ประสิทธิภาพทางเทคนิคและขนาดของโรงพยาบาล ระดับจังหวัดและภูมิภาคประเทศมองโกเลีย

นางสาวแกนตัก ยุนเดนดอร์จ

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
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TECHNICAL AND SCALE EFFICIENCIES OF PROVINCE AND DISTRICT LEVEL HOSPITALS IN MONGOLIA

Miss Gantugs Yundendorj

A Thesis Submitted in Partial Fulfillment of the Requirements

for the Degree of Master of Science Program in Health Economics

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การศึกษานี้มีวัตถุประสงค์ในการแสดงซึ่งหลักฐานเชิงประจักษ์ของความไม่มีประสิทธิภาพของนโยบายสาธารณสุข โดยการวัดเปรียบเทียบประสิทธิภาพของโรงพยาบาลในระดับจังหวัดและระดับภูมิภาคของประเทศมองโกเลีย ในการศึกษาดังกล่าวได้ทำการศึกษาประสิทธิภาพทางเทคนิคและขนาดของโรงพยาบาล ตลอดจนปัจจัยของความไม่มีประสิทธิภาพโดยการวิเคราะห์ข้อมูลของโรงพยาบาลระดับจังหวัดจำนวน 21 โรงพยาบาล และโรงพยาบาลระดับภูมิภาคจำนวน 10 โรงพยาบาล ตั้งแต่ปี พ.ศ. 2546 ถึง พ.ศ. 2548

ในการประเมินประสิทธิภาพทางเทคนิคและขนาดใช้เทคนิคการวิเคราะห์แบบ Data Envelopment Analysis ด้วยการวิเคราะห์ปัจจัยนำเข้าจำนวนสามปัจจัย ได้แก่ จำนวนของแพทย์ จำนวนของพยาบาล และจำนวนของเตียง และปัจจัยนำออกจำนวนสองปัจจัย ได้แก่ จำนวนวันรับการรักษาของผู้ป่วยภายในและจำนวนครั้งของการเข้ารับการ บริการของผู้ป่วยนอก

ในการระบุและประเมินปัจจัยที่กำหนดประสิทธิภาพทางเทคนิคนั้น มีดัชนีชี้วัดโดยการวิเคราะห์คะแนนระสิทธิภาพสำหรับแต่ละโรงพยาบาลในฐานะของตัวแปรที่ถูกกำหนดภายใต้แบบจำลองถดถอยโดยการใช้เทคนิคการวิเคราะห์แบบ Data Envelopment Analysis และตัวแปรอิสระจำนวนสี่ตัวแปรที่มีผลต่อระดับประสิทธิภาพในการดำเนินการให้บริการ ทางสาธารณสุขของโรงพยาบาล อันได้แก่ ระยะเวลาการเข้าพักเฉลี่ย งบประมาณสาธารณสุขต่อหัว จำนวนผู้สูงอายุ และจำนวนของผู้เข้ารับบริการในเขตเมืองและเขตชนบท ในขณะที่การระบุประสิทธิภาพทางขนาดนั้นมีดัชนีชี้วัดโดยการวิเคราะห์คะแนนประสิทธิภาพสำหรับแต่ละโรงพยาบาลในฐานะตัวแปรที่ถูกกำหนดภายใต้แบบจำลองถดถอย และมีตัวแปรอิสระสามตัวแปร อันได้แก่ จำนวนแพทย์ สัดส่วนของแพทย์และพยาบาล จำนวนเตียงของโรงพยาบาลในฐานะของตัวแทนขนาดของโรงพยาบาล

