteria for diagnosis, which makes it easier to identify patients to be included in the study; and it is a common chronic disease for which all hospitals in the study provide services.

1.3 Public health insurance in Thailand

In Thailand, universal coverage was achieved in 2001 by expanding public insurance through the UC scheme to cover the uninsured group. There are now three major health insurance schemes covering almost the entire population: the Social Security Scheme (SSS), Civil Servant Medical Benefit Scheme (CSMBS), and Universal Coverage Scheme (UC). There are considerable differences between the schemes, for example, in system design, institutional arrangements, and population characteristics. SSS is a scheme for the formal sector; companies with more than one employee are required to participate in this scheme. About 13.5% of the population is enrolled in the scheme. CSMBS is a scheme for government officers and dependants, covering 6.7% of the population (Mills et al. 2005). The remaining population is eligible for the UC scheme. The main payment mechanisms differ between the three insurance schemes: CSMBS uses fee-for-service (FFS) for hospitals: SSS uses capitation for ambulatory and inpatient services: and the UC scheme uses capitation for prevention, promotion and ambulatory services with prospective payment by diagnosis related groups (DRGs) within a global budget for hospital inpatient services. An important political issue is whether ultimately there should be a single scheme or multiple schemes. The National Health Security Act of 2002 set the target to be a single scheme but in practice, there is resistance to merging all these three schemes into one. A less ambitious goal, to harmonize the design of the multiple schemes, is another political issue given the current differences between the schemes.

There is little evidence to show the effects of these differences. Some limited research has compared differences in provider behaviour, for example, scheme effects on the use of expensive drugs (Limwattananon et al. 2004), different prescription behaviour between schemes for chronic diseases (Chansung et al. 2003), and equality of access to health services (Chariyalerdsak et al. 2004). However, the impact of health insurance variations on scheme performance is not clearly understood, presenting a need for further study in this area.

1.4 What is known?

Health insurance performance has been widely researched in developed countries. There is substantial evidence relating to health insurance functions and the performance of health insurance schemes, for example, studies in Taiwan which found that health disparity is narrowed after 10 years of universal coverage implementation (Wen et al. 2008), and the US which found that public insurance coverage provides better financial protection than private insurance (Yu et al. 2008). However, there are few comprehensive performance studies related to a health insurance system in low and middle income countries. Most low and middle income countries, including Mexico and Colombia have used a strategy of expanding insurance to move toward universal coverage and improve health system performance (Knaul and Frenk 2005). Studies on scheme performance are mainly limited to a specific disease or characteristic. For example, there is evidence that expanding health insurance improved medical access and use in Lao PDR and Rwanda (Vialle-Valentin et al. 2008). There are few comprehensive studies of scheme performance encompassing different models of health insurance, and there are relatively few studies complying with standard methods to study the quality of the process of care for specific diseases.

The Thai context provides lessons in how to achieve universal coverage for other countries. First, Thailand has undertaken big bang reforms of the health care system, for example, reforming the financing system by allocating funds by capitation to a registered population, and introducing a purchaser and provider split. However, this runs the risk of being challenged by the old system which is administered by the Ministry of Public Health (MOPH), and cultural resistance to the new concept (Hughes and Leethongdee 2007). Second, universal coverage in Thailand was implemented in a period of economic crisis which demanded strong leadership from politicians and other stakeholders such as civic groups and academics (Pannarunothai 2007).

There has been little exploration of the performance of the Thai public health insurance schemes in terms of quality of care, patient satisfaction, accessibility, and efficiency of health services. There have been some studies of scheme performance,

but most have studied only specific aspects and have not compared comprehensively the effect of the variations in health insurance schemes. There is a lack of evidence on the influence of variations in public health insurance scheme characteristics on scheme performance.

How health insurance affects health outcome is still an unknown in achieving universal coverage (Levy and Meltzer 2008). Differences in culture, socioeconomic status, attitudes, social networks etc. might be expected to produce differences in insurance systems. These result in variation of health outcomes. Questions of achieving universal coverage with a mix of different existing insurance schemes are whether it is possible to narrow the gap of performance or not.

1.5 Contents of the thesis

The aim and objectives of this thesis are to identify and assess the performance of three public insurance schemes in Thailand in respect of two main themes, overall use and Diabetes Mellitus (DM) analysis. In terms of DM analysis, there are two performance issues including length of stay and early readmission in DM, and quality of service for DM patients. The thesis is comprised of ten chapters including background information, literature review, purpose, scope and methodology of the study, results of the study, discussion, summary, and recommendations. The details of each chapter are shown below.

- Chapter 2 provides the framework and contents of the literature review. The aim is to elicit a theoretical perspective on insurance and the effect of insurance on performance, to highlight key issues concerning health insurance and the interaction of health insurance functions, and to relate the performance issues to health insurance functions. This review covers international experiences in both developed and developing countries.

- Chapter 3 provides a review of the literature on Thailand's experience. It provides a perspective on Thailand and its health insurance system. Furthermore, related research in Thailand on insurance schemes and health system performance is reviewed and appraised.

- Chapter 4 provides information on the objectives and methodologies of this thesis. It presents the conceptual framework, methods of study, and data collection. This study used both primary and secondary data with quantitative and qualitative approaches. The chapter also presents information on the quality of data, any possible biases of the study and what was done to control for these biases.

- Chapter 5 provides the results of the analysis of national survey data (Health and Welfare Survey 2005) to show the macro picture of utilization between health insurance schemes. The chapter also identifies the effect of the different insurance schemes on utilization of both ambulatory and inpatient services.

- Chapter 6 provides details of the efficiency of hospital resource use and quality of service in terms of length of stay (LOS) and readmission within 30 days after discharge. This study used Diabetes Mellitus (DM) as a tracer condition. Data used in this chapter are from claims data of the three insurance schemes.

- Chapter 7 provides a picture of the quality of care by looking at the process and intermediate outcome of care for DM patients in hospitals in Samutsakhon province by reviewing medical records for one year. The aim of this chapter is to identify any differences in the quality of care within the three public insurance schemes provided by different hospitals.

- Chapter 8 provides more in-depth data on the quality of treatment of patients and on policy affecting provider practice by using a qualitative approach. Data were collected from both the patient and the provider side to explore attitudes and practices related to DM treatment.

- Chapter 9 discusses the overall methodology and study findings in terms of the effects of insurance scheme using selected performance indicators. This chapter also indicates the limitations of the study.

- Chapter 10 presents the overall conclusions of the study and identifies the additional knowledge provided by the study. The study contributes additional

knowledge for the policy of the Thai health insurance system and the other developing countries. Furthermore, recommendations are made for further research.

1.6 Significance of the study

The study has significance to Thailand and other countries in that it explores the range of performance from the different health insurance schemes and advances knowledge of universal coverage implementation that is relevant in Thailand and other countries. It provides policy recommendations, as a starting point for further rigorous analysis and assessment in the future. Furthermore, it provides additional valuable information for policy makers in Thailand and other developing countries on the effect of different insurance scheme characteristics on health system performance.

CHAPTER 2: LITERATURE REVIEW

The aim of this chapter is to review the role of health insurance in relation to health system performance. There are two main sections in this literature review. The first section focuses on health insurance functions and roles. The second section focuses on the links between health insurance and specific measures of health system performance.

2.1 Key areas to be examined and review sources

Typically, achieving universal coverage through the expansion of health insurance is done through two approaches, expanding social insurance (the Bismarck model) or expanding tax based insurance (the Beveridge model) (Mills 1998). An example of the Bismarck model is the German system, while a good example of the Beveridge model is the UK system. Most low and middle income countries moving toward universal coverage have tried to expand coverage through social insurance, as taxation poses challenges due to limited government budgets (Preker et al. 2007). Thailand achieved universal coverage in 2001 by using funding from general taxation to expand public insurance coverage to include the uninsured; the existing contribution-based low income card scheme, and the health card scheme for the poor, were merged into this new scheme which together with the social insurance scheme for the formal sector and civil servant scheme ensured universal coverage. As more countries have implemented insurance schemes, of various kinds, so knowledge on implementation and on different characteristics of performance has increased.

This chapter examines in detail from international experience both conceptual and empirical analyses of health insurance and the effect of health insurance on system performance. It provides insight into policy concerns about performance.

The review discussion is organized into the following themes:

- Health insurance
- The role, function, and operation of health insurance
- Linking health insurance with system performance

The main online databases searched were composed of international and Thai sources.

International sources:

- PUBMED- the United States National Library of Medicine provides access to the MEDLINE database in biomedical and health science research. It provides a database from 1951 with abstracts and some full text. The website is http://www.ncbi.nlm.nih.gov/pubmed/.
- LSHTM database- produced by London School of Hygiene and Tropical Medicine and covering publications in public health, health management, health policy etc. It can be accessed at http://www.lshtm.ac.uk/library/ or from Google Scholar with attached mark "LSHTM eText" at the end of an article. Those with this mark can be accessed as full text from the LSHTM library.
- GOOGLE SCHOLAR - produced by Google Inc. It provides both full text and abstract and links with the LSHTM library full text catalogue. The website is http://scholar.google.co.uk .

Thai sources:

- HSRI- produced by Health System Research Institute of Thailand. It focuses on health system research of Thailand. Currently, there are more than 1,000 research documents on the Thai health care system. The website is http://library.hsri.or.th/th/index.php.
- NHSO research library- produced by the National Health Security Office with their own research after UC implementation. There are more than 100 research documents from 2001 onwards related to health insurance in Thailand.
- MOPH – produced by Ministry of Public Health with 15 Thai journals. There are more than 1,000 articles on both public health and clinical research in this source at the website http://pubnet.moph.go.th/techjrn.php.

In addition, other sources of material such as proceedings, books, or research papers came from online sources such as World Bank, WHO, WHO Euro (http://www.euro.who.int), the Milbank Quarterly

(http://www.milbank.org/quarterly.htm), and the Social Security Office website (http://www.sso.go.th).

The search strategy identified relevant material on health insurance and system performance using as key words such as health insurance, performance, utilization, quality of care, access, length of stay, readmission etc. The materials were mainly from the LSHTM library and internet full text sources. Review of references from articles was also used to find other relevant articles.

2.2 Health insurance

Kutzin (1998) proposed that health insurance consists of two basic functions. First, health insurance provides access to effective health care services when needed. Second, it provides effective protection of family income and assets from the financial cost of expensive medical care. Thus in theory, expanding the breadth and depth of coverage of health insurance schemes will enhance the performance of these two basic insurance functions.

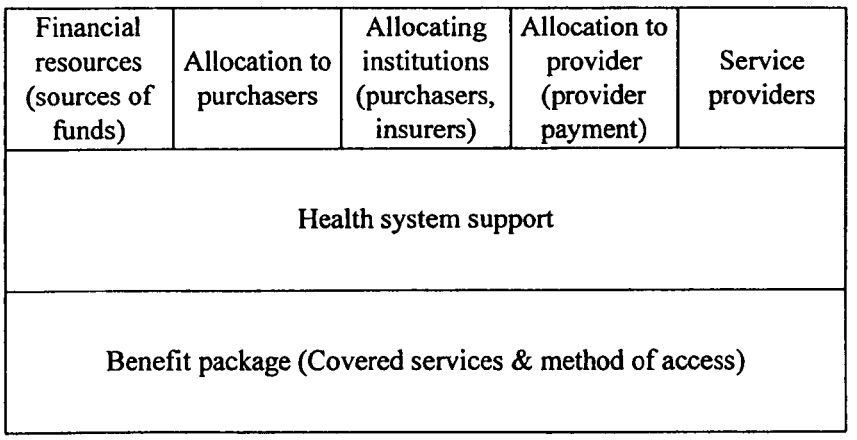
Insurance can reduce financial risk in the presence of uncertainty. In economic theory, to reduce the risk of uncertainty individuals will make a choice on whether or not to insure by choosing the option that maximizes the expected value of their utility function (Jack 1999). In a situation where an individual has the opportunity to choose an insurer, an insurance company may not be able to differentiate individuals according to their risk. This effect leads to adverse selection, where low risk individuals tend to leave the market if the premium is too high. Adverse selection can result in two problems (Hurley 2000) . First, the insurer lacks information on who are high risks or low risks. This leads to over-reimbursement. One common strategy to tackle this problem is to set up compulsory insurance. The second problem is where the insurer has better information than the insured person, which leads to cream skimming by the insurer to cover expected losses (Belli 2001). Cutler (2004) stated that all health insurance systems where individuals are allowed choice of insurance have experienced adverse selection. One approach to tackle this is to set a risk-adjusted premium.

A second problem of the insurance market is moral hazard where insurance leads to overuse of services. Moral hazard is a tendency of insured persons to take less care of themselves because they will not bear the financial consequences of illness and demand more services than persons without insurance (Hurley 2000). This affects the behaviour of both the insured and the provider. The insured might demand high cost care while the provider might increase the quantity of treatment if they can earn more money from providing more services. One strategy to tackle this problem is to set up cost sharing for the insured or to limit the supply of services from the provider. Another example is that some insurers use a gatekeeper system to prevent the insured from passing straight to specialists.

2.3 The role, function, and operation of health insurance

Kutzin (1998) proposed a conceptual framework to describe health insurance, as shown in Figure 2.1. This conceptual framework links seven insurance elements; each is described separately but it is important to note the interdependency between each element.

Figure 2.1 Conceptual framework of health insurance functions



2.3.1 Financial resources (sources of funds)

The range of financial resources in a system can be categorized by initial source of funding and contribution mechanism, as shown in Table 2.1. Most countries use a mix of sources of funding rather than only one source. Some health insurance schemes require compulsory contributions from the formal sector (employees, employers), while others rely on voluntary prepaid contributions or co-payments as an additional

source of funds since both can exist in one country. A key attraction of the co-payment is that it may limit non-essential use of health care (Mills 1998).

Table 2.1 Financial sources and contribution mechanisms

Initial funding sources	Contribution mechanisms
Individual/families	Direct tax
	Indirect tax
	Voluntary prepaid contributions
	Co-payment
Employers/corporate entities/employees	Payroll tax
	Other compulsory contributions (mandates)
Foreign and domestic NGOs and charities	Grants
Foreign governments and multilateral agencies	Grants and Loans

Adapted from: Kutzin 2001

Taxes play an important role in redistribution of funds amongst the population. The study of O'Donnell (2005) in 13 Asian countries including Thailand found that all countries had progressive direct taxes. The redistribution effect was strongest in Bangladesh, Sri Lanka, and Thailand (O'Donnell 2005).

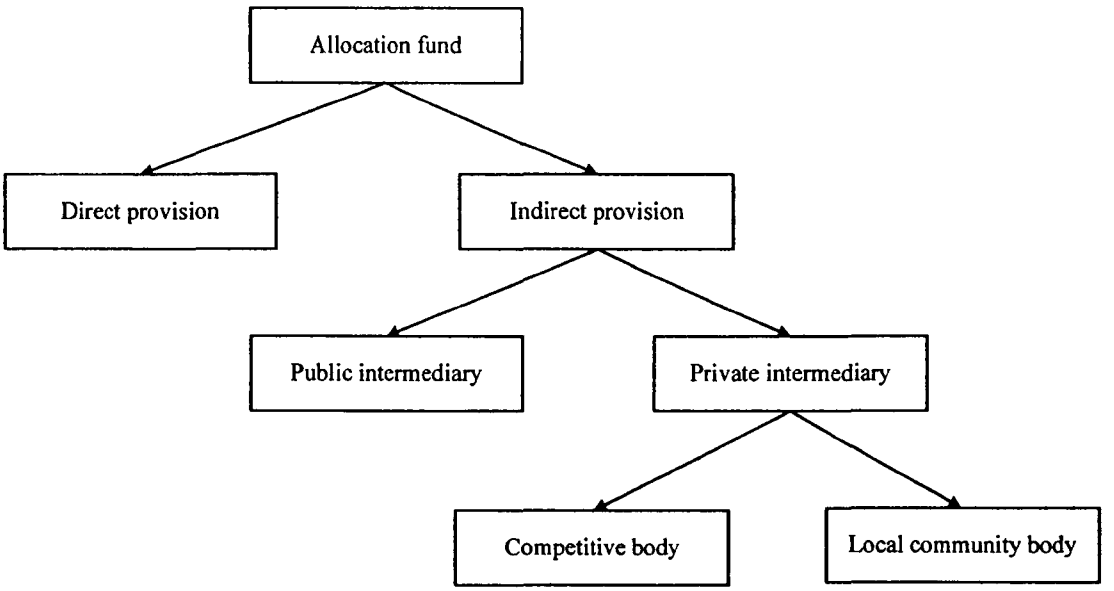
Compulsory contributions are an important source of funds in many developed countries, while developing countries have tended to extend compulsory contributions and payroll tax to the formal sector only (Hsiao et al. 2007). Vietnam, for example, introduced a pilot project of two schemes, a compulsory scheme for the formal sector, and a voluntary scheme for the informal one in 1993. The majority of its population, however, are still not covered in these schemes and are liable for user charges (Ensor 1999, Sepehri et al. 2006).

2.3.2 Allocation to purchasers (insurer, payer)

The allocation of funds usually takes one of two forms: direct or indirect provision (Hsiao 2007). Direct provision is a common model for developing countries and involves using managed and integrated provision in the same organization, for example, the Ministry of Health manages the hospital and transfers the budget from the government to providers. Indirect provision separates provider and purchaser into two different organizations by using either public or private intermediary. An example of a public intermediary is Thailand after UC implementation in 2001. The NHSO

were set up to purchase services for population under UC scheme. The private intermediaries can be divided into competitive bodies and local community management bodies. Colombia uses a competitive private intermediary (Hsiao et al. 2007), while the UK uses a local community model. A diagram of the allocation of funds is shown in Figure 2.2.

Figure 2.2 Allocation fund model



Adapted from: Hsiao 2007

The allocation of general revenues is typically made by using either a historical pattern of the previous year plus or minus some percentage, or various weighted averages of need and cost per capita. The latter method tends to result in greater equity of public subsidies for health. Thus, some countries such as Thailand and the Philippines have shifted allocation from historical patterns to population-based allocation (Kongtawon et al. 2007, Obermann et al. 2006).

Compulsory and voluntary contributions come from premiums which are commonly calculated as a percentage of salary or income of employers and employees. It may be calculated by experience-rated, flat-rated, or calculated according to number of people in household (Hsiao et al. 2007). The main advantage of compulsory premiums is that individuals with higher risk cannot self-select into the scheme, preventing adverse selection, and the purchaser cannot select only people who have lower risk. Recognising that all individuals have different risks, some countries use a risk

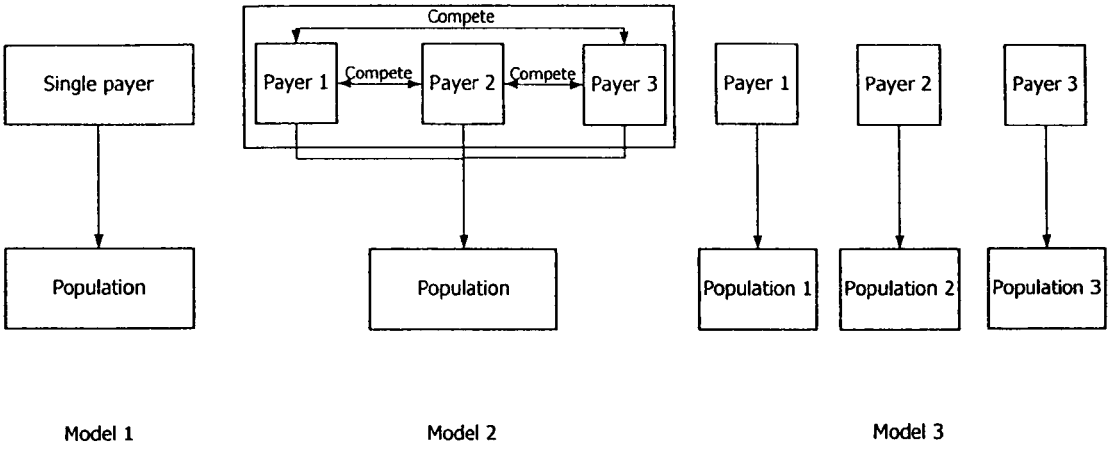
adjustment mechanism or reinsurance fund to compensate purchasers for high risk populations. In Germany ,for example, the risk adjustment formula using income, age, sex, and pension status led to increased payments for insurance funds which served high risk populations (Exter 2005).

2.3.3 Allocating institution (purchaser, insurer, payer)

The insurer's role either can be limited to management of fund transfers for the purchasing of health care, or can include active purchasing. Active purchasing aims to promote the quality and efficiency of the health care system by providing financial incentives through provider payment, maintaining a provider profile to monitor provider treatment, undertaking utilization review and quality assurance activity in order to reduce inappropriate care, and promoting standard treatment protocols (Cutler 2004).

Kutzin (2001) categorizes market structure into three models: single payer, multiple payers with competition, and multiple payers without competition (Figure 2.3). The single payer is generally responsible for the whole country population, as in New Zealand. A system with multiple payers creates competition across several organizations performing the insurance function for specific populations. They can compete to be selected by consumers, as in, for example, the U.S. health insurance system (Anderson and Hussey 2004), or the Netherlands (Enthoven and van de Ven 2007). Multiple payers without competition are responsible for specific groups of the population, as in the Thai and Mexican insurance systems.

Figure 2.3 The model of single and multiple payers



The four characteristics of single payer and multiple payer systems include revenue collection, risk pooling, purchasing, and social solidarity (Table 2.2).

Table 2.2 The characteristics of single and multiple payer systems

Characteristic	Single payer	Multiple payer
Revenue collection	Usually existing tax	Multiple sources e.g. from payroll tax, contributions
	Lower collection cost	Higher collection cost
Risk pooling	Avoids risk selection and reduces use of individual data	Can design appropriate insurance package for specific groups
Purchasing	Greater purchasing power and can control technology use	Insurer more responsive to people's preferences, can selectively contract with provider
Social solidarity	Spreads financial burden more equitably and finance is more progressive.	Increase solidarity in specific groups

From: Anderson and Hussey 2004

Korea and the Czech Republic are examples of countries that restructured the market to change the health insurance system. Korea moved from a system of multiple payers without competition to a single payer system for two reasons (Yang 2002). First, the existence of multiple payers meant that economies of scale could not be exploited, since each insurance arrangement covered about 30,000-200,000 people. Second, the proportion of administrative cost to expenditure was high, on average 8.5%. After the merger into a single payer arrangement, there were improved economies of scale, as demonstrated by the fact that 62.2% of households paid less in contributions (Kwon 2003a). There was also reduced administrative cost though there was still evidence of inefficient management. However, the government has failed to control total

expenditure, and especially to regulate the supply-side use of high technology and pharmaceutical equipment (Lee 2003, Kwon 2009).

In the Czech Republic in 2004, the social health insurance system failed to reform after the fall of Communism due to inadequate institutional support. Subsequently, the system was changed to allow competition between insurance institutions (Figueras et al. 2005). However, there is no empirical evidence on the outcome of this change (Rokosova and Hava 2005).

There is no clear indication as to which insurance structure is likely to be most effective and empirical evidence of performance is required to support the decision to promote either one.

2.3.4 Allocation of funds from insurer to provider (provider payment)

Types of payment can be categorized in different ways. They can be classified into prospective payment and retrospective payment. Payment can be made to either hospitals or physicians. Common payment methods include line item budget, global budget, capitation, case-based payment, per diem, fee-for-service (FFS), salary, and bonus (Maynard and Bloor 2000; Maceira 1998). A breakdown of payment methods is shown in Table 2.3.

Table 2.3 The characteristics of different payment methods

Payment method	Unit of service	Type of payment	Target
Line item budget	Functional budget categories	Prospective and retrospective	Hospital
Global budget	Health facility	Prospective	Hospital
Capitation	Per person to a health care provider who acts as fund holder	Prospective	Hospital, Physician
Case-based payment	Per case or episode	Prospective	Hospital
Per diem	Per day	Prospective	Hospital
Fee-for-service	Per unit of service	Retrospective	Hospital, Physician
Salary	Physician or health care employee	Prospective	Physician
Bonus	Per case, per person	Prospective	Hospital, Physician

Adapted from: Maceira 1998

The aims of the payment method, as proposed by the World Health Organization (WHO), are to improve efficiency and quality, increase accessibility, permit patients to choose the physician, and be easy to implement (WHO cited in Maceira 1998). Each payment method has different impacts on quality, efficiency, equity, and patient satisfaction, and each method has its own advantages and disadvantages. Therefore, linking payment with performance is a crucial issue. There are a considerable number of studies about the effect of payment method on system performance. This review examines evidence on payment method in terms of the advantages and disadvantages of each method, as summarized in Table 2.4.

Table 2.4 Advantages and disadvantages of different payment methods

Payment Method	Main Advantages	Main Disadvantages
Line Item Budget	- Allows strong central control, desirable where local management is very weak - Predictable expenses for fund holder (unless supplemental budgets provided)	- No direct incentives for efficiency - Provider may under-provide services - Imposes fixed resource use, directly impeding efficiency
Global Budget	- Predictable expenses for fund holder, low administrative costs - Unified budget permits resources to be used efficiently	- No direct incentives for efficiency - Provider may under-provide services
Capitation	- Predictable expenses for the fund holder - Provider has incentive to operate efficiently - Eliminates supplier-induced demand	- Financial risk may bankrupt provider. Provider may seek to minimize risk by "cream skimming" - enrolling low-risk patients - Provider may under-provide services
Case-based	- Strong incentives to operate efficiently	- Unpredictable expenses for fund holder, high administrative costs (but less than fee for service) - Provider has incentives to select low-risks within case categories - Case-based payment less suitable for outpatient care (difficult to define case)
Per diem	- Incentives to reduce	- Incentives to increase length of

Payment Method	Main Advantages	Main Disadvantages
	services per day	stay and increase admission rate
Fee for Service (no fee schedule)	- Incentives to provide services	- Unpredictable expenses for fund holder - Cost escalating: strong incentives for supplier-induced demand
Fee for Service with Fixed Fee Schedules	- Incentives to operate efficiently - Efficiency is greatly enhanced when combined with a global budget cap	- Unpredictable expenses for fund holder - Cost escalating: incentives for supplier-induced demand - Higher administrative costs (price controls must be established, revised periodically and enforced)
Salary	- No incentive to provide excessive treatment and deny access of patient	- May contribute less effort in patient care - Less incentive to pay attention to quality of care
Bonus	- Increase motivation for specific objectives - Can take account of quality, quantity, and outcome	- Can mislead if only use outcome measurement - More factors motivate performance

Adapted from : Barnum et al. 1995

A line item budget typically includes specific line items such as salary, drugs, equipment etc. Efficient use of the budget is reduced because of tight controls on using the budget. For example, line managers have an incentive to spend money rapidly without regard for efficiency because unspent money is an indicator of an excessive budget (Barnum et al. 1995). However, line item budgets are common in developing countries because they are easy to implement in a context with lack of data, shortage of resources, and changing health needs (Maceira 1998). Furthermore, some managers lack training in management, making the line item budget easy for central government to oversee, especially in rural areas.

A global budget is a fixed budget for a certain period. It is not linked to budget line items so managers are allowed to reallocate budgets within the global amount. Fund holders can reduce administrative costs in the control process. A global budget can be a powerful tool to control hospital costs by fixing the maximum amount of budget. However, it can create a financial risk for providers when the budgets are not sufficient to cover hospital costs (Barnum et al. 1995).

Under capitation, a periodic fixed amount is paid per insured person. It promotes equitable allocation of resources. The significant advantage of this type of payment is to remove overprovision of services. Providers have incentives to minimize cost. However, there may be an incentive to cut essential care, and encourage cream skimming. In addition, referrals may increase to other providers to reduce the risk of cost of care if the contracted providers do not have to pay for the referred cases (Langenbrunner and Liu 2004). Van Horn et al. (1997) studied the impact of hospital use of resources under capitation payment and fee for service (FFS) payment in the US. They found that hospitals which had a high volume of capitation patients tended to use resources more efficiently than hospital with high volume of FFS patients (Van Horn et al. 1997). They also found the evidence of greater resource use in FFS patients in some conditions such as vaginal deliveries. This implied cross-subsidization from FFS patients. Furthermore, the study showed that physicians who had a low percentage of capitated patients were likely to be less efficient than physicians who had more capitated patients.

Case-based payment involves fixing the amount per patient case or episode of illness. The most common form of case-based payment is Diagnosis Related Groups (DRGs). A major advantage of this payment method is that it provides incentives for providers to control costs by reducing the cost per case and improving technical efficiency. Disadvantages of case-based payment are code creep, cost shifting, increase in unnecessary admissions, under-provision of services, and early discharge of patients. Consequently, case-based payment raises concerns about quality of care. Administrative costs are also likely to be high for either the fund holder or provider because of the data requirements needed to reimburse and monitor a system that is technically complicated and requires individual patient data. There are no empirical data comparing administrative costs between case-based payment and other payment types. However, it is presumed that administrative costs of case-based payment are higher than for capitation and FFS payment (Barnum et al. 1995).

Manning et al (1984) studied the effects of case-based payment and FFS on number of visits and hospitalization rates. They found that case-based payment could lower the hospitalization rate compared to FFS. However, there was no supporting evidence that

prepayment led to provision of more preventive care or treating more outpatients to avoid hospitalization (Manning et al. 1984). Yip et al. (2004) evaluated the effect of case-based payment and FFS payment in Hainan province on drug expenditure and high technology procedures. They found that average expenditures per admission in case-based patient groups decreased compared to the previous period which was paid by FFS. The number of high technology procedures reduced by 9% after the reform. The results of the study support the theory that prepayment can slow the rate of growth of expenditure especially compared to FFS payment (Yip and Eggleston 2001). In Europe, a number of countries have experience of using DRGs for reimbursement such as Denmark, France, Germany, Hungary, Italy, the Netherlands, Poland, Spain, and England (Schreyogg et al. 2006, Ettelt et al. 2006). There is evidence of the benefit of DRGs payment, for example, Hensen et al. (2007) found that DRGs implementation in Germany associated with reduction of LOS in dermatological admissions, despite increasing number of admissions (Hensen et al. 2007).

Per diem payment is a payment of a fixed amount for reimbursement for each inpatient day. The advantage of this type is that it is easy to calculate. However, the disadvantage is that it provides incentives for the hospital to increase patient days by increasing length of stay and the number of admissions (Langenbrunner and Liu 2004).

Fee-for-service is paid directly to the provider by the patient or a third party. It can be based on a set fee schedule before treatment, or reimbursing the total charge after treatment. Fee-for-service has three main advantages: it is easy to develop and implement, relates to work and effort, and encourages cost-effective service provision if the schedule creates incentive for this. However, there is the disadvantage of supplier-induced demand which can lead to over-provision of services. FFS may satisfy consumers who believe that provision of more services means higher quality. There is evidence that FFS is associated with using unnecessary and potentially harmful services (Barnum et al. 1995). In addition, FFS payment may have high administrative costs because every service and procedure has to be billed.

Ireland is a good example for comparing capitation and FFS payments to general practitioners (GP). Ireland had two major groups of patients: medical card or free service patients, and private patients. The number of GP visits was high amongst medical card patients even though they made a co-payment for GP services. The poorest quintile shared 34% of all GP visits compared to 14.5% for the richest quintile (Layte and Nolan 2004). The medical card patients' scheme changed payment from FFS to capitation while private patients still had to pay for each visit. This change affected provider behaviour . Madden et al (2005) found that visit rates fell amongst those under capitation payment because providers sought to control costs for capitated patients, and were unchanged in private patients (Madden et al. 2005). Pantilat et al. (1999) used a randomized control trial to compare the effects of payment type on utilization of investigations and referral rates between capitation and FFS patients. They found that there were fewer medical investigations and lower referral rates in patients in the capitation payment group (Pantilat et al. 1999), and concluded that the financial incentives affected the utilization of health services. This finding was the same as in a study by Leibowitz et al., who found that the rate of medical care use was less in patients with capitation payment compared to FFS patients (Leibowitz et al. 1992).

Salary is the most common form of physician remuneration. Physicians are paid a fixed amount for predetermined work hours. The advantage of a salary payment system is that physicians have no incentive to provide excessive treatment (Chawla et al. 1997). In addition, patients are likely to receive the necessary intervention. If the salary is enough to motivate physicians, the mobility of physicians will be low. However, there are considerable disadvantages to salary payment. Physicians may not have incentives to work hard in providing services to patients, which may affect the quality of care. Furthermore, patients may receive inadequate attention from physicians and may receive less optimal care. Hickson et al. (1987) used paediatric residents as the model to prove the differential effects of payment by salary or FFS in terms of patient visits, unnecessary visits, and patient satisfaction. They found that FFS payment could motivate paediatric physicians to increase well-child visits but could not demonstrate whether they were unnecessary visits or not. However, there was no difference in patient satisfaction between FFS and salaried physicians (Hickson et al. 1987). In the UK, given the problem of retention and recruitment of

GPs in sparsely populated areas and the administrative responsibilities of physicians under capitation payment, England introduced an experiment with salary payment in pilot areas after the NHS Act of 1997. Gosden et al. (2003) studied this experiment by using a controlled before and after study design. The outputs of the pilot were improving accessibility, quality of care, and efficiency. The finding was that salaried physicians provided more consultations and conducted out-of-hours work but spent less time on practice administration (Gosden et al. 2003). There were no differences in quality of care and provision of target services. Gosden et al. (2003) concluded that switching to salary payment may not affect GP productivity or quality of care compared to capitation-paid physicians.

Bonus or performance-related pay directly links a payment with the performance of health care providers (Langenbrunner and Liu 2004). The payment is based on preset performance indicators. It aims to increase the effort of health care providers in specific outcomes. Bonus payments encourage health care providers to allocate time to the target activity. There is no uniform system so it can be adapted to suit the specific context of each country (Liu and O' Dougherty 2004). Although performance measurement may vary in its objectives, it generally consists of quality, quantity, and health outcome measures. However, the disadvantages of performance-related pay are that money alone cannot motivate individual or organizational performance because other factors such as satisfaction and pride in one's job affect the result. Moreover, performance-related payment may be misleading if it uses only outcome measurement. It should be combined with a process progression checklist (The U.S. Merit Systems Protection Board 2006). Beaulieu and Horrigan (2005) studied the effect of pay for performance on quality improvement in Diabetes care. A bonus was added to traditional capitation payment for physicians in managed care organizations in New York. They found that outcomes of Diabetes care were improved in five of six process outcomes and two of three output outcomes (Beaulieu and Horrigan 2005). Kouides et al. (1998) studied the impact of performance-based reimbursement on the influenza immunization rate in the elderly between physicians who received payment with and without additional payment. The study found that the immunization rate increased significantly in the additional payment group (Kouides et al. 1998).

Recently, pay for performance has been widely used in European countries, for example, the UK (Galvin 2006), and Spain (Benavent et al. 2009). In the UK, for example, where financial incentives have been introduced for GPs to encourage greater provision of preventive care, a study in the Wandsworth primary care trust showed that the provision of advice on smoking cessation to DM patients increased from 48% to 83.5% of patients and the prevalence of smoking showed a significant decrease, from 20.0% to 16.2% (Millett et al. 2007).

2.3.5 Service providers

The function of service providers in a health insurance system is to provide services to the target population. The important issues concerning service providers are the market structure of the providers and their distribution. Distribution of providers is important because it affects access to health care. Insurance systems need to protect people from problems of accessibility to health care by providing reasonable access to services such as primary care, emergency care, and an effective referral system.

2.3.6 Health system support functions

Kutzin (1998) defined the health support system as part of the health system that contributes to the depth and breadth of the insurance function. Examples are prescribing and treatment protocols, licensing and accreditation of providers, essential drug lists, technology assessment etc. These support functions help to enhance health care efficiency.

2.3.7 The benefit package

The benefit package consists of three elements: entitlement to benefit, services in the benefit package, and payment by patients.

Entitlement to benefit is generally linked to the financing of the health care system. In general, contributions by individuals or families determine the entitlement to benefit.

Some countries expand coverage to the entire population while only some parts of the population pay contributions (Kutzin 1998).

The benefit packages can be divided into two types: essential packages and catastrophic packages. The essential package includes services with documented cost effectiveness, while a catastrophic package is a package of relatively low frequency use and high cost interventions. Implementation can be categorized into three models: comprehensive benefit package, two-tier benefit package, and three-tier benefit package. A comprehensive benefit package is a package covering extensive benefits with a very limited exclusion list (Pannarunothai et al. 2004). Both Taiwan and Thailand use a comprehensive benefit package with benefits covering preventive to curative care (Lu and Hsiao 2003, Jongudomsuk 2005). Most preventive services are free, as are maternal care and childcare, while there is a small co-payment for hospital services. A two-tier benefit package separates basic ambulatory services from inpatient services. Examples of countries using this model are the Netherlands and Germany which have a co-payment only for patient services but no charge for ambulatory services (Robinson 2002).

A three-tier benefit package separates benefit into three schemes. An example of this model is Singapore which has three funding schemes: Medisave, Medishield, and Medifund. Medisave is a fund for an individual saving account with compulsory contributions. Medishield is an insurance fund for catastrophic health expenditure and Medifund is a fund for the poor covered by the government (Hanvoravongchai 2002).

The main issue of services in the benefit package is cost effectiveness. However, the effectiveness of a policy involving an essential or a catastrophic package depends on other insurance functions; for example, active purchasing will control the unnecessary use of specialized care in a catastrophic package.

Payment by patients is another element directly linked to the benefit package. Fully covered finance means there is no requirement for patients to pay at the time of use, while partial cover requires patients to pay something at time of use (cost sharing). Results of the RAND health insurance experiment study in the US showed that an increase in cost sharing resulted in a reduction in use of treatment in chronic disease

and preventive care, for example Diabetes Mellitus (DM) and hypertension (HT) (Chernew et al. 2008). Services not covered were completely financed by users. The important issue here is how access to services is influenced by charges. While these fees can result in more efficient use of care, user fees can limit access to health services, especially for the poor. In China, for example, the National Health Services Survey in 1993 found that 58.8% of patients in rural areas who refused a hospitalization recommendation reported inability to pay hospital charges (Liu et al. 1999). Bitran and Giedion (2003) suggested a mechanism to boost equity of access to health care which included a waiver and exemption for poor people. However, there is still no clear evidence to demonstrate the effectiveness of this mechanism in developing countries (Bitran and Giedion 2003).

2.3.8 Country experience in health insurance reform

There is considerable knowledge regarding the effect of health insurance on some aspects of performance, especially its payment mechanism. This review examines the overall experience of various countries in order to draw lessons on the development of health insurance in each country and the impact on health services. Korea, China, and Taiwan are the countries discussed because they share some characteristics of health insurance systems and some functions such as payment mechanism. These countries introduced goals of health insurance and scheme performance in cost reduction and increase access to care. They have experience of reform in health insurance over a short time period. They are also East Asian countries that have similar geographic characteristics, societal values, and health care development to Thailand. The results of health insurance studies in these countries might therefore be relevant to and can provide lessons for studies in Thailand.

South Korea

South Korea established a national health insurance scheme in 1977 and achieved universal coverage in 1989. The main provider payment mechanism was FFS according to a national fee schedule. Households incurred co-payments and deductibles for all covered services. However, there were free markets for uncovered services. Providers could make profits from drugs and medical supplies, so they had incentives to increase the volume of drugs and services provided. Therefore, the cost

of care escalated. The main providers in Korea are private for-profit facilities, comprising 50% of acute care hospitals, while 40% are not-for-profit, and only 7% are publicly provided (Kwon 2003b). Stimulated by private provider incentives, drug consumption continued to increase. From 1990 to 1998, the average annual rates of increase in expenditure for medical supplies and drugs per claim were 13.6% and 11.4%, respectively, both of which are greater than the average annual rate of increase in total medical expenditure per claim, which was only 8.2% (Kwon 2003b).

In 1994, the government decided to reform payment to providers in two ways: through diagnosis-related groups (DRGs) for inpatient services and resource-based relative value (RBRV) for ambulatory care (Bitran and Yip 1998). The government planned to gradually replace the current payment method with DRGs and RBRV, but due to political resistance, so they were introduced as an experiment on a voluntary basis (Bitran and Yip 1998). RBRV implementation did not achieve the objective of correcting the distortion in the structure of the medical fee system because the government, for political reasons, increased price of both under-priced and over-priced services. Therefore, the RBRV system still faced the risk of failing to control the over-provision of services.

The DRGs experiment showed good signs of improved system efficiency, for example LOS decreased. Antibiotic use in inpatient care was reduced by 29.6% on average. However, there was concern about quality of care after DRG implementation. Although the pilot programme showed that there was no negative effect on quality of care, as measured by complications and re-operations, there was no definitive conclusion on quality of care since the DRG pilot project used surgical procedures with low complications, so the rates of adverse outcomes were generally low (Kwon 2003b).

In 2001, fee negotiation between provider and insurer replaced the unilateral fee schedule originally set by the government. A plan is underway to introduce global budgeting in the near future. However, a certain period of time will be allowed to build the partnership between the insurer and the medical association to set the global budget based on expenditure because of a severe conflict over pharmaceutical reform (Kwon 2003b).

China

China has considerable experience with health insurance and offers valuable lessons regarding development and implementation of health insurance.

Before 1978, public hospitals in China were financed by government using a fixed budget. Almost all physicians were paid by salary. Following economic reform in 1978, the government reduced the budget and decentralized financial management to local government. Public hospitals had to generate more money by charging fees for some services such as high technology procedures. Physicians were invited to join in the investment in high technology in their hospitals. At the same time, bonus payments were introduced as part of compensation to physicians. The effect of this policy was an escalation of health care expenditure. Between 1978 and 1993, average health care expenditure increased at an annual rate of 11% (Bitran and Yip 1998).

There were two major insurance schemes: the Government insurance scheme (GIS), and Labour insurance scheme (LIS). In 1993, GIS covered 9% and LIS covered 40% of the urban population. In rural areas, more than 90% of the population were uninsured (Bitran and Yip 1998).

Services were organized in three tiers to provide services for both urban and rural populations. In rural areas, services were provided at village stations, township health centres, and county hospitals. In urban areas, the tiers were street health stations, community health centres, and district hospitals provided services. The seriously ill could be referred from county or district hospitals to city or to regional hospitals (Hsiao 1995).

Hsiao (1995) summarized some of the health insurance problems in China. First, there was evidence of inequity of access to health care between rural and urban areas. Health resources were chiefly allocated by patient ability to pay. Furthermore, the government had a policy to modernize tertiary care which shifted more resources from primary care to tertiary care and let to increased disparity between primary and tertiary levels. Second, there were inefficiencies in the health system such as long LOS, excessive use of high technology, and overuse of expensive drugs. Third,

quality of care was affected by over-prescription of drugs. There was no system to monitor the quality of patient care.

To reform the health financing system in China, substantial initiatives were introduced. To contain costs, for example, China experimented with a prospective fixed payment system in four provinces in 1994. The evidence showed the success of cost containment. There were reductions in length of stay, prescription of high cost drugs, and high technology procedures (Bitran and Yip 1998).

Taiwan

Taiwan has implemented universal coverage under a single payer system since 1995. Before full implementation, there were three major social insurance schemes. These were labour insurance (LI) which was chiefly for private workers, government employees insurance (GEI) which was mainly for government employees and retirees, and farmers' insurance (FI) for all farmers. These social insurance schemes covered 50% of the population in 1990 (Cheng and Chiang 1998). The uninsured were discouraged from seeking essential medical services because of the cost of services. This created unequal access to health care, especially between different socioeconomic classes (Lu and Hsiao 2003). Providers were reimbursed by FFS according to a fee schedule. Physicians made profits from pharmaceuticals because they were allowed to prescribe freely. Consequently, health expenditure increased rapidly. From 1960, the average increase in health spending per person was about 6-8% per annum in real terms. This was about 2-3% above the rise in real annual income per person (Lu and Hsiao 2003).

To control health care costs and provide equal access to health care for all citizens, Taiwan proposed a new strategy for implementation in 1995: National Health Insurance (NHI). The NHI offered comprehensive health care for all citizens with financial protection from catastrophic expenses and gave patients free choice of providers. The NHI incorporated a co-payment of $5 for each visit to an outpatient clinic and $8 for hospital outpatient clinics. Physicians were mainly paid on a FFS basis (Lu and Hsiao 2003). The NHI programme was mainly financed by payroll tax plus premiums from other groups. The government subsidized the premium for different groups of people at different rates (Lin et al. 2005).

An evaluation of the effects of health insurance on scheme performance produced some interesting results (Lu and Hsiao 2003). With respect to access, statistics showed that the hospitalization rate increased from 110 per 1,000 in 1994 to 120 per 1,000 in 1996. However, there was no comprehensive evaluation on the effect of access to health care. With respect to quality, a crude indicator of clinical quality neither declined nor improved after the NHI's implementation. To improve quality, the government tried to initiate a voluntary hospital accreditation programme in 1998. However, the NHI did not make a serious effort to prevent widespread use of high-technology medicine (Lu and Hsiao 2003). Consequently, the major problem of the health insurance system in Taiwan has been cost escalation: in 1998, the NHI's expenditure exceeded its revenue. Between 1995 and 2001, the NHI revenues increased at 4.26% p.a., while expenditures increased at 6.26% p.a.

Concerning health care cost inflation, the Department of Health initiated an experiment to reform the financing system in 1997. The plan included developing a case payment system, revising current fee schedules along with a resource-based relative value scale (RBRVS), introducing an essential drug list, and introducing a global budget in the short run and capitation in the long run (Bitran and Yip 1998). To prevent premature discharge because of case payment, hospitals are not paid if they have a readmission within 14 days (Lin et al. 2004).

From these examples, there were three key points from the reform. First, cost escalation pressured government to reform the health care system. Second, related to cost escalation, example countries tried to reform payment from retrospective to prospective payment. Third, to reduce inequity of access to care, Korea and Taiwan reformed their insurance schemes to provide universal coverage. Details of experiences from these three countries are summarized in Table 2.5.

Experience of these countries in terms of controlling cost escalation and addressing inequity of access could be relevant to the development of UC policy in Thailand, in terms of using payment reform to control the long term cost escalation of health care (National Health Security Office 2001).

Table 2.5 Summary of experience of South Korea, Taiwan, and China

Countries	Reasons to reform	Payment		Scale	Results
		before reform	after reform		
South Korea	- National health insurance had financial deficit during economic crisis in 1997	- FFS according to national schedule	- Case-based for inpatients - RBRV for outpatients	- Piloted in some areas	- Results from 3 year pilot programme indicate that LOS, medical expense, number of tests and use of antibiotics reduced
Taiwan	- After 3 years of the UC, total health expenditures exceeded the budgets	- FFS with thousands of fee items	- Case-based for inpatients - Capitation for primary care	- Piloted in some areas	- No difference in quality of care
China	- Experiences of cost escalation from FFS	- FFS & historical global budget from government	- Medical Savings Account and prospective combined with fixed system	- 4 provinces	- Slower increase in spending on expensive drugs and high technology
	- Hospitals had incentives to generate revenue through providing unnecessary care		- Global budget and cost volume contract		- Prospective payment could control rapid cost escalation

Adapted from: Pokpermdee 2005

2.4 Linking health insurance with scheme performance

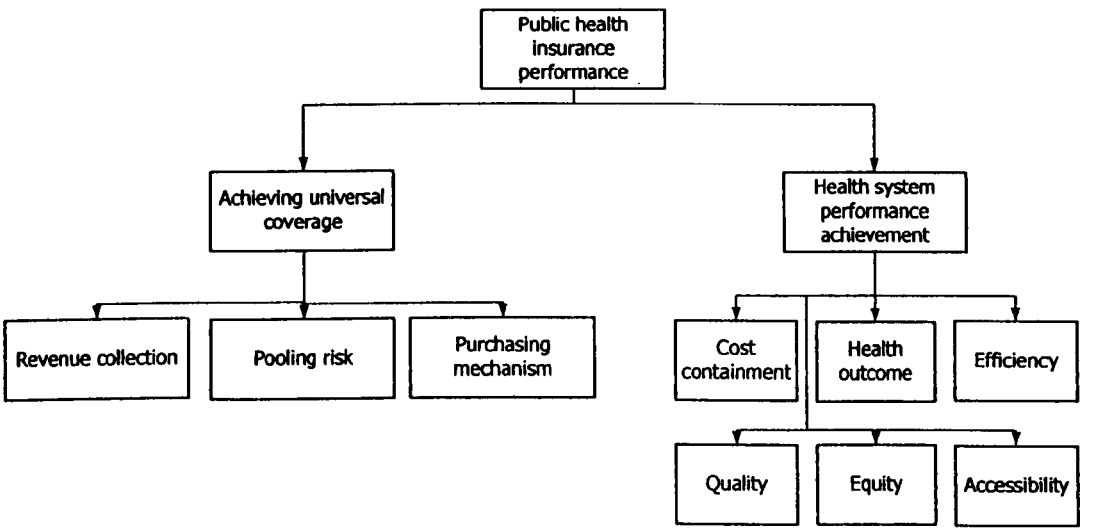
There are two approaches to measure health insurance performance. The first approach measures the achievement of universal coverage (Carrin and James 2005) and use a framework of analysis consisting of three parts: revenue collection, risk pooling, and purchasing mechanism, as shown in Figure 2.4. Carrin and James (2005) proposed eight indicators of achieving universal coverage covering the three parts of the framework, including population coverage, method of finance, composition of risk pools, fragmentation of risk pools, management of risk pools, benefit package, provider payment mechanisms, and administrative efficiency. This set of indicators can help policy makers to monitor development and demonstrate better performance in relation to defined key issues. The indicators may not ensure an ideal design, since

some indicators may improve faster than others, but it can reflect policy-maker decisions, in particular regarding equity-efficiency trade-offs.

The second approach is to measure the performance of the health system that the insurance finances. There is a wide range of objectives of the health system, including health gain, cost containment, health outcome, efficiency, quality, equity, access, choice, transparency, accountability, citizen participation, and provider satisfaction (Figueras et al. 2005). To select issues to measure is not easy and depends on philosophical, technical, and operational possibilities. Differences in objectives and outcomes linked to insurance characteristics can suggest policy adjustments which will improve health system performance.

The approaches to health insurance performance measurement are shown in Figure 2.4. There are substantial debates about what constitutes health system performance and how to measure it (Figueras et al. 2005). However, some empirical studies show that aspects of health system performance can be influenced by health insurance such as cost containment (Jowett et al. 2004), efficiency (Soderlund and Hansl 2000), quality (Ranson and John), accessibility (Yip and Berman 2001), health outcome (McGlynn 1998), and other factors.

Figure 2.4 Approaches to health insurance performance measurement



Adapted from: Figueras et al. 2005, Carrin and James 2005

The international literature includes a considerable number of studies on health insurance scheme performance. Most of these focus on a characteristic of the health insurance system or a specific aspect of scheme performance. However, there are limited measurements of performance covering multiple issues. Large scale evaluations of the effect of alternative financing schemes on performance are few and not well designed (Palmer et al. 2004).

As mentioned above, health insurance aims to provide access to health care services when needed and to protect people from the financial cost of expensive medical care. Some key issues and means to measure scheme performance are utilization and accessibility to health care, efficiency of service in term of LOS and readmission, and quality of care. These are reviewed in detail below.

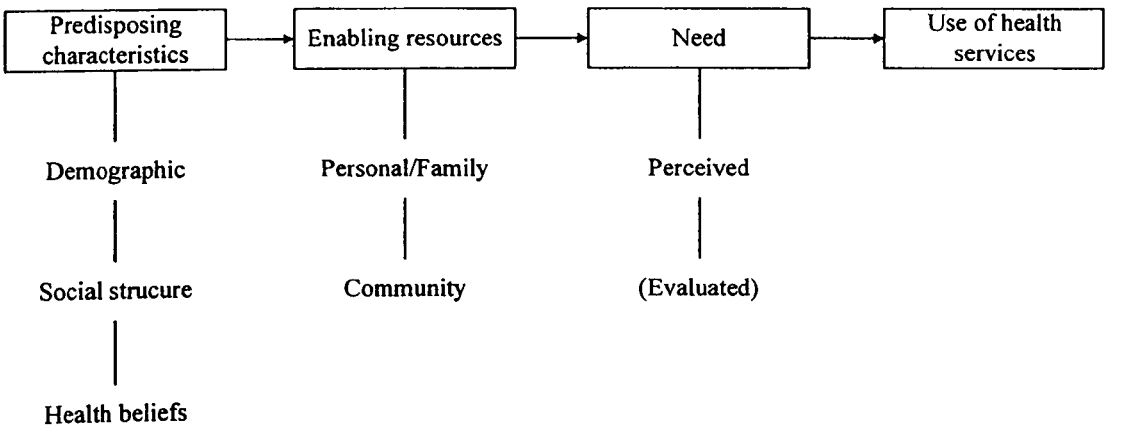
2.4.1 Utilization and accessibility

There are several terms related to access to services such as access to care, accessibility, health need, utilization. These terms have interrelated and some different meanings depending on the context of the study (Ricketts and Goldsmith 2005). This review does not delve deeply into the terminology but aims to review the scope of utilization related to accessibility.

Accessibility is suggested as an indicator of the equity of the health system (Waters 2000). It links to equality of access for equal need and equality of utilization for equal need. However, accessibility and utilization have different meanings since accessibility is a function of supply while utilization is a function of both supply and demand (Smith 2005). Equality of access can be achieved by providing services to patients without barriers due to geographical area. Utilization of health care depends not only on accessibility but also on patients' perceptions of the benefit of care (Aday and Andersen 1974). Although individuals may have equal access to health care, this does not mean that they will have equal utilization (Smith 2005). The popular framework of health service use proposed by Andersen is helpful in describing utilization as shown in Figure 2.5 (Andersen 1995). The framework shows that each factor has different importance in explaining use, for example, need might be more important in use of hospitalization than social structure in dental service use

(Andersen 1995). Although this framework is helpful in understanding utilization, it is less precise in explaining use of health insurance benefits (Andersen 1995)

Figure 2.5 The health service utilization framework



From: Andersen 1995

One challenge that policy makers face is knowing how best to provide equality of access to services for the population (Palmer 2007). Three issues are related to this question, availability of services, utilization of services, and timeliness of services (Kruk and Freedman 2008). Ensuring availability of services requires adequate provision of health personnel, funding, and geographically accessible health service delivery point. Utilization is used in both developed and developing countries to reflect equality of access to health services. Utilization could be for a specific condition such as utilization in cancer services or TB drugs, or general utilization which might be measured by health service visits such as for preventive or hospital services. Timeliness relates to access for emergency and essential services such as immunization. Currently, there is more concern about this issue in developed countries rather than about service availability and utilization (Kruk and Freedman 2008).

Health insurance scheme effects on health service utilization can be grouped into two categories: first, the different use of services between the insured and the uninsured: second, the effect of different insurance types on health service utilization.

Lack of health insurance or incomplete insurance coverage creates barriers to access to preventive care and prompt treatment. For example, a study on cancer treatment in the U.S. showed that lack of health insurance increased barriers to early detection and prompt treatment (Ward et al. 2008). Another study from the U.S. showed that uninsured people are less likely to use the emergency department compared to those with private or public insurance (Zuckerman and Shen 2004). Uninsured people are also less likely to receive medical care, prescriptions and treatment for chronic conditions than insured people (Kennedy and Morgan 2006, Wilper et al. 2008). Freeman et al. (2008) reviewed articles on the effects of health insurance on utilization in the U.S. between 1991 and 2008. The data confirmed that health insurance increased utilization and improve health outcomes compared to uninsured people. Moreover, insured persons were more likely to use preventive care, promotion services, and medical services than uninsured (Freeman et al. 2008). This result corresponds with a study in Australia which found that privately insured people were more likely to use medical and surgical services than uninsured people (Brameld et al. 2006). Regarding developing countries, several articles confirmed the increase in utilization by insured people compared to uninsured groups (Yip and Berman 2001, Hidayat et al. 2004, Jutting 2004, Liu et al. 2002).

Differences in type of insurance can affect differences in utilization of emergency or preventive services. For example, the U.S. government expanded a public insurance scheme called the State Children's Health Insurance Program (SCHIP) to uninsured children in 1997. The finding after implementation was that there was no significant difference in utilization of emergency department services between insured and uninsured (Luo et al. 2003). However, preventive care utilization increased after implementation of the SCHIP project (Szilagyi et al. 2004). Another study by Reschovsky et al. (2000) demonstrated that across four types of insurance (Indemnity, PPO, open HMO, closed HMO), there were differences in utilization of ambulatory, inpatient, and preventive care (Reschovsky et al. 2000). In New Zealand, people who bought additional private insurance were more likely to visit a GP and specialist (by 3.4% and 7.9% respectively) compared to people with only public health insurance (Blumberg 2006). From low and middle-income countries, there are few documents comparing utilization between different health insurance schemes. In one example comparing public and private insurance in Argentina, private insurance was

associated with an increase in use of health services in all income groups compared to those with public insurance (Cavagnero et al. 2006).

2.4.2 Efficiency

In relation to disease and health insurance, length of stay (LOS) is commonly used to evaluate efficiency. It is used widely as a process measure of efficiency (Ray et al. 1990; Palmer et al. 1989; Brizioli et al. 1996; Kahn et al. 1990; Manton et al. 1993). Readmission has also been used as an indicator of efficiency (Ross J. et al. 2008, Heggestad T. 2002) since it implies waste of resources.

Length of stay

With respect to LOS, Eamtrakul et al. (2004) surveyed patients who were admitted at Lerdsin Hospital Bangkok in 2003. They found that being female, elderly, with high severity of the condition, and having chronic disease were related to LOS. They also found that insurance status affected LOS (Eamtrakul et al. 2004). Omachonu et al. (2004) studied factors related to LOS for five conditions - craniotomy, heart failure and shock, psychosis, rehabilitation, and HIV major related condition - in US Medicare patients. The factors affecting LOS could be categorized into two groups: patient factors, and clinical factors. The patient factors comprised age, sex, and marital status, while clinical factors were severity of patient condition, admission type, admission source, and mortality index (Omachonu et al. 2004).

Regarding patient characteristics, several other studies have found that the age and sex of the patient affects LOS. Brasel et al. (2007) studied factors affecting LOS in trauma patients in the U.S. They found that age, sex and insurance status affected LOS (Brasel et al. 2007). However, the effect of gender varied by disease and culture. In a study of patients with chronic health failure in Spain, females had significantly longer LOS than males (Formiga et al. 2008), while a study in the U.S. found males had significantly longer LOS than females for chronic heart failure and shock (Omachonu et al. 2004).

Regarding type of hospital, Mawajdej et al. (1997) found that hospital type affected LOS in Jordan. LOS in public hospitals was significantly longer than in private hospitals (Mawajdeh et al. 1997). Other studies also found type of hospital affected

LOS; for example, community hospital and university hospital in the US (Samuels et al. 1998), and hospitals in rural areas and urban areas in the US (Yang et al. 2007).

Sepehri et al. (2006) studied the influence of health insurance on LOS in Vietnam by surveying a population for any admissions in 2002. They found that there were different LOS between the insured and the uninsured. Furthermore, people covered by different insurance schemes also had different LOS (Sepehri et al. 2006, Mawajdeh et al. 1997).

Severity of the patient's condition before admission has been found to be related to longer length of stay. A study from the U.S. showed that the patients with co-morbidity and high severity scores had significantly longer LOS (Brasel et al. 2007, Stoskopf and Horn 1992).

Insurance schemes normally manage efficiency through the payment system. A change in the payment method can affect LOS because of provider behaviour. For example, in the US, Ellis and McGuire (1996) studied the effect of reimbursement on average resource use at a system-wide level and a provider level. They found that the payment system, and especially prospective payment, appeared to contribute to a reduction of LOS (Ellis and McGuire 1996). Again, in the US, Norton et al (2002) found that the real influence on LOS was the average cost of admission per day: data from Medicaid in Massachusetts between 1991 and 1993 showed that an increase in average price by $2300 led to an increase of one day in LOS (Norton et al. 2002). Murkofsky et al. (2003) studied LOS in home care after changing from FFS to prospective payment between 1996 and 1998. They found that LOS declined 22%-51% in not-for profit and for-profit home health agencies (Murkofsky et al. 2003).

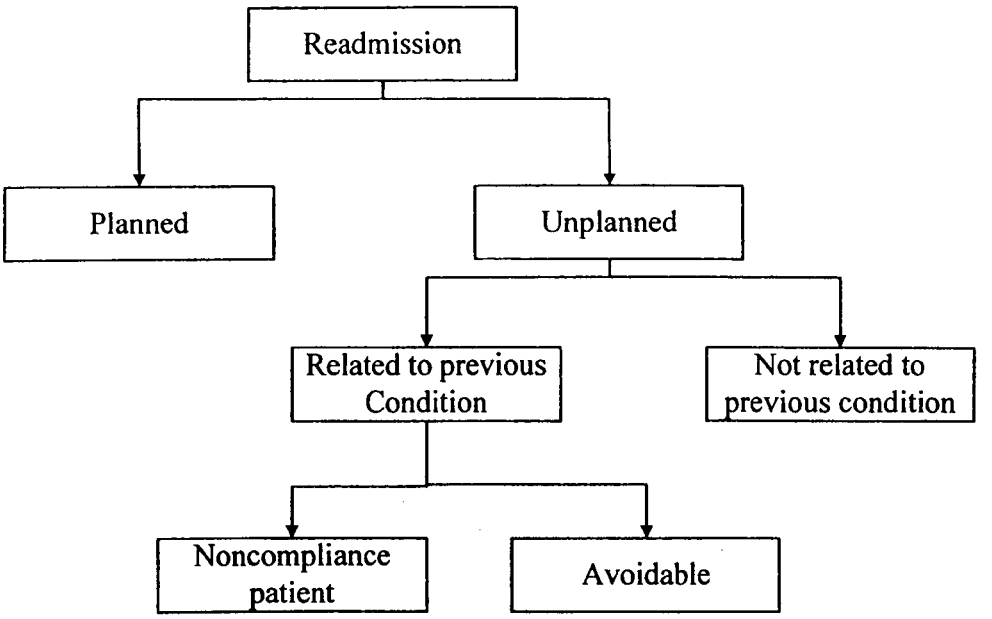
In Belgium after the reimbursement method was changed from per diem to case based in 1995, LOS was reduced. Furthermore, patients with a higher co-payment scheme had shorter LOS compared to lower co-payment groups (Perelman et al. 2008). In another example from Austria, after changing the financial system from per diem to case-based in 1997, average LOS was shortened by 4.6-4.9% from 9.36 days before implementation (Theurl and Winner 2007).

Readmission

The readmission rate is usually used in combination with LOS to refine the measurement of the result of care (Lave et al. 1988). Further details on quality of care will be described in the next section.

Readmission shortly after discharge from hospital is assumed to be related to substandard care and can be used as an indicator not just of efficiency but also of quality of care (Ashton and Wray 1996). Compared to LOS, readmission relating to quality of care is more difficult to define. There are several confounders, especially factors external to the hospital such as compliance of the patient or co-morbidity (Halfon et al. 2006). The important readmission which might relate to quality of service is avoidable readmission, defined as a readmission related to a previous hospitalization for a condition not expected to be readmitted within a certain period such as 30 days (Halfon et al. 2006). Figure 2.6 shows the diagram of readmission classification. Some patients, such as cancer patients, have appointments to be readmitted for further treatment, while other patients are readmitted with other conditions not related to their previous hospitalization. In situation where readmissions are related to the previous hospitalization, some readmissions may be due to the patients not complying with the doctor's advice. The remainder are avoidable conditions which might be related to quality of service in the previous hospitalization.

Figure 2.6 Diagram of readmission



Adapted from: Maurer and Ballmer 2004, Ludke et al. 1990

To explore the effect of quality of care on the early readmission rate, Ashton and Wray (1996) performed a meta-analysis of 42 studies of readmission rates between 1966 and 1996. They found that many studies produced conflicting results. The odds ratio for readmission in patients who received substandard care was 1.24 (0.99-1.57), which meant the increased risk was as low as 0 or as high as 57%. Jiménez-Puente et al (2004) found that validity of the readmission indicator might be higher in the surgical specialty. One difficulty in using readmission is the absence of a unified definition. Evidence from the meta-analysis showed that readmission within 30 days of hospital discharge was related to quality of process of care from prior hospitalization (Heggestad 2002, Milne 1998). Despite the challenges, readmission rate is still used as an indicator because (1) it plausibly relates to quality of care, (2) it is easy to obtain from a hospital database, and (3) readmission appears more frequently than other adverse outcomes such as mortality rate (Jiménez-Puente et al. 2004) and (4) it represents wasted resources.

Readmission rates have also been found to be affected by patient characteristics and clinical characteristics. Demographic status, insurance status, and co-morbidity affected readmission of patients with congestive heart failure (Hamner and Ellison 2005, Philbin and DiSalvo 1999, Benbassat and Taragin 2000). Furthermore, LOS can

be associated with readmission. William et al. (2005) demonstrated that longer LOS after surgical operations in the U.K. were associated with a higher readmission rate (Williams et al. 2005).

Insurance effect on readmission

Insurance status has been found to affect readmission for various conditions, for example, acute and chronic conditions. For example in a study of patients with chronic conditions in Philadelphia, U.S. between 1994 and 2001, Robbins and Webb (2006) found that patients with Medicaid, private insurance or noinsurance were less likely to be readmitted compared to Medicare patients (Robbins and Webb 2006). Another common chronic condition used as a tracer of readmission was congestive heart failure (CHF). Several studies show that different insurance schemes had different effects on probability of readmission (Philbin and DiSalvo 1999, Kosecoff et al. 1990, Ross et al. 2008). Philbin and DiSalvo (1999) found that Medicaid and Medicare patients with CHF had a 92% and 66% higher risk of readmission compared to Health Maintenance Organisation (HMO) patients.

For acute conditions, Bloomberg et al. (2003) studied asthma in children in St. Louis, U.S., between 1990 and 1999. They found that asthma patients with Medicaid or no insurance had a 28% higher risk of readmission than those with commercial insurance (Bloomberg et al. 2003). A study by Smith et al. (2005) of acute stroke readmission compared HMO and FFS patients between 1998 and 2000 in the U.S. They found that HMO patients had higher chance of readmission within 30 days, relative to FFS patients (Smith et al. 2005).

2.4.3 Quality

Quality of care has been identified as an important issue in the health care system for many years (Blumenthal 1996).As such, it is a widely used indicator of performance.

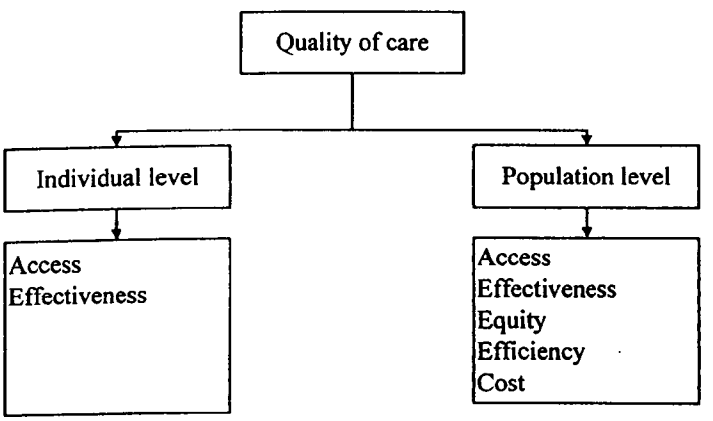
2.4.3.1 Definition of quality of care

There is no clear definition of quality of care because many dimensions are used depending on the perspective of the user and the values of each group (Donabedian 1988). Donabedian defined care of high quality as *"that kind of care which is*

expected to maximize an inclusive measure of patient welfare, after one has taken account of the balance of expected gains and losses that attend the process of care in all its parts." (Blumenthal 1996). According to the Institute of Medicine, quality of care means *"the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge"* (AHRQ 2004). Another approach to define quality of care uses dimensions or components of quality. Furthermore, from the definition above, dimensions of quality of care can be categorized into individual level and population level (Campbell et al. 2000).

At the individual level, Campbell et al. (2000) proposed dividing dimensions of quality of care into two categories, accessibility and effectiveness. At the population level, the proposed three additional components are equity, efficiency, and cost. The dimensions of quality of care are shown in Figure 2.7.

Figure 2.7 Quality of care dimensions



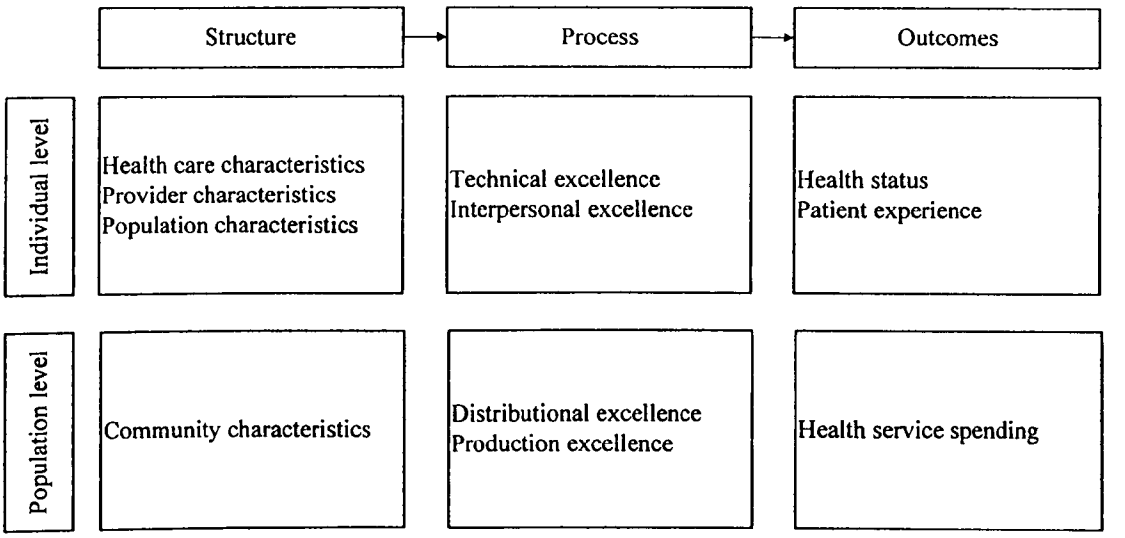
Adapted from: Campbell et al. 2000

2.4.3.2 Measuring quality of care

How to measure and what to measure are important in assessing quality of care. Donabedian (1966) proposed three major components of measurement: structure (characteristics of health personnel and system), process (what health professionals do), and outcome (what happens to people's health) (Donabedian 1966). This approach is commonly used to measure quality of care for both the individual and the population level. McGlynn (2007) proposes a conceptual framework for measuring

quality of care derived from the IOM quality of care definition, as shown in Figure 2.8.

Figure 2.8 Conceptual framework for quality measurement



Adapted from: McGlynn 2007, Campbell et al. 2000

Structure, the first component in the model above refers to elements of health care which facilitate access to care. It comprises four sub-components: community, health care, provider, and population characteristics. Structure may refer to the basic elements between needs of people and capacity of health service. Community and population characteristics represent the need for health service, for example, a community with a high prevalence of DM will demand more services to cope with chronic disease, or a population with a high number of uninsured people creates a barrier to access to care. Health care and provider characteristics usually reflect capacity provided by policy around access to health care, for example ratio of physicians per population and number of beds per head of population.

Process of care at the individual level involves technical and interpersonal excellence, while at the population level it also involves distribution and production excellence, in particular equity and efficiency. Technical excellence is judged by comparison with best practice. An example of technical performance is the use of appropriate and necessary drugs for the illness. Interpersonal excellence needs to meet individual and

social expectations such as privacy, confidentiality, informed choice, concern, empathy, and honesty (Donabedian 1988).

At the population level, equity and efficiency are added to reflect the prioritization of resources by society (Campbell et al. 2000). Equity can be categorized into horizontal equity, which is the equal treatment of individuals or groups in the same circumstances, and vertical equity, which is that individuals who are unequal should be treated differently according to their level of need (Smith 2005). An example of distributional problem of insulin access is in Mozambique and Zambia which have problems of equity to access especially in rural areas because of lacking plan of insulin distribution (Beran et al. 2005). It is still controversial for efficiency to be defined as a dimension of quality of care because cost to benefit may relatively increase as health care is ineffective (Campbell et al. 2000, McGlynn 2007).

Outcome of care is relevant to quality of care (Donabedian 1966). However, there are still limitations and concern when using outcome as a tracer for quality of care. First, there may be several factors influencing outcome. There is no definite conclusion that good process leads to a better outcome, although a good outcome usually comes from a better process. For example, the use of advanced technology or efficient drugs for a patient might not assure a good result since the patient may not comply with the drug regimen or new technology instrument. Second, outcome of care may not be easy to measure. Apart from death, other outcomes may need a long period to follow up or the outcome may be a subjective result such as patient satisfaction.

The structure, process, and outcome approach is commonly used to measure quality of care. However, there are some problems in its use (Brook et al. 2000). There are numerous methodologies available for studying quality of care. For example, structured implicit chart review is a tool for assessing quality of care especially in chronic care (Hofer et al. 2004). Hofer et al (2004) found that chart review for Diabetes Mellitus and hypertension patients, conditions that have a well-developed evidence base for care, is more reliable than for COPD, which has a less well-developed evidence base. Some instruments require follow up of patients for a period of time. For instance, a health outcome survey by the Center for Medicare and Medicaid Services (CMS) used a prospective cohort study to follow up patients.

2.4.3.3 Insurance scheme effect on quality of care

Quality of care is still an important issue even in developed countries which have universal coverage. The effect of insurance scheme on quality of care is not simple because there are intervening factors (Levy and Meltzer 2008). Two intermediate factors affecting quality of care are insurance scheme design such as funding sources, benefit package, payment system etc, and provider behaviour. In terms of insurance design, several studies showed that different funding sources, payment mechanisms, and benefit package affected quality of care (Bennett 2004, Tsai et al. 2005, Roland 2004). In terms of provider behaviour, quality of care associated with insurance scheme has been found to be related to provider behaviour such as that of physicians (Landon et al. 1998, Grimshaw et al. 2001). For example, the study of Meyer et al. (2006) showed that 88% of physicians in the study changed clinical management as a result of patient insurance status (Meyers et al. 2006).

2.4.3.4 Factors affecting provider behaviour regarding quality of care

Based on review of the literature, there are a number of factors influencing quality of care such as type of physician (Kerr et al. 1997; Grumbach et al. 1998), type of hospital, i.e. whether it is public or private (Lin et al. 2004), and level of provider (Safran et al. 1994; Shmueli et al. 2002). However, payment would be one important factor affecting quality of care. To explore the effect of payment on quality of care, this study conducted a systematic review for quality of care to identify articles involving payment for both physician and institution with different methods of study. Searching was done using the electronic MEDLINE database from 1975 to 2006. The search strategy and results are shown in Table 2.6.