ผลการศึกษาโดยการใช้แบบจำลอง Data Envelopment Analysisในการวิเคราะห์ข้อมูลของโรงพยาบาลระดับจังหวัดและภูมิภาคถึงประสิทธิภาพทางเทคนิคและขนาดโดยเฉลี่ยจาก พ.ศ. 2546 ถึง พ.ศ. 2548 มีคะแนนประสิทธิภาพของโรงพยาบาลระดับจังหวัดตั้งแต่ 0.559 ถึง 1 และมีคะแนนประสิทธิภาพของโรงพยาบาลระดับท้องถิ่นตั้งแต่ 0.768 ถึง 1 สัมประสิทธิ์แสดงจำนวนของผู้ป่วยสูงอายุมีนัยสำคัญในทิศทางตรงกันข้ามกับระดับคะแนนประสิทธิภาพ ซึ่งแสดงให้เห็นว่าจำนวนผู้ป่วยสูงอายุผู้ซึ่งอาศัยอยู่ในพื้นที่มีนัยสำคัญในทิศทางตรงกันข้ามกับประสิทธิภาพของโรงพยาบาล สัมประสิทธิ์ของผู้ป่วยในเขตเมืองมีนัยสำคัญในทิศทางเดียวกันกับระดับคะแนนประสิทธิภาพ ซึ่งแสดงให้เห็นถึงประสิทธิภาพในการดำเนินงานของโรงพยาบาลในเขตเมืองในระดับสูง เช่นเดียวกับจำนวนของแพทย์ที่พบว่ามีมีนัยสำคัญในทิศทางเดียวกันกับระดับคะแนนประสิทธิภาพ ในขณะที่สัดส่วนของแพทย์และพยาบาล และจำนวนเตียงของโรงพยาบาลไม่มีนัยสำคัญกับระดับคะแนนประสิทธิภาพ

สาขาวิชา เศรษฐศาสตร์สาธารณสุข ลายมือชื่อนิสิต...... Gantuya ....

ปีการศึกษา 2549 ลายมือชื่ออาจารย์ที่ปรึกษา.....................

498 58 116 29: MAJOR HEALTH ECONOMICS

KEY WORD: TECHNICAL, SCALE, EFFICIECY, HOSPITAL, MONGOLIA

GANTUGS YUNDENDORJ: TECHNICAL AND SCALE EFFICINCIES OF PROVINCE AND DISTRICT LEVEL HOSPITALS IN MONGOLIA. THESIS ADVISOR: ASSOC. PROF PONGSA PORNCHAIWISESKUL. PhD., 65 pp.

The objective of the study was to provide the empirical evidence of inefficiencies to health policy by measuring efficiencies of province and district level hospitals in Mongolia. To reach the goal first we determined the technical and scale efficiencies of the hospitals and then determine the factors of inefficiencies. There are 21 provincial and 10 district hospitals included in this study with available data for 2003 to 2005.

Data envelopment analysis (DEA) technique was used to assess technical and scale efficiencies. The DEA model was used three inputs and two outputs. Following three physical inputs were used which are number of medical doctor, number of nurse and number of hospital bed. Two outputs we consider were number of inpatient days and number of outpatient visits.

To identify and evaluate factors on technical efficiency, the efficiency score for each hospital, calculated using DEA, was used as the dependent variable in regression model, we include four independent variables representing the factors impact on efficiency performance of the hospitals which are average length of stay, Per capita Health budget, Number of elderly, Urban/Rural. To identify the factors of scale efficiency, the efficiency score was used as the dependent variable in regression model; independent variables are number of medical doctor, ratio of doctor, nurse and number of hospitals bed which are can represent the size of the hospitals.

The DEA models estimated for the period from 2003 to 2005 indicate average technical and scale efficiency scores were ranking from 0.559 to 1 at the provincial hospitals and 0.768 to 1 at the district hospitals. The coefficient of number of elderly has negative and significant, confirming the expectation that a high number of elderly who are living that area is negatively associated with efficiency. The coefficient of urban also has positive and significant impact on the efficiency, expecting that the efficiency performance has high in urban areas. The number of medical doctor has significant and positive association with scale efficiency other two variables which are ratio of medical doctor/nurse and hospital bed was not significant on hospital scale efficiency.

Field of study	Health Economics	Student Signature:...Gantugs...........
Academic Year	2006	Advisor Signature..................

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Abbreviation

DEA	Data envelopment analysis
VRS	Variable Returns to Scale
CRS	Constant returns to scale
TE	Technical efficiency
SE	Scale efficiency
DMU	Decision Making Unit
WHO	World Health Organization
OPD	Number of Outpatient visit
IPD	Nember of Inpatient visit
MD	Medical Doctor

CHAPTER I

INTRODUCTION

1.1 Problem and significance

The health system of Mongolia is characterized by large, overstaffed health institutions. Poor infrastructure and scattered, isolated populations limit individuals' access to care. Due to financial constraints, there are severe shortages of basic equipment and drugs throughout the system.

For nearly 70 years, Mongolia was a socialist republic, heavily subsidized and strongly influenced by the former Soviet Union. In 1990, a peaceful, popular revolution led to Mongolia's transformation to a representative democracy and a free market economy. This transition was extremely painful, with the collapse of state farms, industries, health and education systems, and government social services.

Mongolia is experiencing the health problems associated with both developing and developed countries with a constrained economic base. The large number of hospitals in Ulaanbaatar with suboptimal laboratory, radiology and support services provides a real opportunity for consolidation and economies of scale. In 2003, the World Bank prepared a master plan for hospital restructuring and privatization in Ulaanbaatar. Implementation of the plan and the recommendations of the Asian Development Bank and WHO health system experts have not shown any progress.

Promoting public sector efficiency remains an important concern for many governments. Lacking competitive pressures, traditionally it has been held that the public sector has little inherent incentive to pursue efficient behavior. Increasing emphasis is being placed on measures of efficiency in hospitals to compare their relative performance given the need to ensure the best use of scarce resources.

Aggravating factors affecting the health system include a thin population spread over huge areas, growing patient expectations, problems in cost-effectiveness (a high hospital admission rate of 207 per 1000 population and a average length of stay 10.0 days in 2003). The excessive admissions and long length of stay are thought to be related to the quality of diagnostic and care services and persuasive incentives.

Through the introduction of many significant policy reforms, there is a perception that much remains to be done to establish an efficient, equitable and sustainable health system providing good quality, cost effective health care to all segments of the population. In particular, Mongolians health system is still highly centralized system by world standards.

Mongolian public hospitals are poorly funded and that limited resources are an important factor contributing to the poor quality of care. However, Mongolia is currently a low-income country, and there are many competing uses for limited public resources. There is also a perception that hospitals and curative care generally already absorb too high a share of limited public health funding, while primary care and public health and preventive services are under-funded. Although some increases in public funding for hospitals are likely if currently forecast rates of economic growth (about 6% during the period 2005-2008) are in fact realized, it is unlikely that such increases will be sufficient by themselves to enable significant improvements in the quality of care. However, success in resolving issues of poor-quality, inefficiency and inequity in the use of existing resources may create conditions for significant future increases in government and donor funding.

From the policy maker side, there is options for making system to be more efficient may include:

- Reducing the number of hospitals and hospital beds
- Strengthening the primary health care system
- Removing perverse incentives
- Strengthening the referral system
- Performance-based incentives

On the demand side of health, Mongolia has many hospitals and hospital beds. One reason for inefficient utilization patterns is the availability of so many hospital beds and hospital staff that would otherwise be unoccupied in the absence of excessive rates of hospitalization. There should be ample opportunities for reducing the number of hospital beds and for consolidating services in a smaller number of general hospitals over time. The resulting savings could be used to finance much-needed improvements such as quality of care or to strengthen health services through the system. But from the supply side other word from hospitals side we need to measure and analyze the efficiency of the hospitals and to determine the factors of inefficiency.

In 2002, the provincial and district hospitals consumed 33% of total health spending. During the same period, funding to specialized centers (tertiary level) was 24%, *soum* hospitals and family practices were consumed 18% of the total health expenditure. So the largest amount of money budgeted and spent on the provincial and district hospitals. Furthermore the improvement in efficiency of health service delivery is a challenging issue in Mongolia.

At the end of 2003, surplus of the health insurance fund reached 72% or approximately 14 million US $ of its annual income and likely to rise from year to year. It means we need to seek the ways to encourage hospitals to be efficient, so first step is to study and evaluate the relative efficiency of the hospitals.

1.2 Research question:

Which district or provincial hospitals are the most efficient and how much could inputs/resources be reduced to produce the current output levels? What factors determine the inefficiencies of hospitals?

1.3 Objective:

To provide the empirical evidence of inefficiencies to health policy by measuring efficiencies of province and district level hospitals in Mongolia.

1.4 Specific Objectives

- To determine the technical efficiency of the hospitals
- To determine the scale efficiency of the hospitals
- To determine the factors of efficiencies

1.5 Scope:

There are 21 provincial and 10 district hospitals with available data for 2003 to 2005. Panel data of 31 hospitals, 3 years are used in this study.