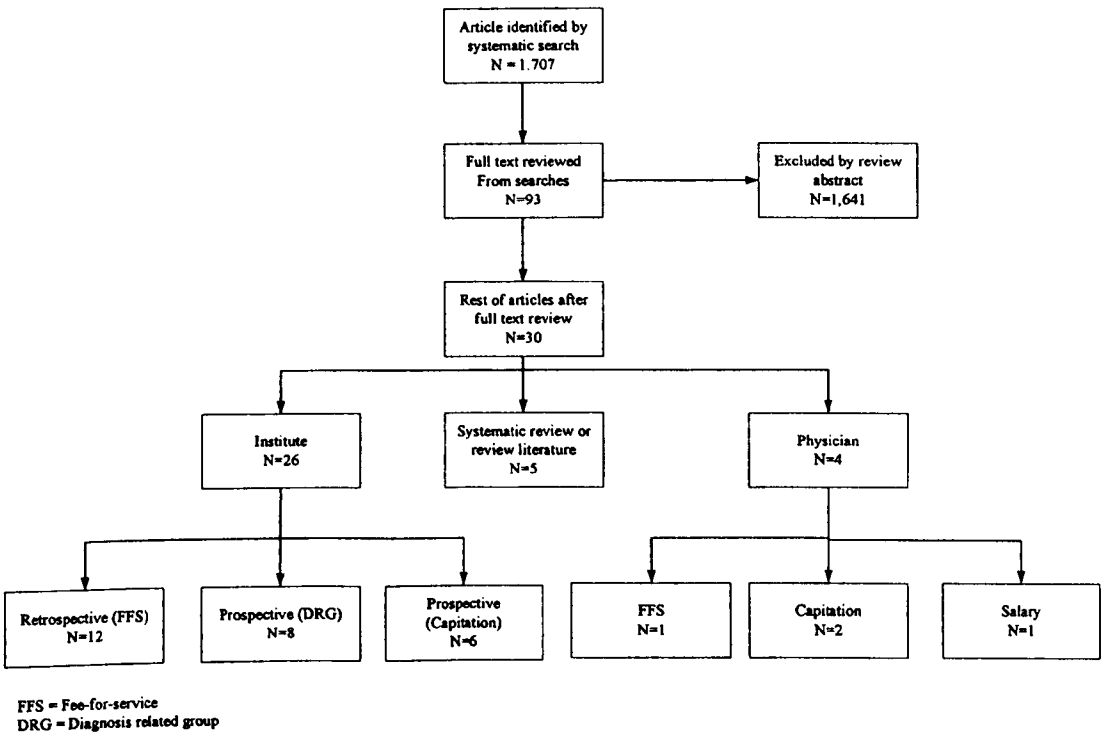
Table 2.6 Search strategy of literature on quality of care and payment mechanisms

Key words for search system	Citation reviewed	Article retrieved	Final article
Quality AND care AND payment	785	14	5
Quality AND care AND payment AND case control	20	4	1
Quality AND care AND payment AND cohort	13	4	2
Quality AND care AND payment AND randomized controlled trial	1	0	
Quality AND care AND Fee-for-service	397	28	11
Quality AND care AND capitation	229	7	2

Key words for search system	Citation reviewed	Article retrieved	Final article
Quality AND care AND case base payment	2	2	
Quality AND care AND global budget	18	0	
Quality AND care AND prospective payment	217	31	8
Quality AND care AND retrospective payment	25	3	1
Total	1,707	93	30

The search results can be categorized to institution and physician as shown in Figure 2.9. Details of searched articles and key findings are shown in Appendix 7.

Figure 2.9 Articles identified by systematic searches



In terms of payment mechanism, there have been some systematic reviews related to payment and quality of care. Cangialose et al. (1997) reviewed the research on quality of care in three dimensions: patient satisfaction, clinical processes and outcome of care, and resource utilization. From the review, no difference in patient satisfaction, process and outcome quality between fee-for-service (FFS) payment and capitation payment under managed care was observed, whereas resource utilization decreased in capitation payment compared to FFS payment (Cangialose et al. 1997). Miller and Luft (1997) found that there were no definite conclusions on quality of care between capitation payment under HMO and FFS plans. Furthermore, the pattern of resources used did not differ between hospitals paid by FFS or those paid by capitation (Miller

and Luft 1997). Gosden et al. (1999) reviewed the effect of payment on quality of care in many topics and many times (Gosden et al. 1999, Gosden et al. 2001, Gosden et al. 2000,Giuffrida et al. 1999). They found that salary payment was associated with lower use of tests and procedures, higher referral rate, and longer consultations compared with FFS and capitation payment system. In a review of payment methods and behaviour of primary physicians, some evidence suggested that how a primary physician was paid affected the behaviour of the physician. Yet, the generalizability of the studies has not been established.

Insurance affects physician behaviour. Physicians have been found to change clinical management according to patient insurance status. Meyer et al. (2006) studied the effect of insurance status on clinical decision making in Georgetown, U.S., finding that physicians changed clinical decision, such as changing from original drug to generic drug, according to insurance status). Patients with insurance had a higher probability of receiving treatment and a better outcome. A study by Bleich et al. (2007) on health insurance and hypertension (HT) treatment in Mexico found that insured patients were more likely to receive HT drugs and have a good outcome.

Apart from financial incentive, nonfinancial incentive is another important factor affecting quality of care. However, there are relatively few articles about nonfinancial incentives compared to financial incentives and quality of care. One example of nonfinancial incentives studied is the achievable benchmark method which uses peer review and feedback mechanisms to improve performance (Kiefe et al. 2001). Another example is pay-for-performance which uses nonfinancial motivation combined with financial incentive (Liu and Mills 2003; Beaulieu and Horrigan 2005). The American Heart Association encourages further research on nonfinancial incentives to improve quality of care to understand the benefits and risks of nonfinancial effects (Bufalino et al. 2007). Town et al. (2004) summarized three approaches: economical, organizational, and psychological aspects to answer the question what is the effect of incentives on the performance of physicians in medical groups.

2.5 Diabetes Mellitus as a tracer for quality

Using the tracer method means using a specific disease, condition, or health problem to analyse or explain the system. The tracer concept came from science, for example, endocrinologists used isotoped iodine to trace thyroid function. Tracers have been used to analyse health services for more than 50 years either as a single condition or combined in sets (Kessner et al. 1973). A good tracer should be a well defined condition, representative, and with appropriate cost (Neuhauser 2004).

There is some empirical evidence on the use of specific diseases as a tracer measuring quality of care, for example, Diabetes Mellitus (DM), hypertension (HT), chronic obstructive pulmonary disease (COPD) (Hofer et al. 2004), acute myocardial infarction (Soumerai et al. 1999), ischemic heart disease (Mushlin et al. 1988), hip fracture (Fitzgerald et al. 1987; Ray et al. 1990; Palmer et al. 1989; Coleman et al. 2000; Draper et al. 1990), congestive heart failure, pneumonia, cardiovascular accident (CVA), depression (Draper et al. 1990; Wells et al. 1994). Surgical procedures are also commonly used as a tracer to measure quality of care, such as coronary artery bypass graft (CABG) (Erickson et al. 2000), haemorrhoidectomy (Tsai et al. 2005), and radiology (Kangarloo et al. 1996). This study used DM as a tracer for quality measurement.

Diabetes Mellitus (DM) is one of the most common chronic diseases in the world and is one of the common tracers for health system performance (Nolte et al. 2006). Using DM as a tracer has been done by several studies, for example, Hopkinson et al. (2004), Beran et al. (2005), Nolte et al. (2006) and others. There are two main types of DM, Insulin Dependent Diabetes Mellitus (IDDM) and Non Insulin Dependent Diabetes Mellitus (NIDDM). Until now, the quality of care in DM was the most important factor for late complications (Schiel et al. 1997). In the US, more than 16 million people have been diagnosed causing a morbidity and mortality cost of almost $100 billion per year (Saaddine et al. 2002). The worldwide prevalence of DM in adults aged over 20 years in 1995 was about 4%. Prevalence of DM in Nordic countries is about 3% of the population (Wandell 2005). To prevent complications and prolong life, it is necessary to control plasma glucose, lipid profile, and

hypertension. Robert et al (1998) found that tight control of hypertension in DM patients can reduce deaths related to DM complications by 32% (Robert et al. 1998).

Quality of care in DM patients is one of the major concerns in the management of DM patients in both developed and developing countries (Saaddine et al. 2002). Evidence on quality of care in DM patients is reviewed below.

2.5.1 Quality of care

The greatest concern in DM is vascular complications. The goal of treatment is to prevent complications of the disease. Complications can be categorized into two types. The first concerns the time span of the complication, divided into short-term and long-term complications. Examples of short-term complications are hypoglycaemia, hyperglycaemia, and Diabetes ketoacidosis. Long-term complications consist of coronary heart disease, stroke, chronic renal failure etc. The second concerns pathology and is divided into microvascular and macrovascular complications. Examples of microvascular complications are retinopathy and nephropathy. Examples of macrovascular complications are coronary artery disease and stroke.

To evaluate the quality management of DM care at community level, Chin et al (2000) studied quality of DM care in community health centres in the U.S. They found that there was inadequate provider education to manage the quality of DM care because of the turnover rate of staff. They recommended enhancing and widening total quality management especially at community health centres.

There is evidence that management of DM patients might be done not only by specialists but also by other trained personnel. In Germany, there was a project to follow up patients over 5 years to compare the quality of care of IDDM and NIDDM under specialized and non-specialized physicians. For short term complications such as hypoglycaemia and ketoacidosis, there were no significant differences between the groups (Schiel et al. 1997). For long-term complications, such as retinopathy and nephropathy, there were also no significant differences between the two groups. Schiel suggested that a quality improvement model for DM patients should be implemented with monitoring and management at all levels of care.

Another issue of quality of care in DM is data for evaluation and measuring quality of care. There are many sources of data to use to study quality of care in DM. Keating et al (2003) reviewed the possibility of using administrative data. Their methodology was to compare the use of administrative data alone with hospital data to detect compliance with accepted standards of DM care in certain groups (Keating et al. 2003). They found that administrative data alone was not sufficient to detect processes of care in DM patients; additional supplementation by medical recordsata was crucial for identifying good quality of care.

Before 1995, many organizations in the US developed indicators to measure quality of care in DM but most of them required providers to collect additional data. In 1995, the Center for Medicare and Medical Services (CMS), the National Committee for Quality Assurance (NCQA), and the American Diabetes Association (ADA) committed to create a set of indicators for measurement of quality of care in DM under the Diabetes Quality Improvement Project (DQIP) (Fleming et al. 2001). The set of indicators has changed from 1995 to 2000. The final version has two major elements of data collection: from medical records or electronic data to measure accountability and quality improvement, and from a patient survey to measure quality improvement. The details of the measurement indicators are shown in Table 2.7.

Table 2.7 DQIP 1.0 measure set

Accountability	
From medical records or electronic data	
	HbA1c tested (annually)
	Poor HbA1c control (HbA1c ≥9.5%)
	Eye examination performed (high-risk annually, low-risk biennially)
	Lipid profile performed (biennially)
	Lipids controlled (LDL <130 mg/dl)
	Monitoring for diabetic nephropathy (high-risk annually, low-risk biennially)
	Blood pressure controlled (<140/90 mmHg)
	Foot examination (annually)
From patient survey	
	Smoking cessation counselling (annually)
Quality indicators (QI)	
From medical records or electronic data	
	Distribution of values for HbA1c (<7.0, 7.0–7.9, 8.0–8.9, 9.0–9.9, ≥10.0%,

	or undocumented)
	Distribution of values for LDL cholesterol (<100, 100–129, 130–159, ≥160 mg/dl, or undocumented)
	Distribution of values for blood pressure (<140, 141–159, 160–179, 180–209, ≥210 mmHg systolic; <90, 90–99, 100–109, 110–119, ≥120 mmHg diastolic, or no value documented)
From patient survey	
	Diabetes self-management and nutrition education
	Interpersonal care

From : Fleming et al. 2001

Because of the huge cooperation in developing the quality indicators in the DQIP, most stakeholders in the American health care system use DQIP as the tool for evaluation of DM quality management, such as the NCQA, and the health plan employer data and information set (HEDIS). However, it is rarely appropriate for administrators to use guidelines as a quality instrument to monitor past performance (Hayward et al. 2004).

The continuum of care in DM patients is very important. Monitoring of tests is important to follow the level of care and prevent complications. Gill et al (2003) studied the impact of continuity of provider on the results of care in DM patients. Continuity of care has benefits for quality of care in the provider-patient relationship, reduced rate of admission, and increased correct prescriptions (Gill et al. 2003). The negative consequences may include poor monitoring of DM if physicians lack knowledge to monitor and comply poorly with the recommended guidelines. Gill et al (2003) found that continuity is not associated with frequency of tests for monitoring DM.

Since data could be collected from various sources, comparing the validity and reliability of data sources is important. Fowles et al (1999) compared the validity and reliability of three major sources of data to study results of quality of care in DM patients. The three sources were self-report, primary care medical and eye records, and administrative claims. The finding was that data from medical records and administrative claims were complementary and not overlapping. The most reliable was microalbumin testing and the least was eye examination. Self-reported data put more emphasis on eye examinations and HbA1C reports. The overall result was that

self-reported data could mislead in overestimating the significance of such reports (Fowles et al. 1999). Fowles et al (1999) concluded that self-reported rates of quality of care data should be evaluated carefully.

Factors affecting quality of care in Diabetes Mellitus

There have been several empirical studies on factors affecting quality of care in other countries. Factors can be summarized into three main components including systemic components, patient components, and provider components (Pringle et al. 1993). In terms of systemic components, health insurance has been found to affect quality of care in primary care, ambulatory care, and hospitalization. An example of a study of insurance and quality of primary care is by Shi (2000), who compared those with public insurance, with no insurance, and with private insurance. The study found that the insured had better opportunity to access better quality of care (Shi 2000). Another example is a study of the State Children's Health Insurance Programme regarding access to care, utilization, and quality of care in the U.S. Kempe et al. (2005) found that quality of care of children in ambulatory and hospitalization services in the newly enrolled group was improved after one year's implementation (Kempe et al. 2005). Another study from the US showed that having health insurance meant that DM patients had a higher chance of receiving an eye examination compared to those without insurance (Beckles et al. 1998, Keating et al. 2003). Porterfield et al (2002) compared quality of care in DM for the uninsured, who mostly lived in underserved areas, between uninsured patients in community centres and uninsured patients in physician offices in North Carolina. The findings were interesting that there was no difference in quality of care between service received from community centres and physician offices (Porterfield and Kinsinger 2002).

In terms of patient factors, several studies showed that different socioeconomic and demographic characteristics affected outcome of DM care such as age, sex, marital status, income, deprivation of area (Hippisley-Cox 2004, Nagpal and Bhartia 2006). However, the result of each factor varied by country, and context etc (Gray et al. 2006). For example, Gray et al. (2006) studied delivery of DM care in England and found that there was no difference by gender in HbA1C testing while the study of Fenton et al. (2006) found that females had lower probablity of receiving the HbA1C test. In deprived areas, patients were less likely to receive services compared to

affluent areas (Hippisley-Cox 2004). Furthermore, comorbidity and health status affected achieving process or outcome of care (Saaddine et al. 2002). Several studies also found that longer duration of DM, and having comorbidity was associated with receiving services and affected the result of DM care, for example, Renders et al. (2001), Helmer et al. (2003), Roubideaux et al. (2004).

In terms of provider factors, having specialized physicians, and hospital type are factors affecting achieving process and outcome of DM care. For example, the study of Suwattee et al. (2003) showed that physician type affected the outcome of DM care (Suwattee et al. 2003). Furthermore, different hospital types also affected DM care. For example, Kerr et al. (2004) compared the result of DM care between veteran hospitals and hospitals which were commercialy managed care and found that veteran hospitals provided better quality of DM care compared to commercially manged hospitals (Kerr et al. 2004).

Assessment of quality of care in Diabetes Mellitus

Quality of care can be assessed in terms of process of care using targets in guidelines as the gold standard, and in terms of intermediate outcomes. For achieving targets on process of care, Roubideux et al. (2004) studied the quality of care of DM in elderly American Indians. They found that education, duration of DM, and older age were the factors affecting having met the standard of care in DM (Roubideaux et al. 2004). For other demographic factors, several studies have shown the effect of age, sex, and marital status affecting quality of DM care in both process of care and intermediate outcomes (Goyder et al. 2000, Hippisley-Cox 2004, Gray et al. 2006). Socioeconomic factors, i.e. income and insurance status, also affect whether the targets in the process of care are achieved (Keating et al. 2003, Beckles et al. 1998). Other studies have found that clinical status affects achievement of standard DM care, such as time to diagnosis of DM, co-morbidity, DM complications, smoking (Fenton et al. 2006, Benoit et al. 2005). In terms of physicians' behaviour, physicians tended to differentiate prescriptions by insurance scheme. A study of prescriptions by physician for two chronic diseases (DM, HT) in the U.S. showed that physicians prescribed drug differently between insurance schemes (Huttin 2007).

For intermediate outcomes, Gray et al. (2006) studied the relationship of the demographic factors age and sex, and deprivation, to intermediate outcomes HbA1C, BP, and serum cholesterol. They found that younger age groups were less likely to achieve treatment targets compared to older age groups. Women were significantly less likely to achieve the cholesterol target (Gray et al. 2006). For socioeconomic factors, Saaddine et al. (2002) studied quality of care in the US between 1988 and 1995. They found that factors affecting process and outcome of DM care included insurance status, and ethnicity. Furthermore, regarding clinical factors, they found that duration of DM and using insurance also affected quality of DM care (Saaddine et al. 2002). Zhang et al. (2008) demonstrated the effect of different insurance schemes on quality of DM care in the US. They found that uninsured and Medicaid patients were less likely to achieve the standard quality of DM care compared to the insured group. (Zhang et al. 2008). This finding corresponds to the situation in developing countries. Pagan and Puig (2005) studied differential access to DM services in Mexico. They found that having insurance increased the use of DM care (Pagan and Puig 2005).

2.6 Summary

This chapter has reviewed the literature relating to health insurance and performance indicators. The review reveals that the insurance system can differ in seven components, which are source of funds, allocation to purchaser, allocation institutions, provider payment, service providers, health system support, and benefit package. The achievements of an insurance scheme can be measured in two dimensions: achieving universal coverage and improving health system performance. Achievement of universal coverage aims to increase access to effective health services and protect families from bankruptcy through catastrophic illness. Health system performance can be measured using health system indicators such as access, efficiency, quality etc.

The review provides the picture of the theoretical framework of the health insurance schemes and their performance. Figures 2.1, 2.3, and 2.4 can serve as the theoretical framework for this study. The empirical findings show that there are differences in

utilization, efficiency, and quality of care between the insured and the uninsured, and between different insurance groups.

In terms of utilization, several empirical studies show that insured people had higher utilization than uninsured. However, utilization from different insurances has various results. It seems that there is less difference in the way patients use emergency services but more variation in utilization of non-emergency services.

In terms of efficient use of resources, LOS is a common indicator for hospital services. Evidence shows that insurance with different payment systems affects LOS in hospital. However, readmission seems to be more complicated than LOS if one sets out to evaluate different effects of insurance characteristics. It depends on the definition used, patient condition, and the disease examined in a study.

Quality of care is another issue in health insurance performance. Dimension of quality can range from the individual to the population level. A common approach in measuring quality of care is to assess quality in terms of structure, process, and outcomes. Several studies demonstrate a relationship between quality and different insurance characteristics. Several factors affect quality of care such as insurance status, payment system, provider behaviour, provider level, provider type etc. In terms of insurance, various studies show that uninsured people tend to receive lower quality care compare to insured people. Different insurances can affect both provider behaviour and patient outcome regarding quality of care. Because of the extensive scope of quality of care, using some condition or disease as a tracer for measuring quality of care is common. Several studies show that a chronic disease such as Diabetes Mellitus can be used as a tracer for quality of care.

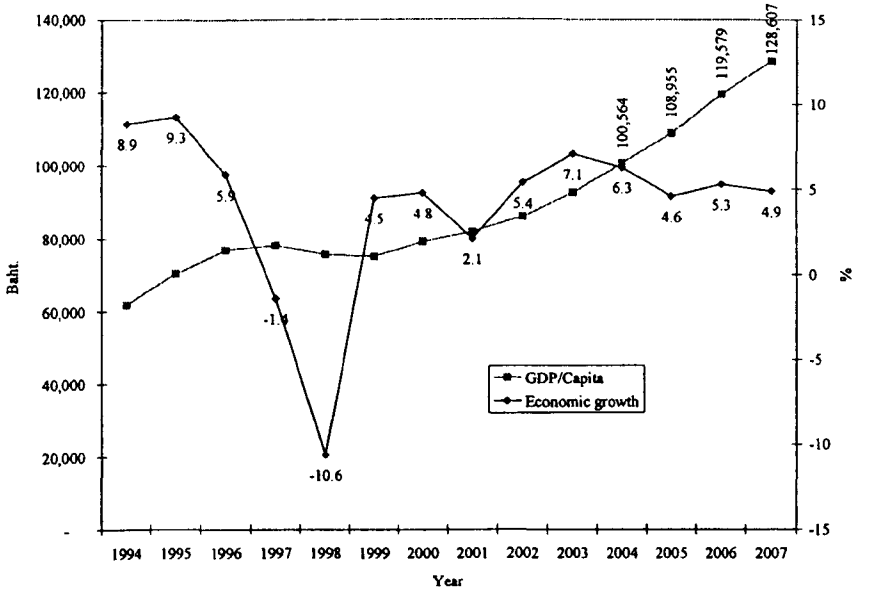
CHAPTER 3: HEALTH INSURANCE IN THAILAND

This chapter aims to provide the context of Thailand and its health insurance system. The chapter first details the background of the country, followed by the history of the insurance system. Then, the different characteristics of the three main public health insurances schemes are described. Finally, empirical evidence regarding the effects of the insurance schemes on selected aspects of performance in the Thai health care system is reviewed.

3.1 Background of Thailand

Thailand is a developing country with an average GDP of 123,673 Baht/capita (£1,741 /capita)(Bank of Thailand 2009b). It is situated in the Southeast Asia region, surrounded by Myanmar, Lao People's Democratic Republic (PDR), and Cambodia. It covers an area of 514,000 square kilometres (2.5 times bigger than Great Britain). The population was approximately 63 million in 2007 (Bank of Thailand 2009a). The population growth rate was 0.41% in 2006. The trend in the population structure is for a decline in the 0-14 year group and an increase in the elderly group. The elderly ratio increased from 9.5% in 2000 to 10.9% in 2005, while the 0-14 year group decreased from 24.3% to 23.1% (Wibulpolprasert 2008). Regarding the economic status of Thailand, GDP per capita has grown steadily while economic growth has averaged about 5%, after a remarkable drop in 1997 due to the Asian economic crisis as shown in Figure 3.1.

Figure 3.1 Economic growth and GDP/capita of Thailand between 1994 and 2007



From: National Economic and Social Development Board (NESDB) http://www.nesdb.go.th/Default.aspx?tabid=95

Health status in Thailand has improved in recent decades. Life expectancy has increased from 68.9 in 1998 to 70.3 in 2004. Maternal mortality decreased from 34.7 per 100,000 live births in 1986 to 9.8 in 2006 and the infant mortality rate has declined from 49 per 1,000 live births in 1980 to 18 in 2004. The major cause of mortality has changed from communicable disease to non-communicable disease. The top three causes of death in 2006 were circulatory system, cancer, and infectious disease (mainly HIV infection) (Wibulpolprasert 2008).

The health service system includes personnel and health facilities. In Thailand, there is both a shortage of health personnel, and inequality in their distribution, especially for physicians in the public sector. Data from the MOPH show that average population per doctor in the last decade improved slightly from 3,400 to 3,200, but the distribution is still unequal, especially in the Northeast region. While Bangkok had one doctor per 867 population in 2005, the Northeast region had one doctor per 7,000 population as shown in Table 3.1.

Table 3.1 Population per doctor of Thailand by region between 1998 and 2005

Region	Population/doctor							
	1998	1999	2000	2001	2002	2003	2004	2005
Bangkok	762	760	793	760	952	924	879	867
Central	3,614	3,653	3,576	3,375	3,566	3,301	3,134	3,124
North	5,050	4,869	4,501	4,488	4,499	4,766	4,534	3,724
South	4,814	4,888	5,194	5,127	4,984	4,609	3,982	4,306
Northeast	8,218	8,116	8,311	7,614	7,251	7,409	7,466	7,015
Total	3,406	3,395	3,427	3,277	3,569	3,476	3,305	3,182

Adapted from: Wibulpolprasert 2008

However, the distribution of health facilities is better. This is because in the last two decades, it was government policy to expand community hospitals to all districts and health centres to all sub districts. Population per bed data show that between Bangkok and Northeast region the difference in ratio was about 3.5 times (223 vs. 740), compared to the ratio for personnel where the difference was nearly 10-fold. Details of bed distribution are shown in Table 3.2.

Table 3.2 Population per bed by region of Thailand between 1998 and 2005

Region	Population/bed							
	1998	1999	2000	2001	2002	2003	2004	2005
Bangkok	199	199	202	205	213	210	224	223
Central	377	376	369	368	391	401	390	388
North	475	478	493	474	496	501	503	498
South	507	509	494	492	496	499	501	498
Northeast	790	780	766	771	759	752	747	740
Total	456	455	454	451	465	467	469	468

Adapted from: Wibulpolprasert 2008

3.2 Development of health insurance in Thailand

Thailand has had a long experience of health insurance since 1929, as shown in Table 3.3. The period between 1991 and 2000 can be viewed as the time of the development of universal coverage (UC), spearheaded by the Ministry of Public Health (MOPH) with support from western countries (Jongudomsuk 2005). CSMBS has begun since 1980 covering civil servant and their dependants including father, mother, and two children under 20 years (Sriratanaban 2002). The SSS was launched in 1990, covering employees of the formal sector for sickness not related to work and maternity care

(Tangcharoensathien et al. 1999b). After the economic crisis in 1997, the Thai Rak Thai party proposed the policy of universal coverage as a safety net for the poor and the party won the 2001 election in a landslide victory (Jindawatana and Pipatrarojkomol 2003). The new National Health Security Act was passed by parliament in 2002.

Table 3.3 Important events of health insurance in Thailand

Year	Important event
1929	Private insurance business
1954	First Social Security Act (but not implemented)
1974	Workmen Compensation Fund
1975	Free medical care for the poor
1978	First private health insurance company
1980	**Royal Decree on CSMBS**
1981	First issuance of Low Income Card
1983	Maternal and Child Health Fund (phase I)
1984	Health Card Project (phase II)
1990	**Social Security Act covered enterprises with 20 and more employees**
1991	Health Card Project - insurance based pilot (phase III)
1992	Free medical care for elderly
1993	Traffic Accident Victim Protection Insurance
1994	**Social Security Act, extension to enterprises with 10 or more employees**
1994	Health Card Scheme (phase IV), equal matching funds provided by government reinsurance policy and cross-boundary card provided by government
1994	Health Card extension to community leader and health volunteer, full government subsidy
1994	Medical Welfare Scheme, expansion of free medical care for the poor to cover other indigent groups, elderly and children up to 12 years
1998	New financial regulation for the Medical Welfare Scheme: management by national and provincial committees, per capita budget allocation to provinces, introduced reinsurance policy for high cost care by using diagnosis related group and global budget.
1998	CSMBS: introduced co-payments by CSMBS beneficiaries, only drugs quoted as essential drugs are reimbursed, limited hospital stays in private room and board
2000	The Social Security Scheme expanded to cover old age pension and child benefits
2001	**Implementation of universal coverage**
2002	**National Health Security Act** **Established National Health Security Office**

Adapted From: Tangchareonsathien et al. 2002

3.3 Public health insurance schemes in Thailand in 2006

Universal coverage (UC) was effected in 2001. Before 2001, Thailand had four major schemes: the Civil Servant Medical Benefit Scheme (CSMBS), Social Security Scheme (SSS), Low Income Card Scheme, and Voluntary Health Card. In 1998, coverage was 80.3% of the population (Wibulpolprasert 2002). Universal coverage was implemented by entitling all uninsured people to the new scheme, known as the "30 Baht cures all diseases" scheme or the 30 Baht scheme (Towse et al. 2004). The

terms universal coverage scheme (UC scheme) and 30 Baht scheme are used interchangeably. The uninsured people were mainly poorer and less educated than the rest of population. 86% were in the low income group (Tangcharoensathien et al. 2002). The UC scheme tried to reduce the gap in the benefit package by using abenefit package based on the existing SSS. After UC was implemented, health insurance in Thailand consisted of three main systems: the UC scheme, CSMBS, and SSS. The main characteristics of the three public insurance schemes are summarized in Table 3.4.

Table 3.4 Different characteristics of the three major public insurance schemes in Thailand

Characteristics	UC scheme	Civil Servant Medical Benefit Scheme[1] (CSMBS)	Social Security Scheme (SSS)
Scheme nature	Citizen entitlement	Fringe benefit	Mandatory
Model[2]	Public contracted model	Public reimbursement model	Public contracted model
Population coverage, 2004[3]	The rest of population who are not covered by SSS and CSMBS	Government employees, pensioners and their dependants (parents, spouse, children under 18)	Formal-sector private employees, establishments/ firms of more than one worker since 2002
Population[4] (millions)	47.2	4.2	8.5
% of total population	75.2%[5]	6.7%	13.5%
Financial resources	General taxation	General taxation	Tripartite (Government, employers and employees each contribute 1.5% of payroll)
-Co-payment	At the beginning of project, nominal payment of 30 Baht per visit or admission for UC Pay members and exemptions for the poor previously covered by the Low Income Card -Co-payment removed in 2006[6]	-Co-payment for non-essential drugs, and for inpatients in private hospitals - Advance payment for OP reimbursed from government (This regulation was changed in 2007 (Sakunphanit et al. 2009)[7]	Co-payment for expenditure beyond the reimbursement level for maternity, emergency services

[1] Including state enterprises employees and their dependents
[2] Based on OECD 1994 classification of relationship between insurance purchasers, healthcare providers and users of services
[3] Source: National Statistical Office, Health and Welfare Survey 2004.
[4] Source: National Health Security Office (http://library.nhso.go.th/page/nhsodoc/nhsodoc8ann.html access date: 6 September 2006), excludes other groups of insurance, e.g. Thai people living in a foreign country, and those not registered for any insurance.
[5] There were 2.9 million or 4.6% of the total population not registered with the 30 Baht scheme, despite the efforts of the National Health Security Office. These are mobile populations, mostly resident in Bangkok Metropolitan Area. They should be entitled to free care, as an entitlement of all citizens.

Characteristics	UC scheme	Civil Servant Medical Benefit Scheme[1] (CSMBS)	Social Security Scheme (SSS)
Allocation to purchaser	Population based	Historically based	Population based
Allocation institutions	National Health Security Office (NHSO)	Ministry of Finance (Comptroller General Department)	Social Security Office (SSO), Ministry of Labour and Social Welfare
Allocation to provider	Capitation for ambulatory care and prevention promotion services, Global budget and DRG for inpatient care	Fee-for-service reimbursement for ambulatory care, DRG for inpatient care since 2007	Capitation inclusive of ambulatory and admission services
Service providers	Public contracted model	Public contracted model	Public and private contracted model
Health system support	No	No	Hospital accreditation or SSS standard
Benefit package			
Ambulatory services	Designated providers, mostly primary care unit	Free choice public only	Public and private contractors
Inpatient services	Designated providers, mostly starting first with District Hospital with referral	Free choice public	Public and private contractors
Choice of provider	Primary care contractor services, plus referral	Free choice	Contracted hospital or its network
Cash benefit for sickness and maternity leaves	No	No	Yes
Conditions included	All	All	Non-work-related illness, injuries
Conditions excluded	12 conditions, e.g. organ transplant, non-essential care, aesthetic services	No explicit exclusions	Small number of limited conditions, e.g. non medical plastic surgery
Maternity benefits	Yes	Yes	Yes, with a separate package, lump sum payment
Annual physical check-up	Yes	Yes	No
Prevention, health promotion	The UC[8] scheme requests budget for prevention and health promotion for the whole population.		
Services not covered	Private bed, special nurse	Special nurse	Private bed, special nurse

Adapted from: Mills et al. 2005

[6] Source: National Health Security Office (2007a) *Manual of national health security (in Thai)*, Nonthaburi, NHSO

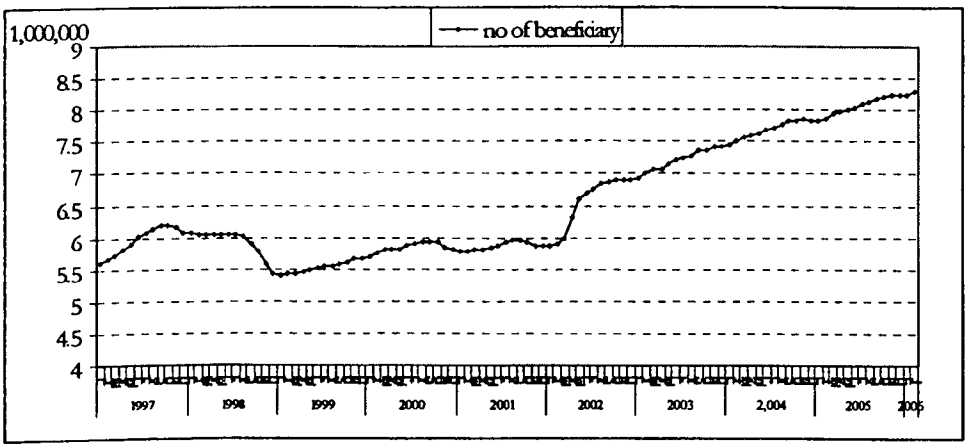
[7] CSMBS patients with chronic disease and registered with a hospital do not have to pay in advance for OPD services

[8] 30 Baht = 0.44 Pound (1 Pound = 71 Baht).

3.3.1 Problems and reform of the Social Security Scheme

The SSS was set up in 1991 to provide financial security to formal sector workers for sickness, maternity, invalidity, and death (Tangcharoensathien et al. 1999b). At first, firms with more than 20 workers were required to participate and coverage was then expanded to firms with more than 10 workers in 1994. Since 2002, firms with more than one worker have to participate in the scheme[9]. This policy has led to an increase in the number of beneficiaries of SSS as shown in Figure 3.2.

Figure 3.2 Number of registered beneficiaries of Social Security Scheme between 1997 and 2006



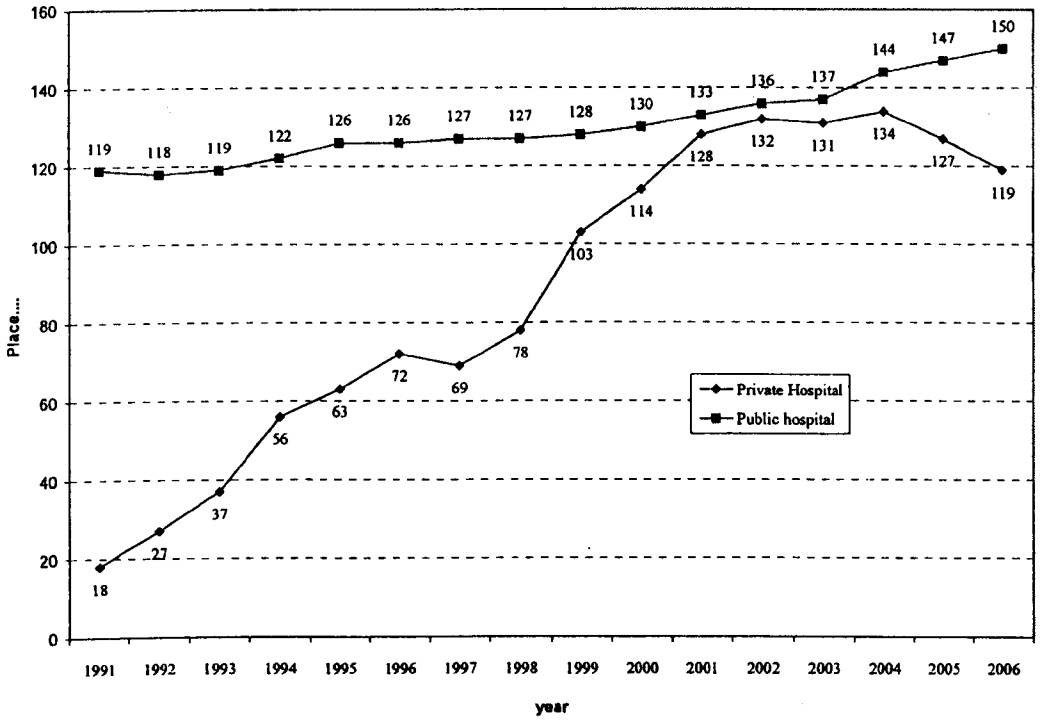
Source: Medical Coordination and Rehabilitation Division, Social Security Office

The SSO enters agreements with hospitals of more than 100 beds, which meet certain requirements regarding infrastructure and personnel, as its main contractors. Each main contractor receives a capitation budget for ambulatory and inpatient services. They can contract with a higher level hospital as a supra contractor for referral of severe cases and with a lower level as a subcontractor. They are responsible for paying for services when beneficiaries receive services from both levels. The main contractor hospitals are both public and private hospitals with more than 100 beds (Jongudomsuk 2005). Private main contractors have increased consistently since the beginning of the SSS because the capitation rate was sufficient to generate profit. The SSS can attract hospitals into the market and expand subcontractors to attract beneficiaries (Yip et al. 2001). Private main contractors have formed nearly half of the total of main contractors since 2001 (Itivaleekul 2002). However, currently, the

[9] Social Security Royal Decree 2002

number of private hospitals has decreased as a result of two major problems. First there has been slow growth in the capitation rate since 2000 (Srithamrongsawat 2007). Second, the policy of promoting Thailand as a medical hub has led private hospitals to change strategy to provide services for foreign patients (Srithamrongsawat 2007). The numbers of hospitals under the SSS from 1999 to 2006 are shown in Figure 3.3.

Figure 3.3 Number of hospitals under Social Security Scheme between 1991 and 2006



From: Research and Development Section 2006

There were several problems with the implementation of the SSS. First, the contributions were inequitable, since the contribution by employees was limited to a maximum salary of 15,000 Baht/month; therefore, employees with a higher salary were paying relatively less contribution than the low salary group. Second, the SSS scheme has focused on curative services, with no budget for preventive and promotive care (Tangcharoensathien et al. 1999b). By law, the SSO cannot provide resources for prevention and promotion activities; but now the NHSO is responsible for setting the budget for prevention and promotion for the SSS and CSMBS. Third, the SSO monitored hospital quality of care only by structural components. There was no monitoring of process or outcome of care at contracted hospitals. Fourth is the limit

on the number of beneficiaries. There were suggestions from academics to expand coverage to dependants of beneficiaries or to the informal sector; but the SSS still focuses on employees in the formal group (Charoenparij et al. 1999). Article 40 of the Social Security Act permits the self-employed or informal workers to participate in the SSS. However, few do so.

3.3.2 Problems and reform of the Civil Servant Medical Benefit Scheme

There are three main problems of the CSMBS scheme: inefficiency, inequity, and cost escalation (Tangcharoensathien et al. 2003). Inefficiency and inequity are evident in the longer LOS. Table 3.5 shows the LOS ratio of various diagnoses for CSMBS patients in public hospitals compared with LOS for private hospital patients. The results imply inefficiency of service in CSMBS patients in public hospitals. Furthermore, the scheme's use of expensive brand name drugs is also inefficient. Limwattananon et al. (2004) studied drug use between health insurance schemes between 2000 and 2002 and found that CSMBS patients were 9.7-13.2 and 15.6-23.1 times more likely to receive COX2 inhibitors in a year than Social Security Scheme (SSS) and UC beneficiaries, respectively (Limwattananon et al. 2004). During the economic crisis in 1999, it was government policy to use only the essential drug list, and there was a decrease in expenditure in the CSMBS as shown in Figure 3.4 (Ratanavijitrasin 2005). However, after that, total expenditure increased again especially during the 2004-2005 period. This was the effect of FFS payment under the CSMBS. Although there was a regulation requiring physicians wishing to prescribe drugs not on the essential drug list to seek approval from the hospital pharmaceutical committee, in practice there was evidence that most hospitals approved those drugs without full consideration (Sriratanaban 2002). Furthermore, shortage of funding put pressure on providers to make more income from the CSMBS, as shown from evidence of CSMBS expenditure (Srianand 2002).

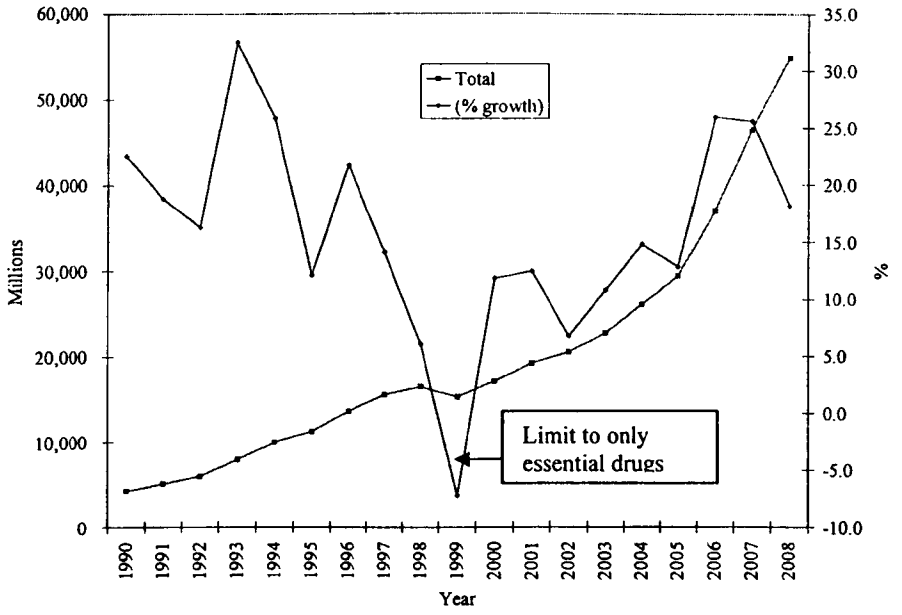
Table 3.5 Average length of stay by different diagnosis of Civil Servant Medical Benefit Scheme patients in public hospitals and private hospital patients

Diagnosis	Public hospital		Private hospital		CSMBS: private ratio
	Mean days	SD	Mean days	SD	
Diarrhoea	6.42	6.11	2.33	2.65	2.9
Cataract	7.56	6.01	3.36	3.37	2.2
Normal childbirth	4.75	2.82	5.49	2.98	0.9
Diabetes	19.71	20.93	5.75	5.65	3.4
Pneumonia	17.78	26.75	5.16	4.68	3.4
Hypertension	17.44	20.03	5.21	7.22	3.3
Heart disease	14.93	17.39	4.82	6.96	3.1

From: Tangcharoensathien et al. 2003

Another problem of the CSBMS scheme is rising expenditure despite falling numbers of beneficiaries due to civil service reform (Sriratanaban 2002). From 1990, growth of CSMBS expenditure was higher than 10% p.a., except in 1999 and 2002 as shown in Figure 3.4. The problems of high expenditure and regulation led to a proposal to reform the CSMBS scheme. The reform proposal included changing the benefit package, the payments to hospital, and setting up an independent organization to manage the scheme (Sriratanaban 2002). However, the reform processes are still ongoing.

Figure 3.4 Civil Servant Medical Benefit Scheme expenditure and percent growth between 1990 and 2008



From: The Comptroller General's Department and GFMIS

3.3.3 Problems and reform of the Universal Coverage Scheme

UC scheme implementation used experience from the SSS and CSMBS in relation to five issues (Tangcharoensathien et al. 2007). First, the UC scheme used a contract model with arrangements for private and public competition, although in the early phase few private hospitals joined the scheme. The contracting unit of the UC scheme was called the contracting unit for primary care (CUP). These were mainly community hospitals acting as main contractor. The CUP is a fund holder providing comprehensive care to the population in its catchment area (Hughes and Leethongdee 2007). Second, a capitation payment system was used since Thailand had favourable experience of using capitation in the SSS to control cost and increase efficiency. However, the UC scheme used capitation for preventive and promotive care and ambulatory care, while using prospective payment with global budget by diagnosis related groups (DRGs) for inpatient services. With respect to the payment system, in the first year of implementation, there were two major dimensions governing the allocation of the budget; the treatment of payment for inpatients and the handling of payment of salary. With regard to inpatients, there were two approaches to payment, inclusive capitation and exclusive capitation. Inclusive payment meant that the CUP received the entire budget, for OP, PP, and IP, and the CUP had to pay for the inpatient expenses at other hospitals when their patients were referred. Exclusive

capitation meant that the CUP received the OP and PP budget and the IP budget was pooled at the provincial level and inpatient expenses reimbursed from the provincial pool using the DRG system. If the CUP referred patients to other CUPs in the province, they did not pay directly since receiving CUPs were reimbursed from the provincial pool (Pokpermdee 2005). As regards salary, there were two alternatives also. Salary deduction at CUP level meant that the CUP received a budget which included staff salaries. Salary deduction at provincial level meant that salaries of staff in all CUPs of the province were deducted (and paid) at this level and each CUP received the non salary budget. Each province could decide whether or not to use inclusive or exclusive payment and on the level of salary deduction so it was possible across the country to have four different payment methods in existence: inclusive or exclusive and with or without salary subtraction as shown in table 3.6. In the second year of UC implementation, the policy was adopted of exclusive payment and salary subtraction at provincial level. By 2009, the policy was exclusive payment at national level and salary subtraction at provincial level (National Health Security Office 2007a).

Table 3.6 Payment alternatives in the first year of UC implementation

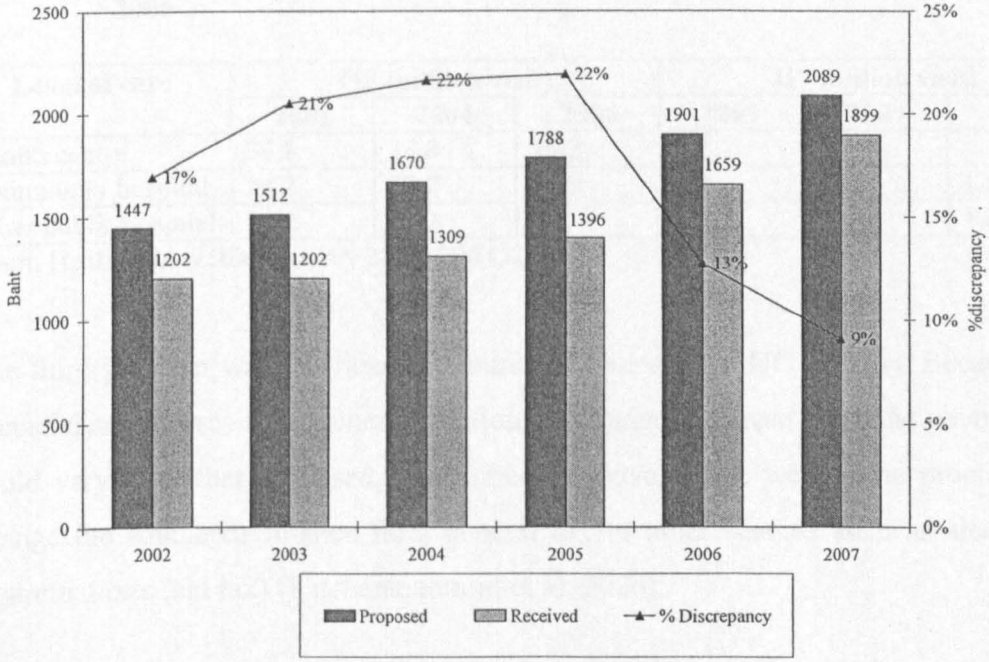
	Inclusive	Exclusive
Salary subtraction at CUP level	1	2
Salary subtraction at provincial level	3	4

Third, the UC scheme tried to split the provider and purchaser roles by setting up a new organization (the National Health Security Office) to be the purchaser and design the benefit package. Fourth, the UC scheme provided a comprehensive package, from preventive and promotive care to ambulatory and hospitalization care. Fifth, to improve access to care, the scheme used neither co-payment nor deductibles for those of low income, the elderly, and children while the co-payment was only 30 Baht for members who were not in the exempt group. However, in 2006, all members were exempted, followed a change of government which led to a new government policy[10].

[10] http://law.nhso.go.th/

After implementation of UC, there were four major problems. First, there was the discrepancy between proposed and received capitation (Tangcharoensathien et al. 2007). This led to constraints for hospitals and to cross-subsidization from other schemes especially CSMBS. Figure 3.5 shows the trend of capitation and discrepancy of proposed and approved capitation from the government.

Figure 3.5 Discrepancy of proposed and received capitation between 2002 and 2007



From: Tangcharoensathien et al. 2007

A second issue was an increasing utilization rate. Data from HWS showed that the number of patients in OP at all levels of the health service increased after UC implementation in 2001 and decreased after full implementation of the system in 2006 as shown in Table 3.6. This might come from three reasons. First, at the beginning of UC, people believed there were fewer barriers to access services so that these were over utilized. Second, UC implementation resulted in an overload on staff and physicians during this period and in turn led to a problem of brain drain as disillusioned staff moved to the private sector, leaving inadequate staff to provide the public service. Third, there were alleged problems of data collection in the HWS 2006 because the data collection method has been changed when HWS was merged with the Socioeconomic Status Survey. This led to a problem of quality control of data

collection and data accuracy. Regarding inpatient (IP) admissions, there was marked increase in community hospitals between 2001 and 2006 while other hospitals seemed to be stable. This might be explained by the investment in community hospitals during this period because most of the UC scheme funds were paid directly to the CUP. Their budgets included funds for investment in equipment or buildings. Hospitals were able to invest in expanding services, especially in expanding the number of beds.

Table 3.6 Utilization by UC members from Health and Welfare Survey 2001 to 2006

Level of care	OP (million visit)			IP (million visit)		
	2001	2004	2006	2001	2004	2006
Health centre	36.8	36.8	19.2			
Community hospital	24.2	27.7	20.9	1.0	2.0	1.8
Other public hospital	26.2	11.7	8.7	1.7	1.7	1.6

From: Health and welfare survey 2001, 2004, 2006

The third problem was the financial source supporting the UC scheme. Because the financial source was from general taxation, the budget received from the government could vary from that proposed, as mentioned above. There were some proposals to change the source of finance from general tax to other sources such as alcohol or cigarette taxes (sin tax) (Patcharanarumol et al. 2006).

The fourth problem was equity of distribution of personnel. At first, the use of capitation payment in the UC scheme, especially inclusive capitation and incorporation of payment for salaries, had a strong effect on redistribution of personnel because CUPs in rural areas had a high catchment population but relatively few personnel while large hospitals with small catchment areas did not receive sufficient funds to cover the salary of all their staff. Therefore, they allowed some staff to transfer to help small hospitals to service patients in their catchment area. However, when the policy was changed to hold the salary budget at the national level, this reduced the effect of capitation on redistributing personnel to understaffed areas (Hughes and Leethongdee 2007).

3.4 Evidence of insurance scheme performance in Thailand

There is some empirical evidence from studies in Thailand about linkages between health insurance attributes and scheme performance. In this review the magnitude of

variation in scheme performance from different characteristics of public health insurance were investigated in terms of quality of care and utilization.

Because of the variation in the insurance system in Thailand, the outcome of health services including quality, efficiency, accessibility, cost, and responsiveness between different public health insurance schemes has been of concern. By reviewing the literature, the study can draw on current knowledge and expose gaps requiring further research. This part of the literature review examines articles on public health insurance in Thailand related to the outcome of health services.

Methods

The objective of the search strategy was to identify all relevant articles using selected text words and MeSH words. Searching was done exhaustively of both Thai and English articles in Pubmed, and some relevant journals on Thailand health policy. The search was done between 4 and 7 February 2009, with the search period being between 1990 and 2009. The inclusion criteria were Thai people, hospital, health personnel and interventions on the different public insurance schemes under different payment types (fee-for-service, capitation, and prospective payment). Within prospective payment, both DRG and case based payment were included. Text was searched used both key words and MeSH words as shown in Table 3.7.

Table 3.7 Details of text search of Thai health insurance articles

Step	Word list	Literature search
#1	Thai* and (payment OR fee-for-service OR capitation OR prospective payment OR DRG* OR social insurance OR universal coverage)	102
#2	Thai* and ("Physician Payment Review Commission"[MeSH] OR "Insurance, Health, Reimbursement"[MeSH] OR "Risk Sharing, Financial"[MeSH] OR "Fee-for-Service Plans"[MeSH] OR "Outliers, DRG"[MeSH] OR "Diagnosis-Related Groups"[MeSH]) OR "Capitation Fee"[MeSH] OR	41

Step	Word list	Literature search
	"Social Security"[MeSH] OR "Universal Coverage"[MeSH])	
#3	#1 or #2	112

Search results

The search of Pubmed resulted in 112 articles. On reviewing the titles and abstracts, 26 articles fitted the inclusion criteria relevant to the search objective, 9 Thai articles and 17 international articles.

Thai articles were searched from three main sources: Journal of Health Science, Health System Research Institute (HSRI), and National Health Security Office Library. There were four articles from the first source and four from HSRI. The text searches in both sources were health insurance, social insurance, civil servant, and payment. Total number of articles was nine, as shown in Table 3.8.

Table 3.8 Total number of search articles in each source

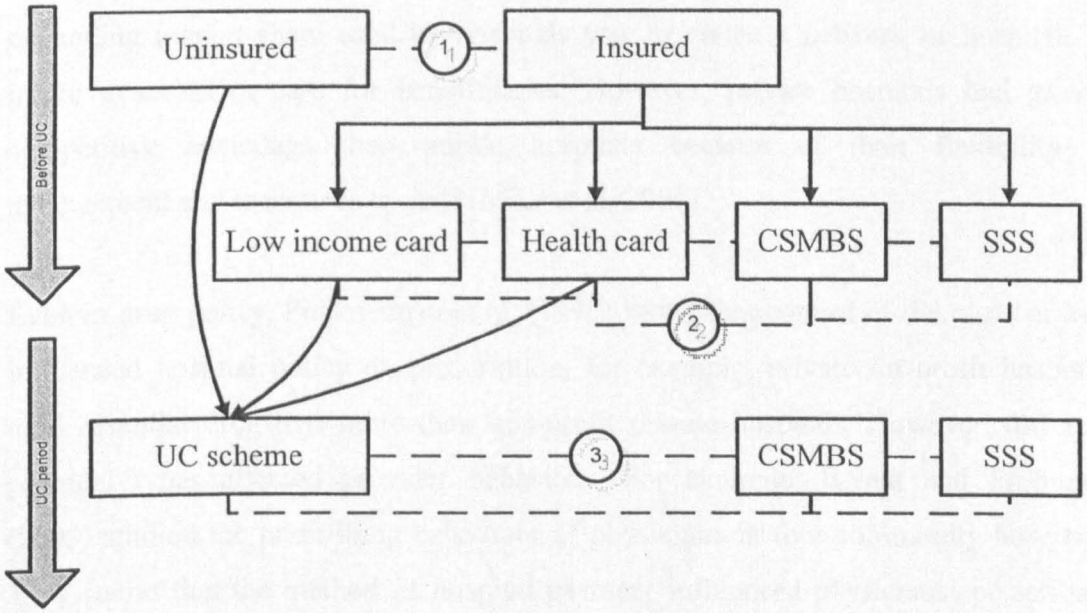
Article	Thai	International
Medline and Embase		17
Journal of Health Science	4	
Health System Research Institute	4	
National Health Security Office Library	1	
Total	9	17

Findings

The discussion of this section can be summarized into two periods, before UC implementation and after UC implementation. As mentioned above, before UC implementation, health insurance in Thailand comprised four major schemes: CSMBS, SSS, low income card scheme, and health card scheme. The framework of

articles related to performance of health insurance differed between those periods. Figure 3.6 presents a diagram of articles related to health insurance in the periods before and after UC implementation. The dotted lines are issues of study which can be divided into three main groups; articles on issues between uninsured and insured groups; articles on the four main schemes before UC implementation; and articles on the three main insurance schemes after UC implementation.

Figure 3.6 Diagram of articles related to insurance schemes in Thailand



Before universal coverage implementation

Studies that compared the uninsured and insured groups covered several topics such as equity, efficiency, quality of care. First, there were problems of inequity of access to care. The study of Pannarunothai and Mills (1997) demonstrated that the poor paid more for health care than the wealthy. Furthermore, the poor usually were not covered by government insurance. The first income quintile spent 21.2% of household income on health care while the fifth income quintile spent only 2.1%. Furthermore, uninsured patients seemed to report lower morbidity and had lower utilization than insured people (Pannarunothai and Mills 1997).

The studies comparing the four schemes examined issues such as effect of payment on utilization and quality of care. Tangcharoensathien et al. (1999) studied perceptions of quality and satisfaction between patients in SSS and the other schemes.

The main comparison was the effect of payment by capitation and by FFS. The study found that patients in the SSS perceived lower quality in process of care than CSMBS patients (Tangcharoensathien et al. 1999a). The utilization rate of health cardholders was higher than SSS. For example, OP/person/year of card holders was 2.04 in 1995, while for SSS it was 1.23 and IP/person/year of card holders was 0.09 while for SSS it was 0.02 (Pannarunothai et al. 2000).

A study of the implementation of the capitation payment for employees in the SSS shows that it created competition between public and private hospitals. The method of expanding market share used by hospitals was to create a network of hospitals to improve access to care for beneficiaries. However, private hospitals had greater competitive advantage than public hospitals because of their flexibility of management and incentives to staff (Mills et al. 2000).

Even in drug policy, Pitaknetinan et al. (1999) found that control of the costs of care influenced hospital policy on prescription; for example, private for-profit hospitals used essential drug lists more than non-profit private hospitals. However, different payment types affected provider behaviour. For example, Bryant and Prohmmo (2005) studied the prescribing behaviour of physicians in four community hospitals. They found that the method of hospital payment influenced physicians' prescribing behaviour, though it was not directly related to physician income. FFS patient received more expensive drugs than capitation patients (Bryant and Prohmmo 2005).

Regarding the cost of services, Yip et al. (2001) compared differences in average LOS, average charge per admission, average drug and laboratory charge per admission between CSMBS paying FFS and of SSS paying capitation. The results confirmed that average LOS, charge per admission, drug cost per case, and laboratory cost per case for SSS patients was shorter than for CSMBS patients. For example, in acute appendicitis cases, the average LOS of CSMBS patients were 4.6 days compared to 2.3 days for SSS patients. Total charges for CSMBS patients were 4.5 times higher while drug cost per case was 2 times and lab cost per case was 4 times higher than for SSS patients (Yip et al. 2001). However, some confounders such as age and sex might affect this result.

Since the health card scheme was a voluntary scheme, the main problem was adverse selection and moral hazard. Pannarunothai et al. (2000) found that there was evidence of adverse selection and moral hazard of voluntary health cardholders.

In 1997, Thailand had faced an economic crisis leading to increased unemployment and poverty. Although the public budget was increased to lessen the social impact of the crisis, the uninsured group had a higher rate of low birth weight (Tangcharoensathien et al. 2000). This situation led to calls for the reform of health insurance from academics, civic groups and politicians to introduce Universal Coverage, which became an important policy of the Thai Rak Thai party in the 2001 election (Jindawatana and Pipatrarojkomol 2003).

After universal coverage implementation

After UC implementation, Thailand had three major public health insurance schemes to cover the whole population but the details of each scheme were different as mentioned above. Articles in this period demonstrated the problems of the different schemes such as utilization, accessibility, quality of care. These groups of articles can be summarized into three indicator approaches, utilization, efficiency, and quality.

3.4.1 Utilization

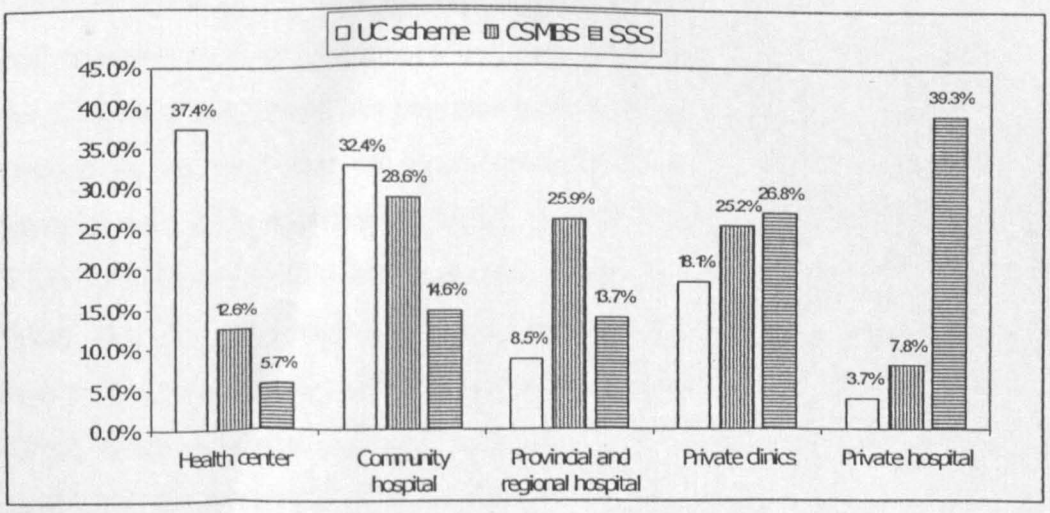
Utilization depends on both patient demand and provider service. From the demand side, universal coverage led to an increase in demand by the population by reducing the barrier of cost to 30 Baht for people who had no insurance coverage. On the supply side, providers have tended to alter their service provision according to different insurance schemes. For example, in DM drug prescription, CSMBS patients receive a more expensive drug than UC scheme and SSS patients (Chariyalerdsak et al. 2004).

Universal coverage achieved the objective of increasing access by expanding coverage to the uninsured who were mainly the poor. Coronini-Cronberg et al. (2007) conducted a survey amongst the poor population of a slum in the northeastern region. They found that 52% of UC scheme respondents had increased use of services since UC implementation (Coronini-Cronberg et al. 2007). Another survey in three poor

provinces in Thailand found that coverage of UC insurance in those provinces was 74%. The study found that insured groups had more likely to seek care than the uninsured group (Suraratdecha et al. 2005). Somkotra and Detsomboonrat (2009) demonstrated that dental services under UC scheme, SSS, and CSMBS were pro rich. Utilization of dental services in the fifth income quintile was four times higher than in the first income quintile (Somkotra and Detsomboonrat 2009). Kitajima et al. (2005) found that CSMBS patients were more likely to receive antiretroviral drugs (ARVs) than UC scheme patients (Kitajima et al. 2005).

Vasavid et al (2004) analysed Health and Welfare Survey data for the years 2001 and 2003 to explore utilization before and after the full effect of universal coverage. They found that, for all three schemes, average utilization by ill patients of health facility based services in 2003 was 70.8%. There were differences in using health facilities between schemes. UC scheme patients mostly used health centres and community hospitals. CSMBS patients generally used community hospitals and provincial or regional hospitals. SSS patients usually used private hospitals. CSMBS and SSS used private clinics at nearly the same rate. The details are in Figure 3.7.

Figure 3.7 Distribution of health facility utilization by scheme in 2003



Source: Vasavid et al. 2004

The outpatient utilization rate increased in all insurance schemes between 2001 and 2003 as shown in Table 3.9. The admission rate increased in the UC scheme by about 8.8%, from 0.076 episode/person/year in 2001 to 0.083 episode/person/year in 2003,

while the admission rate decreased in the other insurance schemes. This might be due to the increase in access to health care for UC scheme patients while the number of beds was limited. In effect the hospitals had to squeeze out other insurance patients. The admission rate of CSMBS patients was higher than the SSS and UC scheme, probably because the age structure was older (Chariyalerdsak et al. 2004).

Table 3.9 Outpatient and admission rates between 2001 and 2003

Outpatient/admission rate (episode/person/year)	UC scheme	CSMBS	SSS	Private insurance	Total
Outpatient					
2001	4.10	3.77	2.44	2.99	3.94
2003	4.93*	4.90	2.98	3.53	4.71
Rate of change (%)	20.1	30.1	22.4	18.0	19.7
Inpatient					
2001	0.076	0.104	0.070	0.153	0.080
2003	0.083*	0.102	0.060	0.099	0.080
Rate of change (%)	8.8	-2.3	-0.3	-34.8	5.6

* Outpatient and admission rate includes uninsured in this group
From: Vasavid et al. 2004

3.4.2 Efficiency

Universal coverage incorporated various features to promote efficiency of health care such as using capitation payment to promote efficient use of resources, and employing the CUP as a gatekeeper. As mentioned above, there were four alternative payment options in the first year of implementation. Provinces which selected inclusive payment and salary subtraction at CUP level had difficulties controlling costs. This forced providers to reallocate staff from areas with low capitation income and high salary bills (mostly where there were large hospitals) to areas with high capitation income (mostly rural areas) (Srithamrongsawat and Lapying 2003). However, this choice lasted only one year and there was no clear evidence on which model was more efficient. Even now, when payment to CUPs is exclusive capitation, DRGs for IP are managed at national level, and salary subtraction is at provincial level, more information is needed to evaluate the efficiency of this model.

The variations and changes in capitation policy in the early years of UC brought a loss of cash flow for some hospitals, especially hospitals with small catchment areas. These hospitals had to request contingency funds from the government to balance their cash flow and they had to submit proposals to improve the efficiency of the CUPs. In the first year of implementation, 70% of public hospitals encountered cash flow problems (Ngorsuraches and Sornlertlumvanich 2006). However, recently Puenpatom and Rosenman (2008) analysed hospital efficiency by using bootstrap Data Envelopment Analysis (DEA). They found that large public hospitals which used to have problems of shortage of cash flow had increased their efficiency in use of resources (Puenpatom and Rosenman 2008).

3.4.3 Quality

Articles related to quality of care after UC implementation can be categorized into two themes. The first concerns the satisfaction of patients and providers. The NHSO has surveyed the satisfaction of UC patients and providers especially physicians since 2002 by using a rating scale (0-10) to assess satisfaction level. The results of this exercise show that Thai people are more satisfied with universal coverage than are providers, as shown in Table 3.10 (National Health Security Office 2007c).

Table 3.10Satisfaction score of providers and Thai people

	Average score of satisfaction (score 1-10)				
	2003	2004	2005	2006	2007
Thai people satisfaction	8.01	7.88	7.83	8.08	7.73
Provider satisfaction	4.96	NA	5.42	5.58	5.56

Adapted from: National Health Security Office 2007c

Table 3.11 shows the percentage of UC patients satisfied with different elements from the survey. Although these results are descriptive, not controlling for confounding factors, UC scheme patients seem to be satisfied with physicians and the outcome of care, but are less satisfied with drugs and equipment.

Table 3.11 Details of satisfaction of patients

	Percent of satisfaction of patients				
	2003	2004	2005	2006	2007
Physician	92.9	92.9	93.3	92.2	90.9
Nurse	89.4	91.2	92.0	90.5	87.6
Drugs	83.3	86.6	91.1	89.8	85.9
Equipment	85.8	90.4	92.9	90.2	88.5
Outcome of care	90.2	91.8	94.4	91.7	90.0

Adapted from: National Health Security Office 2007c

The second theme is the quality of received services. Most of articles in this theme related to hospital services. There were possible two issues in these research including drug quality and result of treatment.

On drug quality, Laosee et al. (2005) studied the prescribing of haemorrhoid drugs in community hospitals. They found that use of an expensive drug (proctosedyl) was in decline, while use of a cheap traditional drug (Petch Sang Kart) for haemorrhoids did not differ between pre and post UC policy periods (Laosee et al. 2005). The reason given for this was the budget constraints under the UC scheme. This finding was the same as in research by Chariyalerdsak et al. (2004) and Panpanich et al. (2003). They found that the use of antibiotics for viral URI reduced significantly in patients who were exempt from co-payment compared to the period before implementation. This research concluded that patients who were exempt from co-payments were prescribed fewer antibiotics after UC implementation. Chansung et al. (2003) show that DM patients under the 30 Baht scheme received a lower priced drug than those under CSMBS, for which payment was fee-for-service, but Chansung et al. (2003) could not demonstrated the outcome of care in these groups (Chansung et al. 2003).

Bryant and Prohmmo (2005) studied the effect of payment mechanisms and prescriptions in four community hospitals. They found that comparing between fee-for-service in CSMBS patients and capitation payments witholder people, physicians prescribed more expensive drugs for fee-for-service patients than for capitated patients (Bryant and Prohmmo 2005).

Limwattananon et al (2004) studied prescription data of specific drugs in hospitals before and after UC implementation. They found that the overall rate of increase of drug expenditure was lower than that before UC implementation. For specific drug usage, they found that prescription of NSAID, ACE inhibitors and A_2 receptor antagonist depended on type of insurance coverage. CSMBS patients received more new and high cost drugs than patients with other insurance. However, the factor that affected prescription was not only different payment types but also physician behaviour and hospital policy. Some hospitals restricted use of drugs in patients making capitation payments, such as UC scheme and SSS patients, but allowed free choice for physicians to prescribe drugs for CSMBS patients who paid fee-for-service (Limwattananon et al. 2004).

In terms of treatment results, Chanjar (2004) studied the outcomes of service in the CSMBS, SSSand Health Card Scheme (the latter later replaced by an expanded UC scheme also covering the uninsured group). She used the outcomes of Caesarean section and Asthma as tracers for non acute and acute conditions. The study found that results of treatment in Caesarean section and Asthma patients were better in the CSMBS group compared to the SSS and Health Card Scheme (Santayakorn 2004).Another example is a study of mortality of patients with acute myocardial infarction (AMI) in Buddhachinaraj hospital. The study found that insurance had no effect on mortality after controlling for confounding factors. Only severity of disease was significantly related to mortality from AMI (Kongtawon et al. 2007).

3.5 Thai experience of Diabetes Mellitus care

In Thailand, Aekplakorn et al. (2003) undertook a study of the prevalence and management of DM in adult patients. The aim of the study was to find the prevalence of DM in people ≥35 year old. The study showed that prevalence of DM was 9.6 ± 0.7% (known DM 4.8 ± 0.5%, newly diagnosed 4.8 ± 0.5%) (Aekplakorn et al. 2003). This data on the newly diagnosed is important, being equal to known DM cases. Chetthakul et al. (2006) found the prevalence of type II Thai DM patients to be 31.4% of DM patients between 35 and 60 years (Chetthakul et al. 2006a). Patients are prone to develop vascular complications if they do not have early diagnosis and prompt

treatment. Diabetic retinopathy (DR) is one of the most common microvascular complications of DM patients. The factors associated with DR were duration of DM of more than 5 years, systolic blood pressure, and HbA1C more than 7%,

3.5.1 Standard treatment of Diabetes Mellitus

Thailand has developed a standard treatment for DM recently. The National Health Security Office supports the use of standard DM care as one of the quality of care indicators. The endocrinology society of Thailand has published standard practice guidelines for DM (Health Service Guidelines Development Project Office 2006). The details of this treatment standard are:

1. Check body weight at least 4 times a year
2. Physical examination once a year
3. Eye examination by ophthalmologist once a year (if possible)
4. Check blood pressure at least 4 times a year
5. Check FPG at least 4 times a year
6. Check HBA_{1c} at least once a year
7. Check microalbumiuria once a year
8. Check lipid profile once a year
9. Educate patient to check blood sugar or plasma glucose
10. Educate to control body weight and food control
11. Stop smoking and limit alcohol consumption
12. Evaluate quality of life of patients

The laboratory targets for management of DM are given in Table 3.12.

Table 3.12 Laboratory targets of Diabetes Mellitus quality indicators

Laboratory test	Target
Fasting plasma glucose (mg/dl)	90-130
Postprandial glucose (mg/dl)	<180
HbA1C (%)	<7
Total cholesterol (mg/dl)	<200
LDL-cholesterol (mg/dl)	<100
HDL- cholesterol (mg/dl)	>40
Fasting triglyceride (mg/dl)	<150
Body mass index (kg/M2)	male (20-25) female (19-24)

Laboratory test	Target
Waist circumference	male 90 cm female 80 cm
Blood pressure	<130/80

From: Health Service Guidelines Development Project Office 2006

There are studies on various outcomes of DM patients. Rawdaree et al (2006) studied the Thailand Diabetes registry project in 11 tertiary centres. The finding was that nephropathy was the most common complication in DM patients and had a prevalence rate of 43.9% followed by retinopathy at 30.7% (Rawdaree et al. 2006). This complication is related to dyslipidemia, hypertension, and long duration of Diabetes Mellitus.

Pannarunothai (2000) studied the knowledge and practice of DM patients at the OPD of Buddhachinaraj Phitsanulok hospital. From interviews with 124 patients, the finding was that most patients (97%) had not understood the process of drug administration. On knowledge of self-care, a significant number of patients (38.7%) had less knowledge on foot care compared to regular exercise (83.9%) (Pannarunothai 2000).

3.5.2 Studies of outcome of care in Diabetes Mellitus and health insurance in Thai experience

There have been a number of studies about DM patients in Thailand. However, few studies have followed the outcome of care in DM.

There are some empirical studies on DM management in Thailand. Chetthakul et al (2006) studied the process of Diabetes care in tertiary hospitals in 1997, 1998, and 2003. They found that the number of patients checked for HbA1c, serum creatinine, urine albumin, lipid profile, retinal examination, and foot examination, increased over the years. In 2003, more than 90% of patients received measurement of FPG, HbA1c, lipid profile, serum creatinine, urinalysis, foot examination. Achievement of the targets for HbA1c and FPG improved significantly. Patients who reached the target of HbA1c (<7%) were 7.7% in 1997 and 38% in 2003. The target for FPG of <130 mg/dL was met for 30% of patient in 1997 to 40.2% in 2003 (Chetthakul et al. 2006b).

Pratipanawatr et al (2006) followed up the mortality rate of DM patients over 3 years between 2003 and 2005 in a cohort study of the Thai Diabetes Register project. The death rate of DM patients was 2.02% per year (Pratipanawatr et al. 2006). The common causes of death were infection, cardiovascular disease, cancer, and chronic kidney disease. The study also found that UC scheme membership, previous history of cardiovascular disease, smoking, insulin treatment, low education level, renal insufficiency, low plasma HDL, and systolic blood pressure were the major mortality risk factors. Possible reasons for UC scheme membership increasing the risk of mortality were that most UC patients have low education, low access to services, and low opportunities to obtain appropriate health care.

Since Thailand implemented universal coverage in 2001, there have been studies of various diseases. DM is one of the chronic diseases that has been used as a tracer for quality of care between major public health insurance schemes. Chariyalerdsak et al (2004) summarized that there is inequity in access to expensive drugs by payment mechanism. Patients under the fee-for-service scheme (CSMBS) tended to receive more expensive drugs than patients under SSS and the 30 baht scheme.

3.6 Summary

The review of the Thai literature has discussed the development of universal health insurance in Thailand. Currently, Thailand has three public insurance schemes. The review highlighted the development of each insurance scheme, with their different objectives when they were established. Each insurance scheme had its own limitations and gaps to reform. After universal coverage implementation in 2001, this changed the health insurance system in Thailand, expanding public health insurance to cover the whole population. Consistent with Kutzin's insurance framework, there are different characteristics of those insurance schemes. However, the challenge is whether the universal coverage can improve the health system performance equally between schemes or not.

In terms of performance, the literature reveals that scheme characteristics affect performance in areas such as utilization, efficiency, and quality of service. Schemes

can affect both beneficiaries and providers. For patients, universal coverage seemed to reduce barriers to access to health services. However, for providers, the insurance schemes seemed to affect hospital policy and provider behaviour, as several studies showed different patterns of drug prescription between different health insurance schemes.

This review of the literature on health insurance and its performance in Thailand has identified a number of gaps in current knowledge. Few empirical studies are available regarding the consequences of scheme performance on the health system. Most of the studies are limited in scope to one particular topic. Therefore, studying the performance of the three public insurance schemes on some selected issues from both the provider and the patient side will make an original contribution and fill a gap in knowledge.

Using DM as a tracer for quality of care in Thailand is possible; there is standard practice guideline for DM management. These standards were used to study process and outcome of DM treatment for patients. However, most of research related to DM in Thailand relates to clinical and patient outcomes. Few researchers have studied insurance scheme and DM service quality, although some research has found that insurance status relates to outcomes for DM patients.

CHAPTER 4: OBJECTIVES AND METHODOLOGY

This chapter discusses the research aim, objectives, and the study methodology. There are seven sections in the chapter. The first section presents the aim, objectives, and development of methodology. The second section describes the study setting in Samutsakhon province, Thailand. The methodology is described in the third section, followed by methodological details for each of the study's objectives in sections four and five. Section six presents a summary of the study methodology. The final two sections then describe the possible biases of the researcher and the study limitations.

4.1 Aim and objectives

4.1.1 Aim

The study aims to evaluate three public health insurance schemes in terms of their performance in selected areas. The results of this study can help policy makers both in Thailand and in other countries to identify appropriate approaches for public health insurance schemes.

4.1.2 Objectives

1. To assess and explain the performance of the three public health insurance schemes in terms of overall use of ambulatory and inpatient care, and efficiency and quality in use of resources for Diabetes Mellitus (DM) patients.
2. To identify the quality of care provided for Diabetes Mellitus (DM) within each insurance scheme, and then explore how quality of care might be affected both by the insurance scheme design and by other factors.

4.1.3 Development of methodology

Based on the literature review, a research framework was developed as shown in Figure 4.1. The framework was developed by integrating the Kutzin model of insurance functions, Carrin and James' framework on achieving universal coverage,

and Figueras et al.'s model of health system performance (Kutzin 1998, Carrin and James 2005, Figueras et al. 2005). Insurance in this context can be defined as coverage that provides for the payments of benefits as a result of sickness or injury and includes insurance for losses from accidents, medical expenses, disability, or accidental death and dismemberment (Marcinko 2006). Within this, the specific concern of this thesis is coverage of the costs of medical care.

Insurance elements can be divided into stakeholder or system components shown as boxes and activities shown as arrows. Different countries have different types of stakeholder and system components. The main stakeholders in health insurance systems comprise purchasers, service providers, and the insured population. The concept of purchaser mechanism can be divided into three models, single purchaser, multiple purchasers without competition, and multiple purchasers with competition. This concern of this study was the model of multiple purchasers without competition, as this is the current situation in Thailand. For service providers, this study included not only institutions such as hospitals but also personnel such as physicians, nurses, and other personnel in the study. Providers also included private hospitals that were main contractors of the SSS. The insured population was different between schemes and providers might provide different services to serve the different needs and demands of the insured populations.

Performance is defined as attainment in the light of what systems should be able to accomplish with given resources (Figueras et al. 2005). The concept of insurance performance was composed of two elements, achieving universal coverage and improving health system performance (dotted boxes in Figure 4.1).

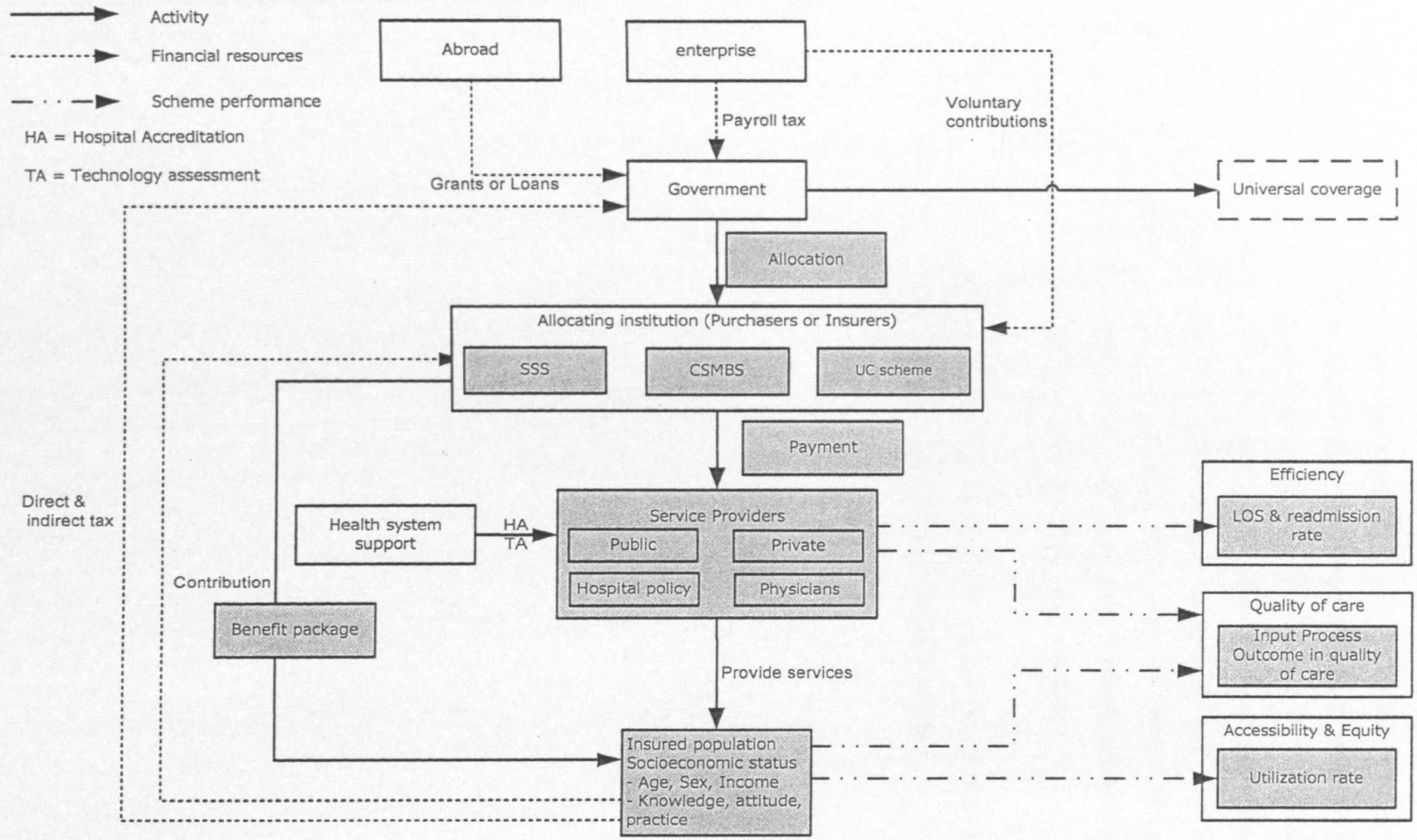
The main concern of this study relates to the grey boxes and dotted-line arrows in the framework. The elements of the insurance system in this study (shown in grey boxes) are composed of a multiple payer system, service providers, and insured population. These elements differ from scheme to scheme. The activities in the different insurance schemes (shown with line arrows) are allocation to insurer, provider payment, service provided by provider, and benefit package. All of these components affect scheme performance. This study focuses on some selected issues of scheme performance.

From figure 4.1, the study has three major elements. The first is overall utilization which, according to the Andersen model, is influenced by predisposing factors (age, sex, marital status, income, education, and socioeconomic status of beneficiaries), enabling resources (insurance status, income), and need (e.g. having chronic disease). Utilization can be defined as patterns or rate of use of single or types of services (Marcinko 2006). In this framework, utilization was defined as visiting health care services for both formal and informal care, and ambulatory or hospitalization service use. Utilization can be viewed as an individual behaviour (Andersen and Newman 1973). Therefore, the scope of the utilization concept is broader and deeper than access to care (Smith 2005).

The second element is analysis at the system level of efficient use of resources, explored in terms of LOS, and early readmission of DM patients. Unlike Donabedian, this study examines efficiency as a factor separate from quality of care per se. Efficiency can be defined as the best use of resources in production (Hollingsworth and Peacock 2008), and the concern of the study was with an aspect of technical efficiency, defined as the relationship between output and costs. LOS sheds light on the efficient use of resources, and was defined as the period from admission to discharge for the episode of hospitalization. Early readmission can be used as an indicator of efficiency and was selected in part because it could be an adverse effect of too early discharge from hospital and hence too short a LOS. This study defined readmission as a readmission with the same primary diagnosis within 30 days after discharge.

The third element is quality of care which can be measured from provider and patient side. Quality of service can be measured from the patient's side by their perceptions and the outcome of treatment, while from the provider's side by input and process of service delivered. In this study, providers are both public and private providers.

Figure 4.1 Conceptual framework of the study



4.2 Study setting

This study used Samutsakhon province as the study site for various reasons. First, it has both public and private hospitals. The public hospitals have patients across all three schemes and all are main contractors of SSS. Second, the province has a mixture of urban and rural characteristics, with areas which are agricultural and similar to rural areas, while the urban area is congested with factories and commercial businesses. Third, patient data were easy to access. Hospitals in Samutsakhon have good information technology systems. Patient data were recorded both electronically and on paper, and were therefore easy to access.

Samutsakhon is located in the central area of Thailand. 30 kilometres from Bangkok (Figure 4.2), and has three districts: Muang, Banpaw, and Kratumban.

Figure 4.2 Map of Samutsakhon province with three districts

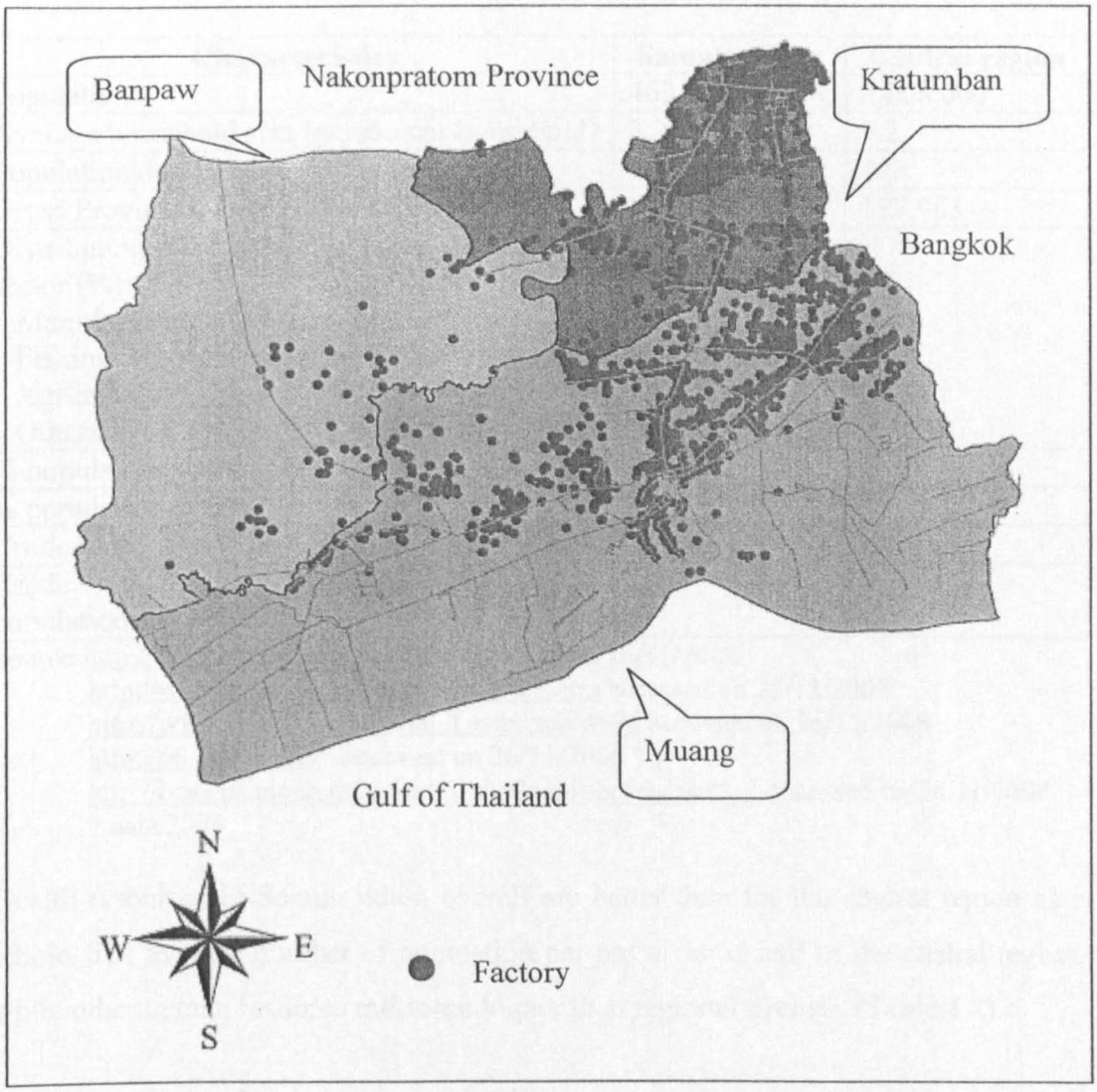


Table 4.1 shows details of the population and social indicators of Samutsakhon province. The economic status of Samutsakhon in terms of Gross Provincial Product per capita is very high. It is the second highest in the country, 2.5 times higher than the country average. The main income of the province is from manufacturing business. Population density is three times higher than the country average. However, in terms of health index, the crude birth rate is higher than average, while the crude death rate is similar to the country value. The average number of people per household size is lower than average for the central region. The ratio of elderly is slightly lower than that for the region, at 10% and the ratio of population under five years old is slightly higher than the regional average.

Table 4.1 Selected social indicators in Samutsakhon 2007

Characteristics	Samutsakhon	Central region
Population	469,934	3,008,000
Average household size (person per household)	2.2	3.2*
Population density (person per square km)	539	178*
Gross Provincial Product per capita in 2007	539,346	197,963
Distribution of Gross Provincial Product by sector (%) - Manufacturing - Fishing - Agriculture - Others	 84 3 0.6 12.4	 64 0.2 6 29.8
% population under 5	8	6*
% population over 60	10	14*
Crude birth rate in 2007 (per 1,000 population)	22.31	10.13*
Crude death rate in 2007 (per 1,000 population)	5.80	5.57*

Source:http://www.samutsakhon.go.th/ accessed on 26/11/2008
http://www.dopa.go.th/hpstat9/people2.htm accessed on 26/11/2008
http://www.nesdb.go.th/Default.aspx?tabid=96 accessed on 26/11/2008
http://66.102.9.132/ accessed on 26/11/2008
http://bps.ops.moph.go.th/index.php?mod=bps&doc=5_1 accessed on 26/11/2008
* data 2006

Health resources in Samutsakhon overall are better than for the central region as a whole. The average number of population per physician is half of the central region, while other human resource ratios are higher than regional average (Table 4.2).

Table 4.2 Ratio of population per health resource

Health personnel resource	Samutsakhon	Central region
Physician	1,857	3,124
Dentist	13,215	15,176
Pharmacist	6,703	6,852
Profession nurse	524	562

Adapted from: http://www.samutsakhon.go.th/

There are three public hospitals in Samutsakhon. Practically, they are all general hospital with more than 150 beds. Furthermore, Banpaw is the first autonomous hospital under MOPH.

4.3 Methodology

Both quantitative and qualitative approaches were employed in the study. The quantitative approach aimed to compare scheme performance, while the qualitative

approach aimed to provide an in-depth explanation of scheme effects through the perceptions of stakeholders. For objective 1, secondary data were used to evaluate scheme performance. For objective 2, retrospective medical record data and patient interviews were used to trace the scheme effect on quality of care of DM. A standard set of service indicators applying to DM were used to judge quality of care. Focus group discussions with DM patients were employed to confirm perceptions of care in DM patients. In-depth interviews and focus group discussions with hospital directors and providers were employed to find perceptions, motivations, and practices relating to DM patients in different schemes and to understand other factors that might affect performance.

4.4 Method of objective 1: To assess and explain the performance of the three public health insurance schemes in terms of overall use of ambulatory and inpatient care, and efficiency and quality in use of resources for Diabetes Mellitus patients.

The methodology here is used to address the question of what the differences in scheme performance are. Some selected indicators were used – overall utilization, LOS and early readmission rate within 30 days of DM patients – to assess the schemes' performance.

This study uses Diabetes Mellitus as the tracer because (1) it is a common disease so there are data available for analysis; (2) it has a clear cut diagnosis so the sample is homogeneous; (3) there is a definite standard of treatment, reducing uncertainty about variation in treatment.

The data come from two sources. The first is the Health and Welfare Survey (HWS) 2005, from which data were used to analyse the overall utilization rate of each scheme. The second is claims data which hospitals use to obtain reimbursement for hospitalized patients. Claims data were used to analyse LOS and early readmission within 30 days from previous admission in DM patients because the accuracy of the data improves every year (Pannarunothai 2002a). Hospitals which provide admissions for CSMBS and UC scheme patients are required to send claims data for

reimbursement while hospitals with SSS patient admissions are required to send claims data for adjusting capitation at the end of fiscal year.

4.4.1 Method for sub-study 1.1: To explore the magnitude of variation in overall utilization between the three insurance schemes

To assess service utilization, a framework of health service utilization was used (Andersen and Newman 1973). The factors determining service utilization were divided into three main types: predisposing, enabling, and illness level. Predisposing factors included demographic structure, social structure, and beliefs. Enabling factors included household income, level of insurance coverage, and living area. Illness level factors included perceived health status and evaluated severity of illness.

1. Source of data

This sub-study addresses the question of overall utilization by households, giving a national picture. HWS data were used to analyse overall utilization rates. The National Statistical Office (NSO) conducts this survey every year. This study uses HWS data from 2005 because this is the most up-to-date survey and has not so far been analysed. The timeframe of data collection is usually between 1-12 April each year (National Statistical Office 2004).The objectives of the HWS are basically to provide:

- Information about morbidity, accessibility to health services, and accessibility to health insurance.
- The coverage of health services in relation to universal coverage aims.
- Information about health care expenditure.

2. Variables

Unit of analysis of health care services (the first objective of the HWS) was the individual household member. Analysis was disaggregated by insurance scheme and quintile of household consumption. The variables in this part drew on the Andersen & Newman framework reviewed in chapter 2. Although there are several behavioural models that can help to specify variables, the Andersen & Newman framework is appropriate for explaining utilization in both ambulatory care and hospitalization. The summary of variables used in the study, definitions, and justification and hypotheses are shown in Table 4.3.

The predisposing variables in the analyses consist of age, sex, education, and marital status. Age was categorized into 20 year groups to accommodate the youngest SSS members (at 15 years) in the lowest group. Working age groups were categorized into two groups: an early working group (21-40 years) and a late working group (41-60 years). The retired age group was set at more than 60 years. The predisposing factors are based on the concept that some individuals tend to utilize services more than others. The elderly normally have more health problems than younger people. Higher education and marital status both tend to increase an individual's likelihood of seeking care.

The enabling variables are income, health insurance status, and living location of residence. Enabling factors are defined as conditions that make resources, such as health care, available and accessible to an individual (Andersen and Newman 1973). Those of higher income have greater opportunity to access health services than the poor do. Having health insurance can reduce the burden of expenditure for health, depending on the conditions on benefits. Area and region of residence affect utilization in two ways, through the norms of utilization and the availability of resources. Different areas not only have differing incidence of illness, but also different access to providers (Phananiramai and Suksiriserekul 1996).

Illness type or severity is also a factor. Individuals who have a chronic disease tend to use more services than others do.

Self-reports by respondents in interviews were used by HWS to assess service utilization. A one-month recall was employed for ambulatory services. Ambulatory care was divided into two major parts, formal care and informal care. Informal care comprised self-prescribing, alternative care, and no treatment, while formal care included health centre, private clinic, and hospital care. A one-year recall of admission was used by HWS for hospitalization care. The probability of visiting, number of ambulatory care visits, probability of hospitalization, and number of hospitalizations were employed as indicators to assess access variations in health insurance schemes.

Table 4.3 Justification and definitions of independent variables used in the utilization study

Variable	Explanation	Justification & hypothesis
Predisposing variables		
• Age group	0-20 21-40 41-60 >60	Older people tend to need health care services more than younger people.
• Sex	Male Female	There are biological factors determining need for health care.
• Education	• No education • <primary school • Primary-Bachelor • ≥ Bachelor	Different levels of education affect knowledge and understanding of service use
• Marital status	Married Unmarried	Married people are more concerned to utilize health care than unmarried people
Enabling variables		
• Income	Represented by household income quintile	High income groups have greater opportunity to access health services than lower income groups
• Insurance schemes	Categorized by three main public health insurance, UC scheme, SSS, and CSMBS	The study aims to explore the effect of different insurance status on service utilization Health insurance helps people use services.
• Regions	Different regions have different health facilities categorized as: Bangkok, Central, North, Northeast, and South	Availability of health facilities affects utilization by individuals
• Area	Rural Urban	People living in urban areas tend to use more services than those in rural areas
Illness variable		
• Having chronic disease	There are two categories, having and not having chronic disease	People with chronic disease tend to utilize more services than those without chronic disease

3. Data analysis

Since the data of HWS are weighted to represent the Thai population, complete weighted data were used as input data. The HWS coded data was analysed using various statistical methods which are explained in detail in chapter 5. Descriptive and inferential statistics were employed to describe variables and to analyse factors influencing the utilization of the three schemes. The statistics used in this study include frequencies and cross tabulations. The effect of scheme characteristics and other influences on utilization are estimated using logistic regression and a count

data model. These various analytical methods are employed using standard software STATA version 10.

4.4.2 Method for sub-study 1.2: To explore the magnitude of variation of length of stay and readmission of Diabetes Mellitus patients between insurance schemes.

A detailed analysis was conducted of the pattern of admissions and readmissions for DM in Thailand using claims data. This analysis provides background data on the efficiency of DM services and quality of care.

1. Source of data

The data were collected from inpatient claims data in the year 2005. Currently, all hospitals in the three schemes - SSS, UC scheme and CSMBS - have to send inpatient data to SSO and the Central Office for Healthcare Information (CHI). The SSO needs this data to adjust the capitation allocation at the end of each year, while NHSO and the comptroller general need this data in the reimbursement process. However, the details of the data sets differ from each other. To analyse these data, all data were combined in the same structure. After data were combined, some detail could not be retained. For example, hospital type could be grouped into private and public hospitals, whereas the original structure of UC scheme claims data divides hospitals by size. The structure of data consists of three parts: patient data, hospital data, and clinical data. The details of the structure of combined data are shown in Table A2.1 (Appendix 2).

2. Data collection

UC scheme and CSMBS data were collected from the Central Office for Health Care (CHI). SSS data were collected from the SSO. Both sources were combined by using the software application Microsoft Access 2003.

3. Variables

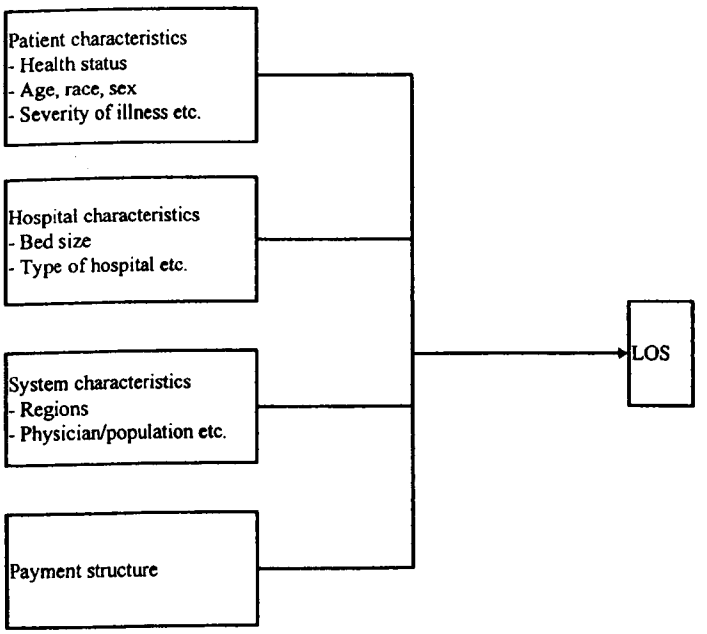
The unit of analysis in this claims data is the DM patient, categorized by health insurance scheme and other influences on LOS and readmission. There are few studies of DM using LOS as a dependent variable compared to other chronic

conditions such as congestive heart failure etc. Therefore, this study reviewed factors affecting LOS for several conditions to evaluate which factors should be included (see section 2.4.2).

The choice of explanatory variables in this study was also guided by Lave and Frank (1990)'s model of LOS. That model proposed four factors affecting LOS including patient characteristics, hospital characteristics, health care delivery system, and payment structure (Lave and Frank 1990) as shown in figure 4.3. Examples of patient characteristics are demographic factors, health status, and severity of disease (Leung et al. 1998).

Examples of hospital characteristics are type of hospital etc (Mawajdeh et al. 1997, Rosenthal et al. 2003). Examples of system characteristics are population density (Daniel et al. 1968). Examples of payment system are prospective payment and per diem payment (Lutjens and Louette 1994, Theurl and Winner 2007),

Figure 4.3 Factors affecting length of stay model



Adapted from: Lave and Frank 1990

Drawing on the literature review in section 2.4.2, the above framework and reflecting the availability of information from claims data, this study separated factors affecting LOS into three components including patient characteristics, hospital characteristics,

and payment structure.. The details of the independent variables are shown in Table 4.4.

Table 4.4 Definition and justification of independent variables used in the length of stay and readmission study

Variable	Explanation	Justification & hypothesis: LOS	Justification & Hypothesis: Readmission
Patient characteristics			
Age group	0-40 41-60 >60	Elderly group usually has Longer LOS.	
Sex	Male Female	Gender affects LOS.	
Severity (calculated by programme DRG grouper into five levels)	0 = no co-morbidity 1=minor 2=moderate 3=severe 4=catastrophic	More severe cases tend to have longer LOS.	
LOS (in readmission analysis only)	0-3 4-7 >7	Not applicable	Shorter LOS tend to have higher readmission rate
Hospital characteristics			
Hospital type	Community General Regional University Private Military	Public hospitals tend to have longer LOS than private hospitals. Bigger hospitals tend to have longer LOS than smaller.	
Payment structure			
Insurance scheme	UC scheme SSS CSMBS	UC scheme and SSS tend to have shorter LOS than CSMBS	

4. Data analysis

Descriptive and inferential statistics were used to analyse the LOS and early readmission rate by public health insurance scheme and other influencing factors for three different conditions: DM with acute complication, DM with chronic complication, and DM without complication. For LOS analysis, data was analysed using both univariate and multivariate techniques. The effects of scheme characteristics and other influencing factors including age, sex, insurance status,

severity, and hospital type on LOS were analysed by a count data model and logistic regression.

For readmission, the unit of analysis is the DM patient. Admissions were organized chronologically. The first admission of each patient was regarded as the index admission. Time interval between admissions was calculated. The inclusion criteria for readmission were readmission within 30 days from the index admission, excluding discharge type as dead. The descriptive statistics used rates of readmission between schemes. The chi-square test was used to compare scheme readmission rates. Insurance scheme and factors influencing readmission including age, sex, insurance status, severity, hospital type, and LOS were analysed using logistic regression. Data were analysed by software STATA version 10. Further details are given in chapter 6.

4.5 Method for objective 2: To identify the quality of care provided for Diabetes Mellitus within each insurance scheme, and to explore how quality of care might be affected both by the insurance scheme design and by other factors.

This method addressed the variations in scheme performance in greater depth regarding process of care and intermediate outcome in Non Insulin Dependent Diabetes Mellitus (NIDDM) patients.

4.5.1 Method for sub-study 2.1: To explore the magnitude of variation of quality of care in Diabetes Mellitus between three insurance schemes.

This study used retrospective data to evaluate scheme effect on the quality of care of DM patients and two sources of secondary data which were the Health and Examination Survey 2004, and Claims data of these DM patients. The justification for using this methodology was that it took less time to collect data. Furthermore, it was easy to follow up patients because most DM patients needed to receive services from the hospital. The study used DM patients within public and private hospitals to cover all schemes and types of hospital. Private hospitals play a major role in the SSS scheme since they cover most of the SSS beneficiaries. Furthermore, the SSS has an incentive system for chronic disease treatment through an enhanced financial

incentive. The SSO has provided an additional budget of about 10% of capitation in each year for hospitals that provide services in 25 chronic conditions (DM is one of the list) after hospitals are audited for performance and a report produced at the end of each year.

A cross-sectional interview and a retrospective medical record review of DM patients in Samutsakhon province were employed to analyse the quality of the care process and outcome. Samples were collected from both private and public hospitals. A proportionate to size sample of DM patients was obtained from all three public hospitals. Two out of nine private hospitals which were the main contractors of SSS were willing to join the study and were included as study sites.

1. Sources of data

Three sources of data were used in this study. The first source was secondary data from the National Health Examination Survey 2004. These data were analysed for the degree of diagnosis and the level of controlled DM of DM patients in different insurance schemes. The second source was primary data collection of outpatient (OP) medical records data and patient interviews to trace the standard of DM care. The period of study was 12 months, retrospectively traced back. The third source was claims data for these DM patients. Claims data were used to follow the hospitalization and short-term complications of patients, because if patients were admitted to other hospitals they could be tracked from these data. The short-term complications consist of hypoglycaemia, hyperglycaemia, and ketoacidosis.

2. Sample

Patients were identified from hospitals in Samutsakhon province including community, general, provincial and private hospitals. The details of hospitals are shown in Table 4.6.

The inclusion criteria of patients in this study are:

- Diagnosis DM by lab criteria of FPG >126mg/dl
- Diagnosis of NIDDM

- Receive treatment in the hospital at least once between 1 October 2006 and 30 September 2007,
- Visit hospital at least once during the period of study
- Exclude IDDM, gestational DM
- Exclude severe chronic complications such as severe renal failure, blindness etc.

This study also excluded patients who came to hospital with other diseases who were found to have DM, because these groups of patient might not follow up with the same hospital and might not have a retrospective history.

For the sample size of patients, since this study seeks to compare the results of the process of care between three insurance schemes, the proportions of patients receiving care in each scheme were used. The formula is shown below.

$$n = \frac{\left(u\sqrt{\pi_1(1-\pi_1)+\pi_2(1-\pi_2)} + v\sqrt{2\ \bar{\pi}(1-\bar{\pi})} \right)^2}{(\pi_2-\pi_1)^2}$$

n = Sample size per group

π_1, π_2 = Proportion

$\bar{\pi}$ $= \frac{\pi_1+\pi_2}{2}$

u = One-sided percentage point of the distribution corresponding to 100% - the power e.g. if power =90% $u = 1.28$

v = Percentage point of the normal distribution Corresponding to the (two-sided) significance level, e.g. if significance level =5% $v = 1.96$

From: Kirkwood 1988

Puapankitcharoen (2005) compared treatment of DM patients between the Health Card Scheme (after universal coverage these patients were included in the UC scheme) and CSMBS in Nakhonayok provincial hospital. He found that the proportion receiving HbA1c measurement at least once a year in the Health Card Scheme was 6.4% compared to 11.6% in CSMBS (Puapankitcharoen 2005). Since that study did not have SSS data, data from CSMBS and UC scheme were used to calculate the sample size. The calculation set the power at 90% and significance level at 5%. In addition, a proportionate to size sample of DM patients under the SSS and registered in the two private hospitals was collected. Details of hospitals and sample sizes in the study are shown in Table 4.5. The sample size of each arm of the study is 634.

Table 4.5 Details of hospitals in the study

Hospital	Type of hospital	Bed	Number of registered DM patients (number in sample)		
			UC	SSS	CSMBS
Samutsakhon	Provincial	509	4,719 (241)	1,127 (46)	1,660 (243)
Kratumban	Community	182	3,938 (306)	206 (202)	872 (309)
Banpaw	General	177	1,775 (117)	101 (14)	307 (80)
Srivichai 3	Private	200		975 (247)	
Mahachai 2	Private	120		960 (134)	
Total			10,432 (664)	3,369 (643)	2,839 (632)

Patients were recruited by consecutive sampling until the target samples of each hospital were achieved. Every patient was interviewed using a questionnaire developed by the researcher and their medical records were reviewed for the preceding 12 months (1 October 2006 – 30 September 2007). The questionnaire and data collection form had been piloted in a community hospital outside Samutsakhon and revised before being used in the study. Two staff from each hospital were recruited and trained as data collectors and supervised by the researcher and a research assistant on a weekly basis. The study was approved by the ethics committee in LSHTM and by the MOPH, Thailand. The hospital director had to sign to give his consent to allow the researcher to access the medical records and all patients needed to sign a consent form before participating in the study.

3. Data collection

The samples were collected in two steps. The first step was to include all DM patients in each scheme who complied with the inclusion criteria. The second step was to select the sample by consecutive sampling until the target number was met.

The measurement of quality of care of DM used indicators from the standards for process of care and intermediate outcome of DM in Thailand, which the NHSO has adopted as indicators for monitoring the quality of DM treatment from registered providers. These indicators consist of:

Process measures

i. Fasting plasma glucose (FPG) at least 4 times a year
ii. Blood pressure (BP) test at least 4 times a year
iii. Urine analysis (UA) for microalbuminuria once a year
iv. HbA1C measurement at least once in the past year
v. Lipid profile once a year
vi. Eye examination once a year

Outcome measures

i. FPG < 130 mg/dl
ii. HbA1C < 7 %
iii. Total cholesterol < 200 mg/dl
iv. LDL-cholesterol <100 mg/dl
v. HDL-cholesterol >40 mg/dl
vi. Fasting triglyceride <150 mg/dl
vii. BP < 130/80

From: Guidelines for treatment of DM, The Endocrine Society of Thailand (Health Service Guidelines Development Project Office 2006)

A form to collect data was developed and tested for validity and reliability using records of 30 DM patient cases in one hospital outside Samutsakhon. The details on the form are composed of five main parts including patient socioeconomic and demographic status, knowledge, attitude and practice of DM patient, clinician detail, process of care, and result of care. The details of the data collection form are shown in Appendix 6.

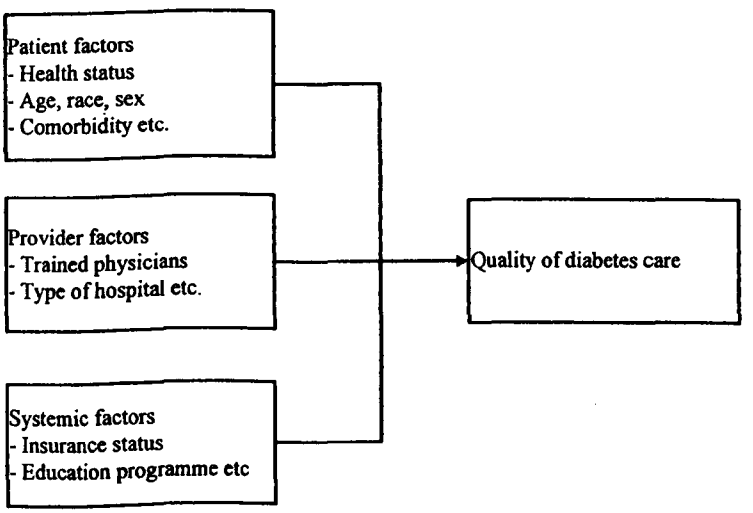
To assure the reliability and validity of the gathering process, medical records and patient interview were collected by two research assistants. These assistants were trained for two days on the data collection form, procedures, how to collect data, and possible problems. The researcher and these assistants followed up the progress of the data collection process, answered questions, and supervised at least once a week per hospital site. The assistants and the researcher met each week to discuss progress in data collection.

The researcher developed a data-coding programme using Microsoft Access. The data were coded by two staff from the IT department at Kasetsart University. Data were cleaned by the researcher using STATA version 10.

4. Variables

To identify independent variables, this study applied a patient, provider, and systemic factors model to analyse the process of care and intermediate outcomes for DM patients as shown in Figure 4.4 (Alberti et al. 2007, Khunti 1999, Pringle et al. 1993, Brown et al. 2002).

Figure 4.4 Patient, provider, and systemic model for quality of DM care



Adapted from: Alberti et al. 2007, Pringle et al. 1993

Because this study aimed to explore variation in DM process and outcomes between health insurance schemes, the key independent variable of interest was insurance scheme. Potential confounding variables considered fell into three groups; 1) patient factors including income, age, sex, marital status, and education, duration of DM, and number of co-morbidities; 2) provider factors including hospital used; 3) systemic factors including insurance status.

Based on the literature review in section 2.5, several factors could affect the process and outcome of DM care. An example which supports using area and income status as explanatory variables came from the studies of Hippisley-Cox 2004 and Gray et al. 2006 who found that patients living in deprived areas tended to receive fewer services than those in higher income areas. Elderly patients usually had co-morbidity and needed services more than younger age groups (Brasel et al. 2007, Grant et al. 2005). This was also related to having had DM for longer and needing more services than those with a shorter history of DM (Robbins et al. 2005). Smoking in DM patients also increase risk of complications and such patients needed more services than patients who did not smoke (Sharrett A et al. 2006). Other factors such as sex, education, occupation, marital status had different results in different studies (Gray et al. 2006) and were included in this study to control for confounders.

Provider factors such as hospital type and use of specialists affect the result of DM care as demonstrated by the study of Kerr et al. 2004 and Suwatee et al. 2003. This study used five hospitals which included both private and public providers.

Table 4.6 shows the variables used in the analysis, with the justification and hypothesis for each. The justification and hypotheses also apply to the analysis of secondary data from the 2004 Health Examination Survey.

Table 4.6 Potential confounding variables and hypotheses of process and outcome of quality of care

Variable	Explanation	Justification & hypothesis
Patient factors		
Income	No income 1-2,000 Baht 2,001-10,000 Baht > 10,000 Baht	Different income groups receive different services

Variable	Explanation	Justification & hypothesis
Age	<40 40-60 >60	Older age group tends to need more care than younger age group.
Sex	Male=1 Female=2	Gender affects DM services received
Marital status	Single =1 Married =2	Marital status affects DM services received
Education	Without education =1 Primary-bachelor =2 >bachelor =3	Those with higher education have greater knowledge and capability to get services than those with less or no education.
Area	Urban =1 Rural =2	Those in urban areas have greater opportunity to receive more services.
Time of DM	<5 years ≥ 5 year	Those having DM for longer need more services than those having DM for less time.
Smoking	Current smoking =1 No smoking =0	Smokers need more services than non smokers
Co-morbidity	No Yes	Having co-morbidity tends to lead to more services than not having co-morbidity.
Provider factors		
Hospital use	1 Kratumban 2 Samutsakhon 3 Banpaw 4 Mahachai 2 5 Srivichai 3	Individual hospitals affect quality of care
Systemic factors		
Insurance status	UC scheme CSMBS SSS	Different insurance status affects DM care

5. Data analysis

To analyse the relation between scheme variations and quality of DM care, the coded data were analysed with descriptive and inferential statistics.

The analysis of data could be divided into three parts. The first was to analyse and seek to explain the likelihood of detection of DM by scheme and the extent of control of DM by scheme. The Health Examination Survey Data 2004 were used for this analysis. The diagnosis in this survey employed both clinical and laboratory criteria and the survey also assessed the severity of DM. It also included uptake of diagnosis tests in high risk groups and assessed the extent of undiagnosed DM in the community.

The second part was to analyse the process of care using medical records and patient interview data. Each process indicator was analysed in terms of rates of receiving

services, comparing between schemes. The Kruskal Wallis test was used to compare rates of process of care. The association between scheme effect and process of care was analysed by logistic regression.

The third part was to analyse the intermediate outcomes of DM patients for each care procedure and hospitalization during the study. Each result was analysed using logistic regression, with independent variables including different scheme characteristics, patient characteristics, and provider characteristics while the dependent variable was the outcome from laboratory tests and hospitalization.

Thus, this analysis consists of three major parts: the degree of diagnosis and the degree of control of DM by scheme using secondary data from the Health Examination Survey; bivariate analysis and multivariate analysis of process of DM service by using medical records data and patient interviews; and intermediate outcome and hospitalization by using medical records data and claims data of these DM patients.

These various analytical methods were employed using standard software STATA version 10.

4.5.2 Method of sub-study 2.2: To understand quality of service as perceived by Diabetes Mellitus patients and to explore perception, behaviour, and motivation of providers regarding quality of Diabetes Mellitus treatment under the different schemes.

In order to understand the hospital policy, provider motivation and behaviour, and patient perception of service, in-depth interviews and focus group discussions were used to collect data.

1. Tools

An open-ended list of questions was used as a tool for the in-depth interviews and focus group discussions. Information sought included:

Patients

- Socio-demographic characteristics
- Local economic and service infrastructure such as transportation

- Expectation of service from providers
- Perceived quality of service received from hospital
- Perception of differences in care received between schemes
- Satisfaction on services received
- Variation of practice of providers

Providers

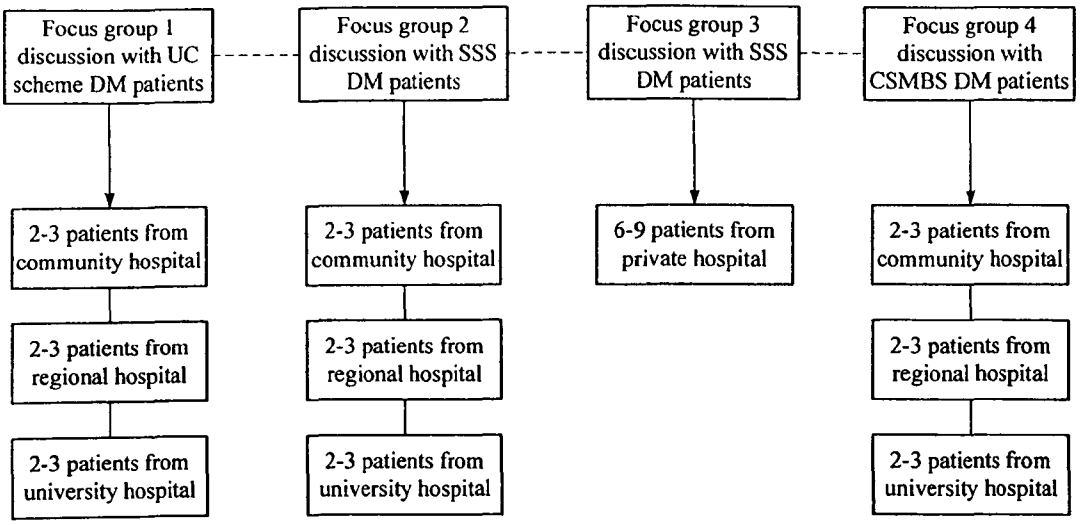
- Constraint of management from insurance schemes such as budget, human resources, cost etc.
- Influence of policy implementation of DM service in hospital
- Hospital policy from insurance scheme regulation
- Problems and constraints affecting implementation of quality of care in DM service
- Different policies in different insurance schemes for DM patients and other influences on DM treatment
- Positive and negative effect of implementation plan of DM service from insurance scheme policy

2. Sample

There were two sets of focus groups, patient and provider. On the patient side, four focus group discussions for each insurance scheme were held. By each insurance scheme, two or three DM patients from the patients of sub-study 2.1 in each hospital were invited to participate in the focus group discussions. SSS patient groups were separated into private and public hospital groups. The total number of patients in each focus group discussion was 6-9 DM patients. Sampling of participants used purposive sampling from patients in the primary data collection group.

The criteria for selecting participants was that focus groups included DM patients with both controlled and un-controlled conditions, without severe complications, who could participate in the discussion. The detail of the sampling frame is shown in Figure 4.3.

Figure 4.5 Sampling frame for focus groups of Diabetes Mellitus patients



On the provider side, in-depth interviews and focus group discussions were held in five hospitals. The number of participants and method of study are shown in Table 4.6. Physicians were invited purposively. In focus group discussions, between 4-6 participants from DM clinic teams were invited to join the discussion.

Table 4.7 Details of participants and methods in the qualitative study

Status	Position	No. of Participants	Method
Manager	Director of hospital	5	In-depth interview
	Head of insurance management section	5	In-depth interview
Providers	Physicians	5	In-depth interview
	Service team of DM clinics in hospital 1	4-6	Focus group
	Service team of DM clinics in hospital 2	4-6	Focus group
	Service team of DM clinics in hospital 3	4-6	Focus group
	Service team of DM clinics in hospital 4	4-6	Focus group
	Service team of DM clinics in hospital 5	4-6	Focus group

3. Data collection

To avoid bias in answers, focus group discussions for DM patients were held at a hotel in Muang district. For provider groups, in-depth interviews and focus group discussions were set up at the hospital because most of these groups had to work every day. The researcher was the main interviewer assisted by research assistants. Data were recorded manually and electronically using a recorder.

4. Data analysis

Electronic data was transcribed verbatim by blind people of the Thailand Association of the Blind. Data from the focus groups was analysed in two steps. The first step was to code and classify the raw data through the researcher reviewing the discussions. Sentences were analysed and assigned to concepts of quality of care. The second step was an analysis of divergent views of DM patients on quality of care and satisfaction on a sentence basis in Microsoft word and Atlast.ti version 4.2.

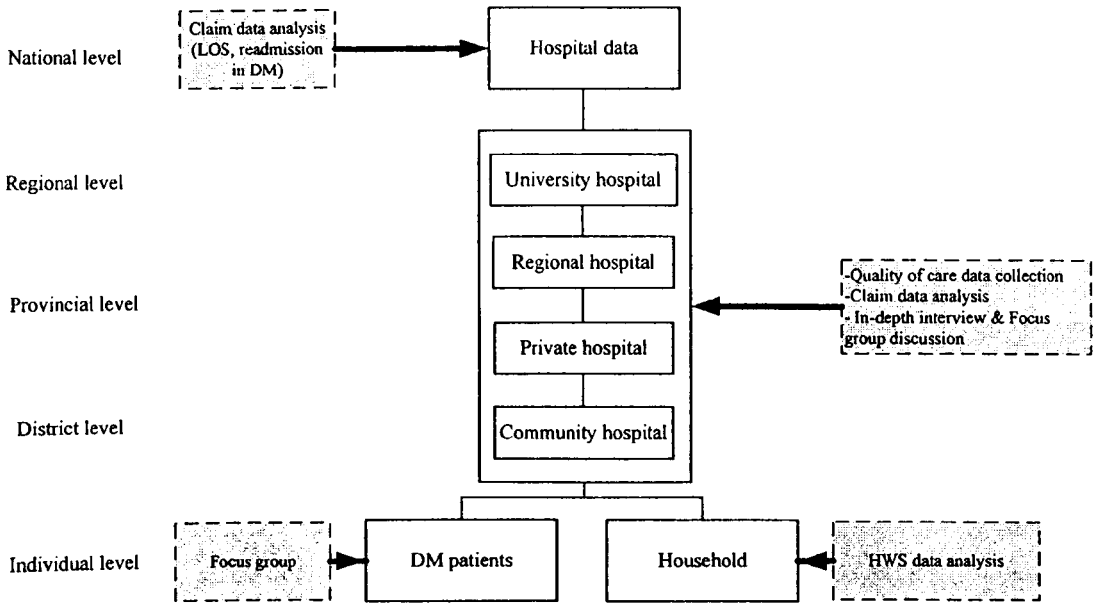
4.6 Summary of study

All methods used are summarized in Table 4.7. A diagram of samples and methods at different levels of the health system is shown in Figure 4.4.

Table 4.8 Summary of objectives and methodology used in the study

Objective	Sub studies	Indicator and information need	Sample	Means of data collections	
				Primary data	Secondary data
To assess and explain the performance of the three public health insurance schemes in terms of overall use of ambulatory and inpatient care, and efficiency and quality in use of resources for DM patients.	To explore the magnitude of variation in overall utilization between three insurance schemes	Utilization rate	All hospitals		HWS
	To explore the magnitude of variation of LOS and readmission of Diabetes Mellitus (DM) patients between insurance schemes	LOS	All hospitals		Claims data
		Readmission rate within 30 days			
To identify the quality of care provided for Diabetes Mellitus (DM) within each insurance scheme, and explore how quality of care might be affected both by the insurance scheme design and by other factors.	To explore the degree of diagnosis and level of controlled DM in DM patients between three insurance schemes	Degree of DM diagnosis	Population		Health Examination Survey 2004
	To explore the magnitude of variation of quality of care in DM between three insurance schemes	DM process care quality at primary, secondary, and tertiary level	DM patients in community, general, provincial and private hospitals in Samutsakhon province	Medical record and patient interview	Claims data
	To understand quality of service perceived by DM patients in different schemes	Response of DM patients in process and result of treatment.	24-36 DM patients	4 Focus groups	
	To explore perception, behaviour, and motivation of provider to quality of DM treatment in different schemes	Response of provider to scheme and hospital policy on DM care.	Managers and providers	15In-depth interview 5 Focus group	

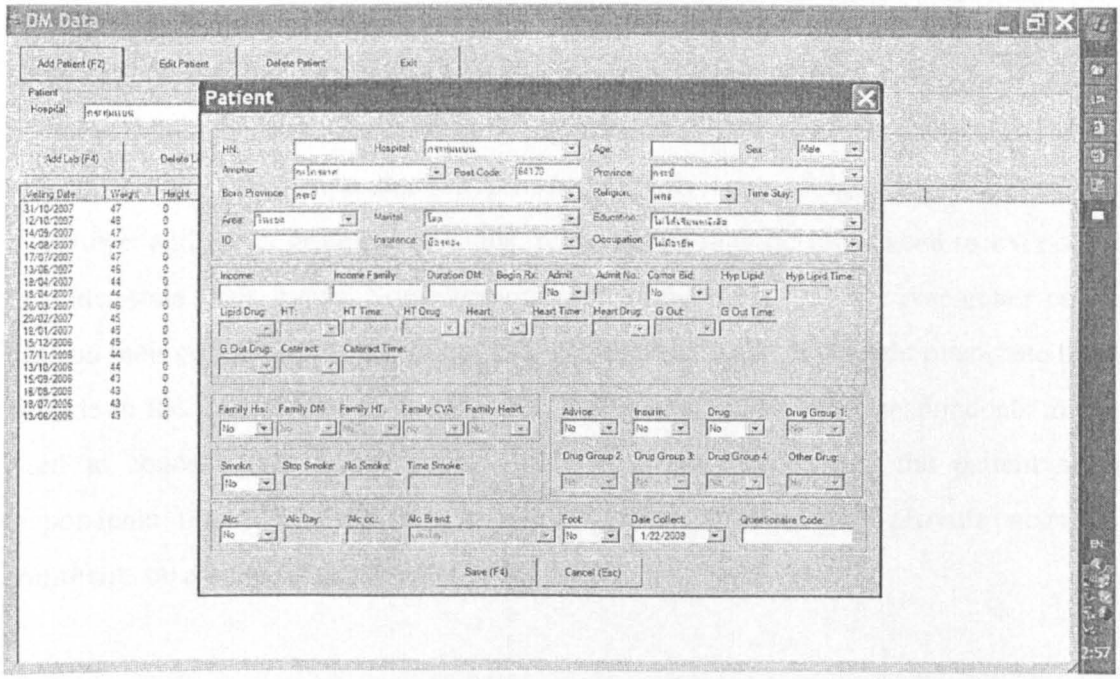
Figure 4.6 Diagram of samples and methods of this study

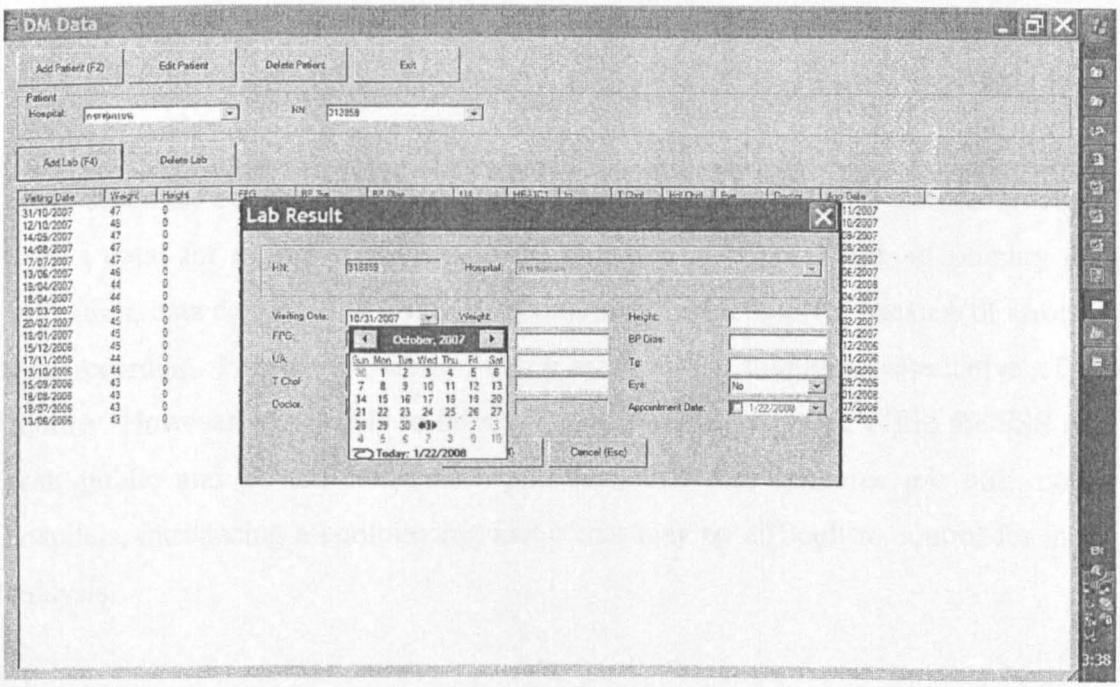


4.7 Quality control of the study

Quality control of the study was of prime importance, especially in the data collection process (both quantitative and qualitative). In the quantitative part, quality was controlled in both data collection and data coding. In the data collection process, this study used two assistants who had a background of qualitative and quantitative research. Both of them had been trained for data collection. In hospital, staffs in different divisions were used to collect data and were supervised by the researcher and assistants. Every day, assistants would check the quality of data collected from each hospital and discuss any problems with the researcher every week. In the data coding process, the researcher designed and used software for data coding which used the relationship database management. The reason for using the relationship database was that one patient could have more than one visit; therefore, the programme for coding was designed to code patient data and laboratory and link these together by patient id, hospital number (HN), and admission number (AN). The limiting range in data coding was used to control human error in coding, for example, age could not be more than 130, and duration of diagnosis of DM could not be longer than age. Furthermore, categorical choices were selected by drop down menu equal to the choices in the questionnaire. Figure 4.5 shows the programme for coding patient data and laboratory results each time patients were followed up for treatment.

Figure 4.7 Coding programme for Diabetes Mellitus patients





In the qualitative part, patient focus groups were held outside the hospital to reduce pressure on patients when providing uncomfortable answers. Furthermore, transportation expenses were paid after the focus group discussion finished.

4.8 Potential biases from the researcher

The researcher presents one of the most important biases, especially in a qualitative study. The researcher has held a position as deputy director of the bureau of policy and planning at the NHSO and has a background as a physician. This might influence respondents in the data collection process in two ways. Regarding the provider interviews and focus group discussions, respondents may be influenced to over-state or under-state their views. Some respondents might think that the researcher could pass on their complaint to the policy level of the NHSO, so they might over-state their attitude to the UC scheme more than the CSMBS and SSS. Other respondents might want to conceal their negative comments from the NHSO. On the patient side, respondents might be reluctant to express their feelings and provide negative comments on a hospital or provider.

4.9 Limitations of the study

There are several limitations in this study. First, the SSO collects claims data in a different form from the standard dataset of the Central Office for Healthcare Information; therefore, some variables cannot be merged for comparison with the other schemes. Second, it might be not easy to correct errors of data recording in claims data; for example, some records have age as zero. Third, in primary data collection, data contained in medical records may be incomplete because of errors in data recording. Fourth, the area of study may not be totally representative of the country. However, it is likely to be representative of most areas. Fifth, the SSS uses both public and private hospitals while the other two schemes use only public hospitals, introducing a confounding factor that may be difficult to control for in the analysis.

CHAPTER 5: THE INFLUENCE OF INSURANCE ON SERVICE UTILIZATION

5.1 Introduction

This chapter examines the overall utilization by the population of the three major health insurance schemes, the Universal Coverage (UC) Scheme, the Social Security Scheme (SSS), and the Civil Servant Medical Benefit Scheme (CSMBS). Evidence from other studies have shown that having insurance influences the probability of utilization (Jakab et al. 2004). The previous Health and Welfare Survey (HWS 2003) in Thailand demonstrated that there were differences in utilization rate between health insurance schemes (Vasavid et al. 2004). However, few studies demonstrate the effects of different health insurance schemes on service utilization.

This chapter aims to assess overall service utilization between health insurance schemes in Thailand and explore the influence of other factors including socioeconomic status and demographic factors. The analysis used Anderson and Newman's framework as a conceptual framework. Service utilization would be explained by individual need and enabling factors focusing on health insurance status.

The next section briefly describes the methodology of this chapter, followed by the results of the analysis. The results are derived from univariate and multivariate analyses.

5.2 Methodology

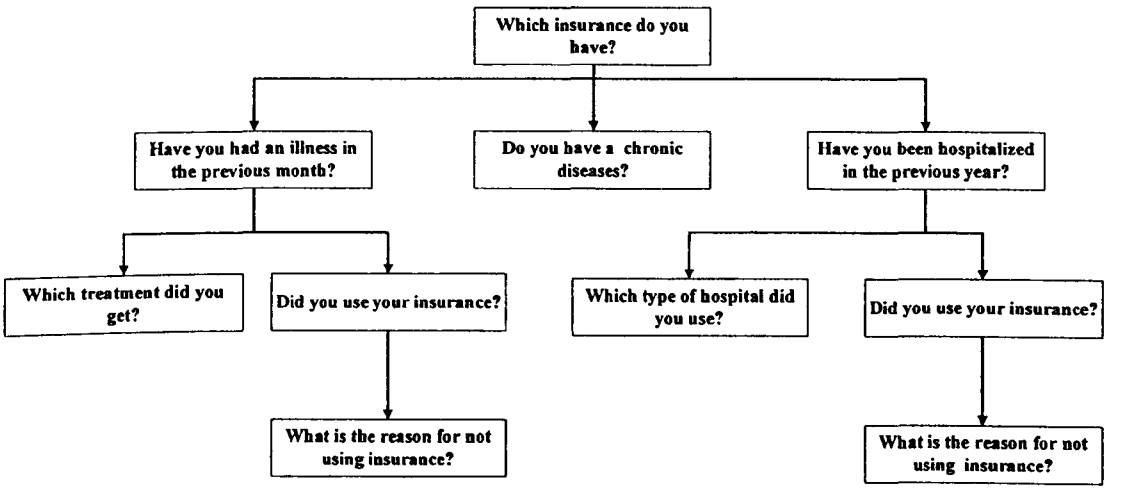
Dataset and analytical method

Data were obtained from the Health and Welfare Survey of 2005, collected by the National Statistical Office (NSO). The HWS started in 1974 and was undertaken annually until 1978. Between 1981 and 2001, the HWS was conducted every five years (National Statistical Office 2004). After UC implementation, NSO planned to conduct the survey every year between 2003 and 2007. The survey was conducted using face-to-face interviews during 1-12 April 2005. The total sample of households was approximately 27,000, in which there were 67,815 individuals (National Statistical Office 2005). The analysis was done using STATA 10. Sampling weights and survey commands in STATA were employed in the analysis process (svy

command). The details of weighting included population weights, 76 strata, and 1,518 primary sampling units (PSUs).

The HWS questions relevant to this study are shown in Figure 5.1. The survey began by asking about insurance status. Subsequent questions covered illness in the previous month, hospitalization in the previous year, and chronic disease co-morbidity. After that, the questions drilled down to how respondents treated themselves and the type of hospital they used. Finally, they covered reasons for not using insurance.

Figure 5.1 Summary of questions used in the Health and Welfare Survey analysis



Descriptive analysis

The descriptive analysis compares individual characteristics stratified by the three major public insurance schemes: the UC scheme, SSS, and CSMBS. The analysis then illustrates the care seeking pattern within each insurance scheme, with reasons for non-use of health insurance. Finally, the results of the analysis demonstrate illness and utilization rates between the insurance schemes in ambulatory care and hospitalization.

Models and dependent variables for ambulatory visits

There were two stages of analysis for ambulatory visits: the probability of a visit and the number of visits in ambulatory care.

Logistic regression was used to analyse the probability of a visit in ambulatory care as the outcome was dichotomous. The model is described as followed:

$$\ln(\frac{\pi}{1-\pi}) = \alpha + \beta_1 X_1 + \beta_2 X_2 + ...\beta_i X_i + \varepsilon \qquad \text{Equation 1}$$

Where π represents the probability of people using a health facility in the previous month, and X_i represents a set of independent variables hypothesized to affect utilization of ambulatory care. The results of the analysis are presented as odds ratios. The odds ratio of each variable refer to the odds of the variable divided by the odds of a reference group on the probability of the outcome occurring. An odds ratio of more than one suggests the variable has a positive effect on the outcome, while an odds ratio of less than one suggests a negative effect on outcome.

Independent variable selection

In addition to Andersen and Newman's framework, statistical methods were used to select independent variables in the model. Bivariate analysis of each factor and outcome was used to explore possible independent variables. For categorical variables, Wald's test was used to explore whether their inclusion provided a better model fit.

Fitting the model

Fitting a model in logistic regression of survey data differs from traditional logistic regression due to the effect of weight on samples. Goodness of fit methods is based on the Chi-squared test, so inflated samples in survey data influence the result of the test. Archer and Lemeshow (2006) developed the test for goodness of fit in survey data using the Stata programme (Archer and Lemeshow 2006). The command for goodness of fit is `svylogitgof`. The results of the analysis show F-adjusted test statistics. The null hypothesis of logistic regression for survey data is H_0: model is a good fit while alternative hypothesis is H_n: model is not a good fit (Archer and Lemshow 2006). A p-value > α means that the logistic model fits with the independent variables.

Post estimation diagnosis

A post-estimation diagnosis is conducted to fit the model. The aim of the diagnosis is to examine whether the fitted model is supported by the entire set of covariate patterns (Hosmer and Lemeshow 2000). Checks are made to the residuals of the logistic model. The primary use of residuals is to detect outliers and to check for normality (Christensen 1997). When the model does not fit well, outliers might be checked to see whether they need to be deleted or not. The assumption of residuals in logistic regression differs from linear regression in some issues having, for instance a mean of approximately 0 and a variance of 1 (Hosmer and Lemeshow 2000). Apart from standard residuals, other measurements include standardized deviance residuals, the weighted leverages, and the change in chi square when the observation is deleted (Chatterjee and Price 2006).

Models and dependent variables for number of ambulatory visits

As the number of ambulatory visits is a positive integer similar to count data, a Poisson or negative binomial regression model could be employed, depending on the data distribution. The issues concerning this analysis; therefore, are model selection, independent variable selection, and fitting the model.

Model selection

The difference between using a Poisson model or a negative binomial model is the distribution of count data. In the Poisson model, the mean of the distribution is equal to variance (μ = Var(y)) which is named equidispersion. However, if several count data have a variance more than the mean, this leads to overdispersion. The suitable model for overdispersed data is the negative binomial regression model.

To test for overdispersion, the negative binomial regression model added a parameter α reflecting unobserved heterogeneity amongst observations (Long and Freese 2006). The hypothesis for overdispersion test is $H_0 : \alpha = 0$. If α is equal to zero, the Poisson model is better than the negative binomial regression model.

Independent variable selection

Variable selection is based on the approaches in the conceptual framework and statistical analysis.

Poisson and negative binomial regression model

The Poisson model is shown below.

$$f(y_i \mid x_i) = \frac{e^{-\mu_i}\mu_i^{y_i}}{y_i!}, y_i = 0,1,2..., \qquad \text{Equation2}$$

Mean parameter

$$\mu_i = \exp(x_i'\beta),$$

From: Cameron and Trivedi 1998

Where $f(y_i|x_i)$ represents the probability of the number of visits when people were ill in the previous month. μ_i is the exponential mean function of linear vector of independent variable (x_i') that determine y_i by parameter β.

The negative binomial model is a model extended from the Poisson model by adding the parameter α. This process begins with adding ε in the model of μ:

$\mu = exp\ (\Sigma\beta_i X_{ij})\ exp(\varepsilon_i)$

Set $exp(\varepsilon_i) = \delta_i$

Therefore, the negative binomial model is:

$$f(y_i \mid x_i, \delta_i) = \frac{e^{-\tilde{\mu}_i}\tilde{\mu}_i^{y_i}}{y_i!}, y_i = 0,1,2..., \qquad \text{Equation3}$$

To compute $f(y_i \mid x_i)$, it is necessary to assume that δ □came from a Gamma distribution where the model can be calculated $f(y_i \mid x_i)$ as a weight of $f(y_i \mid x_i, \delta_i)$ (Long and Freese 2006) .The model of negative binomial regression model is shown below.

$$f(y \mid x) = \frac{\Gamma(y+\alpha^{-1})}{y!\Gamma(\alpha^{-1})}\left(\frac{\alpha^{-1}}{\alpha^{-1}+\mu}\right)^{\alpha^{-1}}\left(\frac{\mu}{\alpha^{-1}+\mu}\right)^{y} \qquad \text{Equation4}$$

From: Long and Freese 2006

Where y represents the number of visits to a facility when respondents were ill in the previous month. Γ is a gamma function, and α is a parameter of dispersion. μ is a function of the independent variable which is shown below.

$$\mu_{it} = \exp(\beta X_{it}) \qquad \text{Equation5}$$

Where X_{it} is a set of vector linearly independent variables hypothesized to affect the number of ambulatory visit in the previous month.

Fitting the model

F-statistics were used to test the negative binomial regression models' goodness of fit.

Model and dependent variables for hospitalization

The model for analyzing admission and number of admissions during one year before the interview date is the same as equation1. In any admission, since the outcome of the dependent variable is dichotomous, logistic regression is employed. In the number of admissions, a Poisson or a negative binomial regression model was employed by using equation2,3.

5.3 Individual and household characteristics between schemes

The characteristics of the respondents in the HWS 2005 in the three health insurance schemes are shown in Table 5.1. Three-quarters of the total population was covered by the UC scheme, while the SSS and CSMBS covered 11.9% and 10.6%, respectively. Females and males were in nearly equal in ratio, with females at 49.9%. About 10% of the total population was elderly. Most of the population were educated to primary school level. Education level in the UC scheme was mostly lower than primary school. CSMBS members were the most highly educated compared to SSS and UC scheme members. About 15.9% of the people had chronic disease. The

CSMBS group had more chronic disease than the UC scheme and SSS groups. Only 9.9% of the SSS group had chronic disease while the figures for the UC scheme and CSMBS were 15.8% and 22.6%, respectively. The majority of the UC scheme and CSMBS groups were children and elderly while the SSS was mainly young adults. Marital status was similar in all schemes, ranging from 60.6% married in the SSS to 69.2% in CSMBS. Regarding the income range, the majority of the UC scheme members were within the first and second quintiles, while the SSS and CSMBS members were mainly in the fourth and fifth income quintiles. The largest numbers of members of the UC scheme were in the North, Northeast, and central regions, while SSS scheme members were more likely to be in the central area. CSMBS members were relatively equally distributed across all regions.

Table 5.1 Characteristics of survey population by insurance scheme

	UC scheme(%)	SSS (%)	CSMBS (%)	Total (%)
N	47,327	6,134	9,943	63,404
Proportion of population	77.6	11.9	10.6	100.0
Sex				
Male	49.9	51.9	47.7	49.9
Female	50.1	48.1	52.3	50.1
Age group				
0-20	38.6	5.5	27.6	33.5
21-40	29.9	76.7	21.4	34.6
41-60	22.4	17.1	31.5	22.7
>60	9.1	0.7	19.6	9.2
Marital status				
Unmarried	36.7	39.4	30.8	36.5
Married	63.3	60.6	69.2	63.6
Income quintile				
1	30.1	1.5	11.9	24.8
2	24.9	7.6	6.5	20.9
3	19.4	17.0	10.0	18.1
4	14.7	34.0	22.8	17.9
5	10.9	40.0	48.8	18.4
Education				
None	4.9	0.7	1.8	4.0
Primary	68.2	27.9	39.7	59.9
Primary<Bachelor	25.1	51.8	31.8	29.3
≥ Bachelor	1.8	19.6	26.7	6.8
Chronic disease				
Chronic	15.9	9.9	22.6	15.9
No chronic disease	84.2	90.1	77.4	84.1
Region				
Bangkok	7.6	27.4	18.2	11.0

	UC scheme(%)	SSS (%)	CSMBS (%)	Total (%)
Central	19.3	43.8	23.6	22.7
North	19.6	10.6	17.2	18.3
Northeast	39.1	11.6	26.1	34.5
South	14.3	6.7	15.0	13.5
Area				
Urban	24.0	54.6	55.2	30.9
Rural	76.0	45.4	44.8	69.1

Source: Health Welfare Survey 2005

5.4 Care seeking in the three public insurance schemes

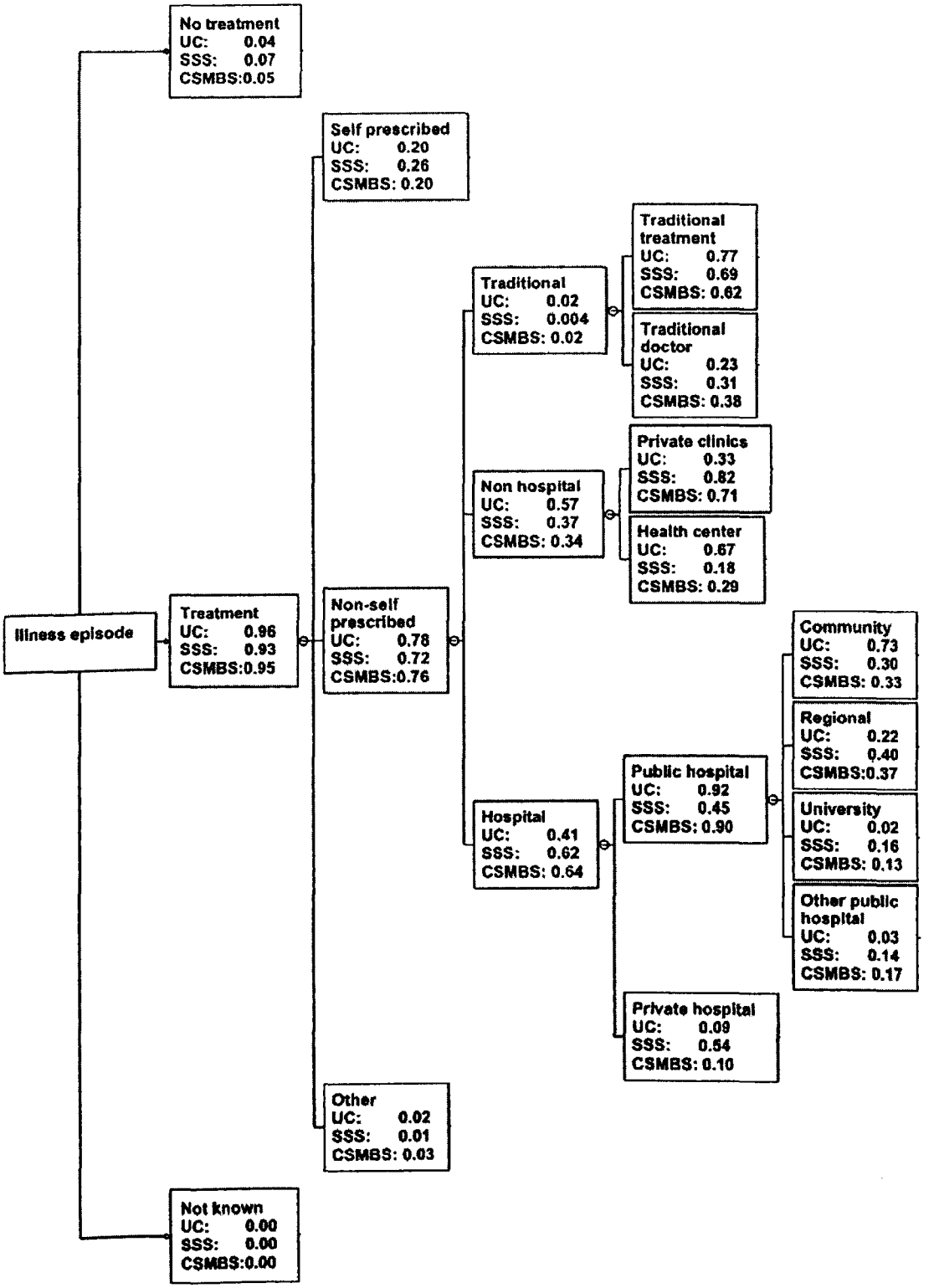
Services sought during sickness can be classified as either informal or formal care. Informal care includes traditional treatments and self-prescribing, while attending a health service facility is considered formal care. Care seeking patterns varied by public health insurance scheme, as shown in Figure 5.2. More than 93% of the population sought care when they were sick. However, 6.9% of SSS, 5.2% of CSMBS and 4.4% of the UC scheme group did not seek care. 20-26% of treatments were self-prescribed drugs. The SSS group had the highest level of self-prescribed drugs, at 26.5%, while levels in the UC scheme and CSMBS were equal at 20%.

Of the patients that did not self-prescribe, members of the UC scheme and CSMBS used traditional treatments more often than SSS members, at 1.7% vs. 0.4%, respectively, of the overall none self-prescribed drug group. In the non-hospital service group, most of the SSS group used private clinics (82.2%) while health centre use was only 17.8%. In the CSMBS group, most individuals also used private clinics (70.6%) while in the UC scheme only 32.6% used private clinics. Regarding hospital use, nearly 90% of UC scheme and CSMBS members used public hospitals while for SSS the figure was only 45.5%. Within public hospitals, community hospitals were most commonly used under the UC scheme, while regional and university hospitals were commonly used by CSMBS members.