1.6 Benefit of this study

This research is expected to help hospital management in the following aspects. Inefficient hospitals should cut their costs by eliminating excess capacity and staff and possibly reducing the number of tests, procedures, and services provided per patient and improve the efficiency, efficient hospitals should save the resources. For example, underutilization of specific resources could be identified from the results. Possible improvement in operation can be indicated. Hospital benchmarking information can be available from such research result will show the competence of specific hospitals. Such information will be helpful to assess the effectiveness of both national health policy and individual hospital management decision in a long-term period, which can add to experience on health care management for future decision making.

CHAPTER II

BACKGROUND OF MONGOLIA AND ITS HEALTH SYSTEM

2.1 Geo-Demography of Mongolia

Mongolia is the world's second-largest landlocked country. It is typically classified as being a part of East Asia, although sometimes it is considered part of Central Asia. It is bordered by Russia to the north and China to the south. Mongolia's political system is parliamentary democracy. Its capital and largest city is Ulaanbaatar.

Mongolia was the center of the Mongol Empire in the thirteenth century and was later ruled by the Manchu Qing Dynasty from the end of the seventeenth century until 1911, when an independent government was formed with Russian assistance. The Mongolian People's Republic was proclaimed in 1924, leading to the adoption of communist policies and a close alignment to the Soviet Union. After the fall of communism in Mongolia in 1990, Mongolia adopted a new, democratic constitution which was ratified in 1992. This officially marked the transition of Mongolia to a democratic country, making it one of the world's youngest democracies.

At 1,564,116 square kilometers, Mongolia is the nineteenth largest country in the world, but also its least densely populated. The country contains very little arable land as much of its area is covered by arid and unproductive steppes with mountains to the north and west and the Gobi Desert to the south. Approximately 30 percent of the country's 2.8 million people are nomadic or semi-nomadic. The predominant religion in Mongolia is Tibetan Buddhism.

2.2 The Economy of Mongolia

Mongolia's economy is centered on agriculture and mining. Mongolia has rich mineral resources, and copper, coal, molybdenum, tin, tungsten, and gold account for a large part of industrial production.

GDP per capita in 2005 was $1,900. Although GDP has risen steadily since 2002 at the rate of 6.2% in an official 2005 estimate, the state is still working to overcome a sizable trade deficit. Despite growth, the proportion of the population below the poverty line is estimated to be 36.1% in 2004, and both the unemployment rate and inflation rate are high at 6.7% and 10.9%, respectively.

According to the household income and expenditure sample surveys of the latest three years, total household income has increased in terms of current prices. According to the results of sample surveys carried out with the purpose of defining household living standards and poverty in 1995, 1998 and 2002-2003, rural areas experience much more poverty than urban areas. However there is a more unequal distribution of income among the population in urban areas.

The percentages of men and women among the economically active population are nearly the same, while women account for a greater share of the registered unemployed. The number of registered unemployed was increasing by 6.7% during 2004, with females accounting for 55.2%. The end of the preferential textile export provisions on 1 January 2004 resulted in some 40 000 additional unemployed, the majority of whom were female. Labour force participation rates are estimated at 64.4% for women and 67.6% for men. Educational enrolment rates at all levels continue to be higher for school-age female than for school-age male. Among the poor, female school enrolment rates greatly exceed those of male while, for the non-poor, female enrolment only marginally exceeds that of males.

Using a low poverty line (approximately US$ 20.00 per month per person), some 36.1% of the population are classified as poor. In urban areas, the poor account for 30%

of the population, while in rural areas they account for 43%. For all of Mongolia, the average consumption per person in 2003 was estimated at less than US$ 30.00 per month. With very harsh winters, poverty and homelessness are life-threatening issues in Mongolia. *Gers* (special small accommodation only used in Mongolia) accommodate 45% of the Mongolian population, with apartments accommodating 20%. Some 43.4% of the population are living in *gers* are estimated to live on less than US$ 20.00 per month, with very limited access to safe water, sanitation and basic infrastructure services. The cost of heating a *ger* is not insignificant for the poor, as the lowest temperature measured in 2005 reached -50C. Inequality, as measured by the Gini coefficient, is 0.33.