Care seeking patterns were related to the regulations of each insurance scheme. The main differences in regulation between the three schemes were that the SSS allowed beneficiaries to choose their own hospital, including private and public hospitals with more than 100 beds. The UC scheme had a gatekeeper at primary care level, mainly the community hospital. The CSMBS allowed their beneficiaries to go to any public

provider. SSS members used private clinics more than UC scheme and CSMBS members because most of the main contractors under the SSS had private clinics as subcontractors, especially private hospital main contractors. 82% of SSS members used private clinics for non hospital care compared to 71% for CSMBS members and only 33% for UC scheme members.

Figure 5.2 Probability pathways of health care seeking by sick people within the three insurance schemes



Source: Health Welfare Survey 2005

Beneficiaries were asked whether they always claimed their insurance rights following sickness. Two questions were asked of respondents: (1) "During your

illness in the past four weeks, did you use any insurance you have?"(2) "From the former question, what was the main reason why you did not use any insurance?"

The data in Table 5.2 show that between approximately 20%-30% of people did not use insurance when they were sick. Furthermore, some people were entitled to more than one insurance scheme, so when they were sick they could choose to use another insurance scheme apart from their own registered insurance.

75% of UC scheme members claimed their own insurance right when they were ill and sought formal care, while only 0.8% used another insurance system. 24.1% of UC scheme members did not use any insurance when they were ill. For CSMBS, 67.3% claimed their own insurance, while 1.15% used another insurance and 31.3% did not claim their insurance right. For SSS, 72.2% claimed their insurance when they were sick, while 4.1% used another insurance (public or private insurance). 21.9% of the SSS did not use any insurance.

Table 5.2 Insurance use by scheme for ambulatory care

Insurance used when sick	Insurance status which people have (%)			
	UC scheme	SSS	CSMBS	Total
UC without 30 Baht[11]	44.8	0.1	0.1	36.8
UC with 30 Baht	30.2	3.4	0.4	25.0
SSS	0.2	72.2	0.4	5.3
CSMBS	0.1	0.1	67.3	7.4
Private insurance	0.4	1.5	0.4	0.5
Employer welfare	0.1	0.7	0.0	0.1
Other	0.3	0.2	0.0	0.2
Do not exercise right	24.1	21.9	31.3	24.7
Total	100	100	100	100
N	7,169	541	1,567	9,277

Source: Health Welfare Survey 2005

For hospital admission, people were more likely to use their own insurance as shown in Table 5.3. Overall, more than 80% used their own insurance and all were less likely not to claim at all. In the UC scheme, 82.7% used their own insurance when they needed hospitalization while 13.7% did not use insurance. SSS members were the least likely to use their own insurance (at 80.6%). However, they were also the least

[11] Between year 2001 and 2006, people who did not have any exemption had to co-pay 30 Baht per episode. Since 2006, all people covered by UC scheme have been exempted from co-payment.

likely not to claim their right, making use of an alternative scheme. CSMBS members were the most likely to use their own insurance when they needed hospitalization, while 7.6% did not use any insurance. It is noteworthy that CSMBS members were more likely to use other insurance schemes for hospitalization compared to ambulatory care. SSS members were more likely to use different schemes (13.9%) compared with 3.2% and 3.6% for UC scheme and CSMBS respectively.

Table 5.3 Insurance use by each scheme for hospitalization

Insurance use when hospitalized	Insurance status which people have (%)			
	UC scheme	SSS	CSMBS	Total
UC without 30 Baht	38.6	0.8	0.2	30.0
UC with 30 Baht	44.1	5.6	0.1	34.7
SSS	0.9	80.6	0.6	8.1
CSMBS	0.3	1.3	89.1	12.3
Private insurance	1.2	4.9	1.1	1.5
Employer welfare	0.2	0.8	0.3	0.2
Other	1.0	0.5	1.0	1.0
Do not exercise right	13.7	5.5	7.6	12.2
N	3,343	370	919	4,632

Source: Health Welfare Survey 2005

Table 5.4 shows insurance use by different income groups for ambulatory care. The low income group tended to exercise their own right when they were sick and used ambulatory services more than high income groups, except for SSS. In the UC scheme, the fifth quintile exercised their right 35.4% of the time, compared with SSS and CSMBS at 45% and 48% respectively. However, the difference between the first quintile and the fifth quintile was greater in the UC scheme group than in the SSS and CSMBS.

Table 5.4 Claiming insurance right by different insurance and income groups in ambulatory services

Quintile	% exercise right by insurance		
	UC scheme	SSS	CSMBS
1	64.7	45.4	68.1
2	58.3	52.7	61.6
3	56.0	57.9	42.2
4	47.1	59.3	41.8
5	35.4	45.3	48.4

Source: Health Welfare Survey 2005

In the group of patients who did not use any insurance when they were sick, most of them (45%) used informal services, consisting of self-prescribed drugs and traditional treatments. Private clinics were the second most used source of care for this group at about 32%. Around 10% of them did not receive any treatment. SSS members had the highest percentage of self-prescribed drugs or not receiving any treatment at 67.5%, as compared with 54.5% for UC members. CSMBS members were less likely to self-prescribe or opt for no treatment, and they were more likely to use private clinics as shown in table 5.5.

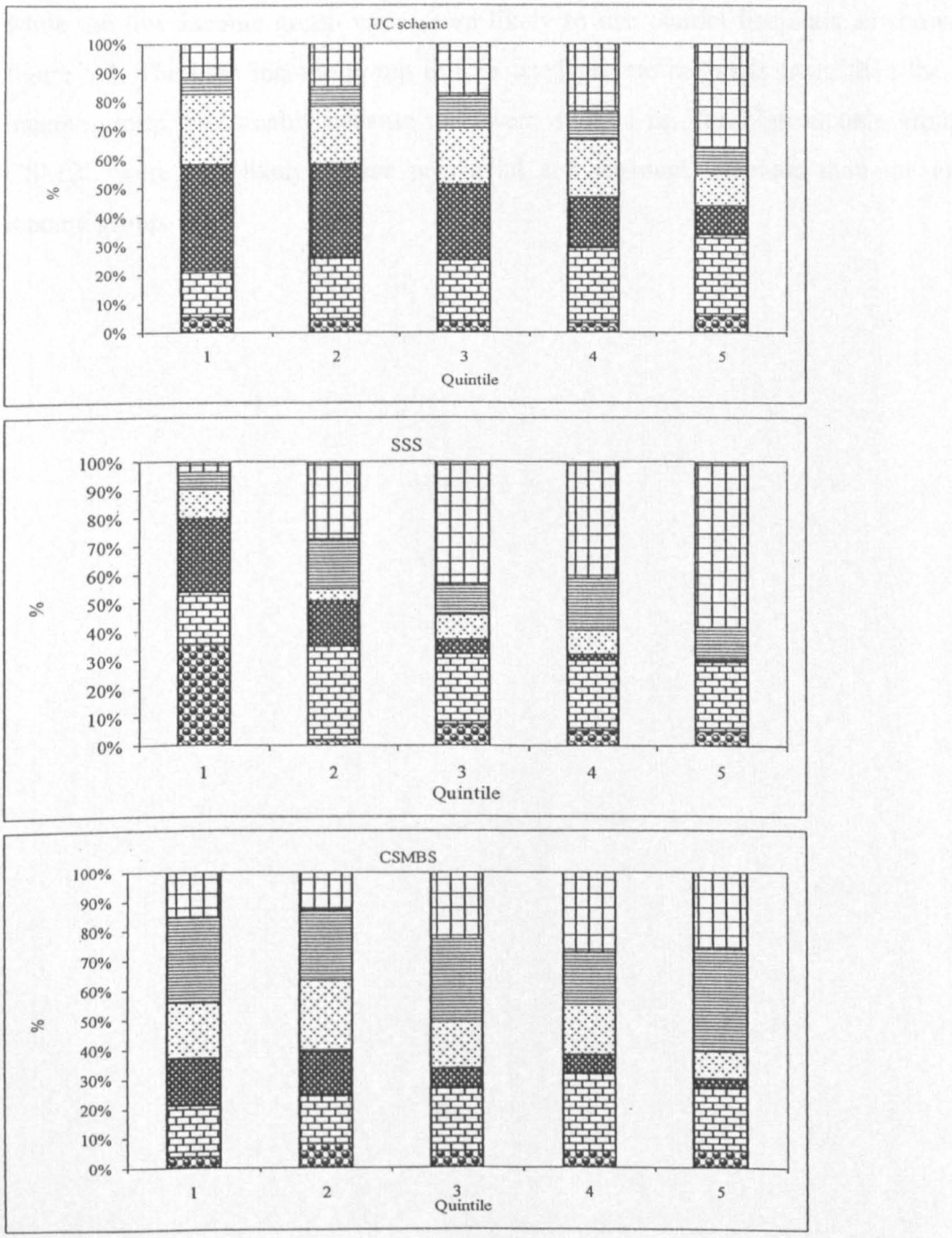
Table 5.5 Details of seeking care amongst those who did not claim insurance right

Seeking care method	UC scheme(%)	SSS(%)	CSMBS(%)	Total
No treatment	10.3	14.5	10.6	10.7
Traditional treatment	2.2	0.4	1.4	2.0
Traditional doctor	0.7	0.2	1.0	0.7
Self-prescribed drugs	44.2	53.0	39.5	44.4
Health centre	0.7	0.1	1.3	0.7
Community hospital	1.3	1.3	0.4	1.2
Regional hospital	0.6	0.0	0.2	0.5
University hospital	0.4	1.0	0.7	0.5
Other public hospital	0.5	0.8	0.1	0.5
Private clinics	32.0	24.7	33.6	31.6
Private hospital	3.2	2.7	5.1	3.4
Other	3.7	1.3	6.2	3.8
Total(N)	4,488	379	950	5,817

Source: Health Welfare Survey 2005

Care seeking behaviour in ambulatory care also differed by income group. Categorized into household quintiles, the finding was that the high income group (5th income quintile) usually used private services more than the low income group (1st income quintile). However, there was not much difference in informal care use between insurance schemes. Details of health seeking in ambulatory care by income quintile are shown in figure 5.3.

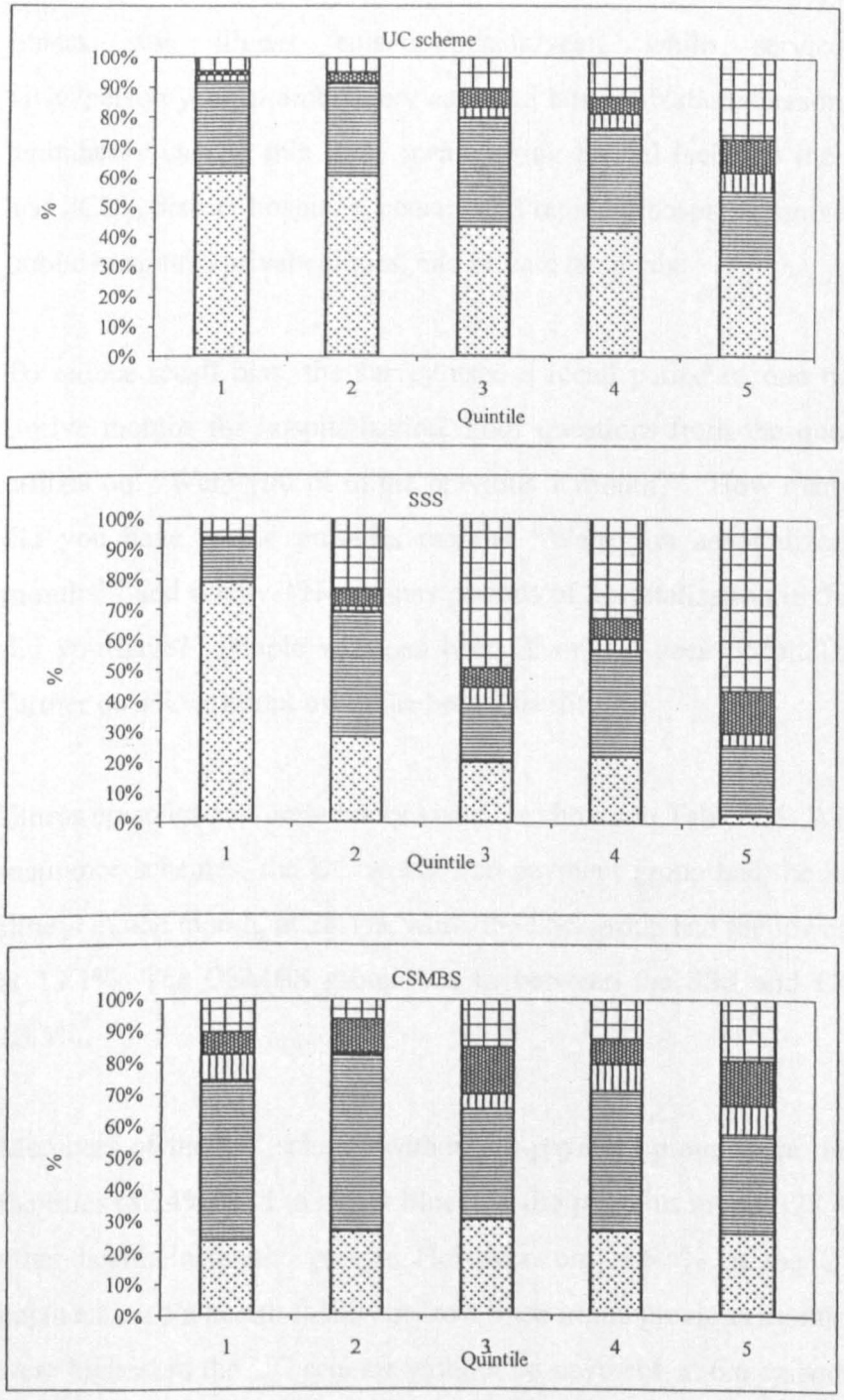
Figure 5.3 Health seeking in ambulatory care by income quintile in different insurance schemes



Source: Health Welfare Survey 2005

There were the same patterns of seeking care by income quintile in hospitalization levels. The high income group were also more likely to seek care in private hospitals while the low income group were more likely to use district hospitals as shown in figure 5.4. The high income group in SSS used private hospitals more than the low income group, presumably because they were entitled to. The high income group in CSMBS were less likely to use provincial and regional hospitals than the lower income group.

Figure 5.4 Health seeking in hospitalization by income quintile in different insurance schemes



Source: Health Welfare Survey 2005

5.5 Illness and service utilization

To compare illness and service utilization between the schemes, the indicator used for illness was illness episodes/person/year, while service utilization used visits/person/year in ambulatory care and hospitalizations/person/year. Utilization of ambulatory care in this study means using formal facilities including health centres and PCUs, district hospitals, general and regional hospitals, university hospitals, other public hospitals, private clinics, and private hospitals.

To reduce recall bias, the survey used a recall period of one month for illness and twelve months for hospitalization. Four questions from the questionnaire related to utilization: "Were you ill in the previous 1 month?" "How many episodes of illness did you have in the previous month? "Were you hospitalized in the last twelve months?" and finally, "How many periods of hospitalization in the last twelve months did you have?" People who had been ill or had been hospitalized would be asked further questions about using the health facility.

Illness episodes and ambulatory visits are shown in Table 5.6. Within the three public insurance schemes, the UC without co-payment group had the highest percentage of illness in one month, at 28.4%, while the SSS group had the lowest illness percentage, at 13.1%. The CSMBS group was in between the SSS and UC scheme group, at 20.5%.

Members of the UC scheme without co-payment group were the most likely to use facilities (82.4%) and to report illness in the previous month (28.4%) compared to the other health insurance groups. However, only 66.4% of the UC scheme with co-payment used a health facility at least once in the previous month. Episodes of illness were highest in the UC scheme without co-payment, at 6.6 episodes/person/year. This was two times more than the UC scheme with co-payment and nearly three times that of the SSS group. The SSS group had the lowest rate of visits to a health facility, at only 1.9 visits per person per year compared to 5.4 visits per person per year for the UC without co-payment. However, the UC scheme with co-payment group had a visit rate between UC without co-payment and CSMBS.

Table 5.6 Illness and ambulatory visits by insurance scheme

	% ill in one month	% of those ill using facility in one month	Mean episode in one month[12]	Illness episode/ person/year[13]	Facility visit/person/ year[14]
No insurance	16.1	63.6	1.76	3.41	2.17
UC without co-payment	28.4	82.4	1.93	6.59	5.43
UC with co-payment	16.3	66.4	1.85	3.61	2.39
SSS	13.1	67.7	1.80	2.82	1.91
CSMBS	20.5	71.8	1.82	4.49	3.22
Private insurance	10.9	74.9	1.60	2.10	1.57
Employer welfare	14.2	68.0	1.69	2.88	1.96
Others	23.7	71.5	1.85	5.25	3.75
Total(N)	19.7(13,282)	73.5	1.87	4.43	3.25

Source: Health Welfare Survey 2005

Hospitalization in a 12-month period under private insurance was the highest, at 9.5%, and with mean number of episodes at 1.34. CSMBS had the highest rate of admission of the public schemes, at 8.5%. Admission per person per year was high in the CSMBS group, which was similar to the UC scheme without co-payment. The SSS had the lowest rate of admission, at 0.072 admissions per person per year. All details are shown in Table 5.7.

Table 5.7 Hospitalization by insurance scheme

	%hospitalized in 12 months	Mean of hospitalization per year[15]	Mean number of hospitalizations/ episode	Hospitalizations /person/year[16]
No insurance	4.2	1.23	1.2	0.061
UC without co-payment	7.8	1.43	1.2	0.137
UC with co-payment	6.2	1.32	1.2	0.094
SSS	5.3	1.19	1.1	0.072
CSMBS	8.5	1.41	1.3	0.152

[12] Means episode in one month means average number of illnesses in people who were ill in the previous month.

[13] Illness episodes/ person/year = % ill in one month × Mean episodes in one month × 12/100

[14] Facility visits/person/year = % of ill using facility in one month × illness episodes/person/year

[15] Mean of hospitalizations per year means the average number of hospitalizations in people who had a hospitalization in the last twelve months.

[16] Hospitalizations/person/year = % of people hospitalized in 12 months × mean of hositalizations per year × mean number of hospitalizations per episode

	%hospitalized in 12 months	Mean of hospitalization per year[15]	Mean number of hospitalizations/ episode	Hospitalizations /person/year[16]
Private insurance	9.5	1.34	1.3	0.162
Employer welfare	2.0	1.00	1.0	0.020
Others	8.7	1.67	1.3	0.198
Total	6.7	1.36	1.2	0.109

Source: Health Welfare Survey 2005

5.6 Factors explaining service utilization

As Figure 5.2 shows, the three public insurance schemes had differing care seeking patterns. Service utilization also differed by insurance scheme. As mentioned in section 4.4.1, there were different characteristics between health insurance schemes such as population characteristics so multivariate analysis was needed to answer what were the factors that influenced service utilization.

The dependent variables of the model can be categorized into four groups. First was use of ambulatory care. Use in this variable meant use of a health facility when people were sick, which includes going to a health centre, clinic, or any type of hospital. Second was the number of times a facility was used. This variable was related to the first variable, and referred to the number of times a facility was utilized when people were sick in the previous month. The third category was hospitalization in the previous year. Fourth was number of hospitalizations in the previous year.

A number of independent variables were included in the multivariate analysis aiming to assess whether public insurance scheme affected utilization in ambulatory care and inpatient care. Description and summary of dependent and possible independent variables of multivariate analyses are shown in Table 5.8.

Table 5.8 Dependent and independent variables in multivariate analysis of ambulatory care use, number of ambulatory visits, admissions, and number of admissions

Variable	Observations	Mean of variable	Std. Dev.	Min	Max
Any use (1=use)	9,611	0.14	0.35	0	1
Any admission (1=hospitalization)	4,899	0.07	0.26	0	1
Number of visits	13,266	0.37	1.11	0	8
Number of admissions	4,899	0.10	0.54	0	36
Male*	31,920				
Female	35,895	0.53	0.50	0	1
Income quintile					
1*	13,593				
2	13,584	0.20	0.40	0	1
3	13,521	0.20	0.40	0	1
4	13,554	0.20	0.40	0	1
5	13,563	0.20	0.40	0	1
Age group					
0-20*	21,229				
21-40	20,276	0.30	0.46	0	1
41-60	17,878	0.26	0.44	0	1
>60	8,433	0.12	0.33	0	1
Marital status					
Unmarried*	34,405				
Married	33,410	0.64	0.48	0	1
Insurance					
UC scheme*	47,327				
SSS	6,134	0.10	0.30	0	1
CSMBS	9,943	0.16	0.36	0	1
Education					
Primary*	26,200				
None	3,075	0.05	0.22	0	1
Primary<Bachelor	27,919	0.45	0.50	0	1
≥ Bachelor	5,125	0.08	0.27	0	1
Chronic disease					
No chronic disease*	55,633				
Chronic disease	12,182	0.18	0.38	0	1
Region					
Central*	21,609				
Bangkok	4,014	0.06	0.24	0	1
North	14,218	0.21	0.41	0	1
Northeast	16,222	0.24	0.43	0	1
South	11,752	0.17	0.38	0	1
Area					
Urban	39,508				
Rural	28,307	0.42	0.49	0	1

* reference group

Source: Health and Welfare Survey 2005

5.6.1 Factors explaining ambulatory service utilization

Two multivariate analyses were carried out for ambulatory service utilization- one for the probability of using a health facility and the other for the number of visits to facilities.

Ambulatory care utilization

Logistic regression was employed to analyse use of health facility, as a dichotomous outcome. Table 5.9 provides cross-tabulations for the use of ambulatory care by the population. The highest percentage users were the elderly, those with no education, and those with chronic disease. In terms of insurance, the UC scheme and CSMBS have higher utilisation of ambulatory care than the SSS.

Table 5.9 Use of ambulatory care by different characteristics, in percentages

Independent variable	Not use (%)	Use (%)	P-value*
N	85.5	14.5	
Sex			<0.001
Male	87.3	12.7	
Female	83.8	16.2	
Income quintile			<0.001
1	79.7	20.3	
2	84.0	16.0	
3	86.6	13.4	
4	89.2	10.8	
5	90.0	10.0	
Age			<0.001
0-20	84.9	15.1	
21-40	91.6	8.4	
41-60	83.8	16.2	
>60	68.8	31.2	
Marital status			<0.001
Unmarried	88.9	11.2	
Married	85.7	14.3	
Insurance			<0.001
UC scheme	84.3	15.7	
SSS	91.2	8.9	
CSMBS	85.3	14.7	
Education			<0.001
Primary school	80.3	19.7	
None	77.2	22.8	
Primary<Bachelor	91.8	8.2	
≥ Bachelor	91.6	8.4	
Chronic disease			<0.001

Independent variable	Not use (%)	Use (%)	P-value*
No chronic disease	90.5	9.5	
Chronic disease	58.6	41.4	
Region			<0.001
Central	88.8	11.2	
Bangkok	92.2	7.8	
North	80.1	19.9	
North east	83.2	16.8	
South	86.8	13.2	
Area			<0.001
Urban	89.5	10.5	
Rural	83.6	16.4	

* Chi-square test
Source: Health and Welfare Survey 2005

Independent variable selection

Bivariate analyses of logistic regression for ambulatory visits were performed for a selection of independent variables, as shown in Table 5.10. A threshold for the level of association of p-value <0.25 was used for their subsequent inclusion, as suggested by Hosemer and Lemeshow, as use of the traditional level of 0.05 failed to identify important variables (Hosmer and Lemeshow 2000). All nine independent variables could be included in the model using this criterion.

Table 5.10 Bivariate analysis of independent variables in ambulatory visit analysis

Independent variable	OR	P-value	95% CI		F statistic	Prob > F
			LL@	UL@@		
Sex						
Male*	1.00					
Female	1.33	<0.001	1.26	1.42	90.13	<0.001
Income quintile						
1*	1.00					
2	0.74	<0.001	0.662	0.838	42.37	<0.001
3	0.61	<0.001	0.536	0.691		
4	0.47	<0.001	0.409	0.546		
5	0.44	<0.001	0.378	0.502		
Age						
0-20*	1.00				245.27	<0.001
21-40	0.51	<0.001	0.455	0.581		
41-60	1.09	0.112	0.981	1.204		
>60	2.55	<0.001	2.284	2.854		
Marital status						
Unmarried*	1.00				40.7	<0.001
Married	1.33	<0.001	1.217	1.448		
Insurance						

Independent variable	OR	P-value	95% CI		F statistic	Prob > F
			LL@	UL@@		
UC scheme*	1.00				25.14	<0.001
SSS	0.52	<0.001	0.436	0.625		
CSMBS	0.93	0.199	0.831	1.039		
Education						
Primary school*	1.00					
None	1.20	0.029	1.019	1.421		
Primary<Bachelor	0.36	<0.001	0.335	0.394		
≥ Bachelor	0.37	<0.001	0.307	0.457		
Chronic disease						
No chronic disease*	1.00				1710.73	<0.001
Chronic disease	6.70	<0.001	6.124	7.335		
Region						
Central*	1.00				34	<0.001
Bangkok	0.68	<0.001	0.531	0.859		
North	1.97	<0.001	1.701	2.284		
North east	1.61	<0.001	1.416	1.825		
South	1.21	0.013	1.040	1.397		
Area						
Urban*	1.00				86.46	<0.001
Rural	1.68	<0.001	1.506	1.874		

* reference group
@ Lower limit
@@ Upper limit
Source: Health and Welfare Survey 2005

In addition to the bivariate analysis, joint significance tests were done to assess whether the inclusion of categorical variables improved the fit of the model compared to their exclusion. Dummy variables which were significant in Wald's test were included in the multivariate model (p-value <0.05). The analysis showed that categorical variables in this model helped to improve the fit of the logistic model, as shown in Table 5.12.

Goodness of fit and logistic regression diagnosis

The goodness of fit in the logistic regression used pseudo-maximum likelihood, as proposed by Archer and Lemeshow (2006), since the survey sampling used weighted data which would be a problem for using Pearson's Chi-square test (Archer and Lemeshow 2006). Therefore, traditional goodness of fit could not be used. The null hypothesis for goodness of fit was that the model fitted the data; the alternative hypothesis was that the model did not fit. Setting α at 0.05, if the result of goodness of fit is more than 0.05, the model will be accepted. This showed that the model was

not best fitted when it included the variables age, sex, marital status, income quintile, insurance status, education, having chronic disease, region, and living area (F-adjusted test statistic = 2.64, p-value=0.005). Therefore, logistic diagnosis and interaction effect analysis were done to check outliers and interaction between variables. Since there was no specific command or programme for the diagnosis of logistic regression when data were weighted, an approach proposed by Hosmer and Lemeshow (2000) was followed using a model without weights to perform other functions such as residual analysis (Hosmer and Lemeshow 2000).

Figure 5.5 shows the distribution of standardized Pearson's residuals with predicted probability. The standardized residual plot is better able to explore outliers than the residual plot because it shows the deviation of residuals in terms of standard deviations. For example standardized residuals outside of 2 standard deviations could be considered outliers (Long 1997). Influential outlier data are those data points with high-standardized residuals and high leverage. Leverage is estimated when the observation is deleted and divided by its standard errors (Agresti 2007). However, there is no broadly acceptable method for the removal of outlier data (Long and Freese 2006). In this dataset, the standardized residuals showed that there were some outlier residuals exceeding three standard deviations that exhibited high leverage, as shown in Figures 5.5 and 5.6. This meant these data had an influential effect on the model fit. To trim outlier residuals, this study used 2.57 standard deviations as the cut-off point for outliers (99% CI). Therefore, data which were outliers with high leverage were deleted from the analytical process.

Figure 5.5 Distribution of standardized residuals with predicted probability

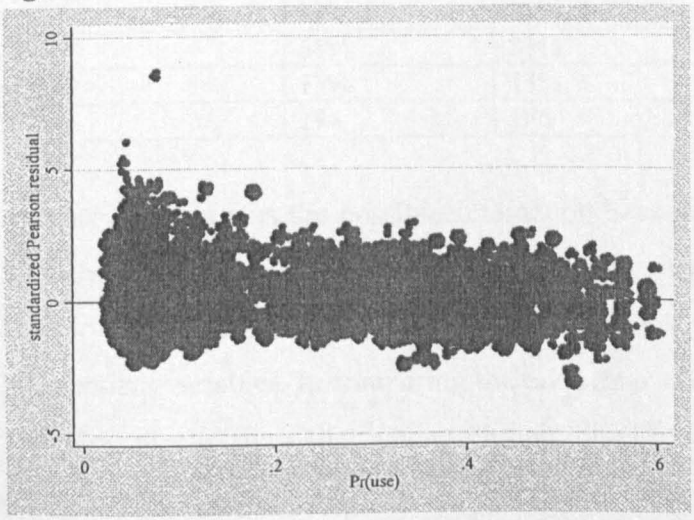
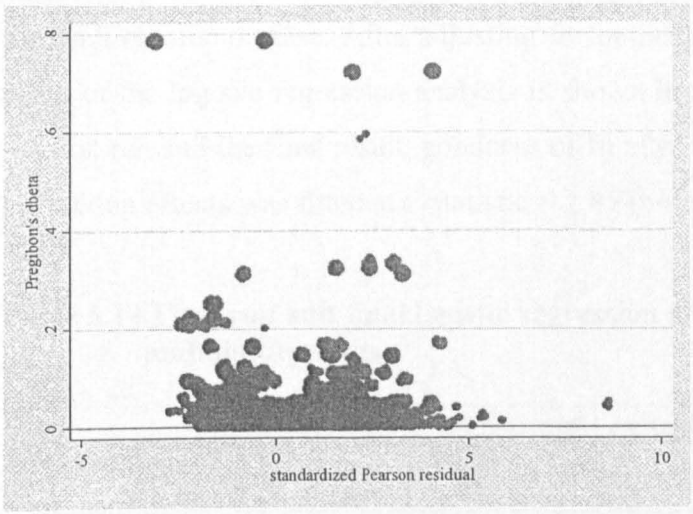


Figure 5.6 Distribution of standardized residuals with leverage value



Out of the total of 67,815 observations, 978 cases were removed from the data. Table 5.11 shows the characteristics of these outliers, which were mainly female, from low income groups and of old age.

Table 5.11 Characteristics of removed ambulatory data

	CSMBS	SSS	UC	Total
Sex				
Female	55%	87%	75%	73%
Male	45%	13%	25%	27%
Income quintile				
1	8%	3%	50%	33%
2	6%	14%	27%	20%
3	13%	4%	6%	7%
4	48%	75%	5%	27%
5	26%	4%	12%	13%
Age group				
>60	18%	1%	28%	21%
0-20	8%	3%	12%	9%
21-40	61%	83%	11%	34%
41-60	13%	13%	49%	35%
N	194	185	599	978

Another concern was the possible interaction between independent variables. Table 5.12 shows that the odds ratio of having chronic disease was high (see the 'first run logistic regression' column). This factor might have an interaction effect with other independent variables. In comparing the odds ratio, chronic disease in relation to other variables, results show that having chronic disease was affected by gender, with the odds ratio increasing from 0.9 to 1.7 if female: other factors showed little difference.

A new variable was therefore introduced in the logistic regression model multiplying sex with chronic disease. After adjusting for outlier and interaction effects, the final result of the logistic regression analysis is shown in Table 5.12. Comparing between the first run and the final result, goodness of fit after removing outliers and managing interaction effects was fitted at F-statistic = 1.85 (p=0.055)

Table 5.12 First run and final logistic regression and test of the model for ambulatory visits

		First run logistic regression				Final result logistic regression			
Dependent variable		Any visit =1							
N		48,721				47743			
F statistics		123.69				115.18			
Prob > F		< 0.001				< 0.001			
Variable	Wald's test P-value** (F-statistic)	Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI	
				LL	UL			LL@	UL@@
Independent									
Sex									
Male*									
Female		1.38	<0.001	1.27	1.5	1.49	<0.001	1.30	1.70
Income quintile	<0.05 (2.53)								
1*									
2		0.89	0.121	0.76	1.03	0.88	0.120	0.76	1.03
3		0.88	0.131	0.74	1.04	0.89	0.188	0.75	1.06
4		0.76	0.002	0.63	0.9	0.74	<0.001	0.62	0.88
5		0.84	0.082	0.68	1.02	0.84	0.109	0.69	1.04
Age	<0.001 (19.03)								
0-20*									
21-40		0.95	0.679	0.76	1.2	0.97	0.830	0.77	1.23
41-60		1.18	0.249	0.89	1.57	1.21	0.190	0.91	1.59
>60		1.81	<0.001	1.36	2.43	1.76	<0.001	1.32	2.35
Marital status									
Unmarried*									
Married		1.11	0.073	0.99	1.24	1.15	0.014	1.03	1.29
Insurance	<0.001 (8.34)								
UC scheme*									
SSS		1.47	<0.001	1.21	1.79	1.41	<0.001	1.14	1.75
CSMBS		0.99	0.842	0.85	1.14	0.91	0.215	0.79	1.06
Education	<0.05 (3.45)								
Primary school*									
None		0.99	0.873	0.83	1.17	0.95	0.588	0.81	1.13
Primary<Bachelor		0.77	0.002	0.65	0.9	0.76	<0.001	0.65	0.90
≥ Bachelor		0.81	0.114	0.63	1.05	0.78	0.079	0.59	1.03
Chronic disease									
No chronic disease*									
Chronic disease		7.15	<0.001	6.4	7.99	8.64	<0.001	7.33	10.18

Region	<0.001 (12.72)								
Central*									
Bangkok		0.78	0.093	0.58	1.04	0.75	0.063	0.55	1.02
North		1.68	<0.001	1.38	2.03	1.68	<0.001	1.38	2.05
North east		1.52	<0.001	1.28	1.81	1.57	<0.001	1.32	1.88
South		1.42	<0.001	1.17	1.72	1.42	<0.001	1.16	1.72
Area									
Urban*									
Rural		1.31	<0.001	1.16	1.47	1.31	<0.001	1.16	1.49
Chronic disease* sex						0.86	0.121	0.72	1.04

* reference group
** Wald's test for joint significance
@ lower level
@@ upper level
Source: Health and Welfare Survey 2005

Results of logistic regression analysis of ambulatory service use

In the logistic regression analysis, after controlling for other factors, the SSS insurance was a significant predictor for an individual using a health care facility in the previous month. SSS members had a 41% higher chance of using health care facilities than UC scheme members. However, there was no difference in the probability of using a health care facility in the CSMBS group compared to the UC scheme. Females were significantly more likely to use a health care facility for ambulatory care than males. Income was a significant factor predicting use of ambulatory care. The fifth income quintile was significantly less likely to use a health facility than the first income quintile. Age was also a significant factor predicting ambulatory service use. The elderly (over 60 years) were 1.76 times more likely to use a health care facility than the 0-20 age group. Rural people were more likely to visit ambulatory care than those in urban areas (31% higher chance). People who lived outside the central region were between 1.4 and 1.7 times more likely to use a health care facility than those in the central region. The exception here was Bangkok area, where use did not differ from the central region.

Number of visits to services

Because number of ambulatory visits was indicated as count data, a count model was used in the analysis. There were four steps of analysis: model selection, independent variable selection, result of multivariate analysis, and goodness of fit.

Model selection

Poisson and negative binomial regression models were tested to select a suitable model and a test for dispersion was used to select between them. The result of the dispersion test (H_0: $\alpha = 0$) was that there was significant dispersion of number of ambulatory visits (likelihood ratio test of alpha =0: chibar2 (01) = 913.73, p-value =0.000). Therefore, the negative binomial regression model was more appropriate than the Poisson model.

Independent variable selection

Table 5.13 shows the bivariate analysis of independent variables and number of ambulatory visits. According to the criteria of Hosmer and Lemeshow (2000), the variables marital status and insurance status could be excluded from the model. However, as this study aimed to compare different effects of insurance schemes, so it was necessary to keep the insurance status variable in the model.

Table 5.13 Bivariate analysis of independent variables and number of ambulatory visits

Independent variable	Coefficient	P-value	95% CI		F statistic	Prob > F
			LL@	UL@@		
Sex						
Male*	1.00					
Female	0.07	0.005	0.021	0.119	7.84	0.005
Income quintile						
1*	1.00					
2	-0.12	0.006	-0.207	-0.034	5.06	<0.001
3	-0.16	<0.001	-0.250	-0.078		
4	-0.14	0.005	-0.234	-0.042		
5	-0.21	<0.001	-0.339	-0.088		
Age						
0-20*	1.00				75.09	<0.001
21-40	0.26	<0.001	0.170	0.351		
41-60	0.39	<0.001	0.319	0.467		
>60	0.54	<0.001	0.464	0.613		
Marital status						
Unmarried*	1.00				0.06	0.805
Married	0.01	0.805	-0.073	0.094		
Insurance						
UC scheme*	1.00				0.51	0.599
SSS	-0.08	0.321	-0.234	0.077		
CSMBS	0.00	0.993	-0.094	0.093		
Education						
Primary school*	1.00				14.86	<0.001

Independent variable	Coefficient	P-value	95% CI		F statistic	Prob > F
			LL[@]	UL[@@]		
None	0.22	<0.001	0.103	0.334		
Primary<Bachelor	-0.16	<0.001	-0.231	-0.088		
≥ Bachelor	-0.04	0.732	-0.247	0.174		
Chronic disease						
No chronic disease*	1.00				202.01	<0.001
Chronic disease	0.46	<0.001	0.398	0.525		
Region						
Central*	1.00				5.06	<0.001
Bangkok	-0.09	0.303	-0.254	0.079		
North	0.15	0.001	0.062	0.246		
North east	0.03	0.494	-0.064	0.132		
South	-0.08	0.142	-0.189	0.027		
Area						
Urban*	1.00				5.32	0.021
Rural	0.09	0.021	0.014	0.168		

* reference group
[@] lower level
[@@] upper level
Source: Health and Welfare Survey 2005

Table 5.14 shows the first run negative binomial regression model and Wald's chi-square p-value for selected independent variables. Wald's chi square p-value was used to test joint significance. Wald's chi square p-value of more than 0.05 means that the variables are not jointly significantly associated with the outcome and can be removed from the model. The result of the joint significance test led to the removal of income quintile, marital status, education, region, and area. The final independent variables for number of visits were sex, age, chronic disease, and insurance scheme.

Goodness of fit

Assessment of goodness of fit in the negative binomial regression used the F-statistic with the hypothesis that H_0: $\beta_i = 0$ while H_a: $\beta_i \neq 0$. Table 5.14 shows the final model of the negative binomial regression. The result of the model fit from F-statistics (F-statistics = 39.55, p-value = 0.000) was that this model fitted for explaining the number of ambulatory visits.

Results for the number of ambulatory visits using negative binomial regression

Using negative binomial regression analyses for the number of ambulatory visits, having CSMBS insurance was significantly associated with a reduced number of visits to a health facility. CSMBS members had 10% ($1- e^{-0.1}$) fewer visits compared

to UC scheme members, while for SSS there was no significant difference. Furthermore, higher age group was associated with a higher number of facility visits. The over-60 year age group had 39% ($e^{0.33}$) more visits compared to the 0-20 year group, while the 21-40 year group had 17% ($e^{0.16}$) and the 41-60 year group had 24% ($e^{0.21}$) more visits. Having chronic disease was another factor affecting the number of visits. Having a chronic disease increased the chances of using a health facility by 40% ($e^{0.34}$).

Table 5.14 First run and final results of negative binomial regression for number of ambulatory visits

		First run negative binomial regression				Final negative binomial			
Dependent variable		Number of visits							
N		6,774				9,192			
F statistics		10.11				39.55			
Prob > F		< 0.001				< 0.001			
	Wald's test P-value**			95% CI				95% CI	
Variable	(F-statistic)	Coef ficient	P-value	LL@	UL@@	Coef ficient	P-Value	LL	UL
Independent									
Sex									
Male*									
Female		0.04	0.249	-0.02	0.1	0.03	0.268	-0.021	0.074
Income quintile	0.592 (0.70)								
1*									
2		-0.06	0.314	-0.16	0.05				
3		-0.07	0.199	-0.17	0.04				
4		-0.06	0.295	-0.18	0.05				
5		-0.11	0.129	-0.25	0.03				
Age	<0.05 (4.52)								
0-20*									
21-40		0.17	0.021	0.03	0.32	0.16	<0.001	0.079	0.247
41-60		0.19	0.015	0.04	0.35	0.21	<0.001	0.132	0.291
>60		0.29	<0.001	0.13	0.45	0.33	<0.001	0.247	0.416
Marital status									
Unmarried*									
Married		0	0.975	-0.09	0.09				
Insurance	0.666 (0.41)								
UC scheme*									
SSS		-0.01	0.875	-0.16	0.13	-0.09	0.27	-0.236	0.066
CSMBS		-0.05	0.367	-0.15	0.06	-0.1	0.028	-0.192	-0.011
Education	0.141(1.82)								
Primary school*									
None		0.07	0.28	-0.05	0.19				
Primary<Bachelor		-0.06	0.205	-0.14	0.03				

		First run negative binomial regression				Final negative binomial			
≥ Bachelor		0.08	0.402	-0.11	0.26				
Chronic disease									
No chronic disease*									
Chronic disease		0.35	<0.001	0.26	0.44	0.34	<0.001	0.269	0.416
Region	0.113 (1.87)								
Central*									
Bangkok		0.05	0.58	-0.13	0.22				
North		0.14	0.012	0.03	0.25				
North east		0.08	0.164	-0.03	0.2				
South		-0.01	0.910	-0.14	0.12				
Area	0.241 (1.38)								
Urban*									
Rural		0.05	0.241	-0.03	0.13				
Constant		0.2	0.108			0.27	0.030		
/lnalpha		-1.6				-2.01			
Alpha		0.2				0.13			

* reference group
** Wald's test for joint significance
@ lower level
@@ upper level
Source: Health and Welfare Survey 2005

5.6.2 Factors explaining hospitalization

Table 5.15 shows the association of different characteristics with hospitalization. The analysis shows that elderly people and those with a chronic disease had a higher likelihood of hospitalization. In terms of insurance status, the CSMBS had higher hospitalizations followed by the UC scheme, and the SSS had the lowest percentage of hospitalizations. Logistic regression and count data analysis were also used to analyse the probability of an individual being hospitalized and the number of hospitalization episodes.

Table 5.15 Percentage of hospitalization by different characteristics

Independent variable	No hospitalization	Hospitalization	P-value
Total	93.3	6.7	
Sex			<0.001
Male	94.3	5.7	
Female	92.4	7.6	
Income quintile			<0.001
1	91.6	8.4	
2	93.1	6.9	
3	93.9	6.1	
4	93.8	6.2	
5	94.6	5.4	
Age			<0.001
0-20	95.1	4.9	
21-40	93.1	6.9	
41-60	93.8	6.2	
>60	86.0	14.0	
Marital status			<0.001
Unmarried	94.4	5.6	
Married	91.7	8.3	
Insurance			<0.001
UC scheme	93.2	6.8	
SSS	94.7	5.3	
CSMBS	91.5	8.5	
Education			<0.001
Primary school	93.0	7.0	
None	91.1	8.9	
Primary<Bachelor	93.5	6.5	
≥ Bachelor	95.0	5.0	
Chronic disease			<0.001
No chronic disease	95.1	4.9	
Chronic disease	83.6	16.4	
Region			<0.001
Central	94.2	5.8	
Bangkok	96.0	4.0	
North	92.0	8.0	

Independent variable	No hospitalization	Hospitalization	P-value
North east	92.5	7.6	
South	93.3	6.7	
Area			<0.001
Urban	94.5	5.5	
Rural	92.7	7.3	

Source: Health and Welfare Survey 2005

Hospitalization utilization

Hospitalization is a dichotomous variable, so a logistic regression model was used in the analysis.

Selection of independent variables

Table 5.16 shows bivariate analysis of independent variables and hospitalization. Independent variables would be selected in the model if p-value <0.25 (Hosmer and Lemeshow 2000). From Table 5.16, all of the variable groups in the table could be included in the logistic regression model.

Table 5.16 Bivariate analysis of independent variables in hospitalization

Independent variable	OR	P-value	95% CI		F statistic	Prob > F
			LL@	UL@@		
Sex						
Male*	1.00					
Female	1.36	<0.001	1.24	1.50	39.55	<0.001
Income quintile						
1*	1.00					
2	0.81	0.003	0.707	0.931	9.21	<0.001
3	0.70	<0.001	0.603	0.822		
4	0.72	<0.001	0.623	0.836		
5	0.62	<0.001	0.520	0.736		
Age						
0-20*	1.00				100.21	<0.001
21-40	1.43	<0.001	1.251	1.636		
41-60	1.29	<0.001	1.130	1.477		
>60	3.15	<0.001	2.743	3.621		
Marital status						
Unmarried*	1.00				56.36	<0.001
Married	1.53	<0.001	1.367	1.706		
Insurance						
UC scheme*	1.00				13.24	<0.001
SSS	0.76	0.008	0.628	0.931		
CSMBS	1.28	<0.001	1.132	1.447		

Independent variable	OR	P-value	95% CI		F statistic	Prob > F
			LL@	UL@@		
Education						
Primary school*	1.00				7.97	<0.001
None	1.30	0.006	1.075	1.561		
Primary<Bachelor	0.91	0.089	0.823	1.014		
≥ Bachelor	0.69	<0.001	0.559	0.853		
Chronic disease						
No chronic disease*	1.00				715.47	<0.001
Chronic disease	3.81	<0.001	3.451	4.199		
Region						
Central*	1.00				14.5	<0.001
Bangkok	0.67	<0.001	0.534	0.839		
North	1.41	<0.001	1.232	1.618		
North east	1.32	<0.001	1.147	1.515		
South	1.16	0.034	1.011	1.327		
Area						
Urban*	1.00				33.75	<0.001
Rural	1.36	<0.001	1.227	1.511		

* reference group
@ lower level
@@ upper level
Source: Health and Welfare Survey 2005

Table 5.18 shows the analysis of each variable for Wald's test of joint significance and a test the final result of the logistic regression model. The test for joint significance showed that the income quintiles did not help to improve the logistic model, so they were removed.

Goodness of fit and logistic regression diagnosis

The first run of logistic regression was tested for goodness of fit using the Archer and Lemshow (2006) test for goodness of fit for logistic regression of survey data. The result showed that the model was not fitted with an F-adjusted test statistic = 2.81, p-value=0.003 (H_0: model is fitted, H_a: model is not fitted). Therefore, residual diagnosis and interaction effects were tested for outliers and interaction of independent variables.

In the logistic regression diagnosis results, Figures 5.7 and 5.8 show that there were outliers of standardized residuals and high leverage, which meant that they might influence the fit of the model. To reduce influential outliers, the data which were outside -2.57 and 2.57 standard deviations of the standardized residuals were deleted.

Figure 5.7 Distribution of standardized residuals with predicted probability

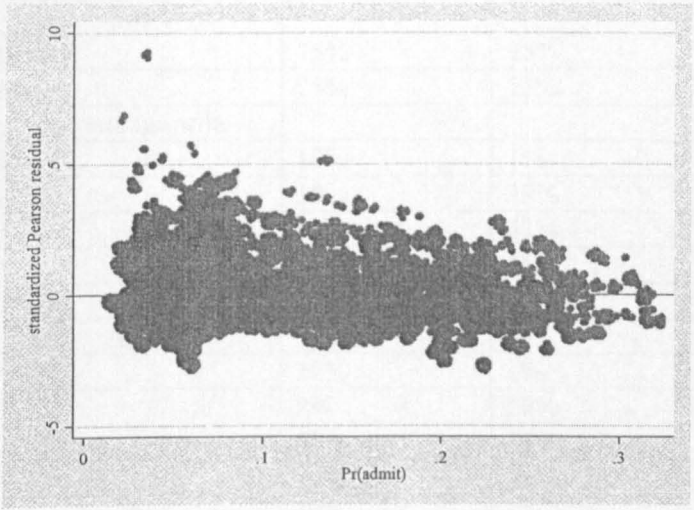
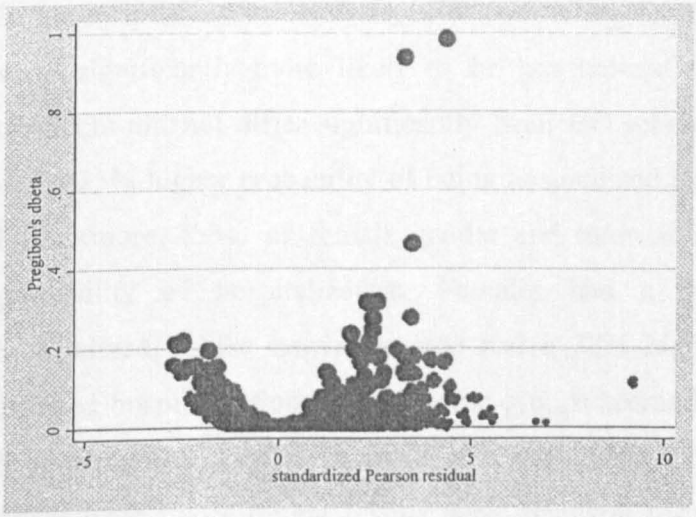


Figure 5.8 Distribution of standardized residuals with leverage value



On interaction effects, the data from the first run logistic regression showed that having a chronic disease might interact with other variables. The odds ratio of sex with chronic disease was 1.65 compared to 0.97 for without chronic disease, while there were no striking differences in other variables. Therefore, the analysis added the interaction of chronic disease and sex in the final analysis. The final result of the logistic regression analysis is shown in Table 5.18. The goodness of fit was F-adjusted test statistic = 1.15, p-value=0.319 which meant that the model was fitted. Table 5.17 shows the characteristics of the removed data, which were female, predominantly in the 2nd income quintile, with age between 21 and 40.

Table 5.17Characteristics of removed hospitalization data

	CSMBS	SSS	UC	Total
Sex				
Female	75%	75%	82%	81%
Male	25%	25%	18%	19%
Income quintile				
1	10%	1%	34%	29%
2	10%	29%	40%	36%
3	9%	43%	7%	9%
4	10%	15%	6%	7%
5	62%	12%	13%	18%
Age				
>60	22%	1%	6%	7%
0-20	2%	16%	16%	15%
21-40	50%	65%	72%	69%
41-60	26%	18%	6%	9%
N	193	126	1,439	1,758

Results of logistic regression of hospitalization

In the hospitalization analysis, after controlling for other factors, CSMBS members were significantly more likely to be hospitalized than UC members, while SSS members did not differ significantly from UC scheme members. CSMBS members had a 25% higher probability of being hospitalized than members of the UC scheme. Furthermore, those of female gender and married status had a significant higher probability of hospitalization. Females had a 55% higher chance of being hospitalized, while married people had a 32% higher chance. Income group also affected hospitalization. High income groups seemed to have a lower probability of hospitalization. Region of residence was another factor affecting hospitalization. There were two different results here. Bangkok residents had a significantly lower probability of hospitalization, while other regions had a higher probability compared to the central region. Living in Bangkok meant a 78% lower chance of hospitalization. Living in the North, North-east, and South meant about a 25% to 36% higher chance of hospitalization compared to the Central region. The details are shown in Table 5.18.

Table 5.18Final logistic regression model of a number of hospitalizations

		First run logistic regression				Final result logistic regression			
Dependent variable		Hospitalization =1							
N		48,721				46,963			
F statistics		39.04				43.8			
Prob > F		< 0.001				< 0.001			
Variable	Wald's test** P-value (F-statistics)	Odds ratios	P-value	95% CI LL@	95% CI UL@@	Odds ratios	P-value	95% CI LL	95% CI UL
Independent									
Sex									
Male*									
Female		1.51	<0.001	1.34	1.70	1.55	<0.001	1.32	1.83
Income quintile	0.138(1.74)								
1*									
2		0.89	0.171	0.75	1.05				
3		0.77	0.011	0.63	0.94				
4		0.85	0.100	0.70	1.03				
5		0.79	0.060	0.62	1.01				
Age	<0.001(30.19)								
0-20*									
21-40		0.99	0.916	0.77	1.27	1.39	0.023	1.05	1.85
41-60		0.73	0.021	0.56	0.95	1.03	0.867	0.76	1.38
>60		1.42	0.012	1.08	1.87	1.97	<0.001	1.47	2.65
Marital status									
Unmarried*									
Married		1.55	<0.001	1.34	1.79	1.32	<0.001	1.14	1.52
Insurance	<0.05 (4.19)								
UC scheme*									
SSS		1.03	0.795	0.83	1.28	1.00	0.995	0.80	1.25
CSMBS		1.26	0.004	1.08	1.48	1.25	0.006	1.07	1.46
Education	<0.01 (5.01)								
Primary school*									
None		0.96	0.707	0.78	1.18	0.90	0.328	0.73	1.11
Primary<Bachelor		1.28	<0.001	1.11	1.48	1.13	0.110	0.97	1.31
≥ Bachelor		0.93	0.575	0.72	1.20	0.74	0.023	0.57	0.96
Chronic disease									
No chronic disease*									
Chronic disease		2.94	<0.001	2.63	3.29	3.95	<0.001	3.32	4.70
Region	<0.001 (8.20)								
Central*									
Bangkok		0.69	0.007	0.53	0.90	0.56	<0.001	0.42	0.75
North		1.24	0.011	1.05	1.46	1.25	<0.001	1.07	1.45
North east		1.34	<0.001	1.14	1.58	1.36	<0.001	1.16	1.59
South		1.31	<0.001	1.13	1.54	1.27	<0.001	1.08	1.50
Area									
Urban*									
Rural		1.06	0.305	0.95	1.20	1.06	0.367	0.94	1.19
Chronic disease*sex						0.70	<0.001	0.56	0.87

* reference group
** Wald's test for joint significance
@ lower level
@@ upper level
Source: Health and Welfare Survey 2005

Number of hospitalization episodes

In the model of number of hospitalization episodes, the steps of analysis included model selection, independent variable selection, and testing the goodness of fit of the model. In model selection, a test for dispersion is done to choose between Poisson and negative binomial regression models. Testing α showed evidence of overdispersion (likelihood ratio test of alpha =0: chibar2 (01) = 3085.56, p-value =0.000); therefore, a negative binomial regression model was selected.

Independent variables selection

Table 5.19 shows the results of bivariate analysis between independent variables and number of hospitalization episodes. Using the criteria of univariate model and p-value <0.25, the variables included in the model were age group, insurance status, education, having chronic disease, and region of residence.

Table 5.19 Bivariate analysis of independent variables in number of hospitalizations

Independent variable	Coefficient	P-value	95% CI		F statistic	Prob > F
			LL@	UL@@		
Sex						
Male*	1.00					
Female	0.03	0.805	-0.175	0.226	0.06	0.805
Income quintile						
1*	1.00					
2	-0.19	0.196	-0.476	0.097	2.02	0.090
3	0.03	0.837	-0.293	0.362		
4	-0.08	0.671	-0.423	0.272		
5	-0.36	0.017	-0.652	-0.065		
Age						
0-20*	1.00				25.57	<0.001
21-40	0.33	0.058	-0.011	0.672		
41-60	0.39	0.007	0.110	0.676		
>60	1.07	<0.001	0.812	1.324		
Marital status						
Unmarried*	1.00				2.28	0.132
Married	0.16	0.132	-0.047	0.357		
Insurance						
UC scheme*	1.00				10.08	<0.001

Independent variable	Coefficient	P-value	95% CI		F statistic	Prob > F
			LL@	UL@@		
SSS	-0.54	0.027	-1.020	-0.060		
CSMBS	0.47	<0.001	0.220	0.727		
Education					6.64	<0.001
Primary school*	1.00					
None	0.12	0.458	-0.195	0.433		
Primary<Bachelor	-0.31	0.035	-0.592	-0.021		
≥ Bachelor	-0.63	<0.001	-0.960	-0.304		
Chronic disease						
No chronic disease*	1.00				128.25	<0.001
Chronic disease	1.26	<0.001	1.040	1.476		
Region						
Central*	1.00				3.23	0.012
Bangkok	-0.49	0.024	-0.909	-0.063		
North	-0.01	0.932	-0.286	0.262		
North east	-0.31	0.039	-0.597	-0.016		
South	0.19	0.323	-0.185	0.562		
Area						
Urban*	1.00				0.03	0.859
Rural	-0.02	0.859	-0.215	0.179		

* reference group
@ lower level
@@ upper level
Source: Health and Welfare Survey 2005

Table 5.20 shows the model test for negative binomial regression and Wald's test for joint significance. From the results in the table, variables which were not significant were income quintile, education, and region. Therefore, the variables to be included in the final model were age group, insurance status and having chronic disease.

Goodness of fit

The negative binomial model of number of hospitalizations showed evidence of a fitted model by F-statistic (F statistic=15.14, p-value=0.000). Therefore, the model can be used in explaining the number of hospitalizations.

Result for number of hospitalizations analysis using negative binomial regressions

Insurance status affected the number of hospitalizations in different ways. SSS members were hospitalized fewer times than UC members, and CSMBS were hospitalized more times. After controlling for other factors, SSS members were 68% ($1/e^{(-0.52)}$) less frequently hospitalized compared with UC scheme members. CSMBS had 27% ($e^{0.24}$) higher chance of being hospitalized compared to the UC scheme.

Furthermore, having a chronic disease was another factor affecting number of hospitalizations. People who had chronic disease were hospitalized 3.14 times more than people who did not have chronic disease. In addition, the elderly had significantly higher frequency of being hospitalized. The over 60 age group had a 40% higher frequency of hospitalization than the 0-20 year group.

Table 5.20 First run and final negative binomial regression model of number of hospitalization

		First run negative binomial				Final negative binomial			
Dependent variable		Number of hospitalization							
N		7,989				9,192			
F statistics		15.41				28.13			
Prob > F		< 0.001				< 0.001			
Variables	Wald's test** p-value (F-statistics)	Coef ficient	P-value	95% CI		Coef ficient	P-value	95% CI	
				LL@	UL@@			LL	UL
Independent									
Income quintile	0.262 (1.32)								
1*									
2		-0.11	0.455	-0.02	0.10				
3		0.10	0.577	-0.26	0.46				
4		-0.04	0.871	-0.48	0.41				
5		-0.29	0.118	-0.66	0.07				
Age	<0.001 (9.44)								
0-20*									
21-40		0.58	0.003	0.20	0.96	0.13	0.472	-0.226	0.487
41-60		0.33	0.053	0.00	0.66	-0.15	0.329	-0.442	0.148
>60		0.80	<0.001	0.47	1.13	0.34	0.016	0.064	0.613
Insurance	<0.001 (6.71)								
UC scheme*									
SSS		-0.45	0.059	-0.91	0.02	-0.52	0.032	-0.997	-0.045
CSMBS		0.39	0.006	0.11	0.66	0.24	0.038	0.014	0.471
Education	0.067 (2.39)								
Primary school*									
None		-0.11	0.546	-0.45	0.24				
Primary<Bachelor		-0.03	0.798	-0.29	0.22				
≥ Bachelor		-0.62	0.009	-1.09	-0.16				
Chronic disease									
No chronic disease*									
Chronic disease		0.94	<0.001	0.72	1.17	1.14	<0.001	0.895	1.393
Region	0.188 (1.54)								
Central*									
Bangkok		-0.41	0.093	-0.90	0.07				

		First run negative binomial				Final negative binomial			
North		-0.03	0.837	-0.32	0.26				
North east		-0.21	0.185	-0.53	0.10				
South		0.17	0.350	-0.19	0.54				
Constant		-2.37	0.190			-2.19	<0.001		
/lnalpha		1.37				1.41			
Alpha		3.93				4.08			

* reference group
** Wald's test for Joint significance
@ lower level
@@ upper level
Source: Health and Welfare Survey 2005

5.7 Discussion

Summary of findings

People in the different insurance schemes (the UC scheme, SSS, and CSMBS) showed different characteristics. The UC scheme was the main provider of insurance to the population, with coverage of nearly 80% of the population. The highest share of members in the UC scheme was in the northeastern area, of low education, and of low income. The SSS had the second largest coverage with about 10% of the population. The highest share of members was in the central area, of a young age, and with low co-morbidity. The CSMBS is the third scheme in terms of coverage with nearly 10% of the population. The highest share of members was in the northeastern area, working age group (41-60), and of a high-income group.

Health seeking behaviour also varied between schemes. SSS members were more likely to report less serious illness, since they showed a high percentage of self-prescribing and no treatment, while UC scheme members tended to use more traditional and non-hospital care. This might also be because SSS members had better health status than members of other schemes. The study found that in claiming the insurance right when they were sick, CSMBS members had the lowest rate of claiming insurance rights for ambulatory care but the highest for hospitalization, contrary to UC scheme which had the highest rate of claiming insurance rights for ambulatory care and the lowest claims for hospitalization.

Illness rate was significantly higher among UC scheme members, followed by CSMBS and SSS members respectively. This pattern was similar to the hospitalization rate. For ambulatory visits, SSS membership is a predictor of

ambulatory visits compared to the UC scheme, while the influence of the CSMBS was not significant. However, none of the insurance schemes was a significant predictor of number of visits. For predisposing factors, being female, married, and elderly were significant predictors of use of ambulatory care, while enabling factors such as high income and region of residence significantly affected use of ambulatory care and number of visits. Having chronic disease was also a significant factor affecting ambulatory visits.

For hospitalization, CSMBS membership was a significant predictor of admission compared to UC scheme membership. Other factors which affect hospitalization were being female, elderly, married status, income group, chronic disease co-morbidity, and region.

Discussion of findings

Bivariate analysis

The HWS 2005 reflected the full effect of UC implementation in Thailand. The Coverage of population improved from 2003. The numbers uninsured fell fromabout 5.1% in 2005 to 4.9% in 2005 (Vasavid et al. 2004). This expansion was based on three major health insurance schemes with the UC scheme covering the majority of the population. The UC scheme's main aim was to increase coverage to the poor and previous uninsured population (NaRanong and NaRanong 2006). There were, however, two challenges of this idea: there was proof that targeting the poor would miss the target of universal coverage, and quality of care could not be improved if only the poor were targeted (Siamwala 2003). Pannarunothai (2002) conducted a survey in 6 provinces of the initial implementation of the UC scheme. The data showed that only 19% of UC scheme members who had an income of more than 15,000 Baht/month (£214 /month) exercised their insurance right (Pannarunothai 2002b). However, the HWS 2005 showed an improvement of this situation, with people in the 5th quintile exercising their right 35.4% of the time.

When people were sick, they usually used their insurance right (Table 5.3). However, some were covered by more than one insurance scheme. This was about 0.1 to 2.2%. The reason for this was that someone could be a member of more than one insurance

scheme. For example, a doctor in a public hospital working part time in a private hospital would have both CSMBS and SSS insurance at the same time.

There were some interesting findings relating to claiming insurance entitlement and income quintile, especially in the SSS. The first income quintile of the SSS claimed their insurance less than the second, third, and fourth income quintiles. This might be because in the lower income group, leaving work to seek care affected their income. Therefore, they might find other ways of treatment such as self-prescribing.

The utilization rate in ambulatory care declined from 4.7 episodes/person/year in 2003 (Vasavid et al. 2004) to 3.25 episodes/person/year in 2005. However, the rate of hospitalization increased from 0.083 admissions/person/year in 2003 to 0.108 admissions/person/year in 2005. The reason for this might be that in 2003 the barrier to access to hospitalization was reduced after implementation of UC, so some people switched to use formal care. This pattern of utilization is the same as experienced in Taiwan with universal coverage where ambulatory care rates have fluctuated over the past ten years while the hospitalization rate has increased consistently (Wen et al. 2008).

Health seeking behaviour differed between health insurance schemes. SSS members were more likely to use self-prescribing drugs and no treatment probably because this group was of younger age with less severe disease. Furthermore, their income might be affected if care-seeking meant they were not working (Sirisinsuk et al. 2003). The SSS group used private clinics and private hospitals more than UC scheme and CSMBS members because the contracting unit of this scheme was mainly private hospitals. As mentioned above, this group of hospitals used private clinics as sub-contractors. Furthermore, SSS members who had longer work experience tended to choose hospitals with longer service hours and easier access (Sirisinsuk et al. 2003). UC scheme members were more likely to use traditional treatments because they mostly lived in rural areas. They still believed in the use of traditional or alternative medicine. This finding corresponds to the study of Boonyoung (2003) which studied health seeking behaviour in Thai Muslim women in Yala (southern province of Thailand). The finding was that UC scheme patients were more likely to seek traditional or alternative medicine more than in other insurance schemes (Boonyoung

2003). Furthermore, when they were sick, the main providers they used were health centre and community hospital (Vasavid et al. 2004). This was firstly because in rural areas where most UC members lived, health centres and community hospitals were the nearest providers, and transportation might be too expensive to seek care far from home, and secondly due to the UC regulations, which required patients to go to services within their CUP (in rural areas PCUs, health centres, or the community hospital) which acted as gatekeeper to other secondary care services. CSMBS members were the main users of formal care. They also used public hospitals, especially regional and university hospitals. This was because this group could go to any public hospital, and no gatekeeper role was assigned to any level. Transportation costs were also less of a problem for them since they were less poor. The payment method in the CSMBS scheme is fee-for-service, so large hospitals were more likely to have felt comfortable in following-up this group of patients. With these results, there remains the problem of which factors influenced the utilization of both ambulatory care and hospitalization.

Multivariate analysis

To explain factors affecting utilization of both ambulatory care and hospitalization, this study hypothesised that there were three main set of factors affecting utilization: predisposing factors, enabling factors, and illness factors (Andersen 1995). The details of the hypotheses are shown below:

- For enabling factors
    - Different insurance status affects service utilization.
    - Those of high-income utilize more services than those of low-income.
    - People living in remote areas use services less.
- For predisposing factor
    - Older age groups use more services than younger groups.
    - Females tend to use more services than males.
    - People with low education use more services than those with high education.
    - Married people use more services than unmarried people.
- Illness factor
    - Having chronic disease increases service utilization.

Both logistic regression and negative binomial regression were used as tools for the analysis of ambulatory visit, and hospitalization levels.

For ambulatory visits, after controlling for demographic and other confounders such as age and sex, SSS insurance status increased the probability of ambulatory care visits by 41% compared to UC scheme membership, while there was no significant difference between UC scheme and CSMBS groups. This result might be due to two reasons. First, the SSS allowed beneficiaries to choose their own main contractor hospital. Beneficiaries knew their entitlements and where to go when they were sick. This corresponds to a study by Yip et al. (1998) which found that utilization of service related to choice of health facilities chosen by beneficiaries (Yip et al. 1998). Second, many clinics were subcontractors which can increase access to care for this group. Furthermore, most providers in the SSS extended OPD hours to provide services outside normal working hours.

Region of residence was also a factor in utilization. After controlling for insurance and other demographic factors, it was found that Bangkok residents had a significantly lower probability of an ambulatory visit (by 32%) compared to the central region, while other regions had significantly higher probability of visits. This can be explained by three reasons. The first is that Bangkok has the lowest illness rate. This was nearly two times less than northern and northeastern regions, as shown in Table A1.1. This data is confirmed by Table A1.2 and Table A1.3 which shows that Bangkok residence is not significant for probability of illness. Furthermore, Bangkok residents are least likely to have insurance cover compared to the other regions presumably because of the high percentage of migrant workers who are either registered under UC scheme with CUP in their home province (Table A1.4). This results in the highest level of no treatment and self-prescribing (Table A1.5). Furthermore, rural area residents were also significantly more likely to visit ambulatory care facilities than those in urban areas. This finding corresponds to a study by Jitatpankul (1999) which found that service utilization in rural areas was 62% higher than in urban areas (Jitapunkul 1999). Likewise, a study by Srithamrongsawat (2005) found that urban residents had fewer visits to health facilities compared with rural residents (Srithamrongsawat 2005).

Regarding number of ambulatory visits, the CSMBS was associated with fewer visits to health facilities than the SSS or UC schemes. Three reasons were suggested for this. First most of the CSMBS group went to a hospital rather than to a health facility near to home. It might take longer time to obtain services at the health facility so discouraging frequent use. Secondly, most CSMBS members were government officers who could only attend hospital after working hours. Furthermore, they could only go to a public hospital otherwise they had to pay the costs themselves. Few public hospitals provided services out of working hours. Third, CSMBS patients had to pay and be reimbursed for OP services. This might have deterred OP use by CSMBS patients.

It was also found that being elderly, having chronic disease, and living in the northern region were significantly associated with a higher number of visits. The first two factors, being elderly and having chronic disease, corresponded with the hypothesis that these groups needed more services than people who were younger or without chronic disease. This finding corresponds to the finding of Srithamronsawat (2005) that elderly people with chronic disease made more frequent use of services. The elderly normally have an increased level of co-morbidity (unlike those in younger age groups) which requires more services.

The reason for the northern region being positively and significantly associated with number of ambulatory care visits could be explained from two aspects, provider and patient. On the patient side, this might be because of the higher incidence of certain diseases such as HIV, for which patients needed more frequent follow up. On the other hand, increased provision of services by providers could have led to an increase in the demand for health care. This might be the result of the policy to expand primary health care provision after UC implementation. After UC implementation, the distribution of health personnel seemed more equitable. Data from the MOPH showed that the ratio of nurses to population increased rapidly in remote regions such as the northeastern and northern areas during 2000 to 2003 (Health Policy and Strategy 2003). The reasons why SSS members made significantly more frequent use of ambulatory service than CSMBS members might be the same as those for ambulatory visit - that members normally chose their main contractor that they would use when they were sick. This finding corresponded to study of Sirisinsuk et al. (2003)

which found that the UC scheme had more frequent use of ambulatory service than CSMBS might be explained by two reasons. First, it might be because when UC members are sick, they might be more severe than CSMBS members. Second, they could go to a PCU or health centre, which were usually not far from their home so they could go more frequently than CSMBS members.

For hospitalization, the results differed from ambulatory care, after controlling for demographic and other enabling factors, the CSMBS was found to be a significant predictor of probability of any hospitalization. This might be due to two reasons. First, CSMBS members were likely to request hospitalization more than other insurance scheme members since they knew that the hospital could receive complete reimbursement from the government and they would not be charged. Second, hospitals might have incentives to admit patients in this group since the reimbursement of CSMBS is fee-for-service. In theory, providers will provide more services under this payment system (Bitran and Block 1992) than alternatives such as payments based on capitation or DRGs. Residents of Bangkok region were less likely to be hospitalized than residents of all other regions. However, living in a rural area was not a significant predictor of probability of hospitalization. The reasons for this might come from two sides, demand and supply. On the demand side, people who lived outside the central region had higher morbidity, but they faced several constraints limiting hospital visits such as limited means of transportation. Some of them might wait until their disease got worse and required hospitalization. On the supply side, although Thailand had a problem of shortage of health personnel in remote areas, the distribution of beds was more equitable allowing for similar equity in admission rates in rural and urban areas.

Regarding the number of hospitalizations, after controlling for demographic and other enabling factors, CSMBS members were more likely to have a higher number of hospital admissions compared to UC scheme members. This might be due to CSMBS members being able to access any public hospital. Furthermore, the regulation which allows CSMBS members to go to hospital directly without going to any gatekeeper might promote hospital use in this group. On the provider's side, FFS payment encourages more frequent admissions than the other insurance schemes.

5.8 Conclusion

This chapter explored service utilization in the different health insurance schemes using the 2005 Health and Welfare Survey. The findings show that there are variations in utilization between health insurance schemes, after controlling for other confounding factors such as demographic factors. The UC scheme design was associated with a lower proportion of members utilizing ambulatory visits, but with more frequent use once members were sick, and with lower level of hospitalization. The SSS scheme design was associated with a higher proportion of individuals using ambulatory service and with higher frequency, while hospitalization levels were low. CSMBS scheme design was associated with lower use and frequency of ambulatory services but higher use and frequency of hospitalization.

CHAPTER 6: VARIATION OF LENGTH OF STAY AND READMISSION IN DIABETES MELLITUS PATIENTS BETWEEN INSURANCE SCHEMES

6.1 Background

This chapter examines the efficiency of resource use in the three health insurance schemes - Universal Coverage (UC), Social Security Scheme (SSS), and Civil Servant Medical Benefit Scheme (CSMBS) - by analyzing length of stay (LOS) and early readmission rate in Diabetes Mellitus (DM) patients, used as the tracer for this analysis. LOS is a common indicator for efficient use of resource as the cost of resources consumed in hospital is related to the number of patient days (Martin and Smith 1996). However, lower resource consumption might also relate to poor quality of care. Readmission is a good indicator to monitor whether shorter LOS led to poor quality (Milne and Clarke 1990). The data come from claims that hospitals servicing all three major health insurance schemes have to send for reimbursement. The aim of the analysis is to compare the effects of insurance schemes and other factors on resource use, LOS as a proxy for resource use and on quality as proxied by the readmission rate. The analysis compares three conditions of DM requiring hospital admission: acute complications, chronic complications, and DM without complication.

The chapter begins by discussing the reliability of the data. Then the descriptive and multivariate analyses of LOS are presented. The final section is an analysis of readmission rates using univariate and multivariate analysis.

6.2 Reliability of data

The validity and reliability of claims data are of major concern since these data are used not only to monitor healthcare performance, but also and primarily for reimbursement purposes. Pannarunothai (2002) reviewed the claims data of public health insurance for 2001 for 4.1 million cases by using software grouper version3. He found that the overall error rate was 8.2%. The main error was the wrong coding in the primary diagnosis, which occurred in 4.2% of claims. The university hospitals had the highest error rate, at 12.8%, followed by community hospitals, at 11.5%. Table 6.1 shows the details of coding errors.

Table 6.1 Coding errors by hospital type from claims data 2001

Cause of errors	Coding error of claims data (%)					
	Regional	General	Community	University	Other	Total
No primary diagnosis	1.3	0.7	0.9	7.6	1.8	1.1
Code not for primary diagnosis	1.1	0.7	8.4	0.2	5.6	4.2
Diagnosis not for inpatient	0.2	0.4	0.7	0.4	0.3	0.5
Primary diagnosis not corresponding with age	0.6	0.7	0.8	0.5	0.5	0.7
Primary diagnosis not corresponding with sex	0.5	0.2	0.2	1.8	0.3	0.3
Age error	0.1	0.0	0.0	0.0	0.0	0.0
Weighted error	2.4	1.8	0.5	2.3	2.6	1.4
Total	6.2	4.6	11.5	12.8	11.0	8.2
Number (10^6)	9.06	1.27	1.75	0.68	0.13	4,12

From: Pannarunothai 2002a

How reliable claims data need to be in order to measure performance is not known. Furthermore, when comparing discordant patient data and claims data, there is the problem of deciding which one is correct. Patient follow-up might be required in order to investigate the accuracy of the medical record data and claims data. In general, the reliability of claims data has been assessed by comparing claims data against medical records. For example, Humphries et al. (2000) compared co-morbidity from claims data and medical records in Canada. They found that reliability (Kappa) ranged between 0.31 and 0.83 (Humphries et al. 2000). Kappa values of more than 0.75 were assumed as representing excellent agreement, while Kappa values of less than 0.4 represented poor agreement (Kirkwood and Stern 2003). Using Thai data, the NHSO investigated claims data in comparison with patient notes in 909 hospitals in 2006. The number of cases analysed was 57,828. The data showed that reliability of claims data had a Kappa value of 0.75, as shown in Table 6.2. This means that the Thai claims data may be suitably representative of data from patient notes.

Table 6.2 Reliability from summary notes and coding data in 2006

Patient notes	Coding		
	Correct	Incorrect	Total
Correct	27,253	6,073	33,326
Incorrect	1,147	23,355	24,502
Total	28,400	29,428	57,828
Kappa = 0.75			

From: Bureau of claims audit and quality audit, NHSO 2004

6.3 Methodology

The methodology used for this study can be divided into two parts: LOS and readmission. The analyses of LOS and readmission used two diagnosis groups, Insulin Dependent Diabetes Mellitus (IDDM) and Non-Insulin Dependent Diabetes Mellitus (NIDDM) which were separated into three conditions: acute, chronic, and no complications. There were two rationales behind this. First, different patient conditions might influence provider behaviour. Second, factors associated with LOS and readmission might differ according to diagnosis. The three conditions demonstrate differing degree of urgency of patient treatment.

To identify the independent variables for the model, since there were few Thai studies of factors relating to LOS and readmission, both Thai and international literature were reviewed. As mentioned in chapter 4, this study employed three components of Lave and Frank's framework of LOS including patient characteristics, hospital characteristics, and payment structure. Factors affecting LOS included disease, condition, and context of study site. However, because of availability of information from claims data, the factors included in the study were age, sex, severity of disease, hospital type, and insurance status. For readmission, there is evidence that longer LOS can affect readmission (Bloomberg et al. 2003, Heggestad T. 2002) so this study included LOS in analysis of early readmission. Normally, in terms of patient characteristics, the elderly have a higher chance of getting severe conditions which might lead to longer LOS. Providers might be influenced by different characteristics of insurance such as the payment system to reduce the LOS of patients. Different

levels of hospital might also have different policies on treating patients. Teaching hospitals might take more time on investigations which might increase LOS.

In the LOS analysis, this study uses the count data model which was presented in chapter 5. The dependent variable is length of stay. Since LOS distribution is usually skewed, so Poisson or negative binomial regression models are suitable for the analysis. Independent variables used in this study are composed of patient factors and clinical factors. Patient related independent variables are age, sex, and insurance status, while clinical characteristics are severity of disease, and hospital type. Severity in the claims data came from DRG grouper software which calculates severity by using co-morbidity and complications when patients are admitted. It can be categorized into five levels: 0 is no co-morbidity and a complication, 1 is minor, 2 is moderate, 3 is severe, and 4 is very severe co-morbidity and complication (National Health Security Office 2007b).

For readmission, since readmission is a binary variable, so logistic regression was used for the analysis as this is a binary variable. The details of the model were given in chapter 5.

6.4 Length of stay in Diabetes Mellitus patients between health insurance schemes

DM patients were divided into acute complications, chronic complications, and admission without complications. The diagnosis of patients in the study used the International Classification of Disease 10th revision (ICD-10) code E1. The details of the retrieval coding are shown in Table 6.3. Acute complications were composed of E100, E101, E110, and E111. Without complications were composed of E109 and E119. The other codes were DM chronic complications.

Table 6.3 Details of coding used in the analysis

Code	Details of diagnoses
E100	Insulin-dependent Diabetes Mellitus, with coma
E101	Insulin-dependent Diabetes Mellitus, with ketoacidosis
E102	Insulin-dependent Diabetes Mellitus, with renal complications
E103	Insulin-dependent Diabetes Mellitus, with ophthalmic complications
E104	Insulin-dependent Diabetes Mellitus, with neurological complications
E105	Insulin-dependent Diabetes Mellitus, with peripheral circulatory complications

Code	Details of diagnoses
E109	Insulin-dependent Diabetes Mellitus, without complications
E110	Non-insulin-dependent Diabetes Mellitus, with coma
E111	Non-insulin-dependent Diabetes Mellitus, with ketoacidosis
E112	Non-insulin-dependent Diabetes Mellitus, with renal complications
E113	Non-insulin-dependent Diabetes Mellitus, with ophthalmic complications
E114	Non-insulin-dependent Diabetes Mellitus, with neurological complications
E115	Non-insulin-dependent Diabetes Mellitus, with peripheral circulatory complications
E119	Non-insulin-dependent Diabetes Mellitus, without complications

Truncated data

Distribution of data on LOS was skewed to the right. The range of LOS was between 0 to 441 days. However, this maximum range might come from coding errors or human error. To truncate the outliers, several methods can be used, depending on the user objective (Lee et al. 1998). This study used right-side truncation at mean+3 SD. However, the left side was not truncated because an admission of zero days was possible: for example, a patient admitted one day and discharged before noon the next day would be counted as zero days. The average LOS of claims data was 5.73 with SD 10.88, so the cut point was 38 days. The truncation removed data on 972 cases from 69,708 (leaving 68,736): 67 with acute complications, 762 with chronic complications, and 143 without complications.

Furthermore, with regard to the age of the patient, ages ranged from 0 to 123 which was likely to be due to human error in coding. To truncate the error, two sides 3 SD from the average were used to remove errors. The new age range was 20 to 101 years. Data were removed in 804 cases from 68,736: 329 with acute complications, 29 with chronic complications, and 446 without complications. The remaining data numbered 67,932 cases.

Table 6.4 shows the number of observations in this study. Most of the cases were DM without complications, with 37,104 cases. The cases of acute complications and chronic complications were nearly equal, at 15,289 and 15,539 respectively. The data showed that between the schemes, the UC scheme had the highest number of cases (78%) while the number of cases in SSS was the lowest (3%). CSMBS cases were about 19% of the total.

Table 6.4 Number of observations (admissions) in the length of stay and readmission study

Diagnosis	Insurance			
	CSMBS N (%)	SSS N (%)	UC N (%)	Number of Admission N (%)
Acute complications (E100-E101,E110-E111)	2,520 (16)	445 (3)	12,324 (81)	15,289 (100)
Chronic complications (E102-E105,E112-E115)	2,622 (17)	431 (3)	12,486 (80)	15,539 (100)
No complications (E109,E119)	8,035 (22)	1,075 (3)	27,994 (76)	37,104 (100)
Total	13,177 (19)	1,951 (3)	52,804 (78)	67,932 (100)

Source: Claims data 2005

The characteristics of patients are shown in Table 6.5. Two-thirds of patients were female. 96% of cases were from public hospitals. 58% came from community hospitals. Most of the patients were elderly. More than 50% were older than sixty years.

Comparing the three schemes, SSS patients were mainly male, while CSMBS and UC scheme patients were predominately female. All CSMBS patients used public hospitals while most SSS patients used private hospitals (57.4%). UC scheme patients also received services mainly from public hospitals, with only 2.4% of UC scheme patient data being from private hospitals. CSMBS and UC scheme patients were older than SSS patients. Most patients in the CSMBS and UC schemes were more than 60 years old (69.8% and 52.5% respectively), while SSS patients were mainly in the 41-60 year age group (61.8%).

Table 6.5 Different characteristics of those admitted by insurance scheme

Characteristics	CSMBS(%)	SSS(%)	UC(%)	Overall
N	13,177	1,951	52,804	67,932
Age				
0-40	1.4	28.8	6.5	6.1
41-60	28.8	61.8	41.0	39.2
>60	69.8	9.5	52.5	54.7
Sex				
Male	37.9	55.8	30.2	32.4
Female	62.2	44.2	69.8	67.6
Severity*				
0	64.0	66.4	59.1	60.3
2	18.8	18.7	20.6	20.2
3	14.2	13.3	16.5	16.0

Characteristics	CSMBS(%)	SSS(%)	UC(%)	Overall
4	3.1	1.5	3.9	3.6
Hospital type				
Community	46.4	2.0	64.0	58.8
General	27.8	19.7	20.4	21.8
Regional	15.9	17.1	11.7	12.7
University	2.9	2.1	1.0	1.4
Private	-	57.4	2.4	3.5
Military	7.0	1.7	0.5	1.8

* No cases of severity level 1
Source: Claims data 2005

6.4.1 Length of stay of Diabetes Mellitus patients

Average length of stay by schemes is shown in Table 6.6. Overall, CSMBS patients had longer LOS compared to SSS and UC scheme patients. LOS of CSMBS patient was on average 5.9 days, compared with 4.9 for both SSS and UC patients .

Table 6.6 Length of stay between schemes for different patient types

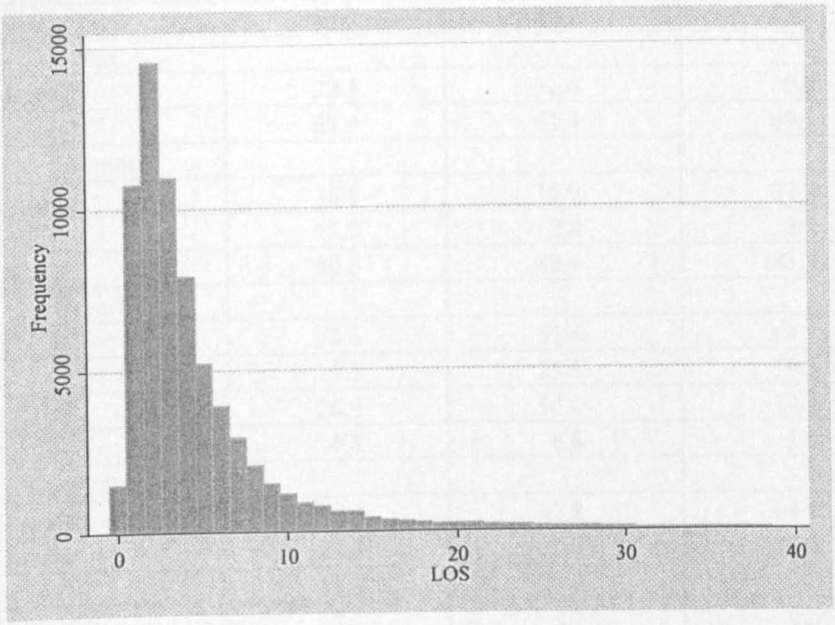
Admission complication type		CSMBS	SSS	UC	Total	P-value*
Acute	$\overline{x}$	5.3	3.8	3.8	4.0	<0.001
	SD	5.0	3.5	3.7	4.0	
	N	2,520	445	12,324	15,289	
Chronic	$\overline{x}$	9.0	7.2	7.3	7.6	<0.001
	SD	8.2	7.2	7.2	7.4	
	N	2,622	431	12,486	15,539	
Without	$\overline{x}$	4.9	3.5	3.6	3.9	<0.001
	SD	4.9	3.7	3.5	3.9	
	N	8,035	1,075	27,994	37,104	
Overall	$\overline{x}$	5.8	4.4	4.6	4.8	<0.001
	SD	5.9	4.9	4.9	5.2	
	N	13,177	1,951	52,804	67,932	

* Kruskal Wallis test
Source: Claims data 2005

6.4.2 Factors explaining length of stay

The summary of independent and dependent variables is presented in Appendix 2. A description and summary of admission conditions is shown in Table A2.2, Table A2.3, and Table A2.4. Figure 6.1 shows the distribution pattern of LOS. The range of LOS was between 0 and 38 days.

Figure 6.1 Length of stay distribution of Diabetes Mellitus patients



Variable	Observations	Mean	Std. Dev.	Min	Max
LOS	67,932	4.8	5.2	0	38

Table 6.7 shows the association of different characteristics with the levels of complications. The main age group for all conditions was >60 years, which was about 50-56%. Females were predominant in all three conditions. Ratio of cases by insurance corresponded to the percentage coverage of health insurance, for example, the UC scheme covered 75-80% of cases. Regarding severity status, most of the cases had no co-morbidity. The main providers were community hospitals and general hospitals. For LOS, those with acute complications were mainly in the 4-7 day group, while those with chronic complications mainly had LOS >7 days. In the group without complications, most had LOS of 4-7 days.

Table 6.7 Different characteristics in different complication conditions

Variables	Complications			
	Acute (%)	Chronic (%)	Without (%)	P-value*
N	15,289	15,539	37,104	
Age group				<0.001
0-40	7.7	5.1	5.9	
41-60	34.6	44.7	38.8	

Variables	Complications			
	Acute (%)	Chronic (%)	Without (%)	P-value*
>60	57.7	50.2	55.3	
Sex				<0.001
Male	32.1	36.6	30.8	
Female	67.9	63.4	69.2	
Insurance				<0.001
CSMBS	16.5	16.9	21.7	
SSS	2.9	2.8	2.9	
UC	80.6	80.4	75.5	
Severity				<0.001
0	58.6	51.4	64.7	
2	19.7	23.3	19.1	
3	16.9	18.6	14.5	
4	4.8	6.8	1.8	
Hospital type				
Community	55.6	47.8	64.8	
General	23.2	22.7	20.8	
Regional	13.4	20.9	9.0	
University	2.1	2.7	0.5	
Private	3.2	4.3	3.3	
Military	2.7	1.6	1.6	
LOS				<0.001
0-3	59.9	35.4	61.2	
4-7	28.8	30.9	28.1	
>7	11.3	33.7	10.7	

* chi square test
Source: Claims data 2005

Model selection

To select between Poisson and negative binomial regression models, a dispersion test had to be done. There was significant evidence of overdispersion (acute complications: chibar = 1.4×10^4, p-value<0.001, chronic complications: chibar =5.0×10^4, p-value<0.001, without complications: chibar = 3.1×10^4, p-value<0.001). Therefore, the analysis used a negative binomial regression model instead of a Poisson model.

Selection of independent variables

Table 6.8 shows the bivariate analysis between individual independent variables and LOS for acute, chronic, and without complications patients. Selection of independent variables was done using the criteria of Hosmer and Lemeshow (2000), i.e. variables with a p-value of less than 0.25; if too low a p-value is used, important variables might be missed. Using these criteria, the variables added into the model were age group, sex, insurance status, severity status, and hospital type.

Table 6.8 Bivariate analysis of variables in the negative binomial regression models and length of stay

Variables	Acute complications						Chronic complications						Without complications					
	Coef-ficient	p-value	95%CI		LR chi2	Prob > chi2	Coef-Ficient	p-value	95%CI		LR Chi2	Prob > chi2	Coef-ficient	p-value	95%CI		LR chi2	Prob > chi2
			LL@	UL@@					LL	UL					LL	UL		
Age group																		
0-40	1.00						1.00						1.00					
41-60	-0.16	<0.001	-0.21	-0.11	39.8	<0.001	0.05	0.141	-0.02	0.11	2.7	0.258	-0.09	<0.001	-0.12	-0.05	113.7	<0.001
>60	-0.13	<0.001	-0.18	-0.08			0.03	0.314	-0.03	0.10			0.01	0.703	-0.03	0.04		
Sex																		
Male	1.00						1.00						1.00					
Female	-0.11	<0.001	-0.13	-0.08	56.7	<0.001	-0.08	<0.001	-0.11	-0.05	31.0	<0.001	-0.10	<0.001	-0.12	-0.09	132.0	<0.001
Insurance																		
CSMBS	1.00						1.00						1.00					
SSS	-0.34	<0.001	-0.42	-0.26	390.6	<0.001	-0.21	<0.001	-0.30	-0.13	120.6	<0.001	-0.35	<0.001	-0.41	-0.30	982.8	<0.001
UC	-0.33	<0.001	-0.37	-0.30			-0.20	<0.001	-0.24	-0.16			-0.30	<0.001	-0.32	-0.28		
Severity																		
0	1.00						1.00						1.00					
2	0.19	<0.001	0.15	0.22	1,467.0	<0.001	-0.35	<0.001	-0.38	-0.32	637.0	<0.001	0.18	<0.001	0.16	0.20	1,806.3	<0.001
3	0.41	<0.001	0.37	0.44			-0.01	0.542	-0.05	0.03			0.39	<0.001	0.37	0.41		
4	0.90	<0.001	0.84	0.95			0.32	<0.001	0.27	0.38			0.74	<0.001	0.69	0.80		
Hospital type																		
Community	1.00				987.4	<0.001	1.00				986.4	<0.001	1.00				855.7	<0.001
General	0.14	<0.001	0.11	0.17			0.42	<0.001	0.39	0.46			0.23	<0.001	0.21	0.25		
Regional	0.32	<0.001	0.29	0.36			0.39	<0.001	0.36	0.43			0.19	<0.001	0.16	0.22		
University	0.89	<0.001	0.81	0.97			0.63	<0.001	0.54	0.71			0.43	<0.001	0.33	0.54		
Private	0.10	0.007	0.03	0.18			0.25	<0.001	0.19	0.32			-0.04	0.061	-0.09	0.00		
Military	0.69	<0.001	0.61	0.76			0.70	<0.001	0.60	0.81			0.50	<0.001	0.44	0.56		

@ lower level @@ upper level

Source: Claims data 2005

Table 6.9 shows the first run of the negative binomial regression with independent variables and the result of Wald's test for joint significance. The results of the joint significance test in the three conditions showed that categorical data in the models helped to fit the negative binomial model. Therefore, all selected independent variables could be included in the models.

Goodness of fit

Goodness of fit in the negative binomial regression used Pearson's chi-square of expected and observed values. The hypothesis tested was that at least one β was not zero (H_0: $\beta_i = 0$, H_a: $\beta_i \neq 0$).

A likelihood ratio test found that all three analysis models fitted (acute complications: LR chi 2,371.2, p-value<0.001, chronic complications: LR chi 1,504.0, p-value<0.001, without complications: LR chi 3,382.9, p-value <0.001). Therefore, the model of negative binomial regression in the first run could be used as the final model to explain the relationship of the independent variables to LOS.

Table 6.9 First run and results of negative binomial regression of length of stay for the three admission conditions

Variable	Joint significance	Acute complications				Joint significance	Chronic complications				Joint significance	Without complications			
	P-value for Adjusted Wald test (F-statistic)	Coef-ficient	P-value	95% CI		P-value for Adjusted Wald test (F-statistic)	Coef-ficient	P-value	95% CI		P-value for Adjusted Wald test (F-statistic)	Coef-ficient	P-value	95% CI	
				LL@	UL@@				LL	UL				LL	UL
LR Chi		2371.24					1504.01					3382.86			
Prob > chi2		0.000					0.000					0.000			
Pseudo R2		0.0322					0.0159					0.0192			
Dependent variable		LOS													
N		15,254					15,455					37,044			
Independent variable															
Age group	<0.001 (42.1)					0.046(6.2)					<0.001(54.5)				
0-40															
41-60		-0.15	<0.001	-0.19	-0.10		0.02	0.584	-0.04	0.08		-0.13	<0.001	-0.17	-0.10
>60		-0.16	<0.001	-0.21	-0.11		-0.02	0.576	-0.08	0.04		-0.11	<0.001	-0.14	-0.07
Sex	<0.001(13.0)					0.001(10.2)					<0.001(96.5)				
Male															
Female		-0.05	<0.001	-0.08	-0.02		-0.05	<0.001	-0.07	-0.02		-0.09	<0.001	-0.10	-0.07
Insurance	<0.001(238.6)					<0.001(53.4)					<0.001(741.5)				
CSMBS															
SSS		-0.40	<0.001	-0.49	-0.30		-0.26	<0.001	-0.36	-0.16		-0.37	<0.001	-0.43	-0.31
UC		-0.26	<0.001	-0.29	-0.22		-0.12	<0.001	-0.16	-0.09		-0.27	<0.001	-0.29	-0.25
Severity	<0.001(1,150.3)					<0.001(472.0)					<0.001(1,726.2)				
0															
2		0.18	<0.001	0.14	0.21		-0.30	<0.001	-0.34	-0.27		0.16	<0.001	0.14	0.19
3		0.36	<0.001	0.33	0.40		-0.02	0.223	-0.06	0.01		0.39	<0.001	0.37	0.41
4		0.79	<0.001	0.74	0.85		0.25	<0.001	0.20	0.30		0.71	<0.001	0.65	0.76
Hospital type	<0.001(380.5)					<0.001(719.0)					<0.001(310.9)				

Variable	Joint significance	Acute complications				Joint significance	Chronic complications				Joint significance	Without complications			
	P-value for Adjusted Wald test (F-statistic)	Coef-ficient	P-value	95% CI		P-value for Adjusted Wald test (F-statistic)	Coef-ficient	P-value	95% CI		P-value for Adjusted Wald test (F-statistic)	Coef-ficient	P-value	95% CI	
				LL@	UL@@				LL	UL				LL	UL
Community															
General		0.06	<0.001	0.03	0.09		0.37	<0.001	0.34	0.41		0.15	<0.001	0.13	0.17
Regional		0.17	<0.001	0.14	0.21		0.34	<0.001	0.31	0.38		0.10	<0.001	0.07	0.13
University		0.61	<0.001	0.53	0.68		0.51	<0.001	0.42	0.59		0.26	<0.001	0.15	0.36
Private		0.15	<0.001	0.06	0.23		0.29	<0.001	0.22	0.37		-0.01	0.621	-0.07	0.04
Military		0.44	<0.001	0.37	0.51		0.60	<0.001	0.49	0.70		0.28	<0.001	0.22	0.34
Constant		1.54	<0.001	1.48	1.60		2.00	<0.001	1.92	2.07		1.57	<0.001	1.53	1.61
/lnalpha		-1.11					-0.56					-1.07			
Alpha		0.33					0.57					0.34			

@ lower level
@@ upper level
Source: Claims data 2005

Results for LOS using negative binomial regression

In the acute complications model, after controlling for confounding factors, SSS and UC cases had significantly shorter LOS than CSMBS cases. SSS had 49% ($1/e^{-0.40}$) shorter LOS and UC scheme had 30% ($1/e^{-0.26}$) shorter LOS than the CSMBS. Female gender and age over 40 years were associated with significantly shorter LOS. High severity cases had significantly longer LOS compared to low severity cases. Very severe conditions had 2.20($e^{0.79}$) times longer LOS compared to cases without co-morbidity. For hospital types, community hospital had shorter LOS than all other hospital types, although the difference for private hospitals was not significant.

In the chronic complications model, after controlling for confounding factors, UC scheme and SSS cases had significantly shorter LOS than CSMBS cases. SSS scheme had 30% ($1/e^{-0.26}$) shorter LOS while UC scheme had 13% ($1/e^{-0.12}$) shorter LOS compared with the CSMBS. Female gender was also associated with significantly shorter LOS. For hospital type, community hospital had significantly shorter LOS than regional, general, private hospitals. However, severity status had a different result. Cases of moderate severity were significantly more likely to have shorter LOS while very severe cases were significantly associated with long LOS. Moderate severity had 35% ($1/e^{-0.30}$) shorter LOS than low severity while very severe cases had 28% ($e^{0.25}$) longer LOS compared to low severity cases.

In the without complication model, after controlling for other confounding factors, UC scheme and SSS cases had significantly shorter LOS than CSMBS cases. SSS cases had 44% ($1/e^{-0.37}$) shorter LOS while UC scheme cases had 31% ($1/e^{-0.27}$) shorter LOS compared to CSMBS cases. Female gender and age over 40 years were significantly associated with shorter LOS. Regarding severity status, more severe cases had significantly longer LOS than those without co-morbidity.

6.5 Readmission rate in the three health insurance schemes

This section describes the readmission pattern between the health insurance schemes for three conditions: admission of DM patients with acute complications, with chronic complications, and without complications. Readmission is defined here as a secondary admission for the same diagnosis within 30 days after discharge from the previous hospitalization. Since claims data in this study combined all admissions in all hospitals participating in the three insurance schemes, readmission could be detected despite admission to different hospitals. This section is divided into two parts. The first provides the details of readmission by different characteristics. The second provides the analysis of factors explaining readmission. Bivariate and multivariate analyses are employed in the study. Logistic regression is used to analyse the variables explaining readmission.

6.5.1 Readmission of Diabetes Mellitus patients

The details of readmission of DM patients in the three condition groups are shown in Table 6.10. DM patients with chronic complications had the highest average readmission rate (9.7%) compared to those with acute complications and those without complications (both 5.2%).

Within the category acute complications, there was no significant difference in readmission rate according to age group, gender, insurance, and hospital type. Only severity level seemed to have a significant association. Cases with higher severity status tended to have lower readmission rates than those with lower severity status.

There were differences in results for chronic complications and acute complications. For the chronic complication group, there was no significant difference by age group or gender, while insurance, severity, and hospital type showed significant differences. For insurance, the UC scheme had the highest readmission rate (10.2%) compared to SSS and CSMBS (8.1% and 7.0%). For different hospital types, regional hospitals had the highest readmission rate, at 11.6%, two times higher than that of military hospitals which had the lowest rate of only 5.3%.

For DM without complications, results were the same as for acute complications, except that age group was a significant factor in this group, as well as severity. The elderly tended to have a lower readmission rate compared to younger people, at 5.4% and 6.2% respectively.

Table 6.10 Readmission rate by different characteristics

Variables	Admission type					
	Acute complications		Chronic complications		Without complications	
	Readmission (%)	P-value*	Readmission (%)	P-value*	Readmission (%)	P-value*
Age group		0.256		0.606		0.001
0-40	5.9		9.0		6.2	
41-60	5.4		10.0		4.7	
>60	5.0		9.6		5.4	
Sex		0.927		0.916		0.272
Male	5.2		9.8		5.3	
Female	5.2		9.7		5.1	
Insurance		0.259		<0.001		0.139
CSMBS	4.6		8.1		4.8	
SSS	4.5		7.0		4.6	
UC	5.3		10.2		5.3	
Severity		0.024		<0.001		0.004
0	5.2		11.0		5.0	
2	6.1		7.9		6.0	
3	4.8		9.0		5.0	
4	3.6		8.3		4.1	
Hospital type		0.512		<0.001		0.024
Community	5.1		9.3		5.3	
General	5.7		10.4		5.2	
Regional	5.0		11.6		4.2	
University	3.7		4.3		2.5	
Private	4.6		6.7		5.5	
Military	5.2		5.3		3.8	
Total	5.2		9.7		5.1	
N	15,289		15,539		37,104	

*chi-square test
Source: Claims data 2005

6.5.2 Factors explaining readmission

To analyse the factors associated with readmission, three steps of analysis were done: selection of independent variables, model analysis, and fitting the model.

Independent variable selection

The inclusion criteria for independent variables in the logistic regression model were those of Hosmer and Lemeshow (2000), that independent variable included should

have a p-value of < 0.25 in the bivariate analysis. For categorical data, Wald's test for joint significance was used to prove that those variables helped to improve the model fit.

Table 6.11 shows the results of the bivariate analysis of each independent variable with readmission. From the criteria above, independent variables to exclude from the acute complication analyses were age group and sex. Variables included in the chronic condition analysis were insurance status, severity status, hospital type, and LOS of the readmission of the previous admission. Variables included in the without complication analysis were age group, sex, insurance status, severity status, hospital type, and LOS of the readmission of the previous admission.

Table 6.11 Bivariate analysis of variables in the logistic regression models and readmission in three conditions

Variables	Acute complication						Chronic complication						Without complication					
	OR	P-value	95%CI LL@	95%CI UL@@	LR Chi2	Prob > chi2	OR	P-value	95%CI LL	95%CI UL	LR Chi2	Prob > chi2	OR	P-value	95%CI LL	95%CI UL	LR chi2	Prob > chi2
Age group																		
0-40	1.00						1.00						1.00					
41-60	0.92	0.525	0.70	1.20	2.68	0.262	1.11	0.413	0.86	1.43	1.01	0.604	0.74	0.002	0.61	0.90	13.57	0.001
>60	0.83	0.172	0.64	1.08			1.07	0.615	0.83	1.38			0.86	0.103	0.71	1.03		
Sex																		
Male	1.00						1.00						1.00					
Female	0.99	0.927	0.85	1.16	0.01	0.927	0.99	0.916	0.89	1.11	0.01	0.916	0.95	0.272	0.86	1.04	1.20	0.273
Insurance																		
CSMBS	1.00						1.00						1.00					
SSS	0.98	0.919	0.60	1.58	2.78	0.249	0.85	0.439	0.57	1.27	15.70	<0.001	0.95	0.763	0.70	1.29	4.02	0.134
UC	1.17	0.134	0.95	1.43			1.29	<0.001	1.11	1.51			1.11	0.075	0.99	1.25		
Severity																		
0	1.00						1.00						1.00					
2	1.19	0.054	1.00	1.42	9.75	0.021	0.70	<0.001	0.60	0.80	32.77	<0.001	1.22	0.001	1.09	1.37	12.81	0.005
3	0.93	0.483	0.76	1.14			0.80	0.002	0.69	0.92			1.01	0.858	0.88	1.16		
4	0.68	0.059	0.45	1.02			0.73	0.008	0.58	0.92			0.83	0.336	0.57	1.22		
Hospital type																		
Community	1.00				4.37	0.498	1.00				46.89	<0.001	1.00				14.23	0.014
General	1.14	0.147	0.96	1.35			1.13	0.073	0.99	1.29			0.98	0.757	0.88	1.10		
Regional	0.99	0.939	0.80	1.24			1.28	<0.001	1.12	1.46			0.78	0.007	0.65	0.93		
University	0.72	0.266	0.40	1.29			0.44	<0.001	0.27	0.71			0.46	0.084	0.19	1.11		
Private	0.89	0.605	0.57	1.38			0.70	0.026	0.51	0.96			1.03	0.799	0.80	1.33		
Military	1.02	0.929	0.65	1.60			0.54	0.034	0.31	0.96			0.70	0.102	0.45	1.07		
LOS																		
0-3	1.00				7.16	0.028	1.00				70.69	<0.001	1.00				44.70	<0.001

	Acute complication						Chronic complication						Without complication					
Variables	OR	P-value	95%CI LL@	95%CI UL@@	LR Chi2	Prob > chi2	OR	P-value	95%CI LL	95%CI UL	LR Chi2	Prob > chi2	OR	P-value	95%CI LL	95%CI UL	LR chi2	Prob > chi2
4-7	1.18	0.047	1.00	1.38			1.08	0.307	0.94	1.24			1.34	0.000	1.21	1.48		
>7	1.29	0.022	1.04	1.60			1.65	<0.001	1.45	1.87			1.45	0.000	1.26	1.67		

@ lower level

@@ upper level

Source: Claims data 2005

Admission with acute complications

For the acute complications model, Wald's test for joint significance showed that age group, insurance, and hospital type did not help to improve model fit. However, since this study needed to explore the effect of insurance on LOS, insurance scheme needed to be included in the model. The details are shown in Table 6.12.

The final model of admission with acute complications included the independent variables insurance, severity, and LOS of previous admission. To fit the model, the Hosmer and Lemshow goodness of fit test was employed. The results showed that this model fitted according to the Hosmer-Lemeshow criteria, $chi^2(6) = 2.41$, prob > $chi^2 = 0.8784$ (H_0: model is fitted, H_a: model is not fitted).

The results show that after controlling for confounding factors, different insurance status did not have an effect on the readmission rate. However, a longer LOS of previous admission was positively and significantly associated with readmission. The 4-7 day group had a 22% higher chance of readmission compared to the 0-3 day group, while a LOS of previous admission more than 7 days meant a 45% higher chance of readmission. For severity status, very severe conditions had a 68% (1/0.60) lower chance of readmission than cases without co-morbidity.

Table 6.12 Joint significance with first run and final result of readmission logistic regression model for Diabetes Mellitus with acute complications

		First run acute complications				Final result acute complications			
LR Chi		31.32				24.85			
Prob > chi2		0.008				0.0008			
Pseudo R2		0.005				0.004			
Dependent variable		Readmission=1							
N		15,254				15,254			
Variable	P-value for Adjusted Wald test (F-statistic)	OR	P-Value	95% CI		OR	P-value	95% CI	
				LL@	UL@@			LL	UL
Independent variable									
Age group	0.345(2.1)								
0-40		1.00							
41-60		0.92	0.567	0.70	1.22	-	-	-	-
>60		0.84	0.226	0.64	1.11	-	-	-	-
Sex									
Male		1.00							
Female		1.01	0.855	0.87	1.19	-	-	-	-

Insurance	0.193(3.3)								
CSMBS		1.00				1.00			
SSS		0.96	0.897	0.54	1.72	1.00	0.996	0.62	1.63
UC		1.20	0.097	0.97	1.49	1.23	0.050	1.00	1.50
Severity	<0.05(11.8)								
0		1.00				1.00			
2		1.16	0.109	0.97	1.38	1.16	0.105	0.97	1.38
3		0.87	0.198	0.71	1.07	0.87	0.189	0.71	1.07
4		0.60	0.016	0.40	0.91	0.60	0.014	0.39	0.90
Hospital type	0.502(4.3)								
Community		1.00							
General		1.15	0.107	0.97	1.37	-	-	-	-
Regional		1.02	0.880	0.81	1.27	-	-	-	-
University		0.73	0.291	0.40	1.32	-	-	-	-
Private		0.95	0.837	0.57	1.59	-	-	-	-
Military		1.02	0.937	0.63	1.65	-	-	-	-
LOS	<0.01(12.2)								
0-3		1.00				1.00			
4-7		1.21	0.020	1.03	1.43	1.22	0.018	1.03	1.43
>7		1.45	0.002	1.15	1.83	1.45	<0.001	1.16	1.82

@ lower level
@@ upper level
Source: Claims data 2005

Admission with chronic complications

From Table 6.13, Wald's test for joint significance shows that age group did not help to improve the fit of the logistic model; therefore, age group was removed from the model. Furthermore, the goodness of fit of the first run model shows that the model was not fitted by the Hosmer-Lemeshow criteria $chi^2(8) = 16.15$, $prob>chi^2=0.0403$ (H_0=model fitted, H_n= model not fitted). To diagnose the model, analyses of standardized residuals and leverage levels were explored to find the outliers. Figures 6.2 and 6.3 show that standardized residuals at a level more than 3 SD and less than -3 SD had a high leverage level. This means those observations have an influential effect on the fit of the model. Therefore, outlier observations were removed at a level of standardized residuals of more than 2.57SD and less than -2.57SD (99% CI). The result after trimming outlier observations showed that the model fitted according to Hosmer-Lemeshow test, $chi^2(8) = 10.4$, $prob>chi^2=0.2382$. The model was checked for interaction effects and no evidence of this was found. 503 cases were removed, characterized by UC scheme with no co-morbidity, and equal number of males and females.

Figure 6.2 Scatter plot of standardized residuals with probability for readmission in Diabetes Mellitus chronic complications

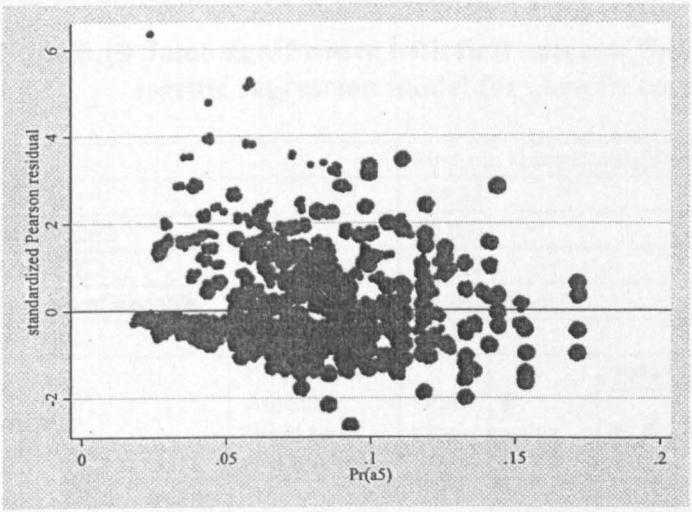
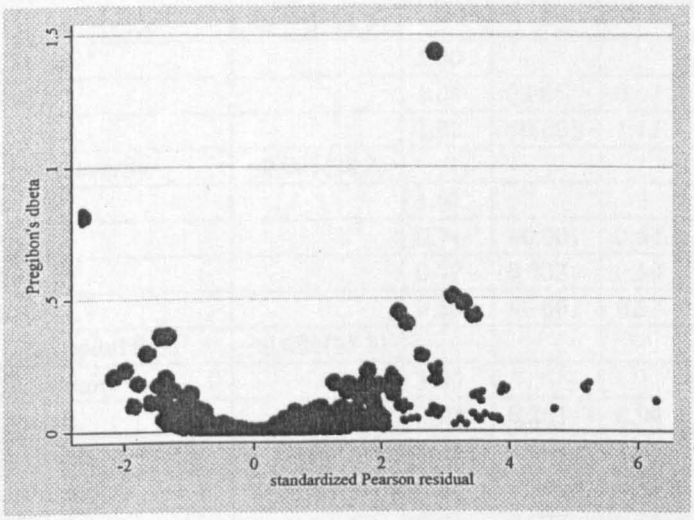


Figure 6.3 Distribution of standardized residuals with leverage level for readmission in Diabetes Mellitus chronic complications



The results of the model are shown in Table 6.13. After controlling for confounding factors, UC scheme status had a significant effect on the probability of being readmitted, while SSS did not have a significant effect. UC scheme cases had a 32% higher chance of readmission compared to CSMBS cases. Furthermore, longer LOS was a significant predictor of readmission compared to shorter LOS. The over 7 day

group had a 58% higher chance of readmission compared to the 0-3 day group. Cases with higher severity status were significantly less likely to be readmitted. There was a 20-50% lower chance of readmission with moderate to very severe cases compared to cases without co-morbidity. University hospitals were 2.7 times less likely to have readmissions compared to community hospitals.

Table 6.13 Joint significance with first run and final result of readmission logistic regression model for chronic complications

		First run chronic complication				Final result chronic complication			
LR Chi		164.18				144.25			
Prob > chi2		<0.001				<0.001			
Pseudo R2		0.0167				0.0153			
Dependent variable		Readmission=1							
N		15,455				14,952			
Variable	P-value for Adjusted Wald test (F-statistic)	Odds ratios	P-value	95% CI		Odds Ratios	P-Value	95% CI	
				LL@	UL@@			LL	UL
Independent variable									
Age group	0.702(0.7)								
0-40		1.00							
41-60		1.12	0.408	0.86	1.44	-	-	-	-
>60		1.11	0.416	0.86	1.44	-	-	-	-
Sex									
Male		1.00							
Female		1.00	0.966	0.89	1.12	-	-	-	-
Insurance	<0.001(14.9)								
CSMBS		1.00				1.00			
SSS		1.04	0.868	0.67	1.61	1.01	0.967	0.65	1.56
UC		1.35	<0.001	1.15	1.58	1.32	<0.001	1.13	1.55
Severity	<0.001(28.3)								
0		1.00				1.00			
2		0.74	<0.001	0.64	0.86	0.75	<0.001	0.65	0.87
3		0.79	0.002	0.69	0.92	0.81	0.005	0.70	0.94
4		0.66	<0.001	0.53	0.84	0.68	0.001	0.54	0.86
Hospital type	<0.001(35.8)								
Community		1.00				1.00			
General		1.08	0.286	0.94	1.24	1.07	0.373	0.93	1.23
Regional		1.23	0.003	1.07	1.41	1.25	0.002	1.08	1.43
University		0.37	<0.001	0.22	0.62	0.37	<0.001	0.22	0.62
Private		0.73	0.077	0.52	1.03	0.74	0.090	0.53	1.05
Military		0.54	0.035	0.31	0.96	0.55	0.039	0.31	0.97
LOS	<0.001(65.7)								
0-3		1.00				1.00			
4-7		1.08	0.310	0.93	1.24	1.07	0.361	0.93	1.23
>7		1.64	<0.001	1.44	1.87	1.58	<0.001	1.38	1.82

@ lower level
@@ upper level
Source: Claims data 2005

Conditions without complications

Table 6.14 shows the results of Wald's test for joint significance and the first run of the logistic model. The first run shows that the sex variable had a p-value of more than 0.25; likewise insurance status would not help to improve the fit of the model. However, since the study needed to explore the insurance scheme effect on readmission, insurance was included in the model. The first run model was not fitted by Hosmer-Lemeshow criteria, $chi^2(8)$, 16.48, $prob>chi^2 = 0.036$ (H_0=model fitted, H_n= model not fitted). Therefore, a residuals diagnosis was done and the interaction of independent variables was tested. Figures 6.4 and 6.5 show the evidence on outliers and high leverage. Figure 6.5 shows very high leverage in the very high outlier zone (>2.57 SD). These groups of data were 18 cases of males in the SSS group aged over 60 with no co-morbidity, treated in private hospitals with LOS of less than 3 days. Removing these data improved the fit of the logistic regression. The Hosmer-Lemeshow goodness of fit of the final run of the logistic regression was $chi^2(8) = 13.21$, prob>chi2 = 0.105, which showed that the model fitted.

Figure 6.4 Scatter plot of standardized residuals with probability for readmission in Diabetes Mellitus without complications

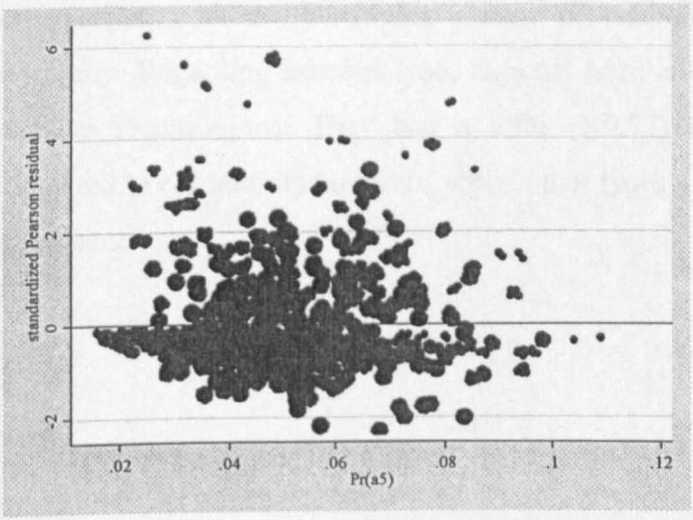
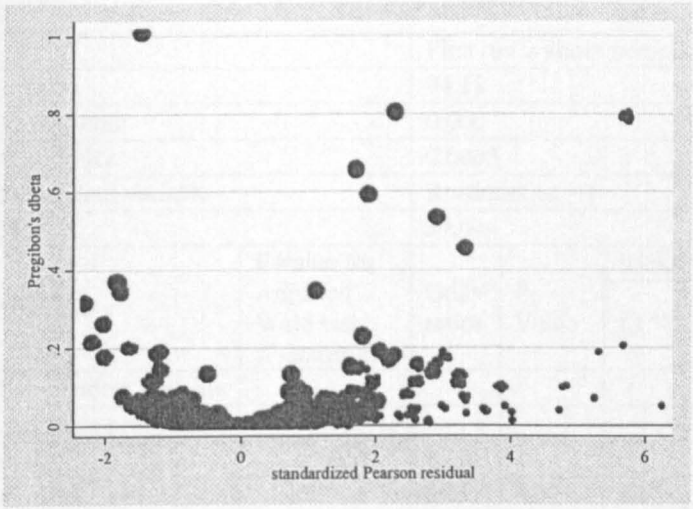


Figure 6.5 Distribution of standardized residuals with leverage level for readmission in Diabetes Mellitus without complications



In the details of the results, after controlling for confounding factors, UC scheme cases were more likely to be readmitted than CSMBS cases, while there was no difference in probability between SSS and CSMBS. Members of the UC scheme were 13% more likely to be readmitted compared to CSMBS members. Regarding severity status, only moderate status had a significant effect on the probability of readmission, with a 19% higher chance of readmission than cases without co-morbidity. Regarding hospital type, regional hospitals were significantly less likely to have readmissions. They had a 29% (1/0.77) lower chance of readmission compared to community hospitals, while other types of hospital were not statistically significant.

Table 6.14 Joint significance with first run and final result of readmission logistic regression model for without complications

		First run without complication				Final result without complication			
LR Chi		94.18				95.12			
Prob > chi2		0.000				0.000			
Pseudo R2		0.0063				0.0064			
Dependent variable		Readmission =1							
N		37,044				37,026			
Variable	P-value for Adjusted Wald test (F-statistic)	Odds ratios	P-Value	95% CI		Odds ratios	P -value	95% CI	
				LL@	UL@@			LL	UL
Independent variable									
Age group	<0.001(13.4)								
0-40		1.00							
41-60		0.75	0.004	0.62	0.91	0.74	0.002	0.61	0.90
>60		0.88	0.170	0.72	1.06	0.85	0.099	0.71	1.03
Sex									
Male		1.00							
Female		0.96	0.384	0.87	1.06	-	-	-	-
Insurance	0.077(5.13)								
CSMBS		1.00				1.00			
SSS		0.96	0.844	0.67	1.38	0.88	0.491	0.60	1.28
UC		1.14	0.037	1.01	1.28	1.13	0.041	1.00	1.28
Severity	<0.01(13.1)								
0		1.00				1.00			
2		1.18	0.005	1.05	1.32	1.19	0.004	1.06	1.33
3		0.94	0.374	0.82	1.08	0.94	0.404	0.82	1.08
4		0.75	0.138	0.51	1.10	0.75	0.143	0.51	1.10
Hospital type	0.013(14.5)								
Community		1.00							
General		0.96	0.449	0.85	1.07	0.96	0.478	0.85	1.08
Regional		0.77	0.004	0.64	0.92	0.77	0.005	0.64	0.92
University		0.45	0.075	0.18	1.09	0.45	0.078	0.18	1.09
Private		1.12	0.441	0.84	1.51	1.07	0.646	0.79	1.45
Military		0.70	0.105	0.45	1.08	0.70	0.109	0.45	1.08
LOS	<0.001(49.2)								
0-3		1.00				1.00			
4-7		1.35	<0.001	1.22	1.50	1.36	<0.001	1.23	1.51
>7		1.52	<0.001	1.31	1.76	1.53	<0.001	1.32	1.77

@ lower level
@@ upper level
Source: Claims data 2005

6.6 Discussion

This study sought to illustrate the effect of different insurance schemes and other factors on LOS and readmission for DM cases in Thailand. LOS is a common indicator for efficiency use of resource in hospitalized patient while early readmission can be used as an indicator for quality. The results of the study suggest that the influence of insurance differs with the severity of DM admission.

Bivariate analysis

Admissions rate of DM patients differed by insurance scheme, however these differences at least in part reflected differences in demographic characteristics of beneficiaries in the three schemes. UC scheme and CSMBS patients were mainly elderly while SSS patients were of a younger age. Differences in providers also corresponded to the regulations of each insurance scheme. CSMBS allowed beneficiaries to go to any providers in the public sector. The UC scheme set CUPs as its main contractor, which in rural areas meant the community hospital was the initial place of admission, with referral needed to access higher levels. SSS included public and private hospitals of more than 100 beds as its main contractors.

In the analysis of LOS, DM patients with chronic conditions had longer LOS than those with acute conditions and without complications. By scheme, CSMBS had longer LOS than the UC scheme or SSS. However, readmissions within 30 days after discharge were not different by scheme except in the case of chronic conditions.

Multivariate analysis

The analysis found that there were scheme effects on LOS and readmission. This study separated analysis of LOS and readmission into three groups according to complications of DM: acute, chronic, and without complications. The rationale behind this approach came from two concerns. First, treatment needs differ in these three conditions. Second, insurance scheme reimbursement mechanisms can influence provider behaviour; therefore providers may respond to patients differently. Some argue that providers are more concerned about payment received from different insurance scheme than people's need for urgent treatment. From the

results of the study, overall, there seemed to be little difference between the insurance schemes in LOS and readmission between the three conditions.

In the LOS analysis, the UC scheme and SSS had shorter LOS for all admission conditions. The reason might come from provider behaviour in response to the scheme's reimbursement mechanism. The UC scheme paid hospitals by capitation for OP and preventive and promotive care, and by prospective payment for admissions by using DRGs within a global budget set at the national level. DRG payment was applied to all levels of hospital (National Health Security Office 2007b).The SSS paid hospitals by capitation payments, while CSMBS paid by FFS. Providers may have stronger incentives to control costs under capitation and prospective payment, while FFS payment tends to encourage longer LOS. These findings correspond to several studies on the effect of payment type on LOS (Sepehri et al. 2006, Chan et al. 1997, Lave and Frank 1990, Yip et al. 2001). Furthermore, the CSMBS regulation by which patients pay nothing when admitted might influence patients to request longer stays in hospital (Tangcharoensathien et al. 2003).

Regarding other demographic factors, after controlling for clinical and insurance factors, the elderly had significantly shorter LOS. This finding did not support the hypothesis that the elderly had higher probability of longer LOS. The reason for this might be cultural issues whereby the families take care of their elderly at home.

On gender, this study found that females had a significantly higher probability of shorter LOS. This may be the result of biological factors or it might be other factors not included in the study, such as higher tobacco and alcohol use amongst males. This finding corresponds to a study of US Diabetes admission which found that hospitalized male DM patients were more likely to have other complication conditions than females (Aubert et al. 1995). This might relate to less physical activity in males (Steyn et al. 2007). Furthermore, there is evidence that women tend to leave hospital early because of child care (Sepehri et al. 2006). Some studies found that females knew about health matters than men so they were more likely to have better health (Omachonu et al. 2004).

Severity status was the strongest indicator of LOS. The more severe conditions had significantly longer LOS. This finding corresponds with other studies showing that longer LOS relates to severity status (Brasel et al. 2007, Stoskopf and Horn 1992).

Regarding the different types of hospital, after controlling for other factors, all types of hospital were more likely to have longer LOS compared to community hospitals, except for private hospitals for acute complications and DM without complications. This might be due to two factors. First, patients in higher-level facilities normally had been referred there from lower-level hospitals such as community hospitals, so they were more severe cases than at lower level. Second, providers in higher-level hospitals might need more investigations to review patients.

In the analysis of readmission, UC scheme patients had a higher probability of readmission than SSS and CSMBS patients after controlling for other factors. This might imply the effect of payment mechanism, especially the prospective payment by DRGs with global budget in the UC scheme. The SSS seemed to be efficient in terms of readmission. SSS patients had a probability of shorter LOS but no difference in readmission rates compared to CSMBS patients. This appears to reflect efficient use of hospital resources.

There were, however, other factors affecting readmission in different conditions. In the acute complications group, factors explaining readmission were severity and LOS of previous admission, while for chronic complications and those without complications factors were age, insurance status, severity, hospital type, and LOS of previous admission. This might imply that patients who were admitted with acute complications received the same standard service across all insurance schemes because acute complications condition was urgent and the provider had limited choice of treatment. In contrast, for chronic conditions and those without complications, providers might have more options to treat the patient since the condition was not urgent and life threatening.

Regarding severity status, there were differences between each severity level. In very severe cases, there was a significantly lower chance of being readmitted than non severe cases in acute and chronic complications cases. This might be because this

group of patients needed longer time in hospital; they received more treatment until all co-morbidity had improved, which reduced their chances of being readmitted. Alternatively, it might be the preference of patients to stay at home when the prognosis of disease was poor.

Controlling for severity, longer LOS of previous admission was a significant predictor of readmission compared to shorter LOS. For example, LOS of more than 7 days meant a 46-62% higher chance of being readmitted compared to a 0-3 day LOS. This may be because patients who needed longer LOS might be in the severe group and have several co-morbidities inadequately controlled for in the analysis, which increased the chance of readmission after discharge.

6.7 Conclusion

This chapter has explored the effect of health insurance and other characteristics on LOS and readmission of DM patients in three conditions: acute complications, chronic complications, and no complications. The findings suggest that health insurance scheme affected LOS and readmission of DM patients. This finding helped to prove the hypothesis that there were differences in LOS and early readmission between the three public health insurance schemes. In terms of LOS, the UC scheme and the SSS had a higher chance of shorter LOS than the CSMBS. However, only the UC scheme had a higher chance of readmission than the CSMBS and SSS, while the CSMBS and SSS showed no difference in early readmission. SSS patients seemed to have received more efficient care with acceptable quality than UC scheme and CSMBS patients.

CHAPTER 7: VARIATION OF QUALITY OF CARE IN NON INSULIN DEPENDENT DIABETES MELLITUS PATIENTS IN DIFFERENT INSURANCE SCHEMES

7.1 Background

The purpose of this chapter is to examine variations in service provision and practice for Non-Insulin Dependent Diabetes Mellitus (NIDDM) patients under the three major health insurance schemes – Universal Coverage (UC), Social Security Scheme (SSS), and Civil Servant Medical Benefit Scheme (CSMBS) – in Samutsakhon province. NIDDM was chosen as a tracer for several reasons. First, it has a definite diagnosis by laboratory criteria; second, a standard clinical practice guideline has been developed for DM and is generally accepted by physicians; and third, DM is a chronic condition which needs continuity of care, so that sampled patients can be regularly followed-up. The standard guidelines for DM in Thailand were used as the gold standard to assess the process of care of individual patients. Moreover, as quality of care might be affected by inaccessibility to appropriate care, this also was examined.

The methodology adopted in this study is explained in the next section. Then, results from the analysis are presented by insurance scheme in terms of accessibility, quality of process of care, and outcome of care in DM patients. Discussion and conclusions are presented at the end.

7.2 Methodology

Secondary data study

The aim of the secondary data analysis was to explore diagnosis of DM and the use of services by DM patients under different insurance schemes. The 2004 Health Examination Survey surveyed the Thai population health using a multistage sampling frame. DM was diagnosed based on clinical examination and laboratory test. Diabetes was defined as FPG $\geq$ 7.0 mmol/l, use of medication (oral glycemic agents or insulin) for the treatment of DM during the previous two weeks, or a report of a previous diagnosis of diabetes by a medical doctor (Aekplakorn et al. 2007). A

database from the 2004 Health Examination Survey containing 39,290 people was employed to analyse diagnosis and measure use of services. 3,410 records met the criteria of having Diabetes Mellitus. 80% of them were UC members, 17% were CSMBS members and 3% were SSS members.

Table 7.1 shows the characteristics of DM patients by scheme in the Health Examination Survey. CSMBS and UC scheme members were mainly in higher age groups (>60) while SSS members were mainly in younger age groups (31-45). The most common educational level in the three schemes was elementary education. However, the share of no education was higher for UC scheme members compared to SSS and CSMBS members.

Table 7.1 Characteristics of health examination survey sample

Variables		CSMBS(%)	SSS(%)	UC scheme(%)
N	3,410	572(17.0)	112(8.0)	2,726(80.0)
Region	BKK	45(7.9)	14(12.5)	162(5.9)
	Central	198(34.6)	61(54.5)	1,023(37.6)
	Northeast	152(26.6)	13(11.6)	657(24.1)
	North	101(17.7)	13(11.6)	571(21.0)
	South	76(13.3)	11(9.8)	313(11.5)
Sex	Male	254(44.4)	63(56.3)	1,144(42.0)
	Female	318(55.6)	49(43.8)	1,582(58.0)
Age group	15-30	1(0.2)	11(9.8)	42(1.5)
	31-45	16(2.8)	42(37.5)	261(9.6)
	46-50	70(12.2)	33(29.5)	637(23.4)
	>60	485(84.5)	26(23.2)	1,786(65.5)
Area	Rural	158(27.6)	37(33.0)	1,253(46.0)
	Urban	414(72.4)	75(67.0)	1,473(54.0)
Education	No formal education	43(7.6)	3(2.7)	335(12.3)
	Elementary education	360(63.5)	61(54.5)	2,089(76.9)
	Secondary/vocational	106(18.7)	35(31.3)	242(8.9)
	University	58(10.2)	13(11.6)	52(1.9)

Source: Health Examination Survey 2004

Primary research study

The aim of the primary research study was to explore the effect of the insurance schemes on quality of care. Data collected from five hospitals (3 public and 2 private hospitals) in Samutsakhon province were analysed. The numbers of patients in the

study were 1,939. Data were collected from medical records and patient interviews. Process of care and outcome of care are two major dimensions measured in this study. Compliance with the standard clinical guidelines for DM is used as an indicator of the quality of the process of care. For outcome of care, achieving the target of care and hospitalization are employed as indicators.

Model and dependent variables

Logistic regression modelling was used in the multivariate analysis. The dependent variables were achieving the standard of process of care in the six indicators (FPG test, BP test, urine protein test, HbA1C, lipid profile, eye examination). Achieving each target was set as 1 while not achieving each target was 0. All six indicators were analysed separately in the analysis. The logistic regression equation used in this study is shown below.

$$\ln(\frac{\pi}{1-\pi}) = \alpha + \beta_1 X_1 + \beta_2 X_2 + ...\beta_i X_i + \varepsilon \qquad \text{Equation 1}$$

where π represents the probability of a patient receiving the set standard of care for each lab test. X_i (i= 1,2...,i) represents independent variables hypothesized to affect target achieved of the standard treatment.

Standard process and intermediate outcome measured from the standard practice guidelines, as mentioned in chapter 4, were employed as the measure of quality. Good quality in this study was defined as having met the minimum standard guidelines and achieving the outcome targets.

The study employed all six-process indicators and five selected outcome indicators (mean FPG, HbA1C, fasting triglyceride, total cholesterol, and BP). The study used total cholesterol as representing cholesterol status. The details of the outcome indicators are shown in Table 7.2.

Table 7.2 Process of care indicators of Diabetes Mellitus

Indicators	Formula	Explanation
Receiving test(process of care)		
FPG test	Number of FPG tests received within one year	≥ 4 times per year = achieved <4 times per year= not achieved
BP test	Number of BP tests received within one year	≥ 4 times per year = achieved <4 times per year= not achieved
Urine protein test	Number of urine protein tests received within one year	≥1 time per year= achieved <1 time per year= not achieved
HbA1C test	Number of HbA1C tests received within one year	≥1 time per year= achieved <1 time per year= not achieved
Lipid profile test	Number of lipid profile tests received within one year	≥1 time per year= achieved <1 time per year= not achieved
Eye examination test	Number of eye examination tests received within one year	≥1 time per year= achieved <1 time per year= not achieved
Intermediate outcome indicator (quality of care)		
Mean FPG	Mean result of FPG within one year	<130 mg/dl = achieved ≥130 mg/dl = not achieved
Mean HbA1C	Mean result of HbA1C within one year	<7% = achieve ≥7% = not achieve
Mean fasting triglyceride	Mean result of total triglyceride within one year	<150 mg/dl = achieve ≥150 mg/dl = not achieve
Mean total cholesterol	Mean result of total cholesterol within one year	<200 mg/dl = achieve ≥200 mg/dl = not achieve
Mean BP	Mean result of BP within on year	<130/80 = achieve ≥ 130/80 = not achieve

Independent variables

Variables used in this study were based on the literature review in section 2.5, and a conceptual framework adapted from Pringle et al. 1993 and Alberti et al. 2007., Choice of variables was justified in section 4.5.1. Since there were few Thai studies on factors associated with DM quality of care, this study mainly drew from international experience.

Three sets of factors were considered to be associated with process and intermediate outcomes of DM care. The first was patient factors which were age, sex, marital status, education, living area, income, duration of having DM, smoking, and co-morbidity. The second was provider factors which was hospital. The study did not use physician specialist type because hospitals had a lot of DM patients and could

not allocate a specific doctor for each patient. The third was system factors which was insurance status. This study aimed to explore the association of insurance scheme with services received from providers.In the analysis of these hospital data, some may argue that this data structure has hierarchical characteristics which makes it possible to use multilevel analysis instead of ordinary logistic regression. To explore the result of an analysis with this different methodology, multilevel analyses of these data were done and are presented in Appendix 3.

7.3 Diagnosis and use of care (data from the Health Examination Survey)

Data from the 2004 Health Examination Survey indicated that diagnosis of DM and use of DM care varied between health insurance schemes, as shown in Table 7.4. Many people having DM had not been diagnosed (43%). SSS had the lowest uptake of DM screening between the three insurance schemes (59.8%), For quality of DM care, only 46.7% of DM patients receiving treatment were well controlled. Well controlled meant that patients had been previously diagnosed and had FPG lower than 7.8 mmol/L (Aekplakorn et al. 2007). A greater proportion of CSMBS and UC patients receiving treatment were well controlled compared to SSS patients; 46.4 and 47.2% respectively compared with only 29.5% of SSS patients (p <0.001).

Table 7.3 Thai people with Diabetes Mellitus by insurance scheme from the 2004 health examination survey

	Scheme			Total	Chi-square p-value
	CSMBS	SSS	UC		
N	572	112	2,726	3,410	
Not diagnosed (%)	30.4	59.8	45.3	43.3	<0.001
Diagnosed not treated (%)	3.7	0.9	2.2	2.4	
Diagnosed and treated (%)	65.9	39.3	52.5	54.3	<0.001
-poor controlled (%)	(53.6)	(70.5)	(52.8)	(53.3)	<0.001
-well controlled (%)	(46.4)	(29.5)	(47.2)	(46.7)	<0.001

Source: health examination survey 2004

7.3.1 Factors associated with uncontrolled Diabetes Mellitus

Table 7.5 illustrates the characteristics of patients with well and poorly controlled DM. There was a greater proportion of uncontrolled DM amongst SSS patients than amongst UC and CSMBS patients. Those residing in Bangkok also had a greater proportion of uncontrolled DM compared with those living in other regions. The

elderly group had a greater proportion of well-controlled DM than the younger age groups but this disparity was not observed by gender.

Table 7.4 Control of Diabetes Mellitus by different characteristics

	N	Controlled(%)	Uncontrolled(%)	P-value*
Insurance				
CSMBS	377	46.4	53.6	<0.001
SSS	44	29.5	70.5	
UC	1,431	47.2	52.8	
Region				
Central	714	47.3	52.7	0.005
Northeast	399	41.9	58.1	
North	378	53.4	46.6	
South	231	46.8	53.2	
Bangkok	130	37.7	62.3	
Sex				
Male	706	45.0	55.0	0.276
Female	1,146	47.6	52.4	
Age group				
15-30	5	40.0	60.0	<0.001
31-45	100	25.0	75.0	
46-50	393	40.5	59.5	
>60	1,354	50.1	49.9	
Area				
Rural	724	47.2	52.8	0.686
Urban	1,128	46.3	53.7	
Education level				
No formal education*	207	52.2	47.8	0.015
Elementary education	1,397	47.2	52.8	
Secondary/vocational	171	39.8	60.2	
University	68	33.8	66.2	

*Chi-square test
Source: Health Examination Survey 2004

The results of the logistic regression are shown in Table 7.6. Comparing between insurance schemes, after controlling for demographic confounding factors, the CSMBS had significantly more uncontrolled DM compared to the UC scheme. The rate of uncontrolled DM was 47% more than for the UC scheme group.

Table 7.5 Insurance scheme explaining uncontrolled Diabetes Mellitus

Factor	Odds Ratio*	P-value	95%CI	
			LL@	UL@@
Dependent variable	Uncontrolled DM = 1			
N	2,323			
Independent variables				
Insurance				
UC	1.00			
CSMBS	1.47	0.027	1.04	2.07
SSS	1.10	0.849	0.40	3.04

*Adjusted by region, sex, age group, area, and education level
@ lower level
@@ upper level
Source: Health Examination Survey 2004

7.4 Description of Diabetes Mellitus patients in Samutsakhon province

The details of data collected from medical records and patient interviews are shown in Table 7.7. The number of samples is nearly equal in the three schemes. UC and CSMBS data are from only public hospitals while SSS data are from both public and private hospitals. Since NIDDM was employed as a tracer, so the major age group of samples was older than 41 years. Most of the patients, 65%, were female. The majority of them were educated between primary level and bachelor degree, and 23% of them did not have an occupation. Most patients, 58%, had been diagnosed for less than five years. 76% had at least one co-morbidity.

For characteristics by insurance scheme, there were a greater proportion of women amongst UC scheme patients compared with SSS and CSMBS. SSS patients were relatively younger and had a shorter period with DM. 75% of them were between 41 and 60 years while more than 50% of UC scheme and CSMBS patients were aged over 60 years. CSMBS patients had a higher educational level than SSS and UC patients. For income status, more than 90% of SSS patients had an income greater than 2,000 Baht per month, while 70% of CSMBS patients did. Only 45% of UC scheme patients had an income greater than 2,000 baht per month. A greater proportion of UC patients resided in rural areas in contrast to SSS and CSMBS patients. Only 14 percent of DM patients had been hospitalized in the previous year;

SSS patients had fewer admissions than UC and CSMBS patients while a greater proportion of CSMBS patients had co-morbidity.

Table 7.6 Diabetes Mellitus patient characteristics by insurance scheme

Different characteristics	Percentage of				P-value*
	UC	SSS	CSMBS	Total	
N	664	643	632	1,939	
Hospital	%	%	%	%	
Samutsakhon (public)	46.1	31.4	48.9	42.1	<0.001
Kratumban (public)	36.3	7.2	38.5	27.3	
Banpaw (public)	17.6	2.2	12.7	10.9	
Srivichai3 (private)	-	20.8	-	6.9	
Mahachai2 (private)	-	38.4	-	12.7	
Age					
<40	2.6	17.9	1.7	7.4	<0.001
41-60	48.2	74.7	30.4	51.2	
>60	49.3	7.5	67.9	41.5	
Sex					
Male	28.0	38.9	37.5	34.7	<0.001
Female	72.0	61.1	62.5	65.3	
Marital status					
Single	8.0	10.1	4.1	7.4	<0.001
Married	92.0	89.9	95.9	92.6	
Education					
Without education	19.4	3.3	10.0	11.0	<0.001
primary-bachelor	79.2	92.4	76.0	82.5	
>bachelor	1.4	4.4	14.1	6.5	
Occupation					
Without occupation	26.5	7.8	33.9	22.7	<0.001
Merchandise	20.5	7.6	7.6	12.0	
Private	16.0	80.1	2.7	32.9	
Government/State enterprise	0.5	0.9	31.7	10.8	
Other	36.6	3.6	24.2	21.6	
Income					
No income	37.7	6.8	20.9	22.0	<0.001
B 1-2,000	18.5	2.8	10.3	10.6	
B 2,001-10,000	38.7	73.9	39.9	50.8	
B >10,000	5.1	16.5	29.0	16.7	
Area					
Urban	52.3	43.9	44.8	47.0	0.004
Rural	47.7	56.1	55.2	53.0	
Duration of DM					
≤5 years	52.9	76.1	46.4	58.4	<0.001
> 5 years	47.1	24.0	53.6	41.6	
Admission					
No admission	84.0	90.2	84.5	86.2	0.002
Admission	16.0	9.8	15.5	13.8	
Co-morbidity					
No	30.1	29.4	12.3	24.1	<0.001

Different characteristics	Percentage of				P-value*
	UC	SSS	CSMBS	Total	
Yes	69.9	70.6	87.7	75.9	

*Chi-square test
Source: Medical record and DM patient data

7.5 Process of care

From the number of tests per year, FPG and blood pressure were common tests when patients came for follow up, while less than 50% received tests for HbA1C, urine protein, or had an eye examination at least once a year. Figures 7.1 to 7.6 show the distribution of number of lab tests per year for several standard tests. Figures 7.1 and 7.6 show that most of the patients received FPG and BP tests six times a year. None of the targets for the other standard tests were achieved. The majority of DM patients were not tested for HbA1C, urine protein, and eye examination. Only a small percentage of them received eye examinations and 30-40% was not tested for lipid profile.

Figure 7.1 Fasting Plasma Glucose checks per year

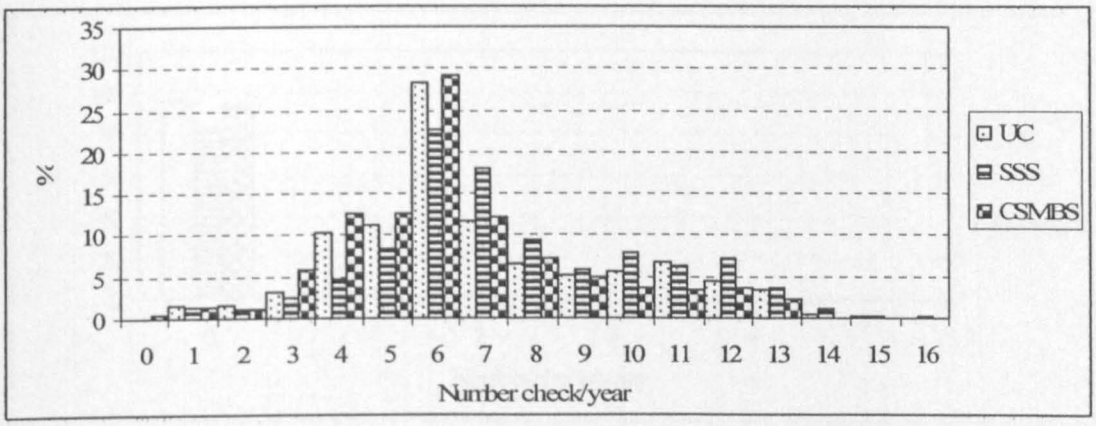


Figure 7.2 HbA1C checks per year

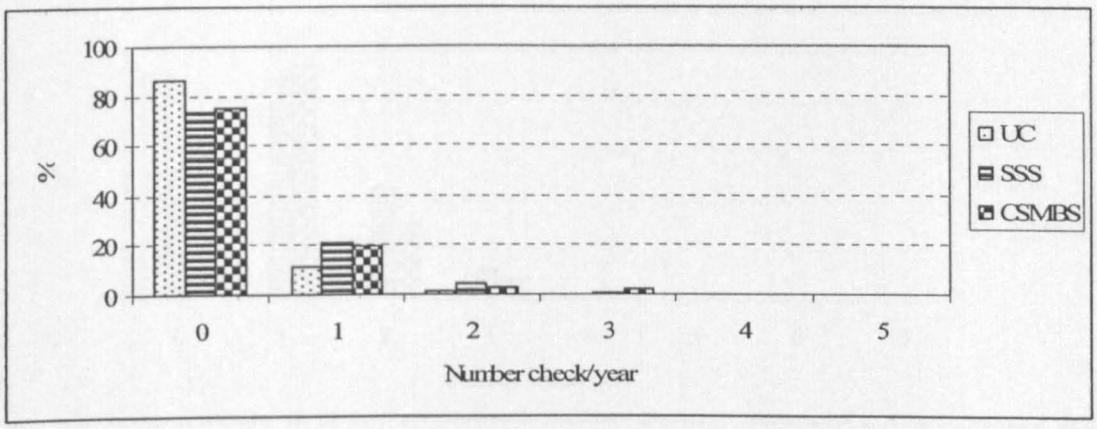


Figure 7.3 Urine protein checks per year

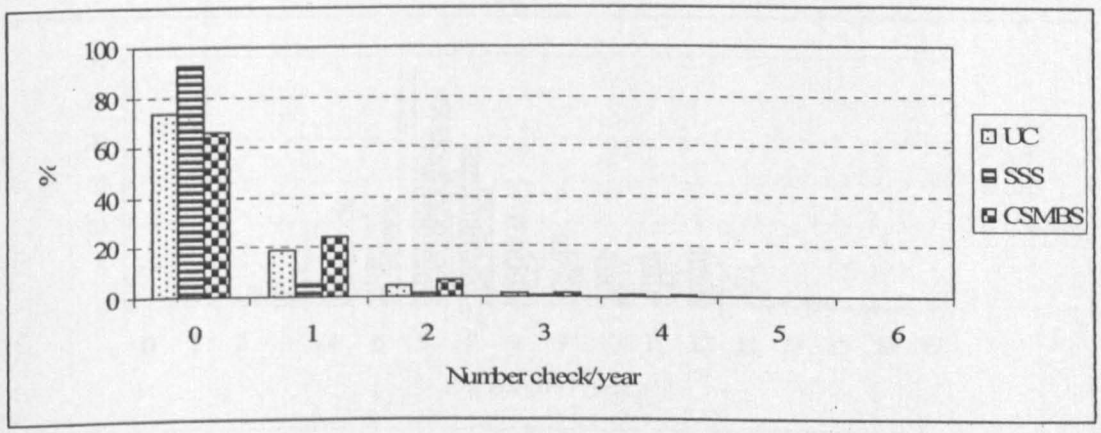


Figure 7.4 Eye examination checks per year

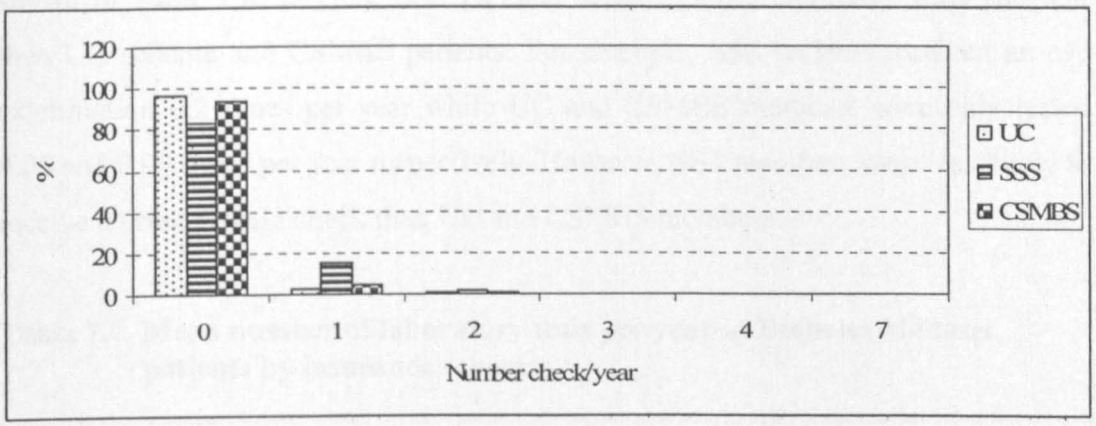


Figure 7.5 Lipid profile checks per year

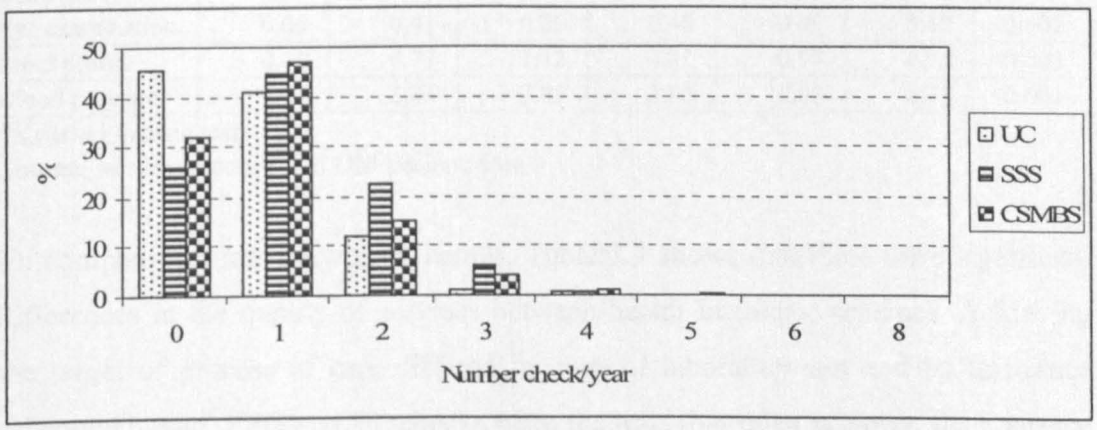
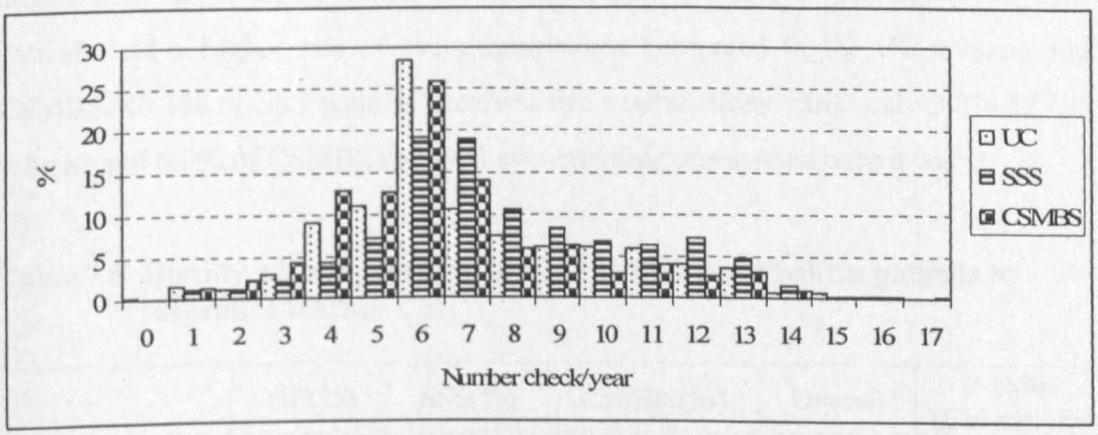


Figure 7.6 Blood pressure checks per year



The details of mean number of laboratory tests for different insurance schemes are shown in Table 7.8. Overall, SSS patients received more laboratory tests per year than UC scheme and CSMBS patients. For example, SSS patients received an eye examination 0.2 times per year while UC and CSMBS members were only tested 0.06 and 0.09 times per year respectively. However, SSS members were less likely to receive a urine protein check than UC and CSMBS members.