As noted in the Household Income and Expenditure Survey (HIES) 2002-2003, spending on health care represents 5% of the average household's consumption, with the non-poor spending more than three times as much as the poor. Expenditure on self-prescribed medicines represents almost half total personal spending on health, and two-thirds of the poors' total health expenditure.

2.3 Health system and trends in Mongolia

Mongolia is experiencing the health problems associated with both developing and developed countries with a constrained economic base. The large number of hospitals in Ulaanbaatar with suboptimal laboratory, radiology and support services provides a real opportunity for consolidation and economies of scale. In 2003, the World Bank prepared a master plan for hospital restructuring and privatization in Ulaanbaatar. Implementation of the plan and the recommendations of the Asian development Bank and WHO health system experts have not shown any progress.

Aggravating factors affecting the health system include a thin population spread over huge areas, growing patient expectations, and an overprovided health system (26.6 physicians and 73.02 beds per 10 000 population in 2003), with problems in cost-effectiveness (a high hospital admission rate of 207 per 1000 population and a average length of stay 10.0 days in 2003). See figure 2.1 and 2.2. The excessive admissions and long length of stay are thought to be related to the quality of diagnostic and care services and persuasive incentives.

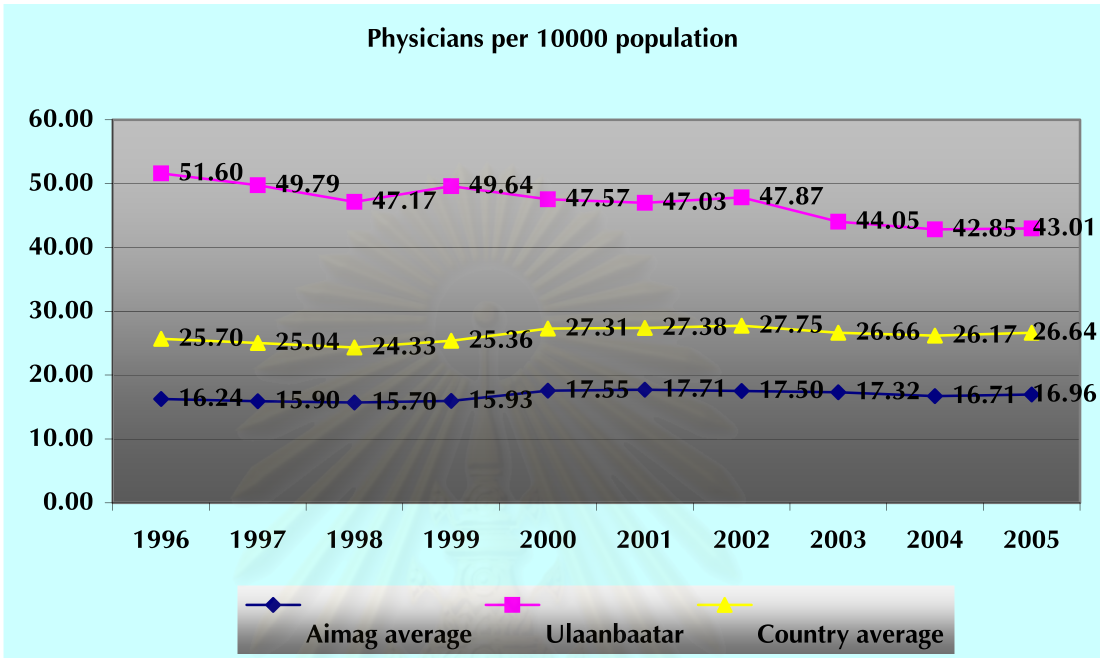

Figure 2.1 Physician per 10 000 population

/Source: NCHD Report 2006/

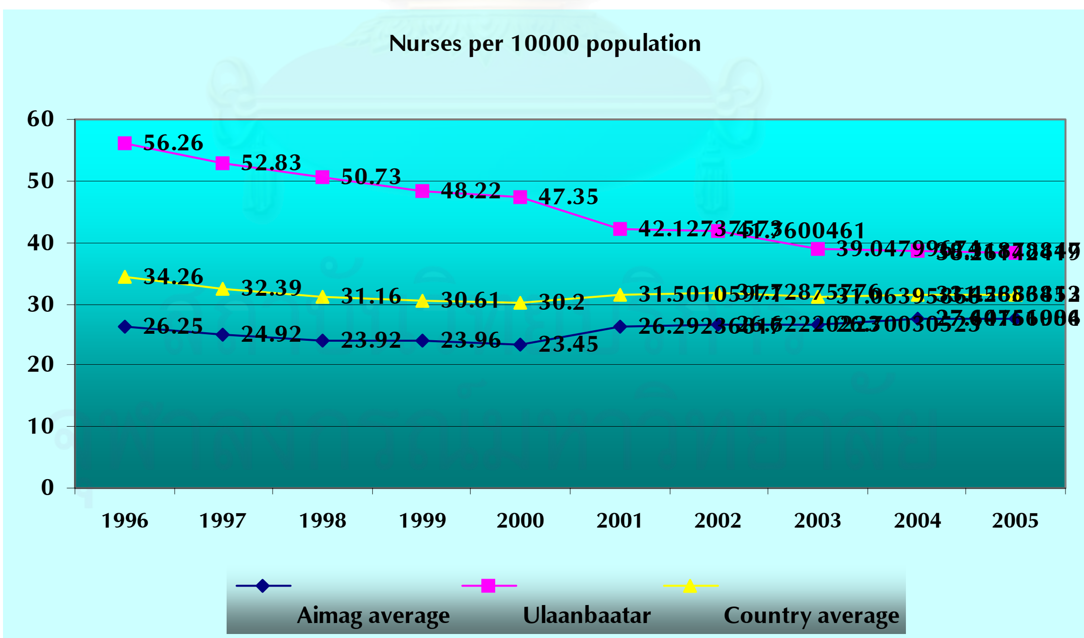

Figure 2.2 Nurses per 10 000 population

/Source: NCHD Report 2006/

In 2003, there were 231 family group practices (FGPs) in Mongolia for the purpose of improving the quality of primary health care and bringing services close to clients. In 2002, the services covered about 55% of population. One family doctor provides health care to 1460 persons (on average), with 3.6 outpatient visits per registered person. Nearly 60% of outpatient visits to family doctors are for preventive check-ups.

In an effort to provide tertiary-level health services on a regional basis, three provincial hospitals were upgraded in 2002 to regional diagnostic and treatment centers, with the objective of also providing specialized services for neighboring provinces. In the last few years, new equipment has been provided and new specialists recruited for these regional centers to improve coverage of the population in remote rural areas and ensure access to quality services. The structure and performance standard for inter-*soum* hospitals were approved in 2001. These hospitals have the mandate of providing higher levels of primary health care to the population of two or more neighboring districts (*soums*). However, the populations served by *soum* hospitals have inadequate access to essential medicines. Additionally, very few *soum* hospitals have running water or acceptable sanitation facilities, and very few have indoor sanitation facilities. Many collect water in containers from unimproved and unprotected water sources.

At the end of 2003, Mongolia had 611 private hospitals and clinics. The private hospitals were increased by 25 during 2004 to reach 161. Most pharmacies are private. Despite the relatively high number of organizations, the private sector is not well developed due to low purchasing power, lack of managerial capacity and a traditionally large public sector. Most private health enterprises are located in the capital city. The number of Mongolians seeking health care in neighboring countries is thought to be increasing as a result of the increased assets of the non-poor and because of poor maintenance and use of diagnostic equipment in Mongolia.

The percentage of GDP spent on health has increased slightly in the last few years, reaching 4.7% in 2002, resulting in per capita health expenditure of US$ 23 per year. The main financing sources are the state budget (64.1% in 2002), health insurance fund (28.5%) and out-of-pocket payments and other sources (7.4%). Donor aid has accounted for about 15%-20% of all health spending during recent years. See the figure 2.3, 2.4 and 2.5.