Table 7.7 Mean number of laboratory tests per year in Diabetes Mellitus patients by insurance scheme.

Test	UC		SSS		CSMBS		P-value*
	Mean	SD	Mean	SD	Mean	SD	
FPG	6.97	2.77	7.62	2.78	6.40	2.50	<0.001
HbA1c	0.15	0.42	0.33	0.64	0.32	0.63	<0.001
Urine protein	0.37	0.77	0.12	0.49	0.48	0.82	<0.001
Eye examination	0.06	0.41	0.20	0.46	0.09	0.40	<0.001
Lipid profile	0.71	0.77	1.12	0.91	0.98	0.95	<0.001
Blood pressure	7.07	2.84	7.85	2.80	6.63	2.75	<0.001

*Kruskal Wallis test
Source: Medical record and DM patient data

To compare services between schemes, Table 7.9 shows that there were significant differences in the quality of services between health insurance schemes. Achieving the target of process of care differed by type of laboratory test and by insurance scheme. Overall, FPG and BP checks were the tests that most achieved their service targets. More than 90% of patients across all insurance schemes received FPG and BP checks more than four times a year. Eye examination was the least achieved target. Only 8.9% received eye examinations at least once a year. However, SSS patients had a higher rate of eye examinations compared to the UC scheme and CSMBS. 17.1% of SSS patients received eye examinations while only 3.8% of UC scheme and 6.0% of CSMBS received eye examinations at least once a year.

Table 7.8 Quality of care process provided to Diabetes Mellitus patients by insurance scheme

	UC(%)	SSS(%)	CSMBS(%)	Overall	P-value (Chi-square)
FPG					
<4	6.3	4.8	8.7	6.6	0.019
≥4	93.7	95.2	91.3	93.4	
HbA1C					

	UC(%)	SSS(%)	CSMBS(%)	Overall	P-value (Chi-square)
0	86.8	73.6	75.5	78.7	<0.001
≥1	13.2	24.4	24.5	21.3	
Urine protein					
0	74.0	93.5	66.5	77.7	<0.001
≥1	26.0	7.5	33.5	22.3	
Eye examination					
0	96.2	82.9	94.0	91.1	<0.001
≥1	3.8	17.1	6.0	8.9	
Lipid profile					
0	45.5	26.0	32.1	34.7	<0.001
≥1	55.5	74.0	67.9	65.3	
Blood pressure					
<4	6.2	4.4	7.8	6.1	0.040
≥4	93.8	95.6	92.2	93.9	
Total	664	643	632	1,939	

Source: Medical record and DM patient data

7.6 Association between insurance schemes and targets measuring process of care of Diabetes Mellitus

This section aims to explain the relationship between insurance scheme and process of care. Details of dependent and independent variables are shown in Table 7.7. Dependent variables consist of the six clinical tests shown in Table 7.8. The result of target achievement is a dichotomous outcome, meeting the target or not. Logistic regression was employed in the analysis. Achieving the target was set as 1 while not meeting the target was set as 0. Results of the analysis are shown in six regressions which are FPG, HbA1C, urine protein, eye examination, lipid profile, and blood pressure.

Bivariate analysis between different characteristics of independent variables and achieving the test targets was conducted to identify significant confounding factors. The results are shown in Table A4.1 (Appendix 4). Hosmer and Lemeshow (2000) suggested that an independent variable with a p-value of more than 0.25 should be included in the model. However, the results showed that each independent variable had a different effect on achievement of test targets. Therefore, to control for confounding factors by statistical criteria, according to the literature review, all factors were included in all models. Confounding factors were age, sex, marital

status, education, living area, income, duration of DM, smoking, co-morbidity, and hospital.

Results of the multivariate analysis are shown in Tables 7.10-7.15. The logistic models were tested for goodness of fit using the Hosmer & Lemeshow method. All test target models fitted with the independent variables. The details of goodness of fit tests are shown in Table 7.10.

Table 7.9 Goodness of fit of multivariate analysis of the six clinical tests

	FPG	HbA1C	Urine examination	Eye examination	Lipid Profile	BP
N	1,939	1,939	1,162	1,728	1,939	1,939
Group	10	10	10	10	10	10
Hosmer-Lemeshow Chi-square	5.12	11.04	11.05	10.66	8.72	12.63
Prob>Chi-square	0.745	0.199	0.199	0.222	0.366	0.125

Source: Medical record and DM patient data

Table 7.11 shows the results of the logistic regression for the six test targets. The data show the adjusted and unadjusted odds ratios. The details of the full model are shown in Table A4.2. For FPG tests, after controlling for confounding factors, insurance scheme did not affect achievement of the target.

For HbA1C test, the results show that CSMBS had a significantly higher probability of achieving the test target compared to the UC scheme. CSMBS had a 91% higher chance of meeting the target than UC scheme. However, the adjusted odds ratio after controlling for confounding factors was lower than the unadjusted odds ratio. There was no significant difference between SSS and the UC scheme in achieving the test target.

For urine protein examination, the SSS had a significantly lower probability of achieving the examination target than the UC scheme, while the CSMBS was significantly more likely to achieve the target compared to the UC scheme. After controlling for other confounding factors, the achievement rate of the UC scheme was 3.3 times higher than that of the SSS, while achievement by the CSMBS was 1.36 times higher than the UC scheme.

For eye examination, there was no significant difference in meeting the target between the SSS and CSMBS compared to the UC scheme. Although the unadjusted odds ratio of SSS showed significantly higher probability of achieving the eye examination target than the UC scheme, there was no significance after controlling for confounding factors.

For the lipid profile test, the SSS and CSMBS had a significantly higher probability of achieving the target compared to the UC scheme. The SSS was 2.95 times, and the CSMBS 1.47 times, more likely to achieve the standard target compared to the UC scheme.

For the BP test, both the SSS and CSMBS were not significantly different to the UC scheme after adjusting for confounding factors,

In summary, the CSMBS scored more highly in the HbA1C test, the lipid profile test, and the urine examination, while the SSS was higher in the lipid profile test but lower in urine examination.

Table 7.10 Logistic regression results of achieving laboratory tests

Laboratory test	Unadjusted				Adjusted*			
	Odds ratios	P-value	LL@	UL@@	Odds Ratios	P-Value	LL	UL
Dependent	Achieving standard target = 1							
FPG (N=1,939)								
UC	1.00				1.00			
SSS	1.33	0.238	0.83	2.15	1.49	0.262	0.74	2.99
CSMBS	0.71	0.105	0.47	1.08	0.68	0.124	0.42	1.11
HbA1C(N=1,939)								
UC	1.00				1.00			
SSS	2.35	<0.001	1.77	3.13	0.79	0.316	0.49	1.26
CSMBS	2.13	<0.001	1.59	2.84	1.91	<0.001	1.37	2.66
Urine examination(N=1,162)								
UC	1.00				1.00			
SSS	0.23	<0.001	0.16	0.32	0.29	<0.001	0.18	0.47
CSMBS	1.43	0.003	1.13	1.82	1.63	0.006	1.15	2.32
Eye examination(N=1,728)								
UC	1.00				1.00			
SSS	5.28	<0.001	3.37	8.27	1.85	0.165	0.78	4.41
CSMBS	1.64	0.062	0.98	2.74	1.43	0.245	0.78	2.60
Lipid profile(N=1,939)								
UC	1.00				1.00			
SSS	2.38	<0.001	1.88	3.00	2.95	<0.001	2.03	4.27

Laboratory test	Unadjusted				Adjusted*			
	Odds ratios	P-value	LL@	UL@@	Odds Ratios	P-Value	LL	UL
CSMBS	1.76	<0.001	1.41	2.21	1.47	0.003	1.14	1.90
BP(N=1,939)								
UC	1.00				1.00			
SSS	1.45	0.143	0.88	2.37	1.26	0.520	0.62	2.56
CSMBS	0.78	0.265	0.51	1.20	0.73	0.210	0.45	1.19

*controlled for: age, sex, marital status, education, living area, income, duration of DM, smoking, co-morbidity, hospital
@ lower level
@@ upper level
Source: Medical record and DM patient data

7.7 Association between insurance scheme and intermediate outcomes

To explore the effects of insurance scheme on intermediate outcomes, five laboratory indicators were studied to indicate whether they are controlled or uncontrolled: FPG (<130 mg/dl and ≥ 130 mg/dl); HbA1C (<7% and ≥7%); total triglyceride (<150 mg/dl and ≥150 mg/dl); total cholesterol (<200 mg/dl and ≥200 mg/dl); and BP (<130/80 and ≥130/80). Table 7.12 shows the percentage of uncontrolled DM status by insurance scheme.

Overall, 71% of patients were classified as having uncontrolled DM if the level of FPG was considered, but only 53% if the level of HbA1C was considered. SSS patients had greater proportions of uncontrolled DM than UC and CSMBS patients. However, when HbA1C level was taken into account, SSS patients had a greater proportion of controlled DM than UC and CSMBS patients. For lipid profile, uncontrolled triglyceride and cholesterol rate were reduced to only 48.9% and 41.1%, respectively. There was no difference in triglyceride level between schemes while CSMBS patients seemed to be better controlled in total cholesterol level than SSS and UC scheme patients.

Table 7.11 Diabetes Mellitus intermediate outcome indicators in different insurance schemes.

Outcome	UC		SSS		CSMBS		Overall		P-value*
	N	%	N	%	N	%	N	%	
FPG									
Controlled	219	33.0	141	21.9	208	33.1	567	29.3	<0.001

Outcome	UC		SSS		CSMBS		Overall		P-value*
	N	%	N	%	N	%	N	%	
Uncontrolled	445	67.0	502	78.1	421	66.9	1,369	70.7	
N	664		643		629		1,936		
HbA1C									
Controlled	36	40.9	97	57.1	63	40.7	196	47.5	0.005
Uncontrolled	52	59.1	73	42.9	92	59.4	217	52.5	
N	88		170		155		413		
Fasting triglyceride									
Controlled	182	50.3	253	53.2	212	49.4	647	51.1	0.500
Uncontrolled	180	49.7	223	46.9	217	50.6	620	48.9	
N	362		476		429		1,267		
Total cholesterol									
Controlled	201	56.2	267	56.2	276	64.3	745	59.0	0.020
Uncontrolled	157	43.9	208	43.8	153	35.7	519	41.1	
N	358		475		429		1,262		
BP									
Controlled	380	57.5	416	64.7	369	58.4	1,165	60.2	0.016
Uncontrolled	281	42.5	227	35.3	263	41.6	771	39.8	
N	661		643		632		1,936		

*Chi-square test
Source: Medical record and DM patient data

Independent variable selection

Bivariate analyses between independent variables and intermediate outcomes are shown in Table A4.3. All independent variables were included in the model, in accordance with statistical criteria suggested by Hosmer & Lemeshow, as mentioned in chapter 5 (Hosmer and Lemeshow 2000). To confirm that the independent variables in all models can explain the intermediate outcomes, the goodness of fit was tested by the Hosmer-Lemeshow chi square method, as shown in Table 7.13. The results showed that the models fitted to explain the intermediate outcomes.

Table 7.12 Goodness of fit of intermediate outcome model

	FPG	HbA1C	Total TG	Total cholesterol	BP
N	1,936	404	1,267	1,262	1,936
Group	10	10	10	10	10
Hosmer-Lemeshow Chi-square	14.49	12.46	7.04	4.86	9.00
Prob>Chi-square	0.070	0.132	0.532	0.772	0.343

Source: Medical record and DM patient data

Table 7.14 demonstrates factors associated with uncontrolled DM. Before adjusting for confounders, SSS had a significantly higher probability of having DM uncontrolled for FPG compared to UC scheme, while a lower probability of DM

uncontrolled for HbA1C and BP compared to UC scheme. CSMBS had a significantly lower probability of DM uncontrolled for total cholesterol in the unadjusted model compared to UC scheme. The full details of the analysis are shown in Table A4.4. However, after adjusting for confounders, there was no significant difference in the results of DM care between health insurance schemes. CSMBS and SSS had no significant difference in the result of care in the adjusted model compared to the UC scheme.

In summary, insurance scheme did not have a significant effect on the intermediate outcomes of DM care.

Table 7.13 Result of logistic regression of the association between insurance scheme and intermediate outcome

Variable	Unadjusted				Adjusted*			
	Odds ratios	P-value	LL@	UL@@	Odds ratios	P-value	LL	UL
Dependent variable	Uncontrolled = 1							
FPG(N=1,936)								
UC	1.00				1.00			
SSS	1.75	<0.001	1.37	2.24	1.44	0.061	0.98	2.11
CSMBS	1.00	0.974	0.79	1.26	1.17	0.249	0.90	1.53
HbA1C(N=413)								
UC	1.00				1.00			
SSS	0.52	0.014	0.31	0.88	1.17	0.733	0.47	2.95
CSMBS	1.01	0.968	0.59	1.72	1.19	0.606	0.61	2.30
Total triglyceride(N=1,267)								
UC	1.00				1.00			
SSS	0.89	0.409	0.68	1.17	0.96	0.842	0.64	1.44
CSMBS	1.03	0.810	0.78	1.37	0.93	0.669	0.68	1.28
Total Cholesterol(N=1,262)								
UC	1.00				1.00			
SSS	1.00	0.985	0.76	1.31	0.69	0.074	0.45	1.04
CSMBS	0.71	0.019	0.53	0.95	0.74	0.063	0.53	1.02
BP(N=1,936)								
UC	1.00				1.00			
SSS	0.74	0.008	0.59	0.92	0.86	0.402	0.61	1.22
CSMBS	0.96	0.744	0.77	1.20	0.80	0.087	0.62	1.03

*adjusted by: age, sex, marital status, education, living area, income, duration of having DM, smoking, co-morbidity, and hospital.
@ lower level
@@ upper level
Source: Medical record and DM patient data

7.8 Association between insurance scheme and admission of Diabetes Mellitus patients

For further analysis of quality of care, the study collected data on hospital admissions from national claims data for the studied patients, partly because these e data allowedthe tracking of patients admitted to different hospitals. The study collected data on admissions with diagnoses related to DM complications such as hypoglycaemia, hyperglycaemia, cardiovascular complications, and cellulites. Admissions not directly related to DM were excluded, such as car accidents and trauma fractures. It was found that there were different rates of admission by sex, age group, insurance, income, duration of DM, and co-morbidity, as shown in Table 7.15.

Table 7.14 Different factors in admission in Diabetes Mellitus patients

Variable	No	No of Admissions	Admission(%)	P-value*
N	1,703	236	12.17	
Hospital				
Samutsakhon (public)	709	108	13.2	<0.001
Kratumban (public)	444	86	16.2	
Banpaw (public)	187	24	11.4	
Srivichai3 (private)	119	15	11.2	
Mahachai2 (private)	244	3	1.2	
Age group				
0-40	134	9	6.3	<0.001
41-60	921	71	7.2	
>60	648	156	19.4	
Sex				
Male	605	68	10.1	0.042
Female	1,098	168	13.3	
Marital status				
Single	131	13	9.0	0.230
Married	1,572	223	12.4	
Education				
Without education	182	31	14.6	0.372
Primary-Bachelor	1,407	193	12.1	
>Bachelor	114	12	9.5	
Area				
Urban	790	122	13.4	0.126
Rural	913	114	11.1	
Insurance				
UC	568	96	14.5	<0.001
SSS	604	39	6.1	
CSMBS	531	101	16.0	
Income				

Variable	No	No of Admissions	Admission(%)	P-value*
No income	348	78	18.3	<0.001
B <2,000	163	43	20.9	
B 2,000-10,000	894	90	9.2	
B >10,000	298	25	7.7	
Duration of DM				
≤ 5 years	1,040	93	8.2	<0.001
> 5 years	663	143	17.7	
Smoking				
No	1,565	222	12.4	0.245
Yes	138	14	9.2	
Co-morbidity				
No	428	39	8.4	0.004
Yes	1,275	197	13.4	

* Chi-square test
Source: Medical record and DM patient data

Independent variables were selected by the same criteria as mentioned above. The details of bivariate analysis between different characteristics and admission are shown in Table A4.5. To test model fit, the study used the Hosmer & Lemeshow goodness of fit test. The result of this test showed that the model fitted to explain the admission of DM patients (Hosmer-Lemeshow chi square=5.17, p-value=0.740).

Table 7.16 shows results from the multivariate analysis of factors affecting admissions of DM patients. Before adjusting for confounders, SSS had a significantly lower probability of having admissions compared to the UC scheme, while for CSMBS there was no significant difference. The details of the full results of independent variables and admissions are shown in Table A4.6. After adjusting for confounding factors, SSS and CSMBS admission rates were not significantly different to the UC scheme.

In summary, insurance scheme did not have a significant effect on admission of DM patients.

Table 7.15Factors affecting admission of Diabetes Mellitus patients

	Unadjusted				Adjusted*			
	Odds ratios	P-value	LL@	UL@@	Odds ratios	P-value	LL	UL
Dependent	Admission =1							
N=1,939								
UC	1.00				1.00			
SSS	0.38	<0.001	0.26	0.56	1.11	0.716	0.63	1.96
CSMBS	1.13	0.445	0.83	1.52	1.08	0.680	0.76	1.52

* confounding factor: age, sex, marital status, education, area, income, duration of DM, smoking, co-morbidity, hospital
@ lower level
@@ upper level
Source: Medical record and DM patient data

7.9 Effect of type of hospital on use of laboratory tests, intermediate outcomes, and hospitalization of Diabetes Mellitus patients

Because patients were recruited from both public and private hospitals, this section will explore the effect of hospital type on quality of DM care. The section begins with presenting descriptive data on different characteristics of patients by hospital. Then, the results of multivariate analysis on achievement of laboratory test targets, intermediate outcomes, and hospitalization are presented.

Table 7.17 shows patient characteristics by hospital type. Overall, private hospital patients were of lower average age than public hospital patients. Most of them had DM for less than five years. Public hospitals had more patients of low income than private hospitals.

Table 7.16Different characteristics in different hospitals

Different characteristic	Samutsakhon (public) (%)	Kratumban (public) (%)	Banpaw (public) (%)	Srivichai3 (private) (%)	Mahachai2 (private) (%)	P-value (Chi-square)
N	817	530	211	134	247	
Age group						
<40	6	4	3	14	18	<0.001
41-60	47	43	40	81	74	
>60	46	53	56	5	8	
Sex						
Male	30	36	32	36	48	<0.001
Female	70	64	68	64	52	
Marital status						
Single	6	6	11	11	12	<0.001

Different characteristic	Samutsakhon (public) (%)	Kratumban (public) (%)	Banpaw (public) (%)	Srivichai3 (private) (%)	Mahachai2 (private) (%)	P-value (Chi-square)
Married	94	94	89	89	88	
Education						
Without education	13	12	17	3	1	<0.001
primary-bachelor	81	78	78	94	94	
>bachelor	6	9	5	3	5	
Income						
No income	35	8	35	9	6	<0.001
B 1-2,000	9	18	13	5	1	
B 2,001-10,000	44	53	38	66	70	
B >10,000	12	21	14	19	23	
Duration of DM						
≤5 years	53	61	43	72	76	<0.001
> 5 years	47	39	57	28	24	
Co-morbidity						
No	21	28	24	28	25	0.052
Yes	79	72	76	72	75	

Source: Medical record and DM patient data

Table 7.18 shows the adjusted and unadjusted achievement of test targets by hospitals. For FPG, there were no significant differences between hospitals in achieving the FPG test after controlling for confounding factors. In contrast, the results show that after controlling for confounding factors Srivichai3 hospital and Mahachai2 hospital had a significantly higher probability of achieving the HbA1C test target compared to Samutsakhon hospital. Srivichai3 had a 100% higher chance of achieving the HbA1C target compared to Samutsakhon hospital while Mahachai2 had a 200% higher chance of achieving HbA1C target compared to Samusakhon hospital. However, within public hospitals, Kratumban and Banpaw hospital had a lower probability of achieving the HbA1C test target compared to Samutsakhon hospital.

Both private hospitals had a significantly lower probability of achieving the standard for urine examination compared to Samutsakhon hospital. Srivichai3 hospital had a 12.6 (1/0.08) times lower probability of achieving the urine examination target compared to Samutsakhon hospital while Mahachai2 hospital had a 13.74 (1/0.07) times lower probability of achieving the target.

The results for urine examination were markedly different to those for eye examination. After controlling for confounding factors, private hospitals had a very

high probability of performing eye examinations. After adjusting for confounding factors, Mahachai2 hospital was 82 times more likely to perform eye examination compared to Samutsakhon hospital while Srivichai3 hospital was 7.5 times more likely to perform eye examinations compared to Samusakhon hospital. Furthermore, Kratumban hospital also had a significantly higher probability of performing eye examinations compared to Samutsakhon hospital. It was 20 times more likely to perform eye examinations than Samutsakhon hospital, after adjusting for confounding factors.

For the lipid profile test, private hospitals had both lower and higher chances of achieving the standard for lipid profile tests. Srivichai2 hospital had a significantly lower probability of carrying out the lipid profile test, while Mahachai2 hospital had a significantly higher probability compared to Samutsakhon hospital. After adjusting for confounding factors, Mahachai2 hospital had a 90% higher chance of performing the lipid profile test compared to Samutsakhon hospital, while Srivichai3 hospital had a 200% lower chance compared to Samutsakhon hospital. Furthermore, Kratumban hospital had a significantly higher probability (47% higher) of achieving the lipid profile test compared to Samutsakhon hospital.

Table 7.17 Results of logistic regression of association between hospitals and laboratory test targets

Test target	Unadjusted				Adjusted*			
	Odds ratios	P-value	LL@	UL@@	Odds ratios	P-value	LL	UL
Dependent	Achieving standard target = 1							
FPG(N=1,939)								
Samutsakhon (public)	1.00				1.00			
Kratumban (public)	0.65	0.044	0.43	0.99	0.79	0.315	0.50	1.25
Banpaw (public)	0.99	0.982	0.53	1.86	1.10	0.771	0.57	2.13
Srivichai 3 (private)	1.18	0.686	0.52	2.67	1.06	0.912	0.41	2.73
Mahachai 2 (private)	1.54	0.220	0.77	3.09	1.52	0.339	0.64	3.59
HbA1C(N=1,939)								
Samutsakhon (public)	1.00				1.00			
Kratumban (public)	0.53	<0.001	0.39	0.70	0.47	<0.001	0.34	0.65
Banpaw (public)	0.14	<0.001	0.07	0.28	0.14	<0.001	0.07	0.27
Srivichai 3 (private)	1.26	0.263	0.84	1.90	2.05	0.007	1.21	3.47
Mahachai 2 (private)	2.03	<0.001	1.50	2.74	3.28	<0.001	2.08	5.15
Urine examination**(N=1,162)								
Samutsakhon (public)	1.00				1.00			
Srivichai 3 (private)	0.10	<0.001	0.06	0.17	0.08	<0.001	0.05	0.13
Mahachai 2 (private)	0.02	<0.001	0.01	0.07	0.07	<0.001	0.02	0.24

Test target	Unadjusted				Adjusted*			
	Odds ratios	P-value	LL@	UL@@	Odds ratios	P-value	LL	UL
Eye examination**(N=1,728)								
Samutsakhon (public)	1.00				1.00			
Kratumban (public)	16.18	<0.001	7.36	35.57	20.03	<0.001	8.81	45.54
Srivichai 3 (private)	7.35	<0.001	2.62	20.61	7.51	0.001	2.26	25.03
Mahachai 2 (private)	69.88	<0.001	31.80	153.54	81.94	<0.001	29.65	226.42
Lipid profile(N=1,939)								
Samutsakhon (public)	1.00				1.00			
Kratumban (public)	1.32	0.020	1.04	1.66	1.47	0.004	1.13	1.91
Banpaw (public)	0.96	0.785	0.70	1.31	1.18	0.334	0.85	1.63
Srivichai 3 (private)	0.55	0.001	0.38	0.80	0.27	<0.001	0.17	0.43
Mahachai 2 (private)	3.76	<0.001	2.56	5.52	1.89	0.008	1.18	3.03
BP(N=1,939)								
Samutsakhon (public)	1.00				1.00			
Kratumban (public)	0.86	0.504	0.56	1.33	1.01	0.976	0.62	1.63
Banpaw (public)	0.87	0.647	0.48	1.58	0.98	0.947	0.52	1.83
Srivichai 3 (private)	1.42	0.427	0.60	3.38	1.28	0.627	0.47	3.47
Mahachai 2 (private)	1.99	0.076	0.93	4.25	1.94	0.156	0.78	4.83

*adjusted by: age, sex, marital status, education, living area, income, duration of having DM, smoking, co-morbidity, and insurance status.
**Note: Kratumban, Banpaw successes completely determined
@ lower level
@@ upper level
Source: Medical record and DM patient data

Table 7.19 shows the results of the logistic regression of hospitals and intermediate outcomes including achieving control of FPG, HbA1C, total triglyceride, total cholesterol, and average BP.

In achieving control of FPG, only Kratumban hospital had a significantly lower probability of achieving FPG control than Samutsakhon hospital. Kratumban hospital had a 71% (1-1/0.58) lower chance of achieving FPG control compared to Samutsakhon hospital. For private hospitals, there was no difference in achieving FPG control compared to Samutsakhon hospital, after adjusting for confounding factors.

In achieving HbA1C control, Mahachai2 hospital had a significantly lower probability of achieving HbA1C control compared to Samutsakhon hospital. . Mahachai2 hospital had 4.78 (1/0.21) times lower probability for achieving HbA1C control compared to Samutsakhon hospital. For other hospitals, there was no significant difference with Samutsakhon hospital.

In achieving total triglyceride control, Banpaw hospital had a significantly higher probability of achieving total triglyceride control compared to Samutsakhon hospital. Banpaw hospital had a 2.66 times higher chance of achieving total triglyceride control than Samutsakhon hospital while other hospitals had no significant difference compared to Samutsakhon hospital.

In achieving total cholesterol control, Banpaw, Srivichai3, and Mahachai2 hospital had a significantly higher probability of achieving total cholesterol control compared to Samutsakhon hospital. After adjusting for confounding factors, Banpaw, Srivichai3, and Mahachai2 hospital were 2.2, 4.5, and 1.6 times more likely to achieve total cholesterol control than Samutsakhon hospital.

All other hospitals had a significantly lower probability of achieving average BP control compared to Samutsakhon hospital. Katumban and Banpaw hospitals had between 1.4 and 2.9 times a higher chance of achieving average BP control than Saumutsakhon hospital, while Mahachai2 and Srivichai3 hospitals had a 2.0 to 2.4 times higher chance of achieving average BP control compared to Samutsakhon hospital.

Table 7.18 Result of logistic regression of association between hospitals and intermediate outcomes

Intermediate outcome	Unadjusted				Adjusted*			
	Odds ratios	P-value	LL@	UL@@	Odds ratios	P-value	LL	UL
Dependent	Achieving standard target = 1							
FPG(N=1,936)								
Samutsakhon (public)	1.00				1.00			
Kratumban (public)	0.57	<0.001	0.46	0.73	0.58	<0.001	0.45	0.76
Banpaw (public)	1.06	0.740	0.75	1.50	1.05	0.781	0.73	1.51
Srivichai 3 (private)	0.98	0.922	0.65	1.47	0.64	0.073	0.39	1.04
Mahachai 2 (private)	1.63	0.007	1.14	2.33	1.11	0.649	0.71	1.75
HbA1C**(N=404)								
Samutsakhon (public)	1.00				1.00			
Kratumban (public)	0.80	0.426	0.47	1.38	0.79	0.436	0.43	1.44
Srivichai 3 (public)	0.92	0.809	0.45	1.85	0.77	0.609	0.28	2.11
Mahachai 2 (private)	0.27	<0.001	0.16	0.46	0.21	0.001	0.09	0.51
Total triglyceride(N=1,267)								
Samutsakhon (public)	1.00				1.00			
Kratumban (public)	1.10	0.474	0.84	1.45	1.12	0.442	0.83	1.52
Banpaw (public)	2.59	<0.001	1.72	3.90	2.66	<0.001	1.73	4.10
Srivichai 3 (private)	1.34	0.271	0.79	2.27	1.41	0.247	0.79	2.53

Intermediate outcome	Unadjusted				Adjusted*			
	Odds ratios	P-value	LL[@]	UL[@@]	Odds ratios	P-value	LL	UL
Dependent	Achieving standard target = 1							
Mahachai 2 (private)	1.13	0.451	0.82	1.56	1.19	0.416	0.79	1.79
Total Cholesterol(N=1,262)								
Samutsakhon (public)	1.00				1.00			
Kratumban (public)	1.24	0.129	0.94	1.65	1.15	0.374	0.84	1.57
Banpaw (public)	2.24	<0.001	1.50	3.33	2.17	<0.001	1.42	3.30
Srivichai 3 (private)	4.52	<0.001	2.52	8.08	4.47	<0.001	2.36	8.44
Mahachai 2 (private)	1.61	0.004	1.16	2.22	1.59	0.029	1.05	2.42
BP(N=1,936)								
Samutsakhon (public)	1.00				1.00			
Kratumban (public)	0.69	0.001	0.56	0.87	0.71	0.007	0.55	0.91
Banpaw (public)	0.38	<0.001	0.27	0.53	0.35	<0.001	0.24	0.50
Srivichai 3 (private)	0.43	<0.001	0.29	0.64	0.43	<0.001	0.27	0.68
Mahachai 2 (private)	0.52	<0.001	0.38	0.70	0.50	<0.001	0.34	0.74

*adjusted by: age, sex, marital status, education, living area, income, duration of having DM, smoking, co-morbidity, and insurance status.
**Note: Banpaw successes completely determined
[@] lower level
[@@] upper level
Source: Medical record and DM patient data

Table 7.20 shows the results of the logistic regression of hospitals and admissions. In the adjusted result, Mahachai2 hospital had significantly lower probability of having DM admissions compared to Samutsakhon hospital. There was a 7.12 (1/0.14) times lower chance of Mahachai2 hospital having an admission compared to Samutsakhon hospital. Kratumban hospital had a significantly higher probability of having DM admissions compared to Samutsakhon hospital after adjusting for confounding factors. Kratumban hospital was a 52% higher chance of having an admission compared to Samutsakhon hospital.

Table 7.19 Result of logistic regression of association between hospitals and admission

	Unadjusted				Adjusted*			
	Odds ratios	P-value	LL[@]	UL[@@]	Odds ratios	P-value	LL	UL
Dependent	Admission =1							
N	1,939							
Samutsakhon (public)	1.00				1.00			
Kratumban (public)	1.27	0.125	0.94	1.73	1.52	0.020	1.07	2.16
Banpaw (public)	0.84	0.476	0.53	1.35	0.68	0.135	0.42	1.12
Srivichai 3 (private)	0.83	0.518	0.47	1.47	1.46	0.304	0.71	3.01
Mahachai 2 (private)	0.08	0.000	0.03	0.26	0.14	0.002	0.04	0.50

*adjusted by: age, sex, marital status, education, living area, income, duration of having DM, smoking, co-morbidity, and insurance status.
[@] lower level
[@@] upper level
Source: Medical record and DM patient data

In summary, it seems that there is different probability of an admission to the type of hospital.

7.10 Discussion

Univariate and bivariate analysis

Use of care

Analysis of the 2004 Health Examination Survey demonstrated that there was still lack of access to care for DM patients in the community. Uptake of diabetic screening remained problematic in spite of having universal health insurance coverage, especially amongst UC scheme and SSS members. This finding corresponds to a previous study which found that nearly fifty percent of Diabetes Mellitus cases were undiagnosed (Aekplakorn et al. 2003). Furthermore, quality of care was also problematic since more than half of those being treated were uncontrolled. The findings confirm that differences in the use of diabetic care exist between health insurance schemes. SSS patients had the most undiagnosed DM between insurance schemes. The reasons explaining low uptake of Diabetes Mellitus screening might come from both the patient and the provider's sides. SSS members might be less concerned about checking for DM because most of them were in the working age group. This is similar to a developed country such as the U.K. which found that only 35% of people older than 45 years old were willing to undergo screening (Lawrence et al. 2001). For the provider side, they might be less concerned

to find new cases of DM amongst UC and SSS members. At the time of data collection (2003), although there was a budget for prevention and promotion from the UC scheme covering the total population, there was no requirement to find new cases of DM.

Process of care

According to demographic characteristics, most SSS patients were in the 41-60 year age group, while most UC and CSMBS patients were in the over-60 year age group. The relative youth of SSS patients meant they had DM for a shorter duration and had correspondingly less co-morbidity.

Regarding laboratory tests, FPG and BP were commonly checked when patients came to a hospital. More than 90% of patients received these laboratory tests more than four times a year in each insurance scheme. In contrast, only 3.8% of UC scheme patients received an eye examination at least once a year, and 17% of SSS patients received one. The reason is likely to be that there are relatively few ophthalmologists in the public sector in Thailand compared to the number of patients. Furthermore, the rate of urine protein checking was also quite low in all three insurance schemes and lower than the lipid profile test. This might be because physicians tended to do other laboratory tests instead such as blood urea nitrogen (BUN) or blood creatinine (Cr). Data from Samutsakhon hospital showed that 39% of patients had a BUN test while 62% received a Cr test, as shown in Table 7.21. However, SSS members still received less of these tests than UC scheme and CSMBS members. This result might confirm the result of a lower chance of receiving a urine examination in the SSS.

Table 7.20 Percentage of BUN and Cr investigations in Samutsakhon hospital

Scheme	BUN	Cr	N
UC	43%	70%	313
SSS	17%	26%	212
CSMBS	48%	78%	332
Total	39%	62%	857

Multivariate analysis

Factors associated with uncontrolled DM

From the Health Examination Survey 2004, after controlling for confounding factors, CSMBS patients were significantly more likely to have uncontrolled DM than UC scheme patients. This might be for two reasons. Firstly, CSMBS patients can get care from any public hospital so they might lack continuity of treatment. They might seek different drugs from different hospitals. Secondly, at the time of the survey, CSMBS patients had to pay in advance for outpatient care and some patients might not have had enough money so this might have affected continuity of care in this group.

Association of insurance scheme and achieving laboratory test targets

This study showed that insurance scheme affected the achievement of the targets for different laboratory tests. The analysis indicated that FPG and BP were the most common laboratory tests for patients to receive. More than 90% of patients received both FPG and BP tests when they were followed up. Furthermore, the multivariate analysis proved that there was no significance difference in achieving these targets between insurance schemes. In eye examinations, there were also no significant differences in achieving the target between insurance schemes but the reason for this was not that it was a common test. On the contrary, it seemed to be due to a lack of personnel, especially ophthalmologists. Although the standard practice guideline did not mention that all patients needed to receive an eye examination from an ophthalmologist, hospitals normally refer patients to an ophthalmologist for examination.

The CSMBS scheme was found to achieve laboratory targets more than the UC scheme and the SSS. The CSMBS was more likely to meet the target in HbA1C, lipid profile, and urine examination tests, while SSS had a significantly higher probability of achieving the target for lipid profile but a lower probability of achieving the target of urine examination than the UC scheme. The reasons for this might be two-fold. On the one hand, CSMBS patients might request more investigations than patients in other schemes because they know that providers tend to respond to such requests. On the other hand, providers might be indirectly motivated by the scheme payment method. CSMBS used FFS as its main payment method to hospitals. This might affect provider behaviour in responding to patient requests more easily than for the SSS scheme patients and the UC patients, which

were paid by capitation and capitation with prospective payment respectively. This finding corresponds to study of Riewpaiboon et al. (2009) that CSMBS patients received services more than SSS patients and UC scheme patients.

In the SSS, the reasons for patients receiving fewer urine examinations might be due to either patient concern or provider behaviour. Doctors might not order urine protein tests for patients, but they might use an alternative test such as the BUN or Cr test. However, the higher achievement of the lipid profile test might be because the SSS had an arrangement for additional payments for hospitals that provided services for 25 chronic diseases[17]. The SSO used three indicators to calculate additional payments including number of registered patients, newly diagnosed patients, and accurate records in software provided by SSO.

Association of insurance scheme and intermediate outcomes

Several studies show that insurance status is associated with glycaemic control (Benoit et al. 2005, Roubideaux et al. 2004). This study used five intermediate outcomes of DM as indicators including mean FPG, mean HbA1C, mean total triglyceride, mean total cholesterol, and mean BP. Results of the analysis showed that there were no significant difference between UC scheme, SSS, and CSMBS patients in achieving the outcome target for five indicators. These results seem not to be related to the achievement of the process of care targets in the different insurance schemes. For example, SSS and CSMBS patients had a higher probability of having the lipid profile test but average results for total triglyceride, and total cholesterol levels were not different to those of the UC scheme. There are two probable reasons for this. The first concerns compliance with the process of care. Some laboratories tests showed low compliance, e.g. only 20% of patients received the HbA1C test. However, it could not be concluded that the process of care did not directly affect the result of care. Second, to specify the reason for this finding is not easy given that there are multiple factors that affect the outcome of care such as patient behaviour, patient beliefs, provider behaviour etcetera. Patients' behaviour might in turn be

[17] SSO have begun a risk adjustment project for chronic disease since 2001. The 25 chronic diseases include DM, HT, Chronic hepatitis, CHF, CVA, Malignancy, AIDS, Emphysema, Chronic renal failure, Parkinson's disease, Myasthenia gravis, Diabetes insipidus, Multiple scherosis, Dyslipidemia, Rheumatoid arthritis, Glaucoma, Nephrotic syndrome, SLE, Aplastic anemia, Thalassemia, Hemophilia, Psoriasis, Chronic vesiculobullous disease, ITP, Thyrotoxicosis.

influenced by their environment. For example, most SSS patients worked in a factory, so they could not easily control their food or exercise.

Association of insurance scheme with admission of DM patients

There was no significant difference between the schemes in the probability of admission. This might imply that hospitalization of patients with DM was not affected by the particular insurance scheme.

Association between hospital and process of care

The study included both private and public hospitals in Samutsakhon province. The effect of hospital on process of care was interesting to examine.

The study found that some laboratory tests showed an effect and some did not. FPG and BP were the two indicators which were not affected by hospital while the HbA1C test, the urine examination, the eye examination, and the lipid profile test were. Comparing between hospital types, it seemed to be that private hospitals had a significantly higher chance of achieving the standard number of laboratory tests for the HbA1C, the lipid profile test, and the eye examination. This might reflect private hospital policy in DM management. For example, for the HbA1C test and the eye examinations, a private hospital might increase the number of tests done by sending HbA1C tests to a private lab or by employing a part time ophthalmologist to help the full time doctors perform eye examinations.

However, it was clear that private hospitals had a significantly lower probability of undertaking urine examinations. This might be the result of doctor behaviour. As mentioned above, most doctors in private hospitals tended to use other tests to monitor kidney function instead of urine protein examination, such as BUN or Cr. Public hospitals did not show any significant difference between them. This might be due to cost concerns of doctors in public hospitals.

Association of hospital type with intermediate outcomes and hospitalization

This study showed that there were differences in intermediate outcomes between hospitals. Patients in different hospitals had different achievement levels for

intermediate outcomes, For example Kratumban patients had a higher chance of achieving the total cholesterol level than patients in Samutsakhon hospital while they had a lower chance for achieving the target FPG. This result might be due to both patient and provider behaviour. Patients in different hospitals might have different eating habits. However, this study did not include patient behaviour in the model, so some of the uncontrolled results may be due to patient behaviour. Provider behaviour may also be a factor here. Some physicians might tend to have tighter controls while others may be more relaxed.

Regarding hospitalization of DM patients, there were also different results from different hospitals. The results showed that one private hospital had a significantly lower chance of having admissions for DM compared to public hospitals. This might be due to good follow up by the hospital. Patients of this private hospital might have more regular follow up, so they can detect any minor complications before admission is required due to complications.

7.11 Conclusion

This study found that there were differences in use of hospital care between insurance schemes. The SSS group had the most undiagnosed DM compared to the UC scheme and CSMBS. However, CSMBS patients were significantly more likely to have uncontrolled DM.

Regarding the effect of the insurance schemes on quality of care, this study confirmed that the process of care received by hospital patients of different schemes was different. CSMBS patients were more likely to receive the set of standard of care than those with the SSS or the UC scheme. CSMBS seemed to affect provider behaviour, presumably because of its payment system. The UC scheme seemed to have the lowest quality process of care in terms of achieving the set standards of care.

For intermediate outcomes, there were no effects of the insurance scheme on laboratory test outcomes. The findings did not correspond to process of care result

where CSMBS patients had a higher chance of receiving standard laboratory tests. There might be other factors affecting the results of care that are not included in the study such as BMI. Furthermore, it might because of the low level of compliance with guidelines in all insurance schemes, for instance only 25% of CSMBS patients achieve the HbA1C test target.

CHAPTER 8: PROVIDER AND PATIENT PERSPECTIVES ON QUALITY OF CARE IN NON INSULIN DEPENDENT DIABETES MELLITUS PATIENTS IN DIFFERENT INSURANCE SCHEMES

8.1 Introduction

To understand quality of care and its relationship to insurance schemes, it is important to understand that it could be affected by both providers and patients. In general, treatment of DM is influenced by various factors including the patient provider, the environment they work in, hospital policy etc. This chapter aims to understand quality of service as perceived by NIDDM patients and to explore the perception, behaviour, and motivation of providers regarding quality of DM treatment in different schemes. It begins with a brief methodology, followed by results of the study. The results are presented in two parts; patients' and providers' views on quality of care in terms of use of care, process of care, and quality of care. This is followed by a discussion and a conclusion.

8.2 Methodology

Qualitative approaches, both in-depth interviews and focus group discussions, were used to understand providers' practices and patient perceptions of quality of DM care in different insurance schemes.

Data collection

An open-ended list of questions was used as the guide for the in-depth interviews and focus group discussions. Details of the questions are shown in appendix 5. The focus group discussions were facilitated by the researcher and two assistants (one assistant had some qualitative research experience; and the second was a nurse practitioner). In-depth interviews were conducted by the researcher and one assistant. The researcher facilitated the sessions with an introduction explaining the objective of the research and clarifying the researcher's role to participants. The focus groups lasted between 160 and 180 minutes with a break of about 15 minutes. At the end of both the in-depth interviews and focus group discussions, a debriefing and discussion session was conducted between the researcher and the assistants.

Selection process and basic information

Providers and NIDDM patients in Samutsakhon province were sampled for this study. The details of hospitals were outlined in chapter 4. DM patients of all study hospitals who were included in primary data collection were invited to participate in a focus group discussion. Two focus groups of SSS patients were conducted, one from private hospitals and the other from public hospitals. They were separated because these different groups selected their own hospital which may affect their attitude and experience of the care they received. The other two focus groups were done for UC and CSMBS patients. The number of participants in each focus group ranged from 5 to 9 participants, as shown in Table 8.1. Twenty-seven patients participated in focus group discussions. Focus group discussions were conducted between September 2007 and January 2008 in a hotel in Muang district, Samutsakhon.

Table 8.1 Number of Diabetes Mellitus participants in each focus group discussion.

DM patients	Srivichai3	Mahachai2	Katumban	Banpaw	Samutsakhon
SSS private	3	3			
SSS public			2	1	2
UC			2	2	2
CSMBS			3	3	3

Characteristics of participants are shown in Table 8.2. Females were predominant and the average age of CSMBS and UC members was relatively higher than that of SSS patients. Most patients were still working, with an average income of between 2,000 and 40,000 Baht / month. They had a history of 1-18 years of DM, with UC and CSMBS members having the longest period of illness. Time treated in hospital corresponded with duration of diagnosed DM. CSMBS participants had a relatively high educational level compared with the other two schemes.

Table 8.2 Characteristics of Diabetes Mellitus participants in focus group discussions

	SSS (private)	SSS(public)	UC scheme	CSMBS
Patients	6	5	6	9
Age (years)	33-52	41-49	43-59	48-68
Sex				
· Male	2	2	2	5
· Female	4	3	4	4
Occupation				
· Full time	6	5	4	5
· None	-	-	2	4
Time since diagnosis (years)	1 to 6	1 to 10	2 to 18	2 to 12
Time treated in this hospital(years)	1 to 5	1 to 10	2 to 12	2 to 12
Education	Primary-Secondary	Primary-Secondary	Primary	Primary-Bachelor
Salary(baht)	5,000-20,000	5,000-8,000	3,000-15,000	2,000-40,000

Hospital staff who were involved in providing care to DM patients were purposively selected for the in-depth interviews and focus group discussion. The in-depth interview participants were directors of each hospital, physicians who were responsible for managing DM patients, the head of the insurance unit, and DM clinic teams. Details of the number of in-depth interviews and focus groups are shown in Table 8.3.

Table 8.3 Summary of number of participants in in-depth interviews and focus group discussions from provider side

Status	Position	Planned	Done	Method
Patient	DM patient	4	4	Focus group
Manager	Director of hospital	5	4	In-depth interview
	Head of insurance	5	5	In-depth interview
Providers	Physicians	5	9	In-depth interview
	DM clinics team	5	5	Focus group
N		24	27	

Conceptual framework and analysis

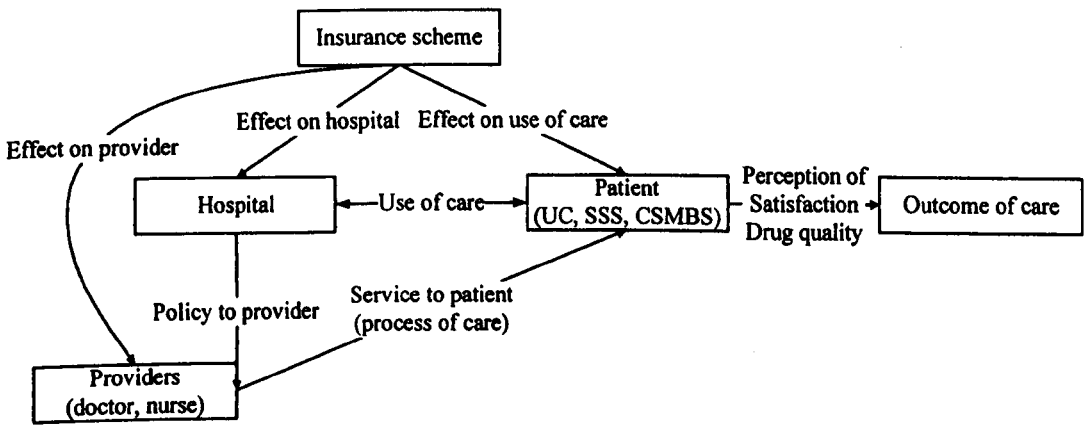
Figure 8.1 shows the conceptual framework of the effect of insurance scheme on stakeholders. Different characteristics of an insurance scheme affect hospitals, providers, and patients. A hospital might respond to different scheme characteristics

by setting a different policy for each scheme. To implement these policies, hospitals use providers, including doctors, nurses and other staff. Furthermore, different schemes might affect a provider's behaviour directly. Providers are aware of scheme regulations, so they might provide services to patients differently in accordance with this. The provider is a key person providing services, especially doctors providing services to patients. One provider can provide services to patients in different schemes.

Scheme regulations might create obstacles to patients' use of services. For example, if an insurance scheme contracts with a large hospital, this might create geographic constraints for patients to access services. Patients can also be constrained by the policy regulations of a hospital.

The outcome of service is hard to measure from only the provider's viewpoint. This study uses indirect indicators including satisfaction or perception of drug quality from the patient side.

Figure 8.1 Conceptual framework for qualitative analysis



The interviews and discussions were audiotaped and fully transcribed (in Thai). Data were analysed on a sentence basis using the Atlas.ti 4.2 software and Microsoft Word 2003. Three main issues were explored from the in-depth interviews and focus group discussions: use of care, process of care, and perception of outcome of care. The analytical framework used in the study is shown in Table 8.4.

Table 8.4 Details of framework for qualitative analysis

Elements	Provider			Patient		
	UC scheme	SSS	CSMBS	UC scheme	SSS	CSMBS
Use of care						
Process of care						
Perception of outcome of care						

The results of the study are presented based on two groups of stakeholders: providers and patients. The provider section consists of perceptions, behaviour, and motivations regarding use of care and process of care. The patient section consists of perceptions of use of care, process of care, and outcome of care.

8.3 Provider Views

8.3.1 Use of care

Most providers agreed that the differences between insurance schemes affect the services provided to patients. Hospital behaviour was different regarding the detection of new cases in the community, separation of services, and referral of patients to health services near their home.

Effect of schemes on finding new cases and referral of patients to services near to home

Detecting new cases in the community is an important policy. It is worth balancing expenditure on detection of cases and resources needed to treat newly detected cases (Engelgau et al. 2000). It is better to diagnose DM earlier to prevent complications (Statements ADA 2008). Currently, DM tends to be diagnosed before the patient has symptoms of complications.

Finding new cases

The different insurance schemes affect hospital policy on detecting new cases in the community. NHSO has set an incentive budget for hospitals to find new cases in the community. This budget covers all three insurance schemes. However, most of this budget is passed through public providers. Thus, private hospitals rarely gain access to this budget to find new cases. Furthermore, public hospitals have outreach teams to detect new cases of DM. This was also the MOPH policy and incentives were

provided by the UC scheme with additional money for hospitals to find new cases of DM.

> *"... We use preventive and promotive teams to screen DM in community of UC scheme two times a year."*
>
> (Head of insurance, public hospital)

> *"... After NHSO provide an additional budget for finding new cases of HT and DM, we cooperated with the elderly club to set a team to screen new cases in the community and factory...Overall, there is about 10% increase of new cases coming to the hospital"*
>
> (Head of insurance, public hospital)

In respect of the SSS, the SSO now makes additional payments to hospitals, which diagnose new cases of 25 chronic diseases, including DM. However, the calculation criteria do not include new cases in the community. In this study private hospitals do not have a policy actively to detect new cases in the community. Nonetheless, they had an annual screening programme to check employees in registered factories.

> *"... We have a plan to check up on employees' health in the factory every year. If we find whoever has a high blood sugar level, we can refer them to our hospital"*
>
> (Head of insurance, public hospital)

> *"... We report new cases of DM to SSO every month... We will check the new case form. If some data are missing, we will send this data to the doctor to complete again."*
>
> (Head of insurance, private hospital)

Referral of patients to health services near home

Because most of the general hospitals in this study had several specialists, there were few DM patients in need of referral to higher-level hospitals. It is important to know whether hospitals referred patients to lower levels of care such as clinics, health centre, or PCU. Given the geographic characteristics of Samutsakhon Province,

providers considered few problems in transportation or patients' transport cost. Moreover, some providers believed that most patients preferred to be treated in hospital, because of more convenient transport and preference for specialist care.

> *"... There are no geographical constraints in this area. There are lots of ways to come to hospital such as car, bus, or boat."*
>
> (DM clinic nurse, public hospital)

> *" ...Transportation in this area is good. Some UC patients can come together within one car. Some CSMBS patients have their own car....."*
>
> (Doctor, public hospital)

However, in the UC scheme, public hospitals in this study have a policy to refer patients back to a health centre close to patient's home, which did not seem to be effective.

> *".... We have a policy of referring patient back to a PCU or health centre near the patients' home, but it depends on the patient as well."*
>
> (Director, public hospital)

> *"... After their blood sugar is stable, most of them do not want to go back to the PCU or health centre. They would like to be treated by a specialist."*
>
> (DM clinic nurse, public hospital)

SSS staff in private hospitals in this study did not have a policy to refer patients back to services close to their home. Furthermore, the private hospitals had a policy to reduce the numbers of subcontractor clinics in order to reduce costs. In SSS, the hospital is the main contractor with SSO. If they set other health facilities as their subcontractors, they have to pay for services in those subcontractors. Furthermore, the private hospitals believed that patients preferred hospital to clinics.

> *"...next year, we will reduce the numbers of subcontractor clinics from 150 to 100 because of the cost problem. Furthermore, some clinics don't want to*

receive chronic cases because these patients use more resources than acute care."

(Head of insurance, private hospital)

Separated service between schemes

Most of the hospitals in this study set different tracks for different types of patient. The main separation was of SSS patients from other schemes. The two private hospitals had separate service sections for SSS patients and out-of-pocket patients, especially for OPD and registration. However, some parts including doctor or pharmacy could not be totally separated, because they would like to ensure a premium service for out-of-pocket patients.

"... We separate OPD for SSS from out of pocket patients because some patients who pay by themselves don't want to wait for the doctor at the same area with SSS patients."

(Director, private hospital)

In public hospitals in this study, they also separated SSS from UC and CSMBS patients but for different reasons than in private hospitals. All contracted public hospitals for SSS members were requested by the SSO to set a separate OPD area and inpatient ward for shortening the queue. The marketing strategy was another reason for the service separation, because of competition between public hospitals and private hospitals in attracting SSS members.

" ... We do not separate UC and foreigners but we have to add more doctors for SSS because they are about six to seven hundred patients per day in this group."

(Director, public hospital)

"...We separated services between schemes because of the marketing strategy especially SSS. We would like them to choose our hospital next year. Furthermore, the team responsible was also separated for SSS patients from the others."

(DM clinic team, public hospital)

8.3.2 Process of care

Insurance scheme affected five aspects of the process of care: 1) the hospital management process and method of payment to doctors; 2) doctors' practice in following the standard practice guidelines; 3) the prescription of laboratory tests; 4) doctors' drug prescription patterns; and 5) the follow up of patients.

Effect of scheme on payment of doctors

The different schemes had different effects on physician income. In SSS, one public hospital paid physicians by fee with a maximum limit related to the capitation budget received from SSS. The private hospitals paid physicians a reduced fee for providing care to SSS members, but a full fee for out-of-pocket patients.

> *"...We pay doctors corresponding to the payments we receive, for example, we pay our specialists by doctor fee but have maximum payment for each month for UC and SSS patients. After that we reduce the fee to 10% of normal."*
>
> (Director, public hospital)

> *"... Doctor fees for providing care to SSS patients are less than the normal fee...We have to freeze it because the capitation has been stable for two or three years while hospital expenses on employees have increased every year. This situation makes it hard for the hospital to plan the yearly budget. However, doctors can charge more doctor fees for private patients."*
>
> (Director, private hospital)

Since the UC scheme and CSMBS use only public hospitals, doctors are paid by salary from the government. However, one hospital had an incentive for doctors who treated CSMBS patients.

> *"...We had sixty doctors as a government agency and twenty doctors we hired with hospital money. These groups of doctors provide services mainly*

for UC and CSMBS patients. Furthermore, we had part-time doctors to help provide services for SSS patients. "

(Director, public hospital)

"... The hospital adds a doctor fee for me when I treat a CSMBS patient."

(Doctor, public hospital)

There was no evidence of a direct effect of this regulation on physician behaviour. However, physicians in one private hospital had limited the number of SSS patients seen to have more time for patients paying out of pocket.

Effect of scheme on adherence to standard practice guidelines

In DM management, adherence to the standard practice guidelines can improve the outcome of DM care (Knight et al. 2005). A study from Australia has shown that the important barriers of adherence to guidelines from the provider side are too heavy workload, guidelines being too rigid, and no financial incentive (Grol and Wensing 2004). In Thailand, standard practice guidelines have been set up by The Endocrine Society of Thailand. The question was whether providers know and follow the guidelines or not. Another question was whether patients with different insurance schemes receive treatment of the same standard or not.

The interviews revealed that most doctors in this study knew the standard guidelines. They accepted the importance of guidelines but they did not strictly follow them. Most physicians used their own experience to manage patients. Furthermore, sticking to guidelines depended on the patient's status and availability of services in the hospital.

"... We have a meeting about the guidelines but we don't use them for all patients...However, style of treatment of the doctor might be different...We cannot control all activities of the doctors but we try to manage patients not lower than the standard"

(Doctor, public hospital)

"...We do not adhere strictly to the standard guidelines. We set up our own guidelines suitable for our hospital....Our guidelines are not complicated.

The major part is about when to order special lab tests, when to refer to ophthalmologist."

(Doctor, public hospital)

"... I used my experience to treat DM patients... This hospital has almost every laboratory test I need. Now, the problem is only that we have a shortage of ophthalmologists."

(Doctor, private hospital)

Effect of scheme on prescription of laboratory tests

Insurance scheme affected the prescribing of laboratory tests to a certain degree. In general, hospitals did not limit routine laboratory tests for DM patients. However, in the SSS and the UC scheme, for the high-cost tests or the ones required to be done at a private laboratory, the hospital may have instructed doctors to order those only for specific cases. In addition, some doctors helped the hospitals by using a lower-cost blood test. Furthermore, some hospitals had a policy of limiting a screening test to patients with DM symptoms.

"...We don't have a policy to limit lab tests.... It depends on the doctor."

(Director, public hospital)

"...I know that the doctor can check more lab tests for patients...I may ask the doctor whether it is needed for all patients or not....If it is needed for only specific cases then there is no need to check for all patients."

(Director, private hospital)

"... If we find patients without any DM symptoms and want to check their FPG, we will tell them that they have to pay for lab tests if the result shows normal.

(DM clinic team, public hospital)

"...We found that it cost the hospital too much and some investigations are not essential at that time, for example HbA1C is not essential for all patients. So, now we try to point to only the uncontrolled group"

(Doctor, public hospital)

For SSS patients in private hospitals in this study, physicians might use higher-cost lab tests to give more information. For instance, instead of prescribing a urine protein tests, some doctors ordered BUN and Cr, because it could provide more information on kidney function.

> *"... I usually check BUN and Cr more than urine protein because I think I can know more about kidney function than from urine protein."*
>
> (Doctor, private hospital)

In the CSMBS in this study, doctors tended to prescribe laboratory tests on patients' request.

> *"... If a UC patient requests more tests, I will discuss with them whether it is essential or not. But for CSMBS patients, I know that they can reimburse 100%; so I might order as they request."*
>
> (Doctor, public hospital)

Effect of scheme on drug prescription

There were some differences in drug use for patients in the different insurance schemes. In the SSS and the UC scheme in this study, public hospitals tried to set a single hospital drug list which used only one generic drug for one indication.

> *"... We control overuse of drugs by limiting the number of drugs in the hospital drug list and using only one drug for one indication... We have 550 items of drugs for UC patients. If doctors need to use more than those, they have to report the reason for using that drug."*
>
> (DM clinic team, public hospital)

Hospitals used various methods to control drug use for UC scheme patients. For example, doctors might negotiate with UC scheme patients on whether they could pay the additional costs of expensive drugs. One hospital had a policy of monitoring drug prescribing. If use of high cost drugs was increasing, they would discuss this in

the executive meeting. However, drug prescription mainly relied on doctors' behaviour. Physicians in public hospitals in this study were concerned about prescribing drugs, which were not on the hospital drug list for UC scheme and SSS patients. Physicians tried to help hospitals to control cost by limiting the use of high cost drugs for UC scheme and SSS patients.

"... We have a policy that some drugs are not allowed to be prescribed by a GP. They have to refer the patients to see a specialist if those patients need those drugs."

(Director, public hospital)

"... I will ask UC scheme patients whether they can help to pay something for this drug or not."

(Doctor, public hospital)

"...our doctors know that if they need to prescribe a drug not on the drug list, they have to tell the patient to buy it."

(DM clinic team, public hospital)

"... If the drugs prescribed by our doctors affect the costs of service, we will bring this issue to the executive meeting."

(DM clinic team, public hospital)

For the SSS, public hospitals in this study required an approval process for prescribing high cost drugs.

".. For high cost drugs, when doctors prescribe, they need to have the signature of the specialist or deputy director... But cases of this are very rare."

(DM clinic team, public hospital)

".. I have an example of one patient who was using a high cost drug from another hospital and asked our doctor to prescribe it. We had to negotiate with the patient to change to a cheaper drug since we did not have that drug in our hospital."

(Head of insurance unit, public hospital)

Sometimes, the DM clinic team would help to negotiate with patients to pay an additional charge for high cost drugs. In private hospitals, doctors knew that prescribing high cost drugs might affect the hospital's financial status. They considered this in prescribing.

> *"... Yes I know that if I prescribe high cost drugs for SSS patients, it may affect the hospital's financial status."*
>
> (Doctor, private hospital)

A doctor might negotiate with a patient to make additional payments for a high cost drug.

> *"... Some SSS patients received drugs from another hospital that we don't have, we have to tell them to pay for this item."*
>
> (Doctor, private hospital)

In respect of the CSMBS group, some doctors felt comfortable in prescribing for CSMBS patients. Patients who requested more drugs or a branded drug, might have received them more easily than under the other schemes.

> *"... I know that we tend to spoil CSMBS patients by using expensive drugs in this group. For me, I try to set my own standard of drug use for any insurance status... DM disease is a disease where much of the outcome of care depends substantially on patient behaviour"*
>
> (Doctor, public hospital)

> *"...I am more comfortable to sign for buying high cost drugs for CSMBS patients because I know that the hospital can reimburse all the costs of these drugs. For the UC scheme, I try to persuade them to help the hospital by paying for these drugs... if they cannot afford this, I may change to a cheaper drug... But in essential cases, I used to order Avandia for free."*
>
> (Doctor, public hospital)

> *"...CSMBS patients may receive the original drug item."*

(DM clinic team, public hospital)

Effect of scheme on treatment follow up

Post-treatment follow up of patients in different schemes differed in various hospitals. A hospital might have a set system for monitoring and follow-up of the outcomes of treatment. In the UC scheme and CSMBS groups, follow up of the outcomes of treatment was the duty of the DM clinic team and the doctors.

> *"... We help doctors to screen patients by checking the results of care. Patients who cannot control their blood sugar to fewer than 200, we will arrange to consult a specialist. We are also responsible for making appointments with the ophthalmologist for patients who have not been checked this year, but we have to prioritise cases because our ophthalmologist limits the numbers of patient to only 10 cases per day."*
>
> (DM clinic team, public hospital)

> *"... My aim is to control DM for each patient. In uncontrolled cases, I will spend more time on these patients and if they still cannot be controlled, I will invite their close relatives to discuss how to control DM in the patients."*
>
> (Doctor, public hospital)

Furthermore, there were some activities which a nurse was able to conduct. Some public hospitals assigned those duties to the DM clinic team.

> *"... We will check the foot of a patient. If they have even small ulcer, we will check and report to the doctor.... Now, we request more personnel to help us in checking foot status."*
>
> (DM clinic team, public hospital)

In the SSS group, different systems were used in public and private hospitals. Private hospitals typically arranged for the education and marketing team to interview every patient after they were seen by the doctor. This team would provide information for

the patient and follow up the result of care by interviewing the patient and writing up the results to help the doctor.

> *"... Our hospital had a team to interview patients after they meet the doctor. All patients have to meet our team. Our team will ask them about the result of DM and educate them about the disease. Furthermore, our team also gives them information about the SSS and asks about the service they receive.*
>
> (DM clinic team, private hospital)

In public hospitals, DM clinic teams also have a duty to help doctors to monitor the result of DM care and to educate patients in the same way as mentioned above.

8.4 Patient Views

Patients in the different insurance schemes had differing experiences of services. There were three categories of experience in this study: use of care, process of care, and perception on quality of DM care.

8.4.1 Use of care

Patient views on use of care can be divided into five sub-categories: geographic constraints, awareness of patient rights, new DM case finding, patient choice, and the separation of services between health insurance schemes.

Geographic constraints to service use

In general, participants in the focus group discussions did not feel that travelling to hospital was a constraint to use of care. However, this study interviewed patients who received services from a hospital, which may introduce bias into the study.

Among CSMBS participants, the geographic constraint was less of a concern compared with the lack of confidence in services provided by health services near to their home. Participants felt that distance and cost of transportation were not obstacles to access to hospital care. They did not trust the local health centre or PCU, because these had few staff and no permanent doctors. They trusted the hospital more than the PCU and health centre.

"... We are not sure that the health centre can manage our disease. We choose to come to hospital because it is a one-stop service. If we go to the health centre, finally they have to refer us for tests at the hospital."

(CSMBS patient, public hospital)

In SSS participants, there were few problems about geographic constraints for two reasons. First, SSS participants selected their hospital, which was usually near their house or their factory. Second, they believed in hospital treatment more than treatment from clinics or health centres.

"... go to hospital is the best for me. I live near a clinic but I am not sure whether it has good quality care like the hospital or not....Transportation cost is not a problem. The hospital is not too far from my house."

(SSS patient, public hospital)

"...This hospital is near my house and factory. It is easy to come to hospital....Actually; both private hospitals are not far, the transportation to both hospitals is good."

(SSS patient, private hospital)

For UC scheme participants, in general, they were assigned to a hospital in the district they lived, so the distance between the hospital and their home was not a constraint. Furthermore, they were aware of the limited capability of the health centre to do all the laboratory tests for DM patients. Therefore, finally, they had to go to a hospital. Furthermore, Samutsakhon had no regulation for patients to go to a health centre or PCU so patients could go to their assigned hospital directly.

"...There is not enough staff in the health centre; there is no blood sugar investigation... I don't trust the health centre...coming to the hospital is better."

(UC scheme patient, public hospital)

Awareness of patient rights

Level of awareness of the rights of patients differed between members of the different health insurance schemes. CSMBS participants knew that hospitals received full reimbursement from the government so they could request more in terms of prescriptions or investigations. SSS participants knew and understood their rights because they had contributed to SSS every month. UC scheme participants seemed less aware of their rights compared to CSMBS and SSS patients.

> *"...We have full reimbursement so we can have more expensive services. ... We can request more investigations."*
>
> (CSMBS patient, public hospital)

> *"...I dare to comment on the services of the hospital because I have paid for them every month... This is my right."*
>
> (SSS patient, private hospital)

> *"... I know that with my gold card I don't have to pay anything when I come to hospital....I know from TV advertising."*
>
> (UC patient, public hospital)

Patient choice

The regulations of each insurance scheme promote patient choice in different ways. The SSS allow its beneficiaries to choose their own hospital on an annual basis. UC scheme beneficiaries are assigned to a main contractor which is the hospital in the same district as the beneficiary. CSMBS patients have free choice to go to any public health facility from health centre or PCU to hospital. There are two main parts to patient choice: choice of hospital and choice of doctor.

Choice of hospital

As mentioned above, SSS members can change their main contractor every year. SSS participants registered with a private hospital felt that as it was their right to choose their main hospital, they chose the hospital that gave them a good service and was not far from their home.

"... My criteria for choosing a hospital are that it has good service and is not far from my house."

(SSS patient, private hospital)

"... I choose this hospital because it is not far from my house."

(SSS patient, private hospital)

However, some SSS participants in public hospitals believed that a private hospital might charge them additional fees if they had a very severe illness.

"... I choose the public hospital because I am afraid that when I have a high cost disease, I have to pay additional fees for drugs or laboratory tests where there is no problem in public hospitals."

(SSS patient, public hospital)

In the CSMBS group in this study, since they could go to any public hospital, so their choice was informed by the reputation of the doctor or hospital.

"...I went to Banpaw hospital because the hospital is famous; although, I had to wait for a longer time."

(CSMBS patient, public hospital)

Choice of doctor

Every hospital in this study allowed patients to choose their preferred doctor. However, few patients had experience of changing doctor.

UC participants tried to select the doctor who was recommended by their community, but this option was not strictly followed. Patients knew that the hospital would not be able to provide the same doctor for every patient visit.

"... We can choose our doctor if we want. ... My friend recommends this doctor, so I told a nurse that I would like to see this doctor.... However, we cannot fix to see this doctor every time we come since we do not know whether this doctor will come or not next month"

(UC patient, public hospital)

SSS participants accepted the various doctors who they met at the time of their follow up; they did not have much time to wait for only one particular doctor.

> *"...I needed to go home early... I have two or three doctors in my mind. If those doctors do not come, I can choose other doctors."*
>
> (SSS patient, public hospital)

In the CSMBS, many patients put their faith in the hospital's services, so they did not need to choose a specific doctor. They believed that all the doctors had a standard qualification to provide good service.

> *"... I do not choose any doctors; I think every doctor has equal knowledge.... I trust every doctor. The hospital can provide any doctors for me."*
>
> (CSMBS patient, public hospital)

Separation of services between schemes

Most of the participants accepted the separation of services between the different schemes. UC patients knew that SSS patients had a shorter waiting time and could come to hospital on Saturday or Sunday. They also accepted that SSS patients spent less time in hospital because they had to go to work.

UC scheme participants felt that SSS participants were more privileged in their service provision. However, they still believed that they received the same drugs in all schemes.

> *"...We don't know why the hospital has separate sections for services provided to SSS and UC patients. They separate services but use the same place for drug collection... we think that they give the same drugs."*
>
> (UC patient, public hospital)

SSS participants felt that they received a special service from their hospital. The hospitals provided this special service because they needed to be selected in the next year. Furthermore, SSS participants felt that hospitals provided a special track for them because the hospitals knew that they needed to go back to work.

"... We know that they separate our scheme because they need us to select the hospital in the next year."

(SSS patient, public hospital)

"We need a more rapid service, so we can go back to work...I ask the doctor to make my appointment on Sunday because it may affect my bonus if I am regularly absent from work"

(SSS patient, private hospital)

CSMBS participants accepted the service separation. They thought that it related to the SSS contribution. However, they felt that it might discriminate against other schemes.

"... I understand the reason why they have a separate service section for SSS patients. They have to pay a contribution every month from their salary so when they are sick it is fair to give them special service..."

(CSMBS patient, public hospital)

"Sometimes, I wonder whether this separation discriminates against other patients or not."

(CSMBS patient, public hospital)

However, some participants did not understand the reason for separating services between schemes. They suggested that hospitals should not separate the DM clinics but should merge all patients of all the schemes in the same clinic so that the hospital can provide education about DM to patients in one whole group.

"... I disagree with separating service by schemes. I suggest setting the DM clinic for all schemes. Hospital staff can educate and explain about DM to all patients at the same time. Furthermore, patients can exchange their experience of management of DM with each other. Now, I do not feel that this is the special clinic for DM patients.

(SSS patient, public hospital)

8.4.2 Process of care

There are two important aspects of the process of care amongst patients: expectation of process of care, and knowledge of care.

Expectation of process of care

Providing services to meet the expectations of patients can encourage a good patient-provider relationship (Abdulhadi et al. 2007). Most participants were concerned about hospital 'hotel' services and waiting times when they were asked about their expectations of care.

CSMBS participants demanded a more rapid service from hospitals. They also demanded good quality of services in both process and outcome. They expected the hospital to control the process of management, for example, one patient reported that the hospital mixed up his results with those of another patient.

> *"... We need the hospital to provide services more rapidly especially in the pharmacy unit...We understand about the number of patients but we think that hospitals can shorten some processes to improve their service."*
>
> (CSMBS patient, public hospital)

> *"I want the hospital to control the quality of the blood sugar result.... I had an experience where the lab unit mixed my blood sugar result with another patient's."*
>
> (CSMBS patient, public hospital)

Although most of the CSMBS participants did not pay fees when they went to hospital, some of them expected that the hospital should show the details of service charges to them.

> *"... I would like to know how much does the drug cost even though I don't pay anything."*
>
> (CSMBS patient, public hospital)

UC participants expected to have more DM clinic days because of the congestion of patients. They had experience of long waiting times for laboratory results, and in the process of care.

> *"... I want the hospital to provide DM clinics every day. There are too many patients in a DM clinic per day...I wait so long in that day."*
>
> (UC scheme patient, public hospital)

> *"We hope that lab personnel come earlier. I wait more than 3 hours for lab results every time."*
>
> (UC scheme patient, public hospital)

However, SSS participants in private hospitals had fewer problems about waiting for service. This was because of the competition between hospitals to attract beneficiaries.

> *"Now, we receive better service not having to wait like in the past because the hospital had to compete on service otherwise we will not select this hospital next year.*
>
> (SSS scheme patient, private hospital)

SSS and CSMBS participants expressed expectations about the outcome of care. Most of them knew that DM was a chronic disease and needed continuous care.

> *"... I need to know my sugar level and the result of treatment. I do not mind about other services... I know that the result comes from my behaviour."*
>
> (CSMBS patient, SSS patient, public hospital)

> *"...I expect that my disease can be cured although I know that DM is a chronic disease and needs to be followed up to monitor blood sugar."*
>
> (SSS patient, public hospital, private hospital)

8.4.3 Perceptions on quality of DM care

From the patients' viewpoint, it was not easy for them to understand the result of care. Quality in the view of patients might come from indirect indicators such as drug quality. Furthermore, patient satisfaction with care received is a commonly used indicator of quality of care. Therefore, this study explored drug quality and patient satisfaction.

Drug quality

Patients in different insurance schemes had different attitudes to drug quality.
UC scheme participants believed that they received lower quality drugs compared to SSS patients.

> *"I saw SSS patients receiving drugs earlier than us.... I believe that they got better drugs than I."*
>
> (UC patient, public hospital)

CSMBS participants believed that expensive drugs were high quality drugs. They also believed that doctors prescribed different drugs to patients from different insurance schemes.

> *".. We have to pay for a good quality drug. It is expensive; we have to buy it outside the hospital."*
>
> (CSMBS patient, public hospital)

> *"...I believe that the doctor prescribes different drugs to patients of different insurance schemes."*
>
> (CSMBS patient, public hospital)

However, SSS participants believed that they received good quality drugs. They trusted the doctor's suggestions about drug use, for example, they stopped using herbs when the doctor suggested that they might damage their kidneys.