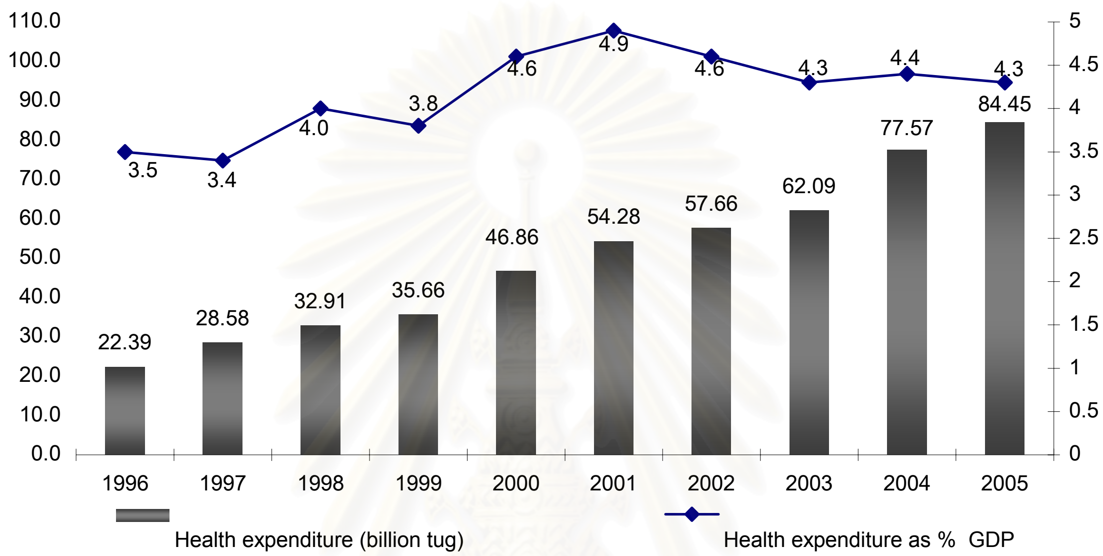

Figure 2.3 Total health expenditure and percentage of GDP

/Source: NCHD Report 2006/

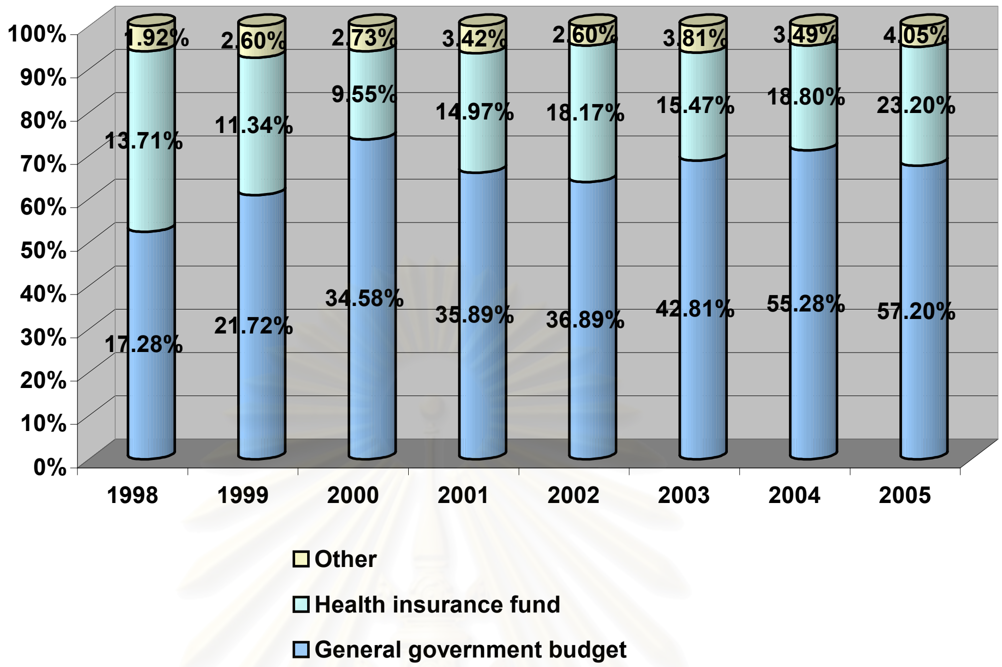

Figure 2.4 Source of Health finance

/Source: NCHD Report 2006/

In 2002, the provincial and district hospitals and the tertiary level centers consumed 54% of health spending, 6% lower than in 1999. During the same period, funding to rural district (*soum*) hospitals and family practices increased by 6.7%, in line with government policies to strengthen primary health care. See the figure 2.5.

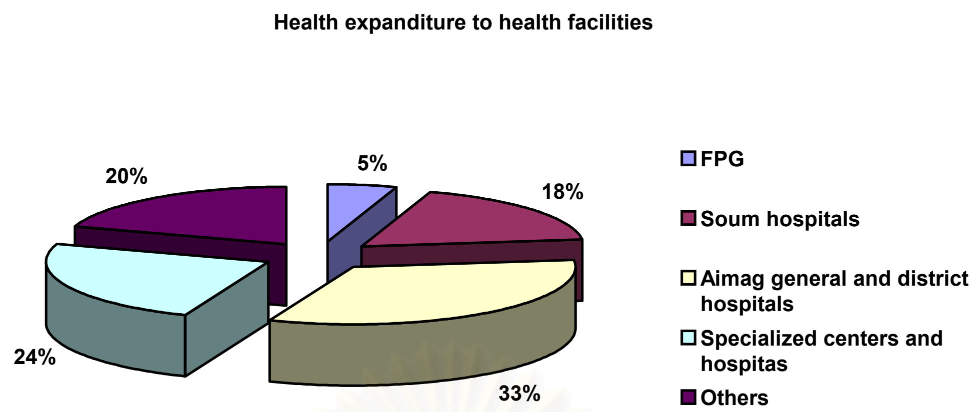

Figure 2.5 Health expenditure (by institution)

/Source: NCHD Report 2004/

Social health insurance (introduced in 1994) covered 80% of population in 2002, with the state subsidizing the premiums for 73% of those insured. Over 90% of health insurance funds are spent on inpatient care, 7% on outpatient care, and about 2% on operational costs.

The health sector is comprised of 17 specialized hospitals and centers, 4 regional diagnostic and treatment centers, 9 district and 21 province general hospitals, 323 soum hospitals, 18 feldsher posts, 233 family group practices, and 536 private hospitals and 57 drug supply companies/pharmacies. In 2002 the total number of health workers was 33273, of which 6823 were doctors, 788 pharmacists, 7802-nurses and 14091 mid-level personnel. At present, there are 27.7 physicians and 75.7 hospital beds per 10.000 population overall. See the table 2.1.

Table 2.1 The number of Health Organizations

	Number	Hospital beds
Primary health care facilities	**571**	**4579**
Soum hospitals	296	3866
Inter soum hospitals	31	713
FGPs	230	0
Secondary health care facilities	**34**	**3644**
Rural general hospitals	4	282
Aimag general hospitals	18	3089
District general hospitals	12	1273
Tertiary health care facilities	**20**	**5815**
Regional Diagnostic and Treatment Centers	3	1635
General and specialized hospitals and centers	17	4180

/Source: NCHD Report 2006/

The high cost of travel for the rural population and especially for poor rural residents serves as a real barrier to their access to basic diagnostic and more advanced health care services.

Excessive maternal mortality is a priority concern of the Ministry of Health. The maternal mortality ratio has been decreasing for the past four years to 98.8 per 100 000 live births in 2004 due to increased government attention, after being relatively stable at the level of 145-176 per 100 000 live births in 1996-2001. Although antenatal care has reached almost universal levels with no rich/poor divide, many rural women do not have physical ease of access to prenatal care.

The infant and under-5 mortality rates have had a four-year downward trend, partially as a result of high immunization coverage (almost 98% for all six EPI vaccines and hepatitis B in 2004). Other contributing actions include well-implemented programs to reduce mortality for diarrhea diseases and respiratory infections and, more recently, the result of extended implementation of integrated management of childhood illness (IMCI) programs. Mongolia, however, still suffers from excessive malnutrition, rickets, anemia and iodine deficiency disorders, and there has been no significant improvement in the nutritional status of children during the last decade.

Mongolia experiences high incidences of cardiovascular diseases, cancer, injuries and mental health problems. Because these non communicable diseases have been accounting for a growing share of all deaths, the Ministry of Health started to plan integrated prevention and control program for NCDs in 2001, with WHO support. In addition, the Parliament has ratified the Framework Convention on Tobacco Control. In 1999, tobacco consumption was excessive, with 56.8% of male's aged 35 to 44 smoking cigarettes daily. Females were less frequent users, with 5.9% smoking daily in 1999.

Injuries, poisoning