> *"... I believe that the drugs we received from the hospital are good quality."*

(SSS patient, public hospital)

"...I used to change treatment to one of herbs but after I had consulted my doctor, he suggested that I stop this because it could damage my kidneys. So, I did not take it again."

(SSS patient, private hospital)

Satisfaction

Two issues involved in satisfaction are the complaints system, and service satisfaction.

Regarding complaints, SSS participants had experience of complaining about the hospital service. Public hospitals had less formal complaints systems than private hospitals. They had a survey on patient satisfaction, but patients did not perceive any changes resulting from the surveys. Private hospitals were more concerned about the complaints system. Patients felt that it was easy to complain about services in private hospitals.

"... I used to do the hospital's satisfaction survey, but I do not know whether they adopted my recommendations."

(SSS patient, public hospital)

"... I will complain if I am not satisfied about the service I received... It is easy to complain about the service. We can complain to the information unit."

(SSS patient, private hospital)

UC scheme participants felt that their hospital did not provide a good system for complaining. They felt that it was hard to complain about services because complainants needed to sign their real name.

"...It is not easy to complain in this hospital, I used to complain about the service but nothing has happened. If we want to complain about anything, we

need to sign our name. Otherwise, the director will not do anything about our complaints.

(UC scheme patient, public hospital)

CSMBS participants did not have any experience of complaining and said they did not know the system for making a complaint in the hospital. However, they tried to accept the service received from the hospital.

"... I did not know how to complain... I understand that there are a lot of patients here.

(UC and CSMBS patient, public hospital)

Patients' satisfaction with services differed by scheme, as did their perception of satisfactory service. UC scheme participants seemed to be less satisfied with the services they received. They still complained about provider behaviour.

"... We need doctors who do a physical examination, not just look at the OPD card or computer data."

(UC patient, public hospital)

CSMBS participants seemed to be more accepting of the service they received at hospital compared to UC scheme patients. They were optimistic about the hospital service. They felt that the services they received now were better than in the past.

".. Now, hospitals improve their services which are much better than those of ten years ago. At that time we called the hospital a slaughterhouse.

(CSMBS patient, public hospital)

SSS participants accepted the service they received. They realized that doctor and hospital tried to provide a good service for them.

"... I am happy with the process of hospital care. Although I have to wait, I understand the process and know that the doctor tries to do his best."

(SSS patient, public hospital)

"... The image of public hospitals is worse than that of private hospitals. They have a lot of patients, so the queue is very long."

(SSS patient, private hospital)

Discussion

8.4.4 Providers

Summary of findings

The main findings of how the providers in the study responded to insurance schemes are shown in Table 8.5. The study results show that the insurance schemes did have an influence on hospital policy and provider behaviour. Insurance scheme affected hospital policy in three areas: detecting new cases in the community, separating services between schemes, and payment to doctors. However, the process of care was mainly influenced by individual providers, i.e. physicians and nurses. Provider behaviour included such issues as referral of patients to receive services near their home, following the standard practice guidelines, prescription of laboratory tests, drug prescription, and treatment follow up.

Table 8.5 Summary of hospital policy and provider views on treatment of Diabetes Mellitus patients in different schemes

Hospital	Public			Private
Insurance	UC	SSS	CSMBS	SSS
Use of service				
Finding new cases	Have outreach teams and additional incentive to find new cases in community			No policy to find cases in community
Refer patient to service near home	Have policy to refer to health centre, but not effective	No clear policy to refer patient back to health service near patients' home		Have policy to reduce use of subcontractors
Separated OPD	Regular track	Set a track separated from UC and CSMBS	Regular track	Set a track separated from OOP patients
Process of care				
Doctor fee	Salary	Doctor fee with limit maximum	Salary+ additional doctor fee(one hospital)	Doctor fee but lower rate than OOP
Standard practice guidelines	All physicians know about guidelines but adapt to their own experiences			
Laboratory tests	Limit high cost laboratory tests		No clear policy to limit	Limit high cost laboratory tests

			investigations	
Drug use	Strictly limit to hospital drug list	Limit to hospital drug list	More common to use high cost drugs	Limit to hospital drug list
Treatment follow up	Doctor follows results and DM clinic team help to monitor but not cover all cases			Have responsible unit to follow result of treatment in every case

Hospital policy

The study showed that scheme regulations influenced hospital policy on the early detection of DM cases. Data from an international review of pay for performance demonstrated that pay for performance as a financial incentive to providers, provider groups, and the health system can improve quality of care (Petersen et al. 2006). In the current study, a good example was the incentive from the SSO and NHSO which aimed at early detection of DM cases in different groups. The NHSO aimed to improve case finding in the community while the SSO aimed to improve case detection in hospitals and factories. Hospital responded to scheme policy depended on the scheme regulations; for example, a hospital that received funding to find new cases of DM in the community set up a team to do this job specifically. This finding confirmed the effect of insurance scheme design on motivation of providers.

Regarding the issue of patient referral to receive services near to home, evidence had shown that providing health services near to home could improve the outcome of DM patients (Strauss et al. 2006). Continuity of care had been found to improve the process and quality of DM care (LI et al. 2008). Currently, in Thailand, the number of DM cases increases every year. A cohort study of a Bangkok power plant of the Electric Generation Authority of Thailand showed that incidence of NIDDM was 13.5% (Aekplakorn et al. 2006). Treatment of patients near to home could reduce congestion in large hospitals. However, this study found that hospitals had no policy to refer patients for treatment near their home. This might be due to various characteristics of the insurance schemes. CSMBS patients can go to any public hospital. In SSS, hospitals were the main contractor. Referral of patients in this scheme to a subcontractor might reduce hospital income. Referring UC scheme patients to services near to home could reduce the burden of the cost of hospital care.

However, most patients did not want to go back to receive treatment from their health centre or PCU after they had come to the hospital.

The most striking evidence of different policies by scheme in the use of care was the separation of services by insurance scheme in this study. SSS patients had a clearly separated OPD in both public and private hospitals. Private hospitals also separated the facilities between SSS and out of pocket (OOP) patients. In the past, the objective of this policy was to promote special treatment for the SSS group since the hospital could make more profit when they had more registered employees even if they were paid by capitation from SSS (Sriratanaban 1998). More recently this seems to have changed; they have needed to improve the hospital image for OOP patients since their profit margin from SSS patients has decreased. Public hospitals provided a separate track of services for SSS patients. SSS received fast-track treatment while CSMBS and UC scheme used the regular system. Hospitals perceived that SSS patients brought additional income to the hospitals. To encourage the SSS group to choose the hospital in the following year, public hospitals had to create an image of special care for this group.

Provider behaviour

Doctors were the main group in the implementation of policy. Policy related to process included payment to doctors, following standard practice guidelines, laboratory tests, and prescription of drugs. Hospitals set different payment methods for physicians according to the different schemes. For example, the private hospitals paid doctors by doctor fee related to capitation for providing services for SSS patients. However, this was not evidence of a direct effect of capitation on physician behaviour but rather an indication that payment method to the hospital led the hospital to adapt their payment of physicians and to seek to influence physician behaviour. For example, in private hospitals physicians in this study helped the hospital to control costs by limiting the use of expensive drugs for SSS patients.

Regarding standard practice guidelines, all interviewed doctors knew that there are standard practice guidelines for DM patients, but they did not totally follow these guidelines. This finding corresponded with research by Brown et al (2002) in Canada about the interaction between physicians, patients, and the system. The finding was

that physicians supported using clinical practice guidelines but need to adapt them for individual patients. Systemic factors which affect use of the clinical practice guidelines included economic, administrative, and educational factors (Brown et al. 2002).

The use of different practices for different insurance schemes was evident in laboratory tests such as HbA1C. In the UC scheme and SSS, hospitals had a policy to limit this test to only cases with high FPG, not for all patients. This might be because hospitals saw this lab test as an expensive test and not essential as a baseline test for all DM patients. Furthermore, doctors realized that they had to help the hospitals in limiting their orders for this test. Thus, the insurance system did affect doctor behaviour, although this was not directly related to doctor income.

For drug prescriptions, hospitals in this study had a policy to control drug costs by using one generic drug, but the degree of control on the usage of drugs was different for different schemes. Doctors could more easily prescribe expensive drugs for CSMBS patients than for UC scheme patients. This finding corresponds to study of Limwatananon et al. (2004) which found that some hospitals restricted drug use in the UC scheme and SSS while they allowed physician to use them more freely in the CSMBS. Physicians also tended to use lower-priced drugs for SSS and UC scheme patients. The reasons for this might be due to influences on physician behaviour such as hospital policy, patient requests, and the payment system of the insurance scheme. Several factors have been found to affect physician prescription of DM drugs, such as clinical status and medication cost (Grant et al. 2007). The findings in this study supports the argument that drug prescription by physicians is influenced by insurance scheme. On the patient side, CSMBS patients might receive more expensive drugs than the other schemes because these patients know their rights and know that the hospitals will receive full reimbursement of the drug costs.

In the area of treatment follow up, hospital policy establishes how patients should be followed up regarding the outcome of care. Private hospitals with SSS patients in this study have set up a system to meet every patient after treatment by a doctor to monitor the service provided by the hospital. This implies that private hospitals treat patients like customers and have a strong policy to keep those customers. Private

hospitals might have more chance to do this than public hospitals because they have fewer patients than public hospitals.

8.4.5 Patients

Patient views in relation to insurance schemes are shown in Table 8.6. Regarding access to care, there were no geographic constraints on travel to hospitals for patients in Samutsakhon. Since Samutsakhon is a small province near Bangkok, there are several ways to get to the hospital such as bus, boat etc. Furthermore, patients trusted the hospital and its doctor more than the health centre and PCU. There is evidence from international experience to show that a short distance to health services is associated with better glycaemic control (Strauss et al. 2006, Littenberg et al. 2006). Furthermore, the regulations of the SSS and CSMBS schemes enabled patients to use hospital care. SSS patients can choose any hospital as their main contractor while CSMBS patients can go to any public health service. Only UC patients are required to use services within the CUP (a PCU, health centre, or community hospital) before referral to higher level hospitals.

Table 8.6 Summary of patient focus group discussions on insurance schemes

Hospital	Public			Private
Insurance	UC	SSS	CSMBS	SSS
Use of care				
Geographic constraint	No geographic constraint to come to hospital			
	Patients know about limited capacity of health centre. They needed to bypass to access hospital.	Patients can choose their preferred hospital every year. They trust hospital more than health centre or PCU	Patients can go to any public provider without any referral system They trust the hospital and transportation is not a constraint	Patients can choose their preferred hospital every year. They trust hospital more than health centre or PCU
Realized right	Less aware of their rights since they did not make any contributions	Aware of their right to receive good services	Know they can go to any public hospital.	Aware of their right to receive good service
Patient choice	Choose doctor by suggestions from neighbours/ acquaintances	Choose their own hospital and doctor by regulation Good service and near house or factory Choose public	Choose their hospital and doctor by reputation of hospital and doctor.	Choose their hospital and doctor Good service and near house or factory

Hospital	Public			Private
Insurance	UC	SSS	CSMBS	SSS
		because of cost concerns when suffer severe disease.		
Separated service	Feel that SSS patients have more special service Think that drugs provided are similar to SSS	Think that hospital can provide more rapid service to them Separate track for marketing reasons	Accept separate service for SSS patients Feel that there might be discriminating between SSS and others.	Need special track for treatment so they can go back to work Need to make appointment on weekend
Process of care				
Expectation of care	Need more hotel services such as reduced waiting time, good manners of doctor and nurse.			
	Need more DM clinic days	Expect to be cured	Some need to know result of disease Expect hospital to control process management	Expect to be cured
Perception on quality of care				
Drug quality	Some believe that other schemes receive better quality drugs	Believe that they receive good quality drugs	Some believe that expensive drug means better quality	Believe that they receive good quality drugs
Satisfaction	No strong complaints system			Strong complaints system and feedback to patients
	Doctor provides less time for examination	Accept service even though service image is lower than private hospital	Satisfied with service from hospital	Good service compared to public hospital

On awareness of patient rights, the level of knowledge differed between members of different schemes. SSS patients seemed to be more concerned about their rights than patients in the UC scheme and CSMBS. The contributions to SSS made its members mindful of their right to good service when they were sick. For CSMBS members, most were civil servants, and they knew the regulations well. They realized that they could go to any public health service so most of them went to a big hospital. However, UC patients seemed to accept the different regulations. They did not make a connection betweenthe taxes they paid to the government and their rights to care, so they were less likely to asset their rights compared to SSS and CSMBS members.

The awareness of their rights resulted in higher expectations of SSS and CSMBS patients. For example, SSS patients in private hospitals in this study expected to have a more convenient service and rapid treatment, while SSS patients chose a public hospital if they were concerned about cost when they had very severe illness. SSS members in both public and private hospitals in this study felt that the hospital could make a profit from their choice so they had the right to receive good quality service. This finding differed from the past when patients lacked knowledge about social insurance (Tangcharoensathien et al. 1999b).

CSMBS participants were particularly concerned about the doctor they saw. They might wait for the doctor they wanted to see even if this took longer. UC participants preferred to be treated at hospital rather than at a health centre or PCU. This seemed to be for a similar reason to the CSMBS patients, i.e. trust in the doctor and hospital. Furthermore, their neighbours might influence their decision regarding choice of doctor in the hospital.

Separation of services by scheme brought positive and negative views from patients. For example, some CSMBS participants felt that they were discriminated against compared with SSS patients, while some participants accepted this system because they felt that SSS patients paid more than the others. Some participants suggested that the hospitals should set up DM clinics for all schemes together, and not separate services. Setting up a DM clinic would enable a hospital to manage cases more easily but could create constraints for patients in utilization.

For expectation of care, all of the patients paid most attention to the 'hotel' aspects of service. This implied that patients were more concerned about convenience than the result of care. It also implied that the minimum requirements in the convenience of services were still not achieved. For example, UC scheme participants would like the hospital to expand the DM clinic to open every day. This finding contrasts to a study in the US where patients had higher expectations about the result of care than about hotel services (Dawn et al. 2003). However, CSMBS participants were more concerned about the result of care; they expected to know more about the results of laboratory investigations. The relatively high education of CSMBS members might explain this. SSS patients had higher expectations regarding curing the disease. This

might be because SSS patients are young working people and most are the income earner of the family so being cured of a disease is particularly important to them.

Regarding patient perceptions of quality, there are two important issues covered here: drug quality, and patient satisfaction. For drug quality, there are different ideas about quality of drugs. Some UC participants believed that patients in other insurance schemes received better quality drugs than they received. This might be explained by the separation of services, greater congestion of patients and attitudes about the UC scheme, which some people perceived was for the poor. CSMBS participants believed that their drugs were as good as those for SSS patient and that expensive drugs were good quality drugs. They might request expensive drugs from their doctor since they know that the hospital will be reimbursed fully from the government. SSS participants were less likely than UC scheme and CSMBS to complain about DM drugs. One reason might be that SSS patients usually controlled their blood sugar better than patients in the other two insurance schemes because they were still young.

On satisfaction, this can be divided into the complaints system of a hospital and satisfaction with services provided. On the former, it seemed that private hospitals were concerned more about the complaints system than public hospitals. In public hospitals, patient had to sign their real name and use their real handwriting, while private hospital patients were only required to complete a complaints form. Furthermore, improvements resulting from complaints made indicated that the private hospitals took on board the comments to improve hospital activities.

UC scheme participants wanted doctors to have more time for patients. SSS participants in public hospitals accepted the services of the hospital, although they knew that public hospitals are perceived as poorer than private hospitals. One reason for this is that the number of patients in private hospitals is less than in public hospitals so providers have more time to check on progression of the disease. However, SSS patients in public hospitals want to make sure that they would not be charged when they had very severe illness.

8.5 Conclusion

This chapter employed qualitative methods to explore scheme effect on quality of DM care from patient and provider perspectives in specific hospitals. This study confined the scope of analysis to three parts: use of services, process of care, and result of care as perceived by patients. Each part of the analysis compared results between the three public insurance schemes – UC scheme, CSMBS, and SSS.

The study found that these schemes influenced both provider and patient behaviour in the study hospitals. On the provider side, insurance scheme affected hospital policy and provider behaviour. Some policies affected patient use of care such as separated services, finding new cases in the community or drug policy. Other policies had effects on physician behaviour, such as different payment methods to hospitals which then affected hospital policy on physician payment for treating patients from different schemes.

Providers adapted their behaviour to comply with the regulations and incentives of the insurance schemes. There were differences between schemes in several areas such as policy on drug use and laboratory tests.

Patients perceived that different schemes gave their members privileges in different ways. SSS patients seemed to receive a privileged service through the fast track provided by hospitals, while CSMBS patients were privileged in their ability to request high cost drugs and laboratory tests. Patient satisfaction differed between schemes on both the complaints system and satisfaction with services received.

CHAPTER 9: DISCUSSION

9.1 Introduction

The thesis set out to explore the effect of insurance scheme on both overall indicator and DM specific indicators. The overall indicator was utilization of services while DM specific indicators consisted of LOS and early readmission within 30 days, as well as quality of service indicator.

The conceptual framework for the study was developed from a combination of Kutzin's insurance function (1998), Figueras et al.'s (2005) health system performance framework, and Carrin and James' (2005) achieving universal coverage framework. The utilization analysis used the Andersen Behavioural model (1995) to assess the role of insurance schemes and other factors in explaining overall utilization of ambulatory and hospitalization care. Kutzin (1998) and Figueras et al. (2005) were adopted to assess the effect of insurance scheme on LOS and early readmission within 30 days, and quality of services. The discussion in this chapter is in three parts consisting of methodological and data issues, summary of findings, and discussion of key findings from the study.

9.2 Strengths and weaknesses of performance indicators used in the study

The conceptual framework of this study used three selected areas of performance to explore variation amongst insurance schemes, namely overall utilization, efficiency of DM care, and quality of care (Figure 4.1). This study was able to shed light on variation using these 3 areas. Overall utilization could shed light on the different access of people belonging to different insurance schemes in terms of ambulatory care and hospitalization. The study also found that LOS and early readmission, as proxies for efficiency, could identify differences between insurance schemes. Finally process of care and intermediate outcome of DM care explored the effect of scheme on quality of care. The study also demonstrated the value of a qualitative approach in confirming and exploring findings of the quantitative study. Furthermore, using DM

as a tracer in studying the association between insurance scheme and efficiency and quality of care proved useful. The strengths and weaknesses of the chosen approaches are discussed further below.

In terms of utilization, this study explored overall utilization with the help of Andersen's 1995 model. To explain health care utilization, there are two major categories of approaches (Joseph and Phillips 1984). The first emphasizes the geographical context, arguing that location of physician has a close relation to utilization. Several studies have shown that physician location is related to patient utilization (Guagliardo 2004, Cooper et al. 2003, Nemet and Bailey 2000). The second focuses on behaviour namely the need of and decision to use services by patients. There are at least five models related to this approach, the Rosenstock model, the Suchman model, the Anderson model, the Gross model, and the Aday and Andersen model (Joseph and Phillips 1984).

This study used the Andersen model because it was easy to understand and apply to explain service utilization. However, there were some weaknesses in the study. First, this study used overall utilization which might not show a strong effect of behaviour on the decision of patients to use specific services. Second, the Andersen model might not explain well the sequence from need to decision to use health care services. Third, there might be other factors not included in the model such as genetic factors.

In terms of efficiency of DM care, LOS and early readmission were chosen as the indicators. There were some strengths of the LOS analysis. First, LOS was easy to understand because it had a clear definition. Other analyses of efficiency are more complex and difficult to interpret such as data envelopment analysis (DEA). Second, from an economics viewpoint, LOS could be a proxy for cost of care and can be compared in different dimensions such as by individual, hospital, and over time (Lindvqvist 2005). However there were some weaknesses in the LOS indicator. First, while a shorter LOS might control cost in the hospital, it might also shift cost from hospital to community, increasing the total cost of disease care. Second, while there is little evidence to show that shorter LOS is related to outcomes such as mortality, some literature suggests that there are variations of outcome with duration of stay

(Clarke 1996). Third, a shorter LOS might increase the total cost of care because providers might increase service intensity through use of high cost technology (Clarke 1996). Furthermore, shorter LOS might come with inappropriate care (Clarke and Rosen 2001).

This study used LOS to measure efficiency of resource use primarily because there was a clear definition and understanding of its significance. Furthermore, the claims data in Thailand were reliable enough to use for analysis and could demonstrate the national picture of efficiency of use of resources. However, LOS could only reflect inpatient care, it does not shed light on other areas of resource use such as prevention and promotion care, ambulatory care, or rehabilitation care. Moreover, using DM as a tracer might reflect only chronic disease conditions. Therefore, to make any generalizations on the efficient use of resources in the whole system, additional indicators would be needed to give a health system picture.

Another indicator in this part was early readmission within 30 days after discharge. As mentioned in chapter 2, readmission which might be related to efficiency can be considered as an avoidable readmission. To explore avoidable readmission by using only claims data was not easy because of the lack of detail of discharge plans. The better way would be to have reviewed medical records. This study did not review such medical records because of the time and burden of the data collection process. However, DM is a disease with few planned readmissions so it is likely that patients who were readmitted within 30 days with the same diagnosis were avoidable readmissions.

In terms of quality of care, the empirical study of DM quality of care used the framework from Donabedien of structure, process, and outcome. This framework is commonly used to study quality of care. There might be two methods of studying quality using this approach. First is the implicit method where there is no prior standard or agreement about what is good or bad quality (Brook et al. 1996). Second is the explicit method which compares expected process or outcome with practice. However, there might be four considerations when using this approach to assess quality. First, what is the relevant outcome to be measured, for example, survival rate might be too broad to use as an indicator. Second, using a relevant outcome as a

criterion for quality of care is not straightforward because there are other factors that affect outcome (Donabedian 1966). Third there might be other factors not included in the framework such as patient acceptability (Donabedian 1968). Fourth, there is a debate about strengths and weaknesses of each element such as process and outcome, structure and process etc.

This study used Donabedian's approach because it is easy to understand and widely used to assess quality of care. The method used the explicit approach by drawing on standard guidelines for DM care in Thailand which specified standard processes and intermediate outcomes, and obtaining data on actual practice by using medical record review. Although the study used one province as the site of the study, it might be generalized to identify problems of variation of performance between schemes since the context of other provinces might not differ much from Samutsakhon province, but this requires further exploration.

9.3 Methodological and data issues

As stated in chapter 4, the aim of this thesis was to evaluate the three public health insurance schemes in Thailand in terms of performance in selected areas. To fulfil the objectives, a mixture of studies including qualitative and quantitative methodologies was used. First, the HWS was analysed to explore the overall utilization under different schemes. This explored care seeking behaviour, factors affecting ambulatory care and hospitalization of beneficiaries in each scheme.

Second, claims data providing LOS and early readmission within 30 days for DM patients were analysed. These data covered all hospitalizations of DM patients in 2005. This analysis can indicate the efficiency of resource use in hospitals and quality of treatment of DM patients as indicated by early readmission within 30 days of a previous discharge.

Third, Health Examination Survey 2004 data was analysed to explored diagnosis of DM and the controlled level of DM in DM patients of different insurance schemes. This analysis could explore the extent of undiagnosed and uncontrolled DM amongst members of different schemes in the community.

Fourth, the medical records and patient interviews of DM patients in public and private hospitals of Samutsakhon province were analysed. A sample of patients was interviewed to obtain socioeconomic data while their medical records were used to track process and result of care. This methodology analysed process of care and intermediate outcomes of DM treatment. It provided indicators of quality of services in hospitals provided to DM patients.

Fifth, in-depth interviews and focus group discussions with patients and providers were conducted to explore perceptions of quality of treatment in DM. On the provider side, the objective of the interviews was to explore the effect of insurance scheme through hospital policy and physician behaviour.

9.3.1 Methodological issues: Health and Welfare Survey

There is some strength in the HWS. First, it provides accurate data on individuals and households across the country. This is because of the wide scope of the survey, the random selection of households and individuals, and the reliability of data provided by interviewed respondents (Patcharanarumol 2005). Second, the HWS is conducted by the NSO which has long experience of survey data collection; therefore, data could contain few errors (National Statistics Office 2003) because NSO uses well trained interviewers every year which leads to a lower rate of non response (Rattanalangkarn 2001). Third, the coding process was also less prone to error because they use special software and experienced personnel for coding (National Statistics Office 2003).

However, there are also concerns about the household survey. The survey was not designed to compare services by the three insurance schemes; therefore, the data might not be fully suitable for this analysis. For example, some people have multiple insurance cover which would not have been clarified in depth by interviewers on whether they were eligible for which insurance and the reason for having multiple insurance. This might affect the use of data on insurance status of people in this study.

In the analysis of HWS data, this study found two issues related to the goodness of fit analysis of the model, influential outliers and interaction effects of variables. Influential outliers was outlier data with a large effect on the estimation of parameters (Long 1997). This study found that there was a problem of outliers in fitting the regression model. Analysis of residuals found that there were influential outlier data which affected the goodness of fit of the model. To remove influential outliers, since there was no specific rule for this process (Long and Freese 2006), this study used the 99% confidence interval of the distribution of the standardized residuals as a cut point for evaluation. Furthermore, it was not easy to find the cause of outliers from outlier data. Long and Freese (2006) suggested that most outliers could not be explained by exploring the details of data because the model of analysis was not linear, unlike linear regression which can explore outliers by exploration a scatter plot. Therefore, in this study a trial of removing influential outliers and rerunning the model was the method used to check for influential outliers. In terms of interaction effects, normally interaction effects might be found by reviewing other studies and adding multiplication of interaction variables in the model (Jongsuwiwatwong 2002). However, there was no previous study of interaction effects in utilization in Thailand. Therefore, this study explored interaction effects of variable by analysed each variable.

Another issue of data analysis was that there was no specific command or programme for diagnosis of residuals of the logistic regression in the survey data because data were weighted to represent population data. However, this study used diagnosis without weights as suggested by Hosmer and Lemeshow (2000) to perform diagnosis and residual analysis.

9.3.2 Methodological issues: Claims data

Claims data or administrative data, recently, have been used to assess performance of health insurance in developed countries such as the U.S. (MacLean et al. 2006). It has also been a tool for quality improvement. Claims data were a good resource for secondary data analysis related to quality of care, efficiency etc. There were several strengths of the claims data analysis in this study. First, the database has rich information on the hospitalization of patients in all schemes since each insurance scheme needs this data for reimbursement or adjusted capitation. NHSO, for

example, has set up a unit for controlling quality of data by random checks of claims data against medical records; therefore, it is considered that the accuracy of data is improved every year (Pongpirul and Wongkanaratanakul 2008). Second, it was low cost in the collecting data process because all schemes used a computerized system for receiving hospitalization data. Furthermore, data were double checked with different schemes when patients might use different hospitals in case of emergency hospitalization.

However, claims data may have weaknesses. First, the aim of claims data was for reimbursement; therefore, data might not suitable for measuring other indicators. For example, socioeconomic information is not included in the data because it is not related to the reimbursement calculation. Another difficulty is that hospitals might ignore data which does not affect reimbursement such as minor co-morbidity. Second, coding accuracy might still be a problem especially for diagnosis and procedures provided to the patients. Normally, hospitals use non-medical staff (i.e. not physicians) in the coding process; they might not confirm codes with the physician when they have questions about patient data (Pongpirul and Wongkanaratanakul 2008). Third, the structure of claims data was different in each insurance scheme, resulting in problems in making comparisons between schemes. For example, the CSMBS had additional details of charges of each department in the data because they reimbursed based on FFS, while NHSO did not require data on charges because they reimbursed by global budget with DRGs and capitation. SSS had a special structure in the details of referral from the main contractor to other hospitals because they needed details of the cost of the hospital and the pattern of referral. SSS had more details on the expenses of hospitals while CSMBS had more details on drug prescription. This led to problems of combining data for three insurance schemes. However, diagnosis and procedures coding were still the same across schemes. Fourth, in analysis of early readmission, claims data could not identify avoidable conditions or unavoidable readmissions. However, this study focused only on a chronic disease, which normally had no planned readmission.

The claims data from 2005 had two problems of outliers in LOS and age that may come from input errors such as LOS at 400 days or age of 130 years. Therefore, this

study truncated data by using the 99% confidence interval as suggested by Lee et al. (1998).

The claims data of 2005 also had a problem of influential outliers. Therefore, this study used the same adjustment as in the HWS analysis.

9.3.3 Primary data collection on Diabetes Mellitus patients

The primary data collection in this study used medical records and patient interviews from public and private hospitals in Samutsakhon province. Medical records lacked some important data such as socioeconomic status of patient, time of DM diagnosis, income etcetera; therefore, this study used patient interviews to get additional information. Nevertheless, patients might have been hospitalized with additional admissions outside Samutsakhon during the period of data collection, which could not be picked up from the medical records in the study hospitals. To minimize failure of detection of hospitalization outside Samutsakhon, this study used claims data which included hospitalization in outside provinces to track admissions in the year of data collection.

There were some strengths of this primary data collection. First, medical records information was more accurate than the past because four of the five hospitals in this study had a computerized system in parallel with paper records. This made it easier to track and review data (Yatum et al. 2008). Second, using face-to-face interviews could ensure a high response rate. Interviewers could clarify any ambiguous information during interviews.

However, there were some weaknesses of the approach to primary data collection. First, samples were included consecutively during the period of data collection. Although consecutive sampling seemed to be suitable for chronic disease patients who had to follow up with physicians regularly (Jongsuwiwatwong 2002), there might be bias in who physicians request to be seen frequently and which patients come. Second, some hospitals might have intervention projects to improve patient care such as training courses or special projects for DM patients; therefore, patients in some hospitals might have more knowledge than in other hospitals. This might affect the result of care of patients in different hospitals. For example, Kratumban

hospital has a project of special training courses for patients and provides special nurse teams to take care of patients who have FPG more than 200 mg% while other hospitals have only education during the intervals when patients are waiting to see physicians. Third, although there was a computerized system for collecting data in four of five hospitals, the quality of the medical records still depended on the completeness of physician notes. The study found that some medical records had problems of completeness. To reduce this error, this study asked physicians or nurses to clarify ambiguous records. Fourth, the result of care in DM was not only affected by the structure or process of care provided by hospitals. It might be influenced by patient behaviour, or other factors, beyond the hospital's control.

To check the analytical method, the study tested the use of multilevel analysis as shown in Appendix 3. The multilevel analysis produced different results for process of care in relation to HbA1C test and eye examination, and outcome result in HbA1C. These can be explained by the effect of clustering within hospitals in those indicators. Such an effect can be explained by the intraclass correlation (ICC) concept, which represented the extent of total variance that was accounted for by variance between groups (Roberts 2004). An ICC value more than 0.15 is considered a high cluster effect (Hox 2002), indicating that multilevel analysis should be considered. In this analysis, the ICC were between 0.00 and 0.78 and were high only for three indicators; achieving HbA1C test, eye examination test, and achieving the result of HbA1C test. So, it was considered appropriate not to use multilevel modeling as the main analysis technique.

9.3.4 Qualitative data on provider and patient views on quality of Diabetes Mellitus care

A qualitative approach can help to explore more detailed information such as how hospital policy affected physician treatment behaviour, which is not possible by conducting quantitative research alone.

The qualitative approach provides flexibility in exploring informants' views: for instance, focus group discussions with patients of each insurance scheme. This study conducted focus group discussions with some patients from the samples of each hospital. Furthermore, to cover all insurance schemes, the study set up focus group

discussions with patients in the four groups namely the UC scheme, CSMBS, SSS in public hospitals, and SSS in private hospitals. To reduce the influence of other schemes, each focus group included patients from the same insurance scheme. In addition, since the study set up four focus group discussions, results from one could provide further questions for the other groups. Concerns on quality of care might not be the same depending on the expectations and perceptions of patients; the group process could help patients express their own perceptions and experiences of care from the hospitals.

To explore the provider views, this study undertook in-depth interviews and focus group discussions with the director, physicians, DM clinic team, and the head of health insurance unit in each hospital. These data shed light on comparative perceptions and behaviours of each provider regarding quality of care in DM management. This qualitative data could reflect practice and included comments on hospital policy with respect to treatment of patients covered by different insurance schemes. Furthermore, the provider views were important to reflect how they adapted their practice in response to hospital policy. On physician views, this study included more than the target number because some hospitals had more than one physician responsible for DM management.

There might be some weaknesses of qualitative data collection in this study. First, there might be false negative findings, as for example if patients told the interviewer that they were satisfied with the service when they were not, because it is normal in Thai culture not to express negative views to other people. However, to explore the negative attitudes of patients, the researcher tried to set up hypothetical example cases in the focus group discussions rather than asking about the direct experience of patients. For example, the researcher asked respondents about their suggestions for the hospital to improve DM services by discussing cases of the best and the worst hospital in their view. Second, use of semi structured questions might obstruct interesting topics emerging in the focus group discussions or in-depth interviews. However, because of the time constraint, the researcher sometimes had to steer informants towards relevant answers or intervene to get them back to the topic. Third, the position of the researcher as a doctor and working at the NHSO might bias the data collection and affect the responses of patients. To reduce this effect, the

researcher used assistants with experience of qualitative research as a partner to moderate the focus group meetings. Furthermore, for the patient groups, all focus group discussions took place outside the hospitals to relieve the pressure of the environment for patients.

9.3.5 Broader methodological issues

This study collected data from both secondary and primary sources. In primary data collection, this study was conducted in one province, which made it possible to go into depth on scheme performance. In addition, using DM as a tracer enabled the study to focus on selected performance indicators; overall utilization, LOS and early readmission, and quality of care in DM management.

Employing a mixture of methods made it possible to cross check between sources of information (triangulation). For example, evidence on the decreased number of private hospitals participating in the SSS since 2004 corresponded with evidence from in-depth interviews with private hospital directors who explained the reason: the slow growth of the capitation rate and conflict between private hospitals and the SSO.

There were also some weaknesses of this study. First, assessing utilization from the HWS provided an aggregate picture but may have lost some important detail. It might be argued that utilization for specific conditions might be different by scheme. Second, the study used HWS and claims data for only one year; it might be argued that it could not explore changes over time. Third, the changing policies of the insurance schemes rapidly led to unstable policy in hospitals and changing provider behaviour. Most providers complained about too short a period of preparation for new regulations from insurance schemes such as the UC scheme which has changed policy every year. This change might affect the results found in the study. Lastly, there was limited existing evidence to which this study can be compared in terms of performance amongst schemes. Little research has compared the performance of health insurance schemes in Thailand after the coming of universal coverage.

9.4 Summary of findings

The three public insurance schemes have different characteristics such as funding source, method of allocation to provider, service provider, benefit package etc. The UC scheme is funded by tax and covers about 75% of the population. In some area, beneficiaries must go to the primary care unit (PCU) or health centre near their home. They would be referred if the PCU and health centre considered they need service from a higher level such as a community hospital or a provincial hospital. Providers are paid by capitation for prevention & promotion and ambulatory care, and prospective case based payment for hospitalization within a global budget capped at the national level. Contracting units are mainly public network and a small number of private hospitals because they could not assemble the necessary network. The CSMBS is also funded by tax with FFS payment to provider. Coverage is about 7% of the population. Beneficiaries can go to any public provider, from health centre to hospital. The SSS is funded by a tripartite arrangement of government, employer, and employee. It covers about 14% of the population. Beneficiaries choose their main contractor and can change every year. The main contractors are hospitals with more than 100 beds of which about 50% are private hospitals. Payment to providers is capitation for both ambulatory and inpatient care.

The results from chapters 4-8 are summarized in this section, beginning with the overall utilization of people under different insurance schemes. These findings reflect the different utilization patterns in ambulatory care and hospitalization between schemes. The second part explains findings on LOS and early readmission within 30 days of DM patients from claims data. These data provide information of how insurance scheme affects the resource use of hospitals in terms of LOS and quality of care in early readmission. The third part provides information on quality of service by explore the compliance in process of care to standard guidelines, and intermediate outcomes of DM patients. The fourth part provides in depth information on quality of service from patient and provider perspectives. This reflects perceived quality of care from patient views and the response of providers to insurance scheme and hospital policy on quality of treatment for DM.

9.4.1 Scheme effect on overall utilization from Health and Welfare Survey 2005

Care seeking behaviour

The UC scheme covers poor people and children more than the other schemes. The SSS mainly covers those in the working age group while the CSMBS has a high percentage of the elderly. Most people sought health services when they were ill and self-prescribed drugs were about 20%. The pattern of care seeking depended on the insurance scheme regulations. For example, SSS patients mainly went to private hospitals since most of the beneficiaries registered with private hospitals. CSMBS can go to any public hospital, while UC scheme members have to go to a primary care facility within the local CUP network.

Some beneficiaries did not exercise their right when they were sick. For example, 31% of CSMBS members, 21% of SSS members, and 24% of UC member did not exercise their insurance when they went to hospital. Data showed that amongst these groups, 44% used self-prescribed drugs and 32% used private clinics.

Illness and service utilization

The HWS found that UC scheme and CSMBS members were more likely to be ill and to utilize health facilities, both ambulatory care and hospitalization. This might reflect insurance effects or other factors such as demographic characteristics of these groups. To check for this, multivariate analyses were done for factors affecting utilization, dividing utilization into four groups: ambulatory care use, frequent use of ambulatory care, hospitalization, and frequent use of hospitalization.

The study found that insurance scheme affected utilization, both ambulatory care and hospitalization. For ambulatory care, after controlling for other factors, SSS members had a higher probability of using care and more frequent use compared to CSMBS members while UC scheme members had no different use of services compared to CSMBS members but had more frequent use than CSMBS members. Data from focus group discussions showed that SSS respondents sought care earlier because they realized that if they had severe illness it would affect their job and their income.

In terms of health need, UC scheme members seemed to require more frequent services when they were ill compared to CSMBS members.

Regarding hospitalization, CSMBS members had a higher chance of admission and more frequent admission than UC scheme and SSS members. However, despite no difference in probability of hospitalization between SSS and UC scheme members, UC scheme members had a higher probability of frequent admission than SSS members.

9.4.2 Scheme effect on length of stay and readmission for Diabetes Mellitus patients

This study explored efficiency in use of resources by analysing LOS in DM and quality of service from early readmission to cross check for too early discharge from hospitals. Furthermore, to answer the question about whether providers could manipulate LOS, three conditions were compared including acute conditions, chronic conditions, and without complication conditions. In overall, data showed that the CSMBS had longer average LOS compared to the UC scheme and SSS. To explore factors affecting LOS, multivariate analyses were done by using three groups of explanatory factors including demographic, illness, and enabling factors.

The study found that, on demographic factors, females and the age group more than forty had a higher chance of shorter LOS. On illness factors, high severity had a higher chance of longer LOS. In enabling factors, admission in general, regional, and university hospitals had a higher chance of longer LOS compared to community hospitals. Insurance status also affected LOS. This study found that SSS and UC scheme patients had a higher chance of shorter LOS after controlling for other factors.

For early readmission, in chronic and without complication conditions, the UC scheme had a higher chance of early readmission within 30 days. However, this study also showed that for acute complications, there was no difference in readmission by the scheme.

9.4.3 Scheme effect on Quality of Diabetes Mellitus treatment

The effect of insurance scheme on quality of care was investigated through both qualitative and quantitative approaches in this study. The aim was to identify scheme effect on quality of care.

In the quantitative study, this study explored the degree of diagnosis and controlled level of DM in the population and quality of care in terms of achieving standard guideline of DM within hospitals. Three sources of data were used: the Health Examination Survey 2004, primary data collection from medical records and patient interviews in Samutsakhon province, and claims data of those DM patients. Processes of care were measured by standard service guidelines including achieving target number of services in FPG test, HbA1C test, urine examination, eye examination, lipid profile test, and blood pressure test, while results of care were measured by intermediate outcomes including mean results of FPG, HbA1C, fasting triglyceride, total cholesterol, and BP, and admission from acute complications.

Health Examination Survey data provided information that the SSS was the least likely to diagnosis DM compared to the UC scheme and CSMBS, while CSMBS was the most likely to have uncontrolled DM.

Data from medical records and patient interviews in DM demonstrated the results of process of care and intermediate outcomes. In summary, this study found that insurance scheme was associated with differences in the process of care but this was not associated with intermediate outcomes. CSMBS members had a higher chance than UC scheme members of receiving standard guideline care for HbA1C, lipid profile and urine examination, while SSS had higher achievement on lipid profile than the UC scheme.

In terms of intermediate outcomes, after controlling for other factors, there were no different results between schemes. This seemed not to relate to results in the process of care analysis.

In the qualitative study, this study showed patient perceptions and provider behaviour in DM services. Provider behaviour could be investigated throughtwo indicators, use of services and process of care, while patient perceptions could explored via three issues, use of services, process of care, and perceptions on quality of care. In terms of provider behaviour, this study found that hospitals set policies differently according to insurance scheme, for example, hospitals encouraged the finding of new cases of DM depending on the financial incentives that applied. Hospitals set a special track for SSS members to attract them to register with the hospital.

In terms of physician behaviour, this study found that payment to the hospital had more effect on physician behaviour than payment to the physician directly. Private hospitals set payments for physicians according to the rules of the insurance scheme. For example in the SSS the private hospitals paid physicians by doctor's fee with a cap, but there were no views expressed that this affected physician behaviour. In contrast, physicians provided more or less services corresponding to the payments received by the hospital: for example, physicians tended to provide more services for CSMBS patients who were paid by FFS.

As far as patient perceptions were concerned, SSS and CSMBS patients seemed to be more satisfied with services than UC scheme patients. Furthermore, UC scheme patients believed that they received a lower quality of care than CSMBS and SSS patients, especially regarding drug quality. In terms of service use, UC scheme and CSMBS members knew that hospitals separated services to provide special services for the SSS scheme, and felt that this might discriminate against them. SSS members felt that they were the owners of their scheme. They perceived that they had the right to choose the hospital, and expected good quality care from that hospital.

9.5 Discussion of key findings from the study

This section discusses the findings of the studies presented in the previous section on performance by scheme. Following a general discussion, there are four subsections, each focusing on an insurance scheme. The details of the discussion try to explain how the different scheme characteristics affect performance. The analysis is based on

the framework of Kutzin for the insurance function, Andersen's behavioural model, and Donabedien's quality of care framework.

Analysis of health service utilization in this study used the behavioural model of Andersen (1995) to understand scheme effect. Three main groups of factors were proposed as explanatory variables including predisposing factors (Age, Sex, Marital status), Enabling factors (income, insurance status), and illness factors. Findings from the study showed that insurance status affected utilisation. In addition, those who were females, elderly, and had chronic disease had a higher chance of using ambulatory care and hospitalization. This reflected the health needs of these groups of people. However, females' higher need for utilization might come from obstetric and gynaecologic problems (Nandi et al. 2008).

In care seeking behaviour, one issue was the confidence in use of services; some UC and CSMBS members were reluctant to use community hospitals or health centres, so they sought services from other sources such as private clinics or big hospitals. SSS members had appeared to have fewer problems in this issue because they choose main hospitals by themselves.

For LOS and early readmission to hospital, how long should LOS be is a problem between efficiency and quality of care. Too long a LOS might reflect inefficiency in use of resources, while too short a LOS might be a sign of low quality and problem of morale (Clarke and Rosen 2001). Several factors that affect LOS have been studied, for example, socioeconomic factors, insurance status (Gazmararian and Koplan 1996), financial incentives (Chaix-Couturier et al. 2000, Lutjens and Louette 1994), illness condition (Ottenbacher et al. 2004), hospital type (Mawajdeh et al. 1997). However, which factors have positive or negative effects on LOS depended on the diseases studied and the context of each country. For example, the study of de Jong et al. (2004) found that under different insurance status, shorter or longer LOS depended on the condition and disease of the patient. For emergency cases, several studies have shown that there were no differences in LOS by insurance status (de Jong et al. 2004).

This study found that insurance status affected LOS. Other factors explaining longer LOS were greater severity of condition and admission to a higher-level hospital, such as a regional hospital, and factors explaining shorter LOS were females and patient age more than 40. The reasons why more severe condition and admission to higher-level hospital affected LOS might be bound up with the health status of patients who needed more services. Furthermore, higher-level hospitals normally have more high technology facilities, such as special labs. This might mean that patients stay longer in hospital for more investigations. Females and patients more than 40 years old had shorter LOS, which might be explained by gender specific aspects of DM or other factors not included in the study such as cultural factors as mentioned in the discussion of chapter 6.

Early readmission within 30 days after a previous admission is broadly used as a quality indicator (Ashton and Wray 1996). This study found that factors associated with high early readmission were patient with age between 40 and 60, severity level 2, and high LOS of previous readmission, and the factor associated with low early readmission was being admitted in regional hospital. This finding may reflect quality of care effects of shorter LOS in the previous paragraph. For example, a patient more than 40 years old might be discharged too early, giving a higher chance of early readmission. In contrast, regional hospitals which had longer LOS might have provided more special services which lead to a lower chance of early readmission.

For quality of care, good outcomes of DM care depend on several factors such as tight control of DM (Edelman et al. 2003), adherence to guidelines (Chin et al. 2000, Saaddine et al. 2002), type of physician (Suwattee et al. 2003), deprivation (Hippisley-Cox et al. 2004), co-morbidity (Niefeld et al. 2003), and having insurance (Benoit et al. 2005) etc. This study finding confirms the effect of insurance scheme on quality of care in DM.

Findings from the Health Examination Survey 2004 that SSS members were more likely to have undiagnosed DM were confirmed by in-depth interviews with directors of hospitals, who said that there was no policy to find new cases in the community for SSS scheme member. For uncontrolled DM in the CSMBS, this might reflect patient concerns and provider behaviour. CSMBS patients can go to any public

hospital without limitation; therefore, this might result in irregular treatment from various hospitals. Most of them sought specialists for treatment as confirmed by focus group discussions which revealed that they preferred to go to hospitals more than the health centre or PCU. Furthermore, the hospitals also have no penalties for patients who do not come on an appointment date, as in the UC scheme. Data from in-depth interviews with DM clinic teams in one public hospital showed that the hospital had a policy to penalize UC patients if they missed an appointment. Typically, UC patients with no proper appointment have to wait until all patients with an appointment have seen the doctors, while CSMBS patients can see doctors at anytime without any penalties.

9.5.1 Effect of Universal Coverage scheme on performance

Utilization data showed that UC scheme members had a lower probability of using ambulatory care and hospitalization compared to other schemes after controlling for other factors. This might imply a problem of access in this scheme. The UC scheme required patients to go to providers near their home and required referral to other services. This might be a barrier of access in this group because some patients might not feel confident to use services from the health centre or PCU. Qualitative data showed that some UC patients wanted to bypass the lower level to receive services from the community hospital to provincial hospital.

However, the frequency of use of services in the UC scheme was high in ambulatory care once services were accessed compared to CSMBS. In high frequent ambulatory use, this finding seemed to show that despite lower probability in use of ambulatory care, UC scheme members made more frequent use when they were sick. This might imply greater severity of UC scheme beneficiaries compared to other schemes. Furthermore, most UC scheme members received services near home. They might easily go to the health centre or PCU more frequently than CSMBS members. Few instrument in PCU and health centre limited use of service in CSMBS. This might also be the result of investment in primary health care infrastructure in Thailand for more than twenty years because adequate supply of services provided high opportunity to access care (Gulliford et al. 2002).

Regarding hospitalization, the UC scheme had lower hospitalization and less frequent hospitalization compared to the CSMBS. This might be an effect of the payment mechanisms of the UC scheme and CSMBS. Several empirical studies show that under FFS payment providers tend to provide more services due to the linkage between provider income and service volume (Liu and Mills 2007).

The UC scheme uses capitation payment in ambulatory care and prevention & promotion, and prospective payment by DRGs within a global budget for hospitalization. This aims to increase efficiency in use of resource and control the long-term costs of services (National Health Security Office 2001). The result of this study showed a sign of efficient use by shorter LOS compared to CSMBS patients while it was not different from SSS patients. This could be the effect of the payment system in the UC scheme and SSS. This result corresponded to the findings of the study of Puenpatom and Rosenman (2008) which found that general hospitals had increased efficiency after UC implementation (Puenpatom and Rosenman 2008). Developed countries have also found the same result, for example, a study in Taiwan showed that changing FFS reimbursement to prospective payment had the effect of decreasing LOS (Tsai et al. 2005).

However, shorter LOS might come from too early discharge of patients. This study also measured early readmission within 30 days for DM patients. Readmission related to poor quality of care is unplanned early readmission (Ashton et al. 1995). This study found evidence that the UC scheme was discharging DM patients too early. This might be a stronger effect of insurance on provider behaviour than in the other two insurance schemes. The reason behind too early discharge, other than payment mechanism, might be the large number of patients in the UC scheme and limited beds in the general wards when UC patients are admitted, in contrast to CSMBS patients who can be admitted in a special room, which normally has a lower occupancy rate than general beds. Furthermore, in-depth interviews with providers revealed that hospital policy for the CSMBS scheme encouraged physicians to provide more services for the CSMBS patients. For example, one public hospital allowed physicians to prescribe expensive drugs with less control than for UC scheme patients, which corresponded to study of Limwatananon et al. (2004). However, for emergency conditions, it was evident that there was no difference by

scheme in early readmission of DM. This suggests that the patient's condition more strongly affected provider behaviour than insurance scheme.

UC scheme members were less likely to receive care according to standard guidelines requiring a HbA1C test and lipid profile test. These tests are more expensive compared to the FPG test and BP test. This finding implies a problem of quality of care in the standard process of service in the UC scheme. One reason might be that the UC scheme expanded from the low-income scheme and health card scheme. A previous study before UC scheme found that low-income card holders ,which was UC scheme without co-payment after UC implementation, had a lower chance of experiencing standard guideline care (Santayakorn 2004). This finding also was confirmed by interview with physicians that they did not follow standard practice guideline. This brought about variation of laboratory prescription of physicians. A study from the US also showed that Medicaid, which is a scheme for poor people, had the problem of quality of DM care (Zhang et al. 2008). Furthermore, a study in Thailand and the US showed that physicians incorporated patient insurance status into clinical decision making (Meyers et al. 2006, Srithamrongsawat and Lapying 2003). Providers might not change the pattern of treatment in these patient groups after UC implementation. Another explanation might come from payment to provider. Data from the qualitative study confirmed that the different payment arrangements of insurance schemes affected physician decisions on matters such as laboratory tests and drug prescription. For example, one public hospital had a policy to limit drug use by setting the drug list for the hospital. This was applied strictly in the UC scheme and less strictly in the CSMBS.

9.5.2 Effect of Civil Servant Medical Benefit Scheme on performance

CSMBS beneficiaries had lower use of ambulatory care and lower frequency use of service compared to the UC scheme. This can be explained by preference of CSMBS patients and regulations of the scheme. CSMBS patients preferred receiving services from big hospitals which had many patients. This could limit choice of health facilities and discourage frequent use of services. This finding was confirmed by focus group discussions of CSMBS members which showed that they preferred to receive service from general hospitals or regional hospitals to health centres or PCUs

despite longer transportation time. Some patients responded that they were willing to wait to be seen by doctors, instead of non-MDs at health centres or PCUs.

For hospitalization, CSMBS had higher hospitalization after controlling for other factors. This is likely to reflect the payment of FFS in CSMBS for hospitalization. Riewpaiboon et al. (2009) demonstrated that CSMBS patients received more services than patients of other insurance schemes (Riewpaiboon et al. 2009). This was also confirmed by interviews with physicians who felt that they could provide more services for CSMBS patients because the hospital could be reimbursed full expenses from the government. Furthermore, it might be the request of patients to be admitted because in the year of study they had to pay in advance and claim reimbursement for drugs and services when they used the OPD whereas they did not pay anything when they were admitted[18].

In terms of efficient use of resources and quality of services in DM care by using LOS and early readmission as indicators, this study found that CSMBS patients had longer LOS than SSS and UC patients. This might be the effect of the FFS payment of the CSMBS on provider behaviour. This result corresponded to the study of Pongchareonsuk et al. (2008) who found that DM patients in the CSMBS received higher cost treatment and investigations when hospitalized than SSS or UC scheme patients that might need longer LOS (Pongchareonsuk et al. 2008). This might also come from the response of provider to the patient being willing to be admitted in the CSMBS. The patients normally needed to be admitted more days because they do not have to pay any expenses when they admitted and physicians usually provide service as per their requests.

In terms of readmission, CSMBS had a lower chance of early readmission compared to the UC scheme and no difference compared to SSS. This implied acceptable quality of CSMBS and SSS patients and seemed to indicate higher quality compared to the UC scheme. This corresponded with focus group discussions with SSS and CSMBS DM patients who felt that they received a good service from hospitals, while UC scheme patients felt that they receive lower quality of services.

[18] This regulation has changed since 2007 and CSMBS patients with chronic disease and registered with a hospital do not have to pay in advance for OPD services.

In following process guidelines, this study found that CSMBS beneficiaries had a higher chance of achieving guideline care for HbA1C test and lipid profile test compared to the UC scheme. This could be a result of influence on both the provider and patient side. First, data from in-depth interviews showed that CSMBS status influenced physicians to provide more investigations. Hospitals had fewer restrictions on prescribing investigations in this group. Second, focus group discussions with CSMBS patients revealed that they felt they could request more investigations from physicians. This also was the effect of the payment mechanism of this scheme. This result was the same as developed country experience that, in a DM and HT study, physicians have different prescription drugs for different types of patient and insurance status (Huttin 2007).

9.5.3 Effect of Social Security Scheme on performance

SSS patients had a higher chance of ambulatory use and greater frequency of use compared to the UC scheme and CSMBS. This might be the result of SSS members asserting their rights under the scheme. Since the beginning of the SSS in 1991, members of the scheme have increasingly had more information about their rights in choosing hospital, their benefit package etc. From focus group interviews with SSS members, choosing their own hospital was a strong incentive to utilize services when they were sick corresponding to study of Yip et al. (1998). They realized that they had to claim their right because they have to contribute to the SSS every month. Furthermore, most hospitals in SSS system normally set a special track for SSS patients. Data from in-depth interviews with hospital directors showed that this was the marketing strategy to attract SSS patients. They also contracted private clinics to provide services out of working hours for SSS patients.

Regarding hospitalization, SSS patients had a lower chance of hospitalization compared to UC scheme and CSMBS patients after controlling for other factors. This might relate to payment by capitation of this scheme that led hospitals to adapt to control the cost of services (Yip et al. 2001). Qualitative data confirmed that private hospitals passed on the incentive built-in to the capitation payment method by applying capitation to physician payments. However, there was no strong evidence of the effect of physician payment on over provision of services. In contrast, for

hospital payment, qualitative data showed an association between over provision of services and hospital payment, especially for FFS in the CSMBS.

In terms of efficient use of resources in LOS and early readmission in DM, SSS patients were more likely to have shorter LOS than CSMBS after controlling for other factors. SSS patients were less likely to be readmitted compared to the UC scheme while there was no difference compared to CSMBS patients. This seems to be the strong effect of the payment scheme of the SSS in encouraging efficiency in use of resources but still with acceptable quality. This might be also the result of the contracting arrangement of the SSS, which includes contracts with many private hospitals. There was evidence that private hospitals tended to have more flexibility in responding to the external environment than public hospitals (Sriratanaban 1998). This might also be the indirect effect of payment to physicians especially in private hospitals, where hospitals applied the payment method from SSO to physicians, so physician were concerned about hospital income from the SSS.

In terms of quality of DM services, SSS patients had a higher chance of receiving lipid profile test compared to the UC scheme. This might be the effect of the regulations of the SSS because it had an additional budget for hospitals which provided services for DM patients by using the criteria of case finding and improving the completeness of data on services provided. Data from interviews with physicians showed that they would help the hospital by avoiding high cost drugs for SSS patients. Furthermore, physicians realized that the hospital could have an additional budget from the SSO if they complete DM patient data and treat DM patients according to required standards, for example checking FPG for the high risk group. This could lead to increase in quality of services for DM patients. This is a good example of performance related pay which aims to increase the effort of health care providers in achieving specific outcomes (Langenbrunner and Liu 2004). Furthermore, it might be the indirect effect of concerns of SSS patients. Data from focus group discussions with SSS patients showed that they appreciated complete physical and laboratory checks from physicians. SSS patients can change doctors if they are not satisfied with services they receive, especially in private hospitals. In regard to eye examinations, although there was no difference between insurance scheme, private hospitals were more likely to provide this service to SSS patients

than public hospitals. This finding supported the explanation about the influence of the incentive payments and regulations of the SSS for specific diseases. Although general practitioners can provide eye examinations, this study found that most of the hospitals used ophthalmologists to provide services to DM patients. Interview data found private hospitals had more flexibility in internal management to increase physician payments and used part time ophthalmologists to provide services for DM patients, thus getting round the shortage of ophthalmologists faced by public hospitals. Furthermore, having an ophthalmologist in a private hospital might be win-win strategy because the hospital can attract other patients especially out of pocket groups to use this service and the ophthalmologist can gain income from both out of pocket and SSS patients.

9.5.4 Finding of no different results between insurance schemes

Although this study found that there was different performance from different insurance schemes for some selected indicators, there were some issues where quality did not differ. This study found that there were no differences in achieving standard guideline care for DM with respect to FPG test and BP test. One reason was probably that this was the basic monitor of all DM patients and the cost of investigation was low. Eye examination test performance also did not differ between schemes. This might be the result of the ophthalmologist shortage. Data from qualitative interviews showed that physicians usually refer patients for an eye examination with an ophthalmologist although the guideline suggests this can be done by a GP if there are no ophthalmologists. Furthermore, this study also found that intermediate outcomes were not different between schemes. There were two possible explanations of this finding. First, the prescription and effect of drugs was not different between expensive drugs and low price drugs. Huttin (2007) proposed that physicians normally have relatively little room for differentiating prescription of DM drugs because the implications of complications are severe relative to drug costs (Huttin 2007). Second, there might be factors other than process of care not included in this study which could affect outcome such as patient behaviour. Data from in-depth interviews revealed that physicians believed that changing the behaviour of patients was equally effective in controlling the outcome of care.

A summary of study results across insurance schemes is shown in table 9.1. There are various results on different performance between schemes, from no difference to very different. This shows the complexity of behaviour, and challenges of analysis of the relationship of insurance design to performance.

Table 9.1 Summary results of performance comparing between schemes.

Performance	Indicators	Comparing between scheme
Utilization	Ambulatory visits	UC = CSMBS < SSS
	No. of ambulatory visits	UC = SSS > CSMBS
	Hospitalization	UC = SSS < CSMBS
	No. of hospitalization	SSS < UC < CSMBS
Efficiency	Length of stay in DM	UC < CSMBS
		SSS < CSMBS
Quality of service	Early readmission in DM	CSMBS = SSS < UC
Process of care in DM		
Achieving process of care in laboratory tests	FPG test	No difference
	HbA1C test	UC = SSS < CSMBS
	Urine examination	UC = CSMBS > SSS
	Eye examination	No difference
	Lipid profile test	UC < SSS
		UC < CSMBS
	BP test	No difference
Quality of DM care		
	Uncontrolled DM	UC = SSS < CSMBS
	Intermediate outcome	No difference
	Admission	No difference

9.6 Conclusions

This chapter has described and explained the strengths and weaknesses of the study, and the results relating to the aims and objectives in terms of public health insurance and performance in Thailand.

Qualitative and quantitative approaches were employed in the study enabling cross checking between methods. Selecting the study site in one province also gave strength in depth of understanding of the context and process of the scheme effects on providers and patients. Samutsakhon is a province which can be representative of urban and rural areas because it is located near Bangkok and has some areas of agriculture.

Universal coverage was successfully implemented in terms of coverage of people in Thailand but because of the specific characteristics of having three different public insurance schemes with different characteristics, it raises questions about performance between schemes. Three public insurance schemes (CSMBS, SSS, UC scheme) differed in payment, benefit package, supporting organization, management organization, socioeconomic status of beneficiaries, and these brought about different responses in hospital policy and provider behaviour.

From the results of this study, two conclusions can be drawn as follows. First, effect of insurance design is transmitted through hospital policy, physician behaviour, and patient behaviour. For example, CSMBS members had a higher chance of hospitalization compared to UC scheme and SSS members while there were no differences between the UC scheme and SSS. This can be explained from three sides, direct effect of payment to hospitals, physician behaviour, and demand of services from patients. In CSMBS, FFS payment created an incentive for hospitals to apply less control of drugs or laboratory prescriptions. Physicians tended to provide more services in this group and prescribe drugs or laboratory tests in response to patient requests. Patients tended to request more services since they knew that the hospital could be reimbursed for all expenses by the government. Another piece of evidence comes from the analysis of the efficient use of resources and quality of care in DM by examining LOS and early readmission within 30 days after discharge from a

previous admission. This study showed that SSS was relatively efficient in use of resources with a shorter LOS with acceptable quality, while the UC scheme had efficient use of resources but relatively low quality compared to SSS and CSMBS. This is likely to be due to the effect of capitation payment and public/private mix of services in SSS. Capitation payment pressures hospitals to reduce cost but in the situation with high competition between public and private hospitals can encourage hospitals to improve quality of care. This can show a picture of balancing between efficient use of resources and quality of services.

Furthermore, scheme regulation can affect patient behaviour, for example, ambulatory utilisations were high amongst SSS members compared to UC scheme and CSMBS members. This can be explained from insurance design which allows SSS members to choose their main contractor while the UC scheme provides the PCU and health centre as primary care facilities and CSMBS members can go to any public facilities. There is evidence that SSS members choose their main contractor deliberately to facilitate use.

Second, independent of scheme design other factors affect performance. For example, CSMBS patients seem to be more knowledgeable than SSS and UC scheme patients. Data from focus group discussions showed that they knew the standard laboratory tests for DM and they usually request these from physicians.

In terms of outcome of care, this can be measured by various steps, for example the structure, process and outcome approach (McGlynn 2007). This study showed that it could be explored for DM in terms of process of care and outcome of care. Furthermore, this study also found that good process could not guarantee good outcomes. There were multiple factors that explained outcomes, although patients received good care in terms of process.

CHAPTER 10: CONCLUSIONS AND POLICY IMPLICATIONS

This chapter aims to demonstrate whether the study's objectives have been met, provide policy recommendations, and identify future research needs. There are four parts to the conclusions presented here. The first section summarizes the overall conclusions from the findings relating to study objectives. The second section outlines the contribution of knowledge related to health insurance performance. The third section discusses implications of the study for policy makers which can be divided into recommendations for Thai policy makers and general recommendations for other developing countries. The fourth section identifies areas for further research.

10.1 Conclusions of findings

This study explored the variation of selected aspects of performance between the three public health insurance schemes. After universal coverage was implemented, public health insurance in Thailand comprised three major schemes. At first, the National Health Insurance Act had one article to merge all three health insurance schemes into one management unit. But there was resistance from the two other insurance schemes and the law opened the option to postpone this article by informing government and informing the people of the reason for delay (National Health Security Office 2002). One important reason for the unmerged management of health insurance came from the lack of confidence of the new management unit (NHSO) to manage all funding sources to achieve good quality services. Furthermore, opposition of other schemes protected the position of the CSMBS and SSS by raising the problems of culture and organizational structure as an obstacle to merging management with NHSO (Sriratanaban 2005). Currently, there is only the prevention and promotion budget that NHSO manages for all the population (Tangchareonsathien and Jongudomsuk 2005).

There were different rationales behind the set up of each insurance scheme. CSMBS aimed to be a fringe benefit of government officers and their dependants to compensate for the low salary of civil servants. The important characteristics of this scheme were to pay hospitals by FFS and there were few limits on use of drugs and investigations. SSS aimed to help employees in seven areas including sickness,

maternity, invalidity, death, child allowance, pension, and unemployment (Social Security Office 2007). The main characteristic of this scheme was that it had contributions from three parties including government, employer, and employee, and paid hospitals by capitation for both ambulatory and inpatient care. Furthermore, this scheme contracted hospitals with at least 100 beds and about 50% of its hospitals were private hospitals. The UC scheme was set up by expanding coverage of insurance into the uninsured. This group was composed of both the poor who previously had limited access and the rich uninsured group. The major characteristic of the UC population was that it had the biggest market share of insured people, and paid the hospital by capitation for preventive and promotive care, and ambulatory care, and by DRG within a global budget for hospitalization.

Each public health insurance scheme had different weaknesses that might affect the benefit gap between different insurance schemes. CSMBS had a problem of high growth of expenditure and seemed to have a strong effect on hospital policy and provider behaviour since CSMBS patient brought substantial income to the hospital. SSS offered limited treatment, and only a hospital setting. The UC had weak points in that it had less funding per capita and increased utilization levels had put pressure on health personnel especially in public hospitals.

These different insurance characteristics were thought likely to lead to variation in scheme performance. Three dimensions of performance were selected to evaluate the variation of scheme performance between these three public insurance schemes; overall utilization of care, LOS and early readmission in DM patients, and quality of DM care. The results of these approaches are as follows.

The analysis of overall utilization indicated that insurance scheme affected the chance of using ambulatory and hospitalization services after controlling for other factors. SSS patients had a higher chance of using ambulatory services compared to UC scheme while CSMBS patients had a higher chance of hospitalization than UC scheme and SSS patients. This might be the awareness by SSS beneficiaries of their rights and deliberate use of services from a hospital they chose. CSMBS hospitalization might be affected by providers who sought additional income through providing more services to CSMBS patients. Data from in-depth interviews of

providers showed that they were comfortable to prescribe expensive drugs and more investigations in CSMBS patients because they knew that hospitals could be reimbursed for all expenses of CSMBS patients. This also implied more frequent admissions of CSMBS patients.

Length of stay and early readmission in DM patients were indicators of the efficient use of resources. This study separated admissions into three conditions, acute, chronic, and without complication, to explore whether providers had manipulated LOS especially in chronic conditions or for DM patients without complications. The result from the national claims data showed that SSS and UC had significantly shorter LOS compared to CSMBS. This might be the pressure of cost containment for these two schemes. Furthermore, early readmission in the SSS did not differ from that in the CSMBS. This implied efficiency of resource use with good quality care in the SSS scheme. However, UC scheme patients with chronic and without complication conditions had a higher chance of early readmission while readmission for acute complication conditions did not differ from the CSMBS. This result implied too early discharge for non-emergency conditions for UC patients. This also confirmed that for emergency conditions, the quality of care offered by providers to DM patients was the same between schemes.

Analysis of the degree of diagnosis and level of controlled DM using data from the Health Examination Survey indicated that SSS had the most undiagnosed DM cases while CSMBS had the most uncontrolled patients. This finding might be related to SSS design which covered only hospital care and no preventive and promotive care in the community. The quality of care study using DM as a tracer in medical records and patient interviews showed that CSMBS patients received standard guideline care more than UC and SSS patients. This result confirmed the effect of CSMBS regulations especially the payment mechanism as supported by data from in-depth interviews that providers seemed to provide more services and be more responsive to the requests for services from beneficiaries in this scheme. However, this study found that there were no differences of intermediate outcome between insurance schemes. This finding implied that there were many factors in addition to process of care affecting outcome of care such as patient compliance and environmental factors.

10.2 Contribution to knowledge

In spite of some limitations as mentioned above, this study contributes to the literature on variation of health insurance scheme performance in a number of ways. First, studies comparing health insurance scheme performance have been mainly conducted in developed countries where there were different insurance scheme. Only a few studies relating to variation of insurance scheme performance in developing countries could be identified in the international literature (Mills et al. 2005, Ngorsuraches and Somlertlumvanich 2006, Somkotra and Detsomboonrat 2009, Sepehri et al. 2006). This study was the first to explore variation of insurance scheme performance after universal coverage was introduced in Thailand in 2001. Thailand is the leading country amongst lower and middle-income countries in implementing universal coverage, especially in a period of economic downturn. Therefore, this study would add understanding on the role of insurance in affecting utilization, LOS, early readmission in DM patient, and quality of care in DM patient in a less developed country context.

The study revealed that there was still inequitable access to care in terms of utilization of people in different health insurance schemes. Furthermore, this study also revealed improvement of access to care of underprivileged groups such as poor people, elderly, and those in rural areas compared to the earlier study of Srithamronsawat (2005).

This study also revealed that SSS seemed to be the middle way of efficiency and quality compared to the UC scheme and CSMBS. The capitation payment in the SSS encouraged efficient use of resources apparently without detrimental effect on DM care quality. Although CSMBS seemed to be more likely to achieve standard process care in DM, the SSS performance seemed to be better than the UC scheme. One important strategy of the SSS is to use a public/private mix of service providers. Data from the qualitative study confirmed that this created competition between providers in terms of efficiency and quality of service.

The study provides information for suggestions on the issue of harmonization of the performance of insurance schemes by setting scheme performance as a target for

system design and management. In Thailand and other developing countries, income inequity is still a main problem of the government, and universal coverage is one way to reduce the gap of income in the country. However, this policy needs support from broader policies to achieve equity of care.

10.3 Implications of the study for policy makers

This section proposes policy implications related to scheme performance and management. Policy recommendations specific to the Thai context are considered first and general recommendations for other developing countries are proposed in the next subsection.

10.3.1 Recommendations for Thai policy makers

The multiple health insurance system in Thailand provides a good example of achieving universal coverage by expanding public insurance to cover all people. There are three recommendations for Thai policy from this study.

First, results of this study confirmed that there weres differences in performance between the three health insurance schemes. To aim at reducing inequity of access to care, protect people from the cost of very severe illness, and provide good service quality, this might lead to discussion as to whether the government should harmonize or how to harmonize the status of the different characteristics of the three insurance schemes. The most important issue is how to harmonize performance, and there are four important points for policymakers to consider. First, the benefit package of all insurance schemes should not differ because this study showed that different benefits affected provider and patient behaviour. The three insurance schemes can currently set the standard benefit package for their own beneficiaries. Second, the payment to providers should be harmonized to reduce the difference in reimbursement methods. Currently, there are three payment options in use: FFS, capitation, and capitation for ambulatory care and prospective case payment and global budget for hospitalization. Third, providers should not have a policy to separate the patients in different schemes during treatment. This might be the effect of the different payment mechanisms and benefit packages of the different schemes. If the government can harmonize these issues, providers might not need to separate patients. Fourth, beneficiaries should be made aware of their rights and encouraged to feel a sense of

ownership of the insurance scheme. This study found that the SSS is a good example of beneficiaries who protect their rights by complaints and suggestions for improving quality of service.

Second, to monitor performance between schemes, the government should have a clear policy and implementation plan for the future. Currently, there is no organization responsible for monitoring the different performance of the schemes, although each insurance scheme has a unit to monitor their own performance. Furthermore, information on performance should be distributed to the public to inform people of the existence of different performance.

Third, from this study, although the intermediate outcomes of DM care were not different by scheme, the UC scheme patients seemed to receive less standard guideline care compared to the CSMBS and SSS. Furthermore, the LOS of UC scheme patients seemed to be shorter than CSMBS and the same as SSS patients, but UC patients had a higher early readmission than CSMBS and SSS. These problems correspond with a popular image for the UC scheme of unattained quality of care. The government has to set a policy to improve quality especially in the process of care at least to achieve standard guideline care in all schemes.

10.3.2 Recommendations for other developing countries

Developing countries have tended to move toward universal coverage through several routes. One possible means is to expand public health insurance into uninsured groups. However, each country usually has some forms of insurance in their countries. Universal coverage implementation with several insurance schemes could be one of the most feasible approaches to achieve universal coverage. Achieving universal coverage with multiple insurance systems is the first step to improve the overall performance of the health system. This study has some lesson for other developing countries as follows.

First, it was clear that different characteristics of health insurance schemes affected health system performance. This study showed that overall utilization, LOS and early readmission in DM patients, and quality of care in DM patients, were affected by insurance scheme. Thailand is a good example of using multiple health insurance

which has different sources of funds. Developing countries with multiple insurances should accept that multiple insurance might increase the feasibility of universal coverage and minimize early opposition, but it still raises problems of unequal access and benefit packages persisting over time, and provides no straightforward solution to harmonization. Therefore, it needs to be considered how to harmonize performance between schemes.

Second, in terms of quality of care, it was not easy to link the process of care and outcome of care. The quality approach of structure, process, and outcome might not reflect a direct sequence of results (Donabedian and Bashshur 2003). This study showed that good process of care for DM did not mean good outcomes.This finding confirmed the suggestion of Donabedian and Bashshur (2003) that the link between structure to process, process to outcome was a probability, which had to be well established but was largely presumed.

Third, despite the problem of different payment methods, Thai experience with payment methods which ensure cost control has been remarkably successful, even it can still be improved.

10.4 Areas for further research

This study has explored and assessed the performance of three public insurance schemes under universal coverage in Thailand. The main emphases are on overall utilization of services, LOS and early readmission in DM patients, and quality of care in DM patients. However, there are research questions that this study could not provide answers to and there is room for further research.

First, there are likely to be other issues of health care performance influenced by scheme such as the cost of care etc. Results from LOS might imply the efficiency of resource use but the direct cost of care under different insurance schemes still needs to be assessed.

Second, since this study focused mainly on DM patients; therefore, further research should explore scheme performance for other conditions. For example in very severe illness and costly conditions, this will respond to the aim of health insurance to

protect families from excessive expenses for illness. There is evidence from a study in the UK that specialist care was pro-rich while general care was more equitable (Dixon et al. 2007).

Third, the quality of care in terms of other outcomes still needs more research such as quality of life, mortality etc. Although the study showed that outcome of care might come from factors rather than insurance itself, it is important to explore the effect of health insurance on other outcomes.

Fourth, the best path to harmonization of insurance schemes is another issue that needs further study. There remain questions on whether Thailand can harmonize some issues such as benefit package, payment system or management. Quantitative and qualitative studies on preferences of stakeholders such as policy makers, academicians, and the people in terms of harmonization should be undertaken. Some developed countries, for example, Canada, had dialogues of stakeholders to propose the direction of policy in health care (Maxwell 2003). The U.K. has experience of using conjoint analysis to elicit preferences for health care issues (Ryan and Farrar 2000).

10.5 Conclusions

Universal coverage in Thailand has been relatively successful in terms of achieving insurance for all the people. However, because there remain three main public health insurance schemes, variation in scheme performance is an unavoidable issue. Different scheme characteristics could affect the performance of health insurance such as payment mechanism, benefit package, contracting unit etc. This study confirmed the different performance for some selected indicators, which are overall utilization, LOS and early readmission in DM, and quality of care in DM. This finding can help policy makers in Thailand and other developing countries to think about how to harmonize the performance of different insurance schemes. This has created more questions about other aspects of performance that should be evaluated and issues of harmonization of insurance schemes in terms of common characteristics.

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APPENDIX 1: Service utilization

Table A1. 1 Illness and ambulatory visit by regions

	% ill in one month	% of those ill using facility in one month	Mean episode in one month	Illness episode/ person/year	Facility visit/person/ year
Region					
Bangkok	12.6	62.5	1.48	2.23	1.40
Central	15.6	72.7	1.82	3.41	2.48
North	27.3	76.0	2.09	6.84	5.20
Northeast	22.1	78.1	1.89	4.99	3.90
South	17.2	78.0	1.63	3.38	2.63

Source: Health Welfare Survey 2005

Table A1. 2 Hospitalization by regions

	%hospitalized in 12 months	Mean of hospitalization per year	Mean number of hospitalizations/ episode	Hospitalizations /person/year
Region				
Bangkok	4.0	1.20	1.1	0.054
Central	5.8	1.43	1.2	0.102
North	8.0	1.40	1.3	0.142
Northeast	7.5	1.24	1.1	0.108
South	6.7	1.57	1.2	0.129

Source: Health Welfare Survey 2005

Table A1. 3 Factors explaining illness

Dependent variable	Illness =1			
N	48,721			
Prob > F	<0.001			
Independent variable	Odds ratios	P-value	LL[@]	UL[@@]
Sex				
Male*				
Female	1.28	<0.001	1.20	1.38
Income quintile				
1*				
2	0.92	0.268	0.80	1.06
3	0.90	0.229	0.76	1.07
4	0.77	0.003	0.65	0.91
5	0.80	0.024	0.66	0.97
Age				
0-20*				
21-40	0.98	0.847	0.81	1.19
41-60	1.27	0.038	1.01	1.59
>60	1.79	<0.001	1.42	2.27
Marital status				
Unmarried*				
Married	1.00	0.941	0.90	1.11
Insurance				
UC scheme*				
SSS	1.30	<0.001	1.12	1.51
CSMBS	1.01	0.872	0.88	1.17
Education				
Primary school*				
None	1.01	0.886	0.86	1.19
Primary<Bachelor	0.80	<0.001	0.69	0.91
≥ Bachelor	0.80	0.044	0.65	0.99
Chronic disease				
No chronic disease*				
Chronic disease	6.29	<0.001	5.69	6.96
Region				
Central*				
Bangkok	0.94	0.691	0.71	1.25
North	1.80	<0.001	1.48	2.20
North east	1.48	<0.001	1.26	1.74
South	1.26	0.011	1.06	1.50
Area				
Urban*				
Rural	1.19	0.005	1.05	1.35

[@] lower level
[@@] upper level
Source: Health Welfare Survey 2005

Table A1. 4 Insurance status by region 2005

	Bangkok	Central	North	Northeast	South	Total
No insurance	12.6	6.3	3.3	2.3	3.9	4.9
UC without co-payment	7.4	19.1	35.9	37.2	29.3	28.1
UC with co-payment	36.6	41.6	42.7	47.8	48.4	44.1
SSS	24.3	21.0	6.5	3.8	5.5	11.1
CSMBS	14.4	10.1	9.4	7.7	11.1	9.8
Private insurance	3.1	1.2	0.7	0.2	0.8	1.0
Employer's Welfare	1.2	0.3	0.2	0.1	0.1	0.3
Others	0.2	0.3	1.3	0.8	0.8	0.7
Not know	0.1	0.1	-	-	-	0.0
N	4,014	21,609	14,218	16,222	11,752	67,815

Source: Health Welfare Survey 2005

Table A1. 5 Health seeking by region 2005

	Region (%)					
	Bangkok	Central	North	Northeast	South	Total
No treatment	5.1	2.6	6.1	4.8	4.0	4.6
Traditional treatment	0.0	1.7	0.7	0.7	1.1	0.9
Traditional doctor	0.0	0.6	0.2	0.2	0.9	0.3
Self-prescribed drugs	32.8	23.2	17.8	17.9	16.9	19.9
Health centre	4.5	16.0	28.1	31.3	18.1	24.1
Community hospital	0.0	13.9	18.4	22.5	20.9	17.9
Regional hospital	0.2	10.1	7.1	6.6	8.9	7.1
University hospital	4.6	1.0	0.8	1.0	1.0	1.2
Other public hospital	13.6	2.5	0.5	0.4	0.3	1.9
Private clinics	16.7	18.6	13.5	11.9	24.8	15.4
Private hospital	22.3	8.8	3.6	0.7	1.8	4.8
Other	0.2	1.3	3.2	1.9	1.4	1.9
N	524	3,639	3,602	3,619	1,898	13,282

Source: Health Welfare Survey 2005

APPENDIX 2: Length of stay and readmission detailed results

Table A2, 1 Data structure of claims data after combining all three schemes.

Variable	Name	Description
Hcode	Hospital code	
h_group	Hospital type	1=public hospital, 2=private hospital
rgeo	Region	1=Bangkok, 2=Central, 3=Northeast, 4=East, 5=North, 6=South, 7=West
pcode	Province	76 Provinces
hmain	Main hospital	
pidpat	ID	ID number of patient
hn	Hospital number	
an	Admission number	
dob	Date of Birth	
age	Age	Year
sex	Sex	1=male, 2=female
dateadm	Admission date	
datedsc	Discharge date	
dischs	Discharge status	1=complete recovery, 2=Improved, 3=Not improved, 4=Normal delivery, 5=Undelivery of pregnant woman, 6=Normal child discharged with mother, 7=Normal child discharged separately, 8=Stillbirth, 9=Dead
discht	Discharge type	1=with approval, 2=Against advice, 3=Escaped, 4=By transfer, 5=Other, 6=Dead autopsy, 7=Dead no autopsy
los	Length of stay	
drg	Diagnostic related group	
rw	Relative weight	
adjrw	Adjusted relative weight	
pdx	Primary diagnosis	
sdx1-12	Secondary diagnosis1-12	
proc1-12	Procedure1-12	
insurance	Insurance	Insurance status

Source: Claims Data 2005

Table A2, 2 Dependent and independent variables for analysis of LOS in acute complications admissions

Variable	Acute complications admissions				
	Observation	Mean of variable	Std. Dev.	Min	Max
LOS	15,289	4.03	4.00	0	38
Age group					
0-40	1,172				
41-60	5,296	0.34	0.47	0	1
>60	8,821	0.57	0.50	0	1
Sex					
Male*	4,913				
Female	10,376	0.68	0.47	0	1
Insurance					
CSMBS*	2,520				
SSS	445	0.03	0.17	0	1
UC scheme	12,324	0.81	0.40	0	1
Severity					
0*	8,939				
2	3,001	0.20	0.40	0	1
3	2,582	0.17	0.37	0	1
4	732	0.05	0.22	0	1
Hospital type					
Community	8,495				
General	3,540	0.23	0.42	0	1
Regional	2,042	0.13	0.34	0	1
University	324	0.02	0.15	0	1
Private	483	0.03	0.17	0	1
Military	405	0.03	0.16	0	1
LOS					
0-3	9,151				
4-7	4,405	0.28	0.45	0	1
>7	1,733	0.11	0.32	0	1

* reference group

Source: Claims Data 2005

Table A2, 3 Dependent and independent variables for analysis of LOS in chronic complications admissions

	Chronic complications admissions				
Variable	**Observation**	**Mean of variable**	**Std. Dev.**	**Min**	**Max**
LOS	15,539	7.62	7.38	0	38
Age group					
0-40	797				
41-60	6,947	0.44	0.50	0	1
>60	7,795	0.50	0.50	0	1
Sex					
Male*	5,692				
Female	9,847	0.63	0.48	0	1
Insurance					
CSMBS*	2,622				
SSS	431	0.03	0.16	0	1
UC scheme	12,486	0.80	0.40	0	1
Severity					
0*	7,941				
2	3,593	0.23	0.42	0	1
3	2,870	0.19	0.39	0	1
4	1,051	0.08	0.27	0	1
Hospital type					
Community	7,427				
General	3,533	0.23	0.42	0	1
Regional	3,245	0.22	0.41	0	1
University	418	0.03	0.17	0	1
Private	670	0.04	0.20	0	1
Military	246	0.18	0.13	0	1
LOS					
0-3	5,499				
4-7	4,804	0.31	0.46	0	1
>7	5,236	0.34	0.47	0	1

* reference group
Source: Claim Data 2005

Table A2, 4 Dependent and independent variables for analysis of LOS in without complications admissions

	Without complications admissions				
Variable	**Observation**	**Mean of variable**	**Std. Dev.**	**Min**	**Max**
LOS	37,104	3.92	3.87	0	38
Age group					
0-40	2,198				
41-60	14,393	0.39	0.49	0	1
>60	20,513	0.55	0.50	0	1
Sex					
Male*	11,416				
Female	25,688	0.69	0.46	0	1
Insurance					
CSMBS*	8,035				
SSS	1,075	0.03	0.17	0	1
UC scheme	27,994	0.76	0.43	0	1
Severity					
0*	23,950				
2	7,064	0.19	0.39	0	1
3	5,353	0.14	0.35	0	1
4	677	0.02	0.13	0	1
Hospital type					
Community	24,029				
General	7,732	0.21	0.41	0	1
Regional	3,328	0.09	0.29	0	1
University	201	0.01	0.08	0	1
Private	1,228	0.03	0.18	0	1
Military	586	0.02	0.12	0	1
LOS					
0-3	22,720				
4-7	10,434	0.28	0.45	0	1
>7	3,950	0.11	0.31	0	1

* reference group
Source: Claims Data 2005

APPENDIX 3: Multilevel analysis of Diabetes Mellitus data

A3.1 Introduction

This appendix analyses the data of chapter 7 using a different methodology. Since the data has a hierarchical structure, patients nested within hospitals, hierarchical or multilevel analysis might be appropriated to this analysis.

The aims of this appendix are to explain hierarchical analysis and compare the results of the hierarchical method and the standard method reported in chapter 7.

This appendix begins with basic concepts, followed by the methodology of the study using hierarchical or multilevel analysis. Then, the results of the analysis are compared between ordinary multivariate regression and multilevel analysis.

A3.2 Basic concepts

a. What is multilevel analysis?

Multilevel modelling is defined as a model involving variables measured at more than one level of a hierarchy (Diez Roux 2002). Multilevel modelling can be used with a nested data structure which can be nested by subgroup or time. The example of a nested group structure is patients within a hospital or students within a school etc, while a nested time structure example is blood pressure in two periods of time. There are different terminologies in multilevel modelling such as hierarchical models, mixed models, random effects models, random coefficient models, covariance component models, or variance component models (Houchens et al. 2007). In this study, the term multilevel and hierarchical models are used interchangeably.

b. When to use multilevel analysis?

Multilevel analysis is considered in hierarchical structures which have group effects. The reasons for using multilevel modelling are several.

1. To correct inferences because ordinary analysis might overstate statistical significance.

2. The researcher is interested in group effects. Research questions might extend to group effects on individual outcomes.
3. The researcher is interested in variability and heterogeneity in the population more than average values.
4. The researcher is interested in estimating level specific effects e.g. hospital effect (Rasbash 2006, Houchens et als 2007).

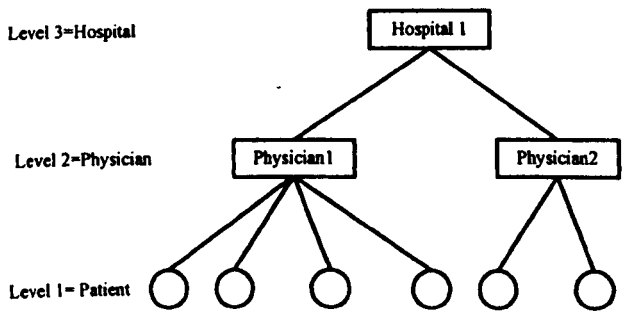
Ignoring the hierarchical structure has three implications. First, it might under estimate standard errors because of lacking the effect of between group variations. Second, multilevel techniques are statistically efficient compared to other methods. For example, to analyze patients from 100 hospitals, using multilevel techniques, we need not run a regression by each hospital to control the effect of hospital. Third, it is possible to perform multiple types of analysis such as ANOVA, multiple regression, logistic regression etc (Roberts 2004).

c. Data structure

There are three data structures in multilevel models, hierarchy, cross-classification, and multiple memberships (Houchens et al. 2007).

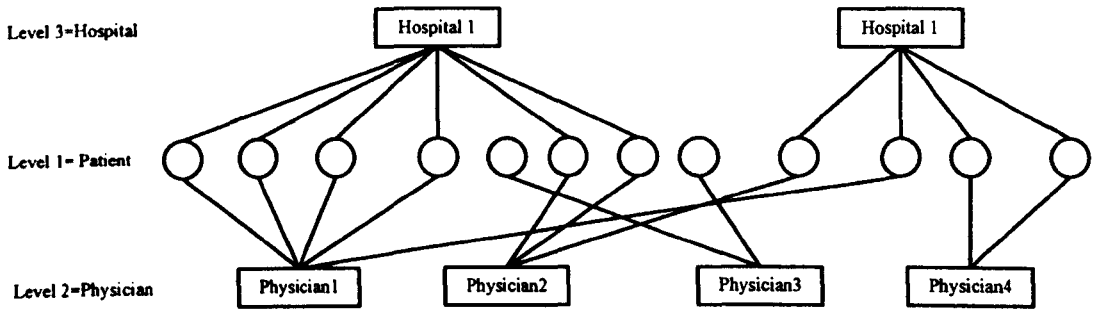
Hierarchical structure means that lower levels are nested in a higher-level structure. The example of this structure is patients might have one physician and go to only one hospital as shown in figure A1.1.

Table A3. 1 Hierarchical structure



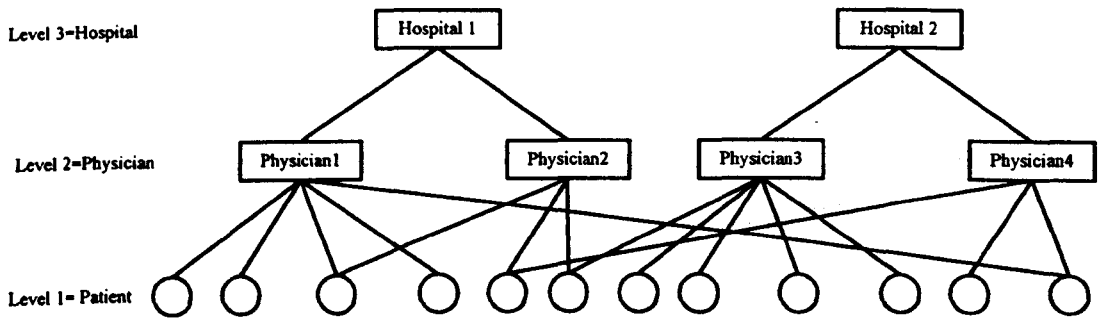
Cross classification structure is a structure where the higher level may not be nested within another higher level. The example is that patients might have one physician but physicians might work in more than one hospital as shown in figure A1.2.

Table A3. 2 Cross classification structure.



Multiple memberships are the structure where level 1 may have more than one higher level. The example is one patient can go to more than one physician but the physician works in only one hospital as shown in figure A1.3.

Table A3. 3 Multiple membership data structure.



d. Intraclass correlation

In multivariate analysis, we try to explain outcome variables by independent variables. Out come of linear regression from a hierarchical structure come from the average values and variances of each level. For example, in the study of factors explaining the fasting plasma glucose (FPG) of patients in a hierarchical structure where level 1 is patient, and level 2 is hospital, the equation of the FPG of each patient can be present below.

$$FPG_i = \overline{FPG} + E_p + E_h$$

FPG_i is the FPG value of each patient. $\overline{FPG}$ is the average FPG of patients. E_p is patient residual while E_h is hospital residual.

The variance of FPG patients is equal to the variance from the patients and from the hospitals. The detail of total variance is shown below.

$$V_{total} = V_p + V_h$$

To explore the importance of variation of level structure, hospital in this example, we calculate intraclass correlation (ICC) by :

$$ICC = \frac{V_h}{V_h + V_p}$$

V_h is upper level variance which is hospital level in this example. V_p is variance of level 1 which is patient level in this example.

Since the variance is a positive number, ICC will have a value between 0 and 1. ICC equal to 1 means that all patients have the same FPG in each hospital while ICC equal to 0 means that all hospitals have the same average FPG. High ICC value implies the important of the upper level in understanding individual differences while zero ICC implies it is unsuitable to perform multilevel analysis (Merlo et al. 2005a). For the size of the ICC value, Hox (2002) suggested values of 0.05, 0.1, 0.15 as small, medium and large values (Hox 2002). However, there is no rule of how much cluster related to affect result of model. Kreft and Yoon (1994) illustrated that some study using ordinary method had similar result with multilevel model with ICC 0.2 (Kreft and Yoon 1994).

However, in multilevel logistic regression, the scale of V_h and V_p is not the same because V_h is on a logistic scale while V_p is on a probability scale ($=\frac{\pi}{1-\pi}$) so the

ICC of multilevel logistic regression can be calculated as shown below (Merlo et al 2005b):

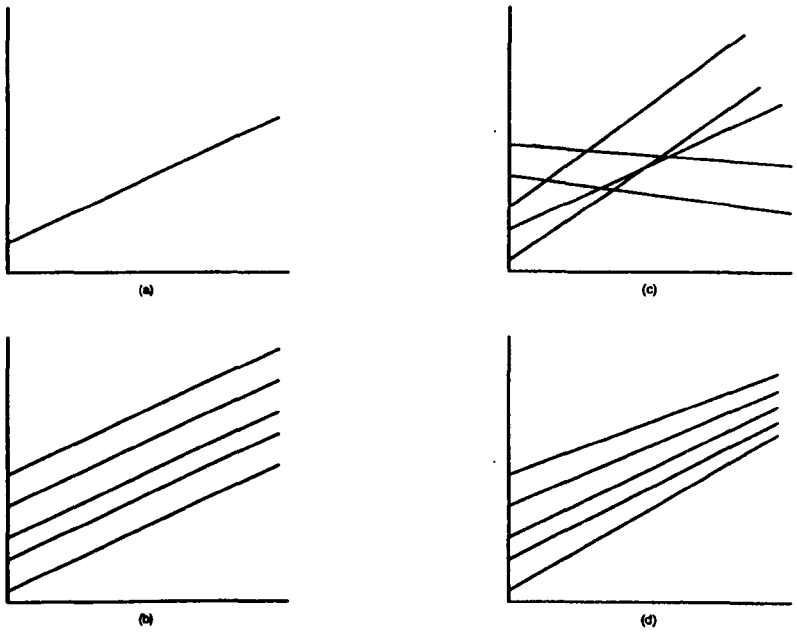
$$ICC = \frac{V_h}{V_h + \frac{\pi^2}{3}}$$

e. Method of analysis

There are four models of multilevel analysis: random intercept(empty model or variance components model), random intercept fixed slopes, random intercept random slopes, and intercept and slope as outcome (Houchens et al. 2007). The exploration of each model below assumes a two level model with a hierarchical structure.

Empty model is the model with only an intercept variable without other independent variables. This model aims to quantify the cluster effect in a multilevel model (Merlo et al. 2005a). A random intercept with fixed slope model expands to include independent variables into the model but fix as the slope of the model. A random intercept with random slope model allows a random slope. An intercept and slope as outcome model is similar to random intercept with fixed slope but allows the intercept as the function of level 2 variables. The graphical figures of each model are shown in figure A1.4. Graph (a) is the empty model. Graph (b) is random intercept with fixed slope while graph (c) and (d) are random intercept with random slope.

Table A3. 4 Graphical figure of each multilevel model



In the analysis process, there are five steps of analysis suggested by Hox (1995) as shown below:

1. Analyze a model with no explanatory variables. This will give an estimate of the intraclass correlation.
2. Analyze a model with all independent variables of the 1st level. This is the same as the ordinary method of analysis.
3. Assess each independent variable for whether any of the slopes has a significant variance component between groups.
4. Analyze a model by adding higher level variables into the model.
5. Add cross-level interaction of higher level variables and lower level variables that had significant slope variation in step 3.

A3.3 Analysis of chapter7 data using multilevel analysis

This section compares the ordinary and multilevel results using the random intercept model as multilevel model. The details of indicators are mentioned in chapter 7.

The model used in multivariate analysis is hierarchical logistic regression. Since the data come from different hospitals and different physicians, so the regression represents 2-levels of hierarchy. The equation is shown below:

$$\ln\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \gamma_{00} + \gamma_{01} z_{1j} + \gamma_{10} x_{1ij} + u_{0j} + u_{1j} x_{1j}$$

$$y_{ij} \sim Bernoulli(\pi_{ij})$$

$$\begin{bmatrix} u_{0j} \\ u_{1j} \end{bmatrix} \sim iid\ N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \tau_{00} & \tau_{01} \\ \tau_{10} & \tau_{11} \end{pmatrix}\right] \forall j$$

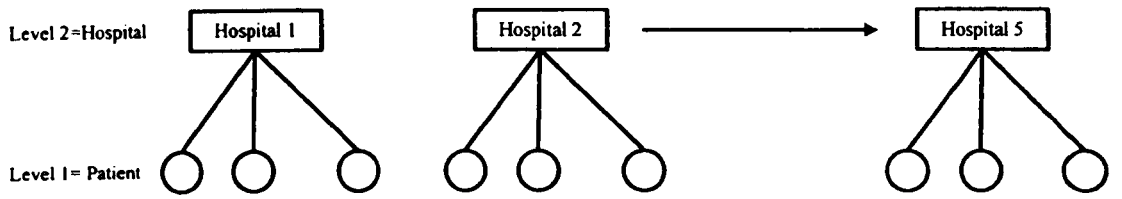
From: Houchens et al. 2007

Since the aim of this study is to compare the results of the multilevel method with the ordinary method, so we employ a random intercept model for the study. We focus on the influence of insurance scheme as the outcome of the analysis.

Hierarchical structure used in this study

In this study, since we selected different patients from different hospitals, so we used a two level hierarchical structure, first level was patient, and second level was hospital. The diagram of hierarchical structure can be shown below.

Table A3. 5 Data structure of hierarchical analysis



A3.4 Results of the study

Process of care

The results of logistic regression of process of care using both ordinary and multilevel analysis are shown in table A3.1. The comparison includes six indicators: FPG, HbA1C, urine protein, eye examination, lipid profile, BP.

In FPG achievement, the ICC of model was zero, meaning that there was no difference between ordinary method and multilevel method. The odds ratios and p-values are similar in both methods.

For HbA1C, the ICC of the model was 0.26. There were different results for age, insurance, and co-morbidity of patients. The odds ratio for SSS is not significant in the multilevel model while it is significant in the ordinary model. This implies the significance of hospital type in the analysis.

For urine protein examination, since the ICC is 0.78, there was a strong effect of the cluster group in the model. The results which differ from ordinary analysis are area, income, and smoking. Although ICC in this model is high, the effect of clustering comes from other factors not from insurance status.

For eye examination, the ICC is 0.59, There were different results in the multilevel model for sex, insurance, and income. This model is similar to HbA1C in finding, Insurance was significant in the ordinary model but not significant in the multilevel model.

For lipid profile examination, the ICC is 0.11. Factors which differ from the ordinary model are gender, and income. This result is the same as for urine protein examination where insurance status effect is not different.

For BP, the ICC is zero, so there is no difference between the models.

Table A3. 6 Result of analysing process of DM care by ordinary and multilevel methods

	FPG				HbA1C				Urine protein				Eye examination				Lipid profile				BP			
	Multilevel		Ordinary		Multilevel		Ordinary		Multilevel		Ordinary		Multilevel		Ordinary		Multilevel		Ordinary		Multilevel		Ordinary	
	Odds ratios	P-Value	Odds ratios	P-value	Odds ratios	P-Value	Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-Value	Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-Value
Dependent Variable	Achieving standard = 1																							
N																								
Independent Variable																								
Age group																								
0-40																								
41-60	1.32	0.437	1.32	0.437	1.64	<0.05	1.56	0.067	1.61	0.205	1.17	0.638	0.86	0.613	0.92	0.775	1.37	0.137	1.28	0.217	1.19	0.661	1.19	0.661
>60	2.21	0.056	2.21	0.056	1.59	0.104	1.47	0.162	1.36	0.449	0.85	0.647	1.18	0.668	1.45	0.289	1.51	0.085	1.48	0.089	1.49	0.366	1.49	0.366
Sex																								
Male																								
Female	1.70	0.011	1.70	0.011	0.93	0.563	0.91	0.450	1.26	0.180	1.18	0.235	1.78	<0.01	1.41	0.077	1.29	<0.05	1.24	0.055	1.59	0.030	1.59	0.030
Marital status																								
Single																								
Married	0.93	0.851	0.93	0.851	1.07	0.765	1.09	0.692	0.98	0.943	1.06	0.824	1.73	0.133	1.48	0.240	1.18	0.378	1.18	0.389	1.34	0.395	1.34	0.395
Education																								
Without education																								
Primary-Bachelor	0.72	0.379	0.72	0.379	1.41	0.127	1.51	0.061	1.41	0.112	1.30	0.161	1.24	0.576	1.49	0.275	1.18	0.295	1.18	0.298	0.97	0.927	0.97	0.927
>Bachelor	0.60	0.311	0.60	0.311	2.01	<0.05	2.01	<0.05	2.34	<0.05	2.03	<0.05	1.97	0.204	1.92	0.196	1.69	0.068	1.70	0.064	0.77	0.591	0.77	0.591
Area																								
Urban																								
Rural	1.29	0.171	1.29	0.171	0.99	0.952	1.03	0.802	1.11	0.476	1.79	<0.001	1.07	0.715	0.74	0.068	0.93	0.491	0.89	0.219	1.21	0.320	1.21	0.320
Insurance																								
UC																								
SSS	1.92	0.018	1.92	0.018	0.84	0.479	2.39	<0.001	0.29	<0.001	0.29	<0.001	2.01	0.107	5.39	<0.001	2.84	<0.001	2.14	<0.001	1.67	0.072	1.67	0.072
CSMBS	0.68	0.123	0.68	0.123	1.91	<0.001	1.95	<0.001	1.63	<0.01	1.61	<0.01	1.43	0.243	1.24	0.445	1.47	<0.01	1.43	<0.01	0.72	0.195	0.72	0.195

	FPG				HbA1C				Urine protein				Eye examination				Lipid profile				BP			
	Multilevel		Ordinary		Multilevel		Ordinary		Multilevel		Ordinary		Multilevel		Ordinary		Multilevel		Ordinary		Multilevel		Ordinary	
	Odds ratios	P-Value	Odds ratios	P-value	Odds ratios	P-Value	Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-Value	Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-Value
Income																								
No income																								
<2,000	0.59	0.127	0.59	0.127	0.99	0.958	0.80	0.331	0.89	0.656	0.35	<0.001	0.75	0.497	1.69	0.171	0.97	0.887	1.09	0.635	0.79	0.501	0.79	0.501
2,000-10,000	0.85	0.574	0.85	0.574	0.94	0.737	0.78	0.124	0.85	0.376	0.36	<0.001	0.76	0.399	1.85	<0.05	1.21	0.181	1.39	<0.05	1.11	0.711	1.11	0.711
>10,000	0.86	0.669	0.86	0.669	0.88	0.576	0.80	0.287	0.61	0.098	0.24	<0.001	0.64	0.259	2.04	<0.05	1.32	0.157	1.50	<0.05	1.10	0.784	1.10	0.784
Duration of DM																								
<= 5 years																								
> 5 years	1.10	0.638	1.10	0.638	0.90	0.395	0.92	0.519	1.53	<0.01	1.65	<0.001	1.29	0.191	1.06	0.758	0.87	0.190	0.84	0.088	1.17	0.451	1.17	0.451
Smoking																								
No																								
Yes	0.71	0.248	0.71	0.248	1.06	0.798	1.08	0.705	2.12	<0.05	1.47	0.107	0.88	0.716	0.94	0.856	1.46	0.072	1.43	0.080	0.82	0.545	0.82	0.545
Comorbidity																								
No																								
Yes	1.17	0.474	1.17	0.474	1.27	0.111	1.40	<0.05	1.68	<0.01	1.88	<0.001	1.20	0.421	1.25	0.280	1.47	<0.01	1.41	<0.01	1.29	0.252	1.29	0.252
ICC	0.00				0.26				0.78				0.59				0.11				0.00			

Source: Medical records and DM patient data

Intermediate outcome

The details of results comparing the ordinary model and multilevel model are shown in table A3. 7.

For average FPG target achievement, the ICC is 0.02. There is no difference between multilevel and ordinary models.

For HbA1C result, the ICC is 0.21. The differences in results are for gender, age, and insurance status. This result corresponds with the process of care analysis where SSS is not a significant factor in the multilevel model while it is significant in the ordinary model.

For total triglyceride, the ICC is 0.03. There is no difference result between multilevel and ordinary model result.

For total cholesterol, the ICC is 0.06. The difference of results in ordinary and multilevel model is for the area factor. However, there is no difference for the insurance factor in this model.

Table A3. 7 Results of intermediate outcome analysis between ordinary and multilevel models.

	FPG				HbA1C				Total triglyceride				Total cholesterol			
	Multilevel		Ordinary		Multilevel		Ordinary		Multilevel		Ordinary		Multilevel		Ordinary	
	Odds ratios	P-Value	Odds ratios	P-value	Odds Ratios	P-value	Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-value
Dependent variable	Achieving standard target = 1															
N																
Independent variable																
Age group																
0-40																
41-60	0.80	0.342	0.76	0.262	0.49	0.136	0.56	0.200	0.85	0.480	0.85	0.471	1.03	0.894	1.03	0.882
>60	0.46	<0.01	0.43	<0.01	0.33	<0.05	0.41	0.078	0.86	0.585	0.86	0.567	0.72	0.233	0.71	0.213
Sex																
Male																
Female	1.31	<0.05	1.30	<0.05	1.61	0.055	1.66	<0.05	1.00	0.992	0.99	0.957	1.22	0.154	1.23	0.137
Marital status																
Single																
Married	1.09	0.657	1.07	0.727	1.95	0.137	1.82	0.159	1.41	0.134	1.30	0.243	1.01	0.957	0.94	0.773
Education																
Without education																
Primary-Bachelor	1.23	0.212	1.23	0.211	1.35	0.487	1.28	0.560	0.81	0.299	0.80	0.261	1.15	0.514	1.16	0.491
>Bachelor	1.55	0.137	1.53	0.144	1.63	0.430	1.69	0.387	0.85	0.599	0.79	0.462	1.36	0.346	1.24	0.504
Area																
Urban																
Rural	0.77	<0.05	0.79	<0.05	1.07	0.769	1.18	0.433	0.96	0.728	0.89	0.303	0.88	0.301	0.79	<0.05
Insurance																
UC																
SSS	1.47	<0.05	1.65	<0.001	0.89	0.813	0.42	<0.01	0.93	0.689	0.91	0.562	0.74	0.134	0.88	0.436
CSMBS	1.17	0.255	1.17	0.235	1.06	0.864	0.88	0.695	0.93	0.644	0.91	0.537	0.74	0.064	0.73	0.051
Income																

	FPG				HbA1C				Total triglyceride				Total cholesterol			
	Multilevel		Ordinary		Multilevel		Ordinary		Multilevel		Ordinary		Multilevel		Ordinary	
	Odds ratios	P-Value	Odds ratios	P-value	Odds Ratios	P-value	Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-value	Odds ratios	P-value
No income																
<2,000	1.31	0.174	1.09	0.638	1.21	0.666	1.22	0.642	0.92	0.730	0.93	0.758	1.42	0.143	1.45	0.108
2,000-10,000	0.97	0.854	0.83	0.201	1.55	0.172	1.56	0.154	0.85	0.339	0.85	0.310	1.09	0.627	1.08	0.647
>10,000	0.96	0.844	0.81	0.294	1.30	0.525	1.23	0.602	1.15	0.546	1.16	0.495	1.24	0.362	1.27	0.279
Duration of DM																
<= 5 years																
> 5 years	1.59	<0.001	1.66	<0.001	1.74	<0.05	1.68	<0.05	0.98	0.890	1.00	0.980	0.91	0.496	0.94	0.644
Smoking																
No																
Yes	1.44	0.092	1.42	0.105	1.26	0.554	1.26	0.548	1.31	0.217	1.30	0.233	0.77	0.248	0.78	0.278
Comorbidity																
No																
Yes	0.72	<0.05	0.76	<0.05	1.17	0.567	1.13	0.643	1.63	<0.001	1.62	<0.001	1.38	<0.05	1.40	<0.05
ICC	0.02				0.21				0.03				0.06			

Source: Medical records and DM patient data

Admission

The ICC of the multilevel analysis for the admission model is 0.12. There are only co-morbidity factors which differ between ordinary and multilevel models. Insurance status is not different between multilevel and ordinary models.

Table A3. 8 Results of analysis of admission between ordinary and multilevel models

	Admission(multilevel)		Admission	
	Odds ratios	**P-value**	**Odds ratios**	**P-value**
Dependent variable			Admission =1	
N	1,939		1,939	
Independent variable				
Age group				
0-40				
41-60	0.74	0.442	0.79	0.541
>60	1.48	0.338	1.60	0.246
Sex				
Male				
Female	1.15	0.433	1.20	0.298
Marital status				
Single				
Married	1.11	0.750	1.17	0.610
Education				
Without education				
Primary-Bachelor	1.31	0.227	1.32	0.216
>Bachelor	1.27	0.579	1.36	0.473
Area				
Urban				
Rural	0.76	0.073	0.81	0.152
Insurance				
UC				
SSS	1.03	0.928	0.74	0.206
CSMBS	1.08	0.670	1.08	0.663
Income				
No income				
<2,000	0.99	0.966	1.18	0.446
2,000-10,000	0.57	<0.01	0.67	<0.05
>10,000	0.44	<0.01	0.50	<0.05
Duration of DM				
<= 5 years				
> 5 years	1.84	<0.001	1.74	<0.001
Smoking				
No				
Yes	1.04	0.909	1.07	0.826
Co-morbidity				
No				
Yes	1.55	<0.05	1.45	0.058
ICC	0.12			

Source: Medical records and DM patient data

A3.5 Conclusion

The analysis has found that there is some difference in the results of analysis when using ordinary and multilevel models. The ICC was used to judge whether there were important differences. Different effects relating to insurance status were found for HbA1C in process and intermediate outcomes, and eye examination in process of care. However, it is difficult to say when ordinary models of analysis should be rejected in favour of multilevel method. Since results of analysis were not very different between ordinary and multilevel method, this study chose to present standard analyses instead of using the multilevel method.

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APPENDIX 4: Quality of service in Diabetes Mellitus detailed results

Table A4. 1 Bivariate analysis of different characteristics and process indicators

Variable	FPG test				HbA1C test				Urine Protein examination				Eye examination				Lipid profile test				BP measurement			
	Odds ratios	P-value	95% CI		Odds ratios	P-Value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI	
			LL@	UL@@			LL	UL			LL	UL			LL	UL			LL	UL			LL	UL
Age group																								
0-40																								
41-60	1.08	0.817	0.56	2.09	1.42	0.134	0.90	2.24	2.55	0.003	1.38	4.71	0.64	0.089	0.39	1.07	1.03	0.867	0.71	1.50	1.04	0.909	0.51	2.15
>60	1.37	0.363	0.69	2.72	1.16	0.523	0.73	1.85	4.45	<0.001	2.42	8.20	0.41	<0.001	0.24	0.70	0.86	0.424	0.59	1.25	1.03	0.927	0.50	2.16
Sex																								
Male																								
Female	1.91	<0.001	1.33	2.74	0.80	0.053	0.64	1.00	1.33	0.015	1.06	1.68	1.12	0.499	0.80	1.57	0.97	0.745	0.79	1.18	1.64	0.010	1.13	2.38
Marital status																								
Single																								
Married	0.94	0.860	0.47	1.89	1.13	0.572	0.74	1.74	1.56	0.059	0.98	2.47	1.20	0.575	0.64	2.27	1.11	0.574	0.78	1.57	1.30	0.419	0.68	2.49
Education																								
Without education																								
Primary-Bachelor	0.63	0.191	0.31	1.26	1.84	0.004	1.22	2.79	0.84	0.291	0.60	1.17	2.36	0.014	1.19	4.70	1.49	0.007	1.11	1.99	0.96	0.888	0.52	1.78
>Bachelor	0.35	0.019	0.15	0.84	2.64	<0.001	1.52	4.60	1.07	0.789	0.65	1.77	2.61	0.033	1.08	6.29	2.38	<0.001	1.46	3.87	0.57	0.182	0.25	1.30
Area																								
Urban																								
Rural	1.30	0.154	0.91	1.86	1.08	0.487	0.87	1.34	1.60	<0.001	1.28	1.99	0.82	0.224	0.60	1.13	0.96	0.697	0.80	1.16	1.26	0.217	0.87	1.84
Insurance																								
UC																								
SSS	1.33	0.238	0.83	2.15	2.35	<0.001	1.77	3.13	0.23	<0.001	0.16	0.32	5.28	<0.001	3.37	8.27	2.38	<0.001	1.88	3.00	1.45	0.143	0.88	2.37

Variable	FPG test				HbA1C test				Urine Protein examination				Eye examination				Lipid profile test				BP measurement			
	Odds ratios	P-value	95% CI		Odds ratios	P-Value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI	
			LL@	UL@@			LL	UL			LL	UL			LL	UL			LL	UL			LL	UL
CSMBS	0.71	0.105	0.47	1.08	2.13	<0.001	1.59	2.84	1.43	0.003	1.13	1.82	1.64	0.062	0.98	2.74	1.76	<0.001	1.41	2.21	0.78	0.265	0.51	1.20
Income																								
No income																								
<2,000	0.62	0.158	0.31	1.21	0.79	0.299	0.51	1.23	0.39	<0.001	0.26	0.57	1.62	0.202	0.77	3.40	1.06	0.734	0.76	1.48	0.79	0.495	0.41	1.54
2,000-10,000	0.78	0.351	0.47	1.31	1.10	0.528	0.83	1.45	0.29	<0.001	0.22	0.37	3.03	<0.001	1.79	5.11	1.69	<0.001	1.34	2.14	1.10	0.716	0.67	1.79
>10,000	0.51	0.021	0.28	0.90	1.39	0.063	0.98	1.96	0.32	<0.001	0.23	0.46	2.74	<0.001	1.50	5.01	2.01	<0.001	1.47	2.73	0.74	0.311	0.42	1.32
Duration of DM																								
≤ 5 years																								
> 5 years	1.08	0.682	0.75	1.56	0.88	0.276	0.71	1.10	2.20	<0.001	1.77	2.73	0.77	0.110	0.55	1.06	0.78	0.010	0.65	0.94	1.08	0.693	0.74	1.58
Smoking																								
No																								
Yes	0.53	0.020	0.31	0.90	1.30	0.173	0.89	1.91	1.04	0.830	0.70	1.55	1.04	0.897	0.59	1.84	1.48	0.039	1.02	2.14	0.67	0.188	0.37	1.22
Comorbidity																								
No																								
Yes	1.15	0.498	0.77	1.73	1.53	0.002	1.16	2.01	2.20	<0.001	1.64	2.95	1.10	0.619	0.76	1.60	1.44	<0.001	1.16	1.79	1.24	0.310	0.82	1.88
Hospital																								
Samutsakhon																								
Kratumban	0.65	0.044	0.43	0.99	0.53	<0.001	0.39	0.70					16.18	<0.001	7.36	35.57	1.32	0.020	1.04	1.66	0.86	0.504	0.56	1.33
Banpaw	0.99	0.982	0.53	1.86	0.14	<0.001	0.07	0.28	0.10	<0.001	0.06	0.17					0.96	0.785	0.70	1.31	0.87	0.647	0.48	1.58
Srivichai3	1.18	0.686	0.52	2.67	1.26	0.263	0.84	1.90	0.02	<0.001	0.01	0.07	7.35	<0.001	2.62	20.61	0.55	<0.001	0.38	0.80	1.42	0.427	0.60	3.38
Mahachai2	1.54	0.220	0.77	3.09	2.03	<0.001	1.50	2.74	-	<0.001	-	-	69.88	<0.001	31.80	153.54	3.76	<0.001	2.56	5.52	1.99	0.076	0.93	4.25

@ lower level

@@ upper level

Source: Medical records and DM patient data

Table A4. 2 Results of factor associated with standard measuring target of DM

Variable	FPG test (N=1,939)				HbA1C test (N=1,939)				Urine Protein examination (N=1,162)				Eye examination (N=1,728)				Lipid profile test (N= 1,939)				BP measurement (N=1,939)			
	Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-Value	95% CI		Odds ratios	P-value	95% CI	
			LL@	UL@@			LL	UL			LL	UL			LL	UL			LL	UL			LL	UL
Age group																								
-40	1.00																							
1-60	1.34	0.420	0.66	2.72	1.64	0.047	1.01	2.68	1.61	0.205	0.77	3.38	0.85	0.604	0.47	1.55	1.38	0.129	0.91	2.09	1.18	0.681	0.54	2.54
60	2.27	0.049	1.00	5.14	1.59	0.103	0.91	2.78	1.36	0.447	0.62	3.00	1.17	0.672	0.56	2.46	1.52	0.082	0.95	2.43	1.47	0.385	0.61	3.53
Sex																								
lale	1.00																							
emale	1.72	0.009	1.14	2.58	0.93	0.566	0.71	1.20	1.26	0.180	0.90	1.76	1.79	0.007	1.17	2.72	1.29	0.028	1.03	1.62	1.62	0.025	1.06	2.46
larital status																								
ingle	1.00																							
larried	0.96	0.912	0.47	1.98	1.07	0.769	0.68	1.69	0.98	0.946	0.53	1.79	1.73	0.132	0.85	3.54	1.19	0.378	0.81	1.73	1.35	0.377	0.69	2.64
Education																								
Vithout ducation	1.00																							
rimary-achelor	0.72	0.364	0.35	1.48	1.41	0.132	0.90	2.19	1.41	0.112	0.92	2.16	1.23	0.597	0.57	2.63	1.18	0.294	0.87	1.61	0.96	0.899	0.50	1.83
Bachelor	0.61	0.321	0.23	1.63	2.01	0.034	1.05	3.84	2.35	0.040	1.04	5.30	1.95	0.210	0.69	5.56	1.69	0.069	0.96	2.98	0.78	0.606	0.29	2.04
Area																								
rban	1.00																							
ural	1.32	0.155	0.90	1.92	0.99	0.951	0.78	1.26	1.11	0.482	0.83	1.50	1.07	0.709	0.75	1.53	0.93	0.503	0.76	1.14	1.26	0.256	0.85	1.86
Insurance																								
C	1.00																							
SS	1.49	0.262	0.74	2.99	0.79	0.316	0.49	1.26	0.29	0.000	0.18	0.47	1.85	0.165	0.78	4.41	2.95	<0.001	2.03	4.27	1.26	0.520	0.62	2.56
SMBS	0.68	0.124	0.42	1.11	1.91	0.000	1.37	2.66	1.63	0.006	1.15	2.32	1.43	0.245	0.78	2.60	1.47	0.003	1.14	1.90	0.73	0.210	0.45	1.19
Income																								
o income	1.00																							

Variable	FPG test (N=1,939)				HbA1C test (N=1,939)				Urine Protein examination (N=1,162)				Eye examination (N=1,728)				Lipid profile test (N= 1,939)				BP measurement (N=1,939)			
	Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-Value	95% CI		Odds ratios	P-value	95% CI	
			LL@	UL@@			LL	UL			LL	UL			LL	UL			LL	UL			LL	UL
<2,000	0.64	0.220	0.32	1.30	0.99	0.977	0.62	1.58	0.89	0.665	0.54	1.49	0.72	0.447	0.31	1.67	0.97	0.872	0.68	1.39	0.79	0.511	0.40	1.58
2,000-10,000	0.93	0.812	0.53	1.65	0.95	0.766	0.67	1.34	0.85	0.386	0.58	1.23	0.74	0.348	0.39	1.39	1.20	0.199	0.91	1.59	1.11	0.711	0.64	1.94
>10,000	0.93	0.841	0.45	1.91	0.88	0.575	0.56	1.38	0.62	0.101	0.34	1.10	0.62	0.226	0.29	1.34	1.32	0.162	0.89	1.95	1.07	0.858	0.52	2.22
Duration of DM																								
≤ 5 years	1.00																							
> 5 years	1.06	0.755	0.72	1.58	0.90	0.390	0.70	1.15	1.53	0.006	1.13	2.06	1.29	0.180	0.89	1.89	0.87	0.198	0.71	1.07	1.17	0.453	0.78	1.76
Smoking																								
No	1.00																							
Yes	0.71	0.259	0.39	1.29	1.06	0.804	0.69	1.62	2.13	0.015	1.16	3.91	0.88	0.715	0.44	1.74	1.46	0.071	0.97	2.22	0.81	0.537	0.42	1.57
Co-morbidity																								
No	1.00																							
Yes	1.13	0.583	0.73	1.75	1.27	0.119	0.94	1.70	1.68	0.007	1.16	2.44	1.20	0.422	0.77	1.85	1.47	<0.001	1.16	1.86	1.27	0.291	0.82	1.97
Hospital																								
Samutsakhon	1.00																							
Kratumban	0.79	0.315	0.50	1.25	0.47	<0.001	0.34	0.65					20.03	<0.001	8.81	45.54	1.47	0.004	1.13	1.91	1.01	0.976	0.62	1.63
Banpaw	1.10	0.771	0.57	2.13	0.14	<0.001	0.07	0.27	0.08	<0.001	0.05	0.13					1.18	0.334	0.85	1.63	0.98	0.947	0.52	1.83
Srivichai3	1.06	0.912	0.41	2.73	2.05	0.007	1.21	3.47	0.07	<0.001	0.02	0.24	7.51	<0.001	2.26	25.03	0.27	<0.001	0.17	0.43	1.28	0.627	0.47	3.47
Mahachai2	1.52	0.339	0.64	3.59	3.28	<0.001	2.08	5.15	-	<0.001	-	-	81.94	<0.001	29.65	226.42	1.89	0.008	1.18	3.03	1.94	0.156	0.78	4.83

@ lower level

@@ upper level

Source: Medical records and DM patient data

Table A4. 3 Bivariate analysis of different characteristics and achieving intermediate outcomes

Variable	Controlled FPG				Controlled HbA1C				Controlled total triglyceride				Controlled total Cholesterol				Controlled average BP			
	Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI	
			LL@	UL@@			LL	UL			LL	UL			LL	UL			LL	UL
Age group																				
0-40																				
41-60	0.67	0.079	0.43	1.05	0.67	0.355	0.29	1.56	1.02	0.923	0.66	1.57	1.14	0.567	0.74	1.75	1.85	0.002	1.25	2.73
>60	0.38	<0.001	0.24	0.60	0.81	0.622	0.34	1.90	1.14	0.564	0.73	1.76	0.75	0.212	0.48	1.18	1.99	<0.001	1.34	2.96
Sex																				
Male																				
Female	1.18	0.113	0.96	1.45	1.51	0.042	1.01	2.25	0.89	0.333	0.71	1.12	1.22	0.103	0.96	1.54	0.90	0.267	0.74	1.09
Marital status																				
Single																				
Married	0.89	0.537	0.61	1.30	1.78	0.150	0.81	3.90	1.30	0.230	0.85	2.00	0.82	0.384	0.53	1.27	0.98	0.908	0.69	1.39
Education																				
Without education																				
Primary-Bachelor	1.40	0.028	1.04	1.89	1.09	0.827	0.50	2.35	0.78	0.201	0.53	1.14	1.16	0.449	0.79	1.73	0.90	0.453	0.67	1.20
>Bachelor	1.72	0.032	1.05	2.81	1.40	0.507	0.52	3.78	0.94	0.823	0.55	1.61	1.26	0.412	0.73	2.19	0.87	0.543	0.55	1.36
Area																				
Urban																				
Rural	0.80	0.028	0.66	0.98	1.30	0.180	0.88	1.92	0.89	0.290	0.71	1.11	0.82	0.075	0.65	1.02	1.09	0.333	0.91	1.31
Insurance																				
UC																				
SSS	1.75	0.000	1.37	2.24	0.52	0.014	0.31	0.88	0.89	0.409	0.68	1.17	1.00	0.985	0.76	1.31	0.74	0.008	0.59	0.92
CSMBS	1.00	0.974	0.79	1.26	1.01	0.968	0.59	1.72	1.03	0.810	0.78	1.37	0.71	0.019	0.53	0.95	0.96	0.744	0.77	1.20
Income																				
No income																				
<2,000	1.02	0.918	0.71	1.46	1.13	0.771	0.51	2.51	0.92	0.710	0.59	1.43	1.40	0.139	0.90	2.19	0.88	0.474	0.63	1.24
2,000-10,000	1.13	0.349	0.88	1.44	1.01	0.983	0.61	1.67	0.80	0.137	0.60	1.07	1.17	0.307	0.86	1.59	0.81	0.067	0.64	1.02

Variable	Controlled FPG				Controlled HbA1C				Controlled total triglyceride				Controlled total Cholesterol				Controlled average BP			
	Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI	
			LL@	UL@@			LL	UL			LL	UL			LL	UL			LL	UL
>10,000	1.11	0.534	0.81	1.52	0.87	0.646	0.47	1.59	1.10	0.600	0.77	1.58	1.26	0.214	0.87	1.83	0.88	0.403	0.66	1.18
Duration of DM																				
≤ 5 years																				
> 5 years	1.30	0.010	1.07	1.60	1.77	0.005	1.19	2.65	1.09	0.467	0.87	1.36	0.86	0.190	0.68	1.08	0.93	0.419	0.77	1.11
Smoking																				
No																				
Yes	1.41	0.085	0.95	2.09	1.06	0.864	0.55	2.05	1.36	0.128	0.92	2.01	0.76	0.186	0.51	1.14	0.61	0.008	0.43	0.88
Comorbidity																				
No																				
Yes	0.69	0.002	0.54	0.88	1.29	0.318	0.78	2.12	1.62	0.001	1.23	2.12	1.19	0.209	0.91	1.57	2.78	<0.001	2.19	3.52
Hospital																				
Samutsakhon																				
Kratumban	0.57	<0.001	0.46	0.73	0.80	0.426	0.47	1.38	1.10	0.474	0.84	1.45	1.24	0.129	0.94	1.65	0.69	<0.001	0.56	0.87
Banpaw	1.06	0.740	0.75	1.50	-		-	-	2.59	<0.001	1.72	3.90	2.24	<0.001	1.50	3.33	0.38	<0.001	0.27	0.53
Srivichai3	0.98	0.922	0.65	1.47	0.92	0.809	0.45	1.85	1.34	0.271	0.79	2.27	4.52	<0.001	2.52	8.08	0.43	<0.001	0.29	0.64
Mahachai2	1.63	0.007	1.14	2.33	0.27	<0.001	0.16	0.46	1.13	0.451	0.82	1.56	1.61	0.004	1.16	2.22	0.52	<0.001	0.38	0.70

@ lower level

@@ upper level

Source: Medical records and DM patient data

Table A4. 4 Results of factors associated with uncontrolled DM in intermediate outcome

Variable	Controlled FPG (N=1,939)				Controlled HbA1C (N=404)				Controlled total triglyceride (N=1,267)				Controlled total cholesterol (N=1,262)				Controlled average BP (N=1,936)			
	Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI	
			LL@	UL@@			LL	UL			LL	UL			LL	UL			LL	UL
Age group																				
0-40																				
41-60	0.81	0.369	0.50	1.29	0.48	0.129	0.19	1.24	0.85	0.489	0.54	1.34	1.03	0.897	0.65	1.64	1.36	0.155	0.89	2.08
>60	0.47	0.004	0.28	0.79	0.31	0.031	0.11	0.90	0.87	0.599	0.51	1.47	0.73	0.242	0.42	1.24	1.25	0.354	0.78	2.01
Sex																				
Male																				
Female	1.32	0.019	1.05	1.66	1.63	0.051	1.00	2.65	1.00	0.985	0.77	1.31	1.21	0.165	0.92	1.60	0.76	0.012	0.61	0.94
Marital status																				
Single																				
Married	1.10	0.633	0.74	1.64	1.94	0.146	0.79	4.76	1.45	0.111	0.92	2.28	1.02	0.934	0.65	1.61	0.82	0.281	0.56	1.18
Education																				
Without education																				
Primary-Bachelor	1.23	0.213	0.89	1.69	1.34	0.500	0.57	3.16	0.81	0.319	0.54	1.22	1.14	0.533	0.75	1.74	0.94	0.705	0.69	1.29
>Bachelor	1.55	0.134	0.87	2.75	1.58	0.466	0.46	5.39	0.86	0.640	0.46	1.61	1.37	0.333	0.72	2.60	0.85	0.540	0.50	1.44
Area																				
Urban																				
Rural	0.77	0.016	0.63	0.95	1.07	0.758	0.69	1.66	0.97	0.829	0.77	1.23	0.89	0.351	0.70	1.14	0.93	0.452	0.76	1.13
Insurance																				
SSS	1.44	0.061	0.98	2.11	1.17	0.733	0.47	2.95	0.96	0.842	0.64	1.44	0.69	0.074	0.45	1.04	0.86	0.402	0.61	1.22
CSMBS	1.17	0.249	0.90	1.53	1.19	0.606	0.61	2.30	0.93	0.669	0.68	1.28	0.74	0.063	0.53	1.02	0.80	0.087	0.62	1.03
Income																				
No income																				
<2,000	1.35	0.126	0.92	1.98	1.14	0.780	0.46	2.78	0.93	0.752	0.58	1.48	1.44	0.134	0.89	2.31	0.92	0.671	0.64	1.33
2,000-10,000	1.00	0.996	0.75	1.34	1.50	0.215	0.79	2.83	0.86	0.367	0.61	1.20	1.10	0.579	0.78	1.56	0.94	0.653	0.71	1.24

Variable	Controlled FPG (N=1,939)				Controlled HbA1C (N=404)				Controlled total triglyceride (N=1,267)				Controlled total cholesterol (N=1,262)				Controlled average BP (N=1,936)			
	Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI		Odds ratios	P-value	95% CI	
			LL@	UL@@			LL	UL			LL	UL			LL	UL			LL	UL
>10,000	0.99	0.949	0.66	1.47	1.27	0.573	0.55	2.04	1.64	<0.001	1.23	2.19	1.36	0.040	1.01	1.83	2.90	<0.001	2.25	3.73
Hospital																				
Samutsakhon																				
Kratumban	0.58	<0.001	0.45	0.76	0.79	0.436	0.43	1.44	1.12	0.442	0.83	1.52	1.15	0.374	0.84	1.57	0.71	0.007	0.55	0.91
Banpaw	1.05	0.781	0.73	1.51	0.77	0.609	0.28	2.11	2.66	<0.001	1.73	4.10	2.17	<0.001	1.42	3.30	0.35	<0.001	0.24	0.50
Srivichai3	0.64	0.073	0.39	1.04					1.41	0.247	0.79	2.53	4.47	<0.001	2.36	8.44	0.43	<0.001	0.27	0.68
Mahachai2	1.11	0.649	0.71	1.75	0.21	<0.001	0.09	0.51	1.19	0.416	0.79	1.79	1.59	0.029	1.05	2.42	0.50	<0.001	0.34	0.74

@ lower level

@@ upper level

Source: Medical records and DM patient data

Table A4. 5 Bivariate analysis of different characteristics and probability of admission

Variable	Odds ratios	P-value	95% CI	
			LL[@]	UL[@@]
Age group				
0-40				
41-60	1.15	0.706	0.56	2.35
>60	3.58	<0.001	1.78	7.20
Sex				
Male				
Female	1.36	0.043	1.01	1.84
Marital status				
Single				
Married	1.43	0.233	0.79	2.57
Education				
Without education				
Primary-Bachelor	0.81	0.300	0.53	1.21
>Bachelor	0.62	0.182	0.30	1.25
Area				
Urban				
Rural	0.81	0.126	0.62	1.06
Insurance				
UC				
SSS	0.38	<0.001	0.26	0.56
CSMBS	1.13	0.445	0.83	1.52
Income				
No income				
<2,000	1.18	0.443	0.78	1.78
2,000-10,000	0.45	<0.001	0.32	0.62
>10,000	0.37	<0.001	0.23	0.60
Duration of DM				
≤ 5 years				
> 5 years	2.41	<0.001	1.83	3.19
Smoking				
No				
Yes	0.72	0.247	0.41	1.26
Co-morbidity				
No				
Yes	1.70	0.004	1.18	2.43
Hospital				
Samutsakhon				
Kratumban	1.27	0.125	0.94	1.73
Banpaw	0.84	0.476	0.53	1.35
Srivichai3	0.83	0.518	0.47	1.47
Mahachai2	0.08	<0.001	0.03	0.26

[@] lower level
[@@] upper level
Source: Medical records and DM patient data

Table A4. 6 Results of factors associated with probability of admission

Variable	Odds ratios	P-value	95% CI	
			LL[@]	UL[@@]
Age group				
0-40				
41-60	0.74	0.432	0.34	1.58
>60	1.47	0.348	0.66	3.32
Sex				
Male				
Female	1.14	0.465	0.81	1.60
Marital status				
Single				
Married	1.10	0.769	0.59	2.04
Education				
Without education				
Primary-Bachelor	1.31	0.225	0.85	2.02
>Bachelor	1.25	0.596	0.54	2.89
Area				
Urban				
Rural	0.76	0.061	0.56	1.01
Insurance				
UC				
SSS	1.11	0.716	0.63	1.96
CSMBS	1.08	0.680	0.76	1.52
Income				
No income				
<2,000	0.98	0.921	0.62	1.53
2,000-10,000	0.57	0.005	0.39	0.84
>10,000	0.44	0.007	0.24	0.80
Duration of DM				
≤ 5 years				
> 5 years	1.84	<0.001	1.36	2.49
Smoking				
No				
Yes	1.04	0.907	0.55	1.96
Co-morbidity				
No				
Yes	1.56	0.024	1.06	2.30
Hospital				
Samutsakhon				
Kratumban	1.52	0.020	1.07	2.16
Banpaw	0.68	0.135	0.42	1.12
Srivichai3	1.46	0.304	0.71	3.01
Mahachai2	0.14	0.002	0.04	0.50

[@] lower level
[@@] upper level
Source: Medical records and DM patient data

APPENDIX 5: Qualitative data analysis

Table A5. 1 Questionnaire for in-depth interview and focus group

	Questions for DM patient	Questions for provider
Accessibility	• Does the distance to hospital affect access to care? How? • How hospital regulations and services affect utilization? • What is the policy of employer on employee with DM? • What and how regulations from SSO affect utilization of service? • Does hospital has home care service and how about the service? • Does anyone have experience of changing hospital and what are the reasons for changing?	• How hospital provides services for patients in different schemes (special pathway, special clinics)? • How special additional payment affects hospital in providing services e.g. additional pay from SSS for chronic disease? • What is the role of interviewees in the process of DM care?
Process of care	• What are your expectations of care from hospital? • How do you improve your knowledge of your DM? • What are the processes of care you receive when you come to hospital? • What are your ideas about special track for SSS patients when you come to OPD? • What are your ideas about special clinics for DM? • Please explain the services you receive from other departments such as lab, OPD, and physician. • Do you have an experience of service from other hospitals, if you have, can you compare the difference in process of care?	• What is hospital policy on DM patients in different schemes eg. Guideline, drug? • How clinical guidelines affect physician practice? • How doctor fee affect process or result of care in different schemes? (may set interview with doctor who get salary and doctor fee) • Compared to CPG, which process of care is done over guideline and which one under guideline? • Data from health examination survey show that DM patient in SSS more than 70% did not know they were DM. What do you think of them?
Result of quality of care	• Do you have any ideas about the drugs you receive from hospital? • Compared to other schemes, do you have any ideas about drug quality? • Are you satisfied with the services from the hospital and in what aspects? • What are the characteristics of a good quality hospital in your view? • What are your suggestions to improve quality of care in your selected hospital?	• What is good quality service in your view? • How do you follow up the quality of care to DM patients? • What is the process of response to satisfaction or complaints from patients?

APPENDIX 6: Questionnaire and medical record data collection form

Patient data

1. Hospital.....
2. Patient name: .....
3. Date of birth

   .....
4. Sex

☐ Male ☐ Female

5. Address.....

   .....

   .....

   .....
6. Birth province .....
7. Time living at recent address.....
8. Living area

   ☐ in-municipality ☐ out of municipality
9. Marital status

   ☐ Single

   ☐ Married

   ☐ Widow

   ☐ Divorced

   ☐ Separated
10. Education

    ☐ No education

    ☐ Primary school

    ☐ Secondary school

    ☐ Bachelor degree

    ☐ > Master degree
11. Religion

☐ Buddhist ☐ Christian ☐ Islam ☐ No religion ☐ Other.....

12. ID number _ - _ _ _ _ - _ _ _ _ _ - _ _ - _

13. Hospital Number.....

14. Insurance

☐ UC scheme

☐ Social security scheme

☐ Civil servant medical benefit scheme

15. Occupation

☐ No occupation ☐ Merchandise

☐ Employer ☐ Entrepreneur

☐ Private employee ☐ Government officer

☐ State enterprise employee ☐ Other

specify.....

.....

16. Average income.....(Baht).....

17. Average family income.....(Baht).....

18. First diagnosis Diabetes Mellitus.....year.....month

19. Time receiving service in this hospital.....year.....month

20. Admission within last 6 months

☐ No admission

☐ Number of admission.....times

Admission	Hospital	Disease	ICD10	Length of stay
1				
2				
3				
4				
5				
6				

21. Co-morbidity

☐ No co-morbidity

☐ hyperlipidemia Time diagnosis.....year.....month

Received hyperlipidemia drug

☐ receive ☐ not receive

☐ hypertension Time diagnosis.....year.....month

Received hypertension drug

☐ receive ☐ not receive

☐ Coronary heart disease Time diagnosis.....year.....month

Received coronary heart disease drug

☐ receive ☐ not receive

☐ Gout Time diagnosis.....year.....month

Receive Gout drug

☐ receive ☐ not receive

☐ Cataract Time diagnosis.....year.....month

22. Family history

☐ Diabetes Mellitus

☐ Hypertension

☐ Cardiovascular accident

☐ Heart disease

☐ None of these diseases

☐ Do not know

23. Treatment

☐ Diet control

☐ Oral drug name:

I. .....

II. .....

III. .....

IV. .....

☐ insulin injection

☐ oral drug + insulin injection

24. Smoking

☐ Not smoking

☐ Former smoker, now stop smoking.....years since smoked

☐ Smoking.....cigarettes/day

☐ Period of smoking.....years

25. Alcohol drinking (within a month)

□ No alcohol drinking

□ Alcohol drinking

Number of drinks per day.....day/month

Drinking volume per day.....mL

Brand.....

26. Date of recording data.....

Hospital data

27. Services received (check with medical records of hospital)

Process	Unit	Number											
		1	2	3	4	5	6	7	8	9	10	11	12
Date of service													
BW	Kg												
Height	CM												
Fasting plasma glucose (FPG)	Mg/Dl												
Blood pressure (BP) test	mmHG												
Urine analysis (UA) for microalbuminuria	0-4+												
HbA1C measurement	Mg%												
Lipid profile													
-Triglyceride	Mg/Dl												
-Total cholesterol	Mg/Dl												
-HDL-cholesterol	Mg/Dl												
Eye examination													
Appointment date													
Physician name													
Physician's age													
Specialty													
Working time(year)													

28. Admission

Admission	Hospital	Disease	ICD10	Length of stay
1				
2				
3				
4				
5				
6				

APPENDIX 7 Summary of articles on effect of payment on provider behaviour

Author, Year of study	Topic	Research question	intervention	Methodology	Target group	Result
Ray et al. 1990	Mortality following hip fracture before and after implementation of the prospective payment system	The mortality of hip fracture change after implementation prospective payment system	Prospective payment system (PPS) and FFS	Observation before and after implementation of PPS	2130 patient with hip fracture before and 2238 patient after PPS, US	LOS decrease 24% but mortality did not change
Palmer et al. 1989	The impact of the prospective payment system on the treatment of hip fractures in the elderly	The quality of care may deteriorate after implementation of PPS in 1984	PPS and FFS	Observation before and after implementation of PPS	190 pre and 196 post implementation patients from private and non-profit teaching hospital, US	LOS decrease 24%, post op complication reduced, other complication increased
Fitzgerald et al. 1987	Changing patterns of hip fracture care before and after implementation of the prospective payment system	Are there any different in manner and outcome treatment of hip fracture after implementation of PPS	PPS and FFS	Observation before and after implementation of PPS	284 patient of university-affiliated municipal teaching hospital, US	LOS decrease 38%, increase in long term nursing home. Quality of care may be deteriorated.
Coleman et al. 2000	A comparison of functional outcomes after hip fracture in group/staff HMOs and fee-for-service systems	Outcome between capitation and fee-for-service payment are different or not	Capitation and FFS	Prospective cohort study	196 fee-for-service and 140 capitation patient with acute hip fracture, US	There are no different with four outcome.(recovery of daily activity, improvement in ambulation, return to community living, mortality
Mushlin et al. 1988	Quality of care during a community-wide experiment in prospective payment to hospitals	To investigate the access to care and quality of care in prospective payment	PPS and FFS	observation prospective experiment	Data from 9 hospital in Rochester, NY, US	There are no different in quality of three tracers that are ischemic heart disease, Perinatal care, Abdominal condition.

Author, Year of study	Topic	Research question	intervention	Methodology	Target group	Result
Kahn et al. 1990	Comparing outcomes of care before and after implementation of the DRG-based prospective payment system	To evaluate quality outcome in five diseases before and after implementation of DRG	PPS and FFS	Observation before and after implementation of PPS	6856 and 7156 patients pre and post implementation of PPS in five disease that are CHF, AMI, Pneumonia, CVA, hip fracture,	LOS reduced 24%. Overall mortality decreased in-hospital but not different in 180 days post admission.
Brizioli et al. 1996	Hospital payment system based on diagnosis related groups in Italy: early effects on elderly patients with heart failure	To evaluate quality outcome of CHF in DRG system in Italy	PPS and FFS	Observation before and after implementation of PPS	1987 patient with CHF in four hospital in central Italy	LOS was shorter from 13.57 to 11.69. The readmission rate increased from 7.73 to 8.90
Soumerai et al. 1999	Timeliness and quality of care for elderly patients with acute myocardial infarction under health maintenance organization vs. fee-for-service insurance	To compare the quality of emergency care for elderly in HMO and fee-for-service patients	FFS and Capitation	Observation before and after implementation of PPS	2304 elderly patients admitted with AMI in 20 community hospitals, US	No different in timeliness of both patients in HMO and fee-for-service. However, use of transportation and aspirin were higher in patient HMO group.
Erickson et al. 2000	The relationship between managed care insurance and use of lower-mortality hospitals for CABG surgery	To compare the ratio of undergo CABG operation between patient in fee-for-service, managed care, and private managed care	FFS and Capitation	retrospective cohort study	59902 patients were hospitalized for CABG. US	Patients with managed care or private managed care were less likely to use CABG compare to patient with fee-for-service

Author, Year of study	Topic	Research question	intervention	Methodology	Target group	Result
Seddon et al. 2001	Quality of ambulatory care after myocardial infarction among Medicare patients by type of insurance and region	To evaluation of rehabilitation and medication after myocardial infarction compare between HMO and fee-for-service	Fee-for-service and HMO	Observation, survey	520 and 520 patients in HMO and fee-for-service group, US	Patients in both groups were no different in medication. But, among fee-for-service patient, there were increase use of rehabilitation more than HMO group.
Silcox 2003	Quality of care by insurance plan. A fee-for-service versus health maintenance organization comparison	To compare quality outcome of patient with CHF between fee-for-service and HMO group	FFS and Capitation	observation case control	154 patients with primary diagnosis is CHF, US	There is no different in result of quality between two groups.
Manton et al. 1993	Use of Medicare services before and after introduction of the prospective payment system	To evaluate the case-mix adjusted pattern before and after implementation of PPS system	PPS and FFS	Observation before and after implementation of PPS	55000 patient form Medicare file	LOS and admission rate were decrease after PPS. However, mortality did not increase. Home health care was increase among unmarried and disable population.
Lave et al. 1988	The early effects of Medicare's prospective payment system on psychiatry	To explore the quality result, LOS and readmission rate, of PPS payment in psychiatric patient	PPS and FFS	prospective cohort study	202,680 psychiatric patients discharge data in 1984 , US	The LOS was decrease in PPS period. In hospital without psychiatric ward decrease 23.2%, with psychiatric ward fell by 20.4%. There are no different in readmission rate in psychiatric patient. The decrease of LOS was not accompanied by deterioration in quality
Retchin and Brown 1990	The quality of ambulatory care in Medicare health maintenance organizations	To study the HMO patient compare to fee-for-service in term of preventive care	FFS and Capitation	Quasi-experimental, non-randomized controlled trial	1.590 outpatients 777 FFS and 813 HMO, US	Patient in HMO were higher performance in preventive activities than fee-for-service patient.

Author, Year of study	Topic	Research question	intervention	Methodology	Target group	Result
Vernon et al. 1995	Medical outcomes of care for breast cancer among health maintenance organization and fee-for-service patients	To compare the outcome of breast cancer between patient in HMO and fee-for-service	FFS and Capitation	Prospective cohort study	425 patients diagnosis of breast cancer	There are no different in stage of diagnosis, survival rate within two group treated by the same provider.
Tsai et al. 2005	The effect of changing reimbursement policies on quality of in-patient care, from fee-for-service to prospective payment	To examine the effect of changing payment from FFS to prospective payment by using hemorrhoidectomy insurance claim as a tracer.	PPS and FFS	Observation before and after implementation of PPS	23,638 insurance claim	LOS was decreased by 0.59 days, the required services increased by 2.19 to 4.24 items, the optional service item decrease 0.32 items and drug prescription decreased by 0.58 to 0.99 items.
Wells et al. 1994	Quality of care for depressed elderly pre-post prospective payment system: differences in response across treatment settings	To evaluate the quality of care in elderly depressed patient before and after implementation of prospective payment system	PPS and FFS	Observation before and after implementation of PPS	2,746 elderly depressed patient hospitalized in 297 hospitals , the US.	The intensities of care had expanded after PPS was implemented.
Ljunggren and Sjoden 2001	Patient reported quality of care before vs. after the implementation of a diagnosis related groups (DRG) classification and payment system in one Swedish county	To evaluate the effects of PPS in quality of care in patient view in Sweden.	PPS and global budget	Prospective longitudinal design	70 patient in each of two hospitals , Sweden	From the perception of patient, the quality of care had decreased after implementation of PPS payment system.

Author, Year of study	Topic	Research question	intervention	Methodology	Target group	Result
Kangarloo et al. 1996	Effect of conversion from a fee-for-service plan to a capitation reimbursement system on a circumscribed outpatient radiology practice of 20,000 persons	To assess the effect of capitation in outpatient radiology	Capitation and FFS	Observation before and after implementation of capitation	670 patients , US	Conversion of payment can leads to improved quality
Udyarhelyi et al. 1991	Comparison of the quality of ambulatory care for fee-for-service and prepaid patients	To determine whether the quality of care in ambulatory condition	PPS and FFS	Retrospective cohort study	246 patients with chronic uncomplication and 250 women without chronic disease, US	The quality of HM O are was equal to or better
Safran et al. 1994	Primary care performance in fee-for-service and prepaid health care systems. Results from the Medical Outcomes Study	To explore the different in quality of primary care between FFS and PPS payment.	PPS and FFS	longitudinal study	2,546 patients with 303 physicians offices , US	Within three type of health care system FFS, PPS, IPA, the results of each has strength and weakness in seven indicators of primary care quality should be considered to set strategies for implementation.
Kerr et al. 1997	Primary care physicians' satisfaction with quality of care in California capitated medical groups	To evaluate satisfaction of primary care physician in capitated payment to quality of care for their patient in California.	Capitation and FFS	Cross sectional survey	910 primary care physician in 89 groups, US	The primary care physicians reported lower satisfaction with capitated patients and lower satisfied with quality to capitated patient.
Fleetcroft and Cookson 2006	Do the incentive payments in the new NHS contract for primary care reflect likely population health gains?	To explore the fee-for-service payment for wide range activities with population health gain in UK	FFS and capitation	Observatory	8 indicators of point system workloads, UK	There were no relations between pay and health gain across the eight interventions. This finding suggest the danger of reward activities relatively low benefits to population health

Author, Year of study	Topic	Research question	intervention	Methodology	Target group	Result
Balkrishnan et al. 2002	Capitation payment, length of visit, and preventive services: evidence from a national sample of outpatient physicians	To test hypothesis that capitation payment reduces the time of patient and physician and increase use of prevention service.	Capitation and FFS	Cross-sectional analysis	46,320 ambulatory visit, US	Capitated patient receive time with physician 5.6% less than non capitated patient but receive 3% more in preventive service.
Ellis and McGuire 1996	Hospital response to prospective payment: moral hazard, selection, and practice-style effects	To examine the change of hospital treatment resulting from prospective payment	PPS and FFS	Analysis claim data between July 1,1987 and June 30,1992	Four types of hospital in New Hampshire, US	The overall reduction of LOS is 4.5 day attributable to payment reform. The author suggests that -1.8 days is from moral hazard, -3.0 days from practice style effect and overall population slightly sicker for +0.3 days LOS.
Gosden et al. 2003	Paying doctors by salary: a controlled study of general practitioner behaviour in England	To evaluate the impact of salary contract to GP in behaviour and quality of care in UK	Salary and capitation	Observation before and after implementation of salary contract	10 GP from 46 salaried pilot sites, UK	GP in salaried practice spent less time in practice but working more on out of hours. List size is smaller and trend to provide shorter consultation. For quality, there is no statistically significance compare between salaried contract and standard contract.
Akashi et al. 2004	User fees at a public hospital in Cambodia: effects on hospital performance and provider attitudes	To assess the user fee program in National Maternal and Child Health Centre in Cambodia	User Fee and unofficial payment from patient	Observatory data before and after implementation of user fee	National Maternal and Child Health Centre in Cambodia	In quality of care after implementation of user fee, the patient utilization was increase. Evaluation of care from patient view was improved.

Author, Year of study	Topic	Research question	intervention	Methodology	Target group	Result
Broyles 1990	Efficiency, costs, and quality: the New Jersey experience revisited	To compare the effect of payment between per diem and PPS in term of cost and quality of care	Per diem and PPS	Observatory cross sectional study	26 hospital in New Jersey, US	Comparing between DRG and Per diem, how to minimize cost of DRG is minimize cost per case and minimize cost per day for per diem. In quality of care, the evidence on this issue is less conclusive. The report shows that LOS, daily use of radiological procedure per patient, and the volume of radiological procedure per patient reduce.
Shaughessy et al. 1994	Home health care outcomes under capitated and fee-for-service payment	To assess the quality or effectiveness of home health care through payment system between FFS and HMO.	FFS and capitation	RCT	9 HMO-owned, 15 FFS , 14 Mixed HMO and FFS agencies in 18 states were included in the study, US	Visit intensity was in FFS patient, relative to HMO.In particular, moderate outcome was better in mixed HMO and FFS than pured FFS.The result showed that higher number of visit associated with better outcome especially among HMO patient.
Chawla and Ellis 2000	The impact of financing and quality changes on health care demand in Niger	To assess the impact of an experiment health care cost recovery, accompanied by quality improvement in three district in Niger	User fee and indirect payment	RCT	3 District in Niger that implemented the new model of user fee. Using household survey to be the tool for baseline and follow up., Niger	The formal visiting is increase in the district that has a user fee intervention compare to control district. The possibly reason is that it hospital has improved the facility to improve the quality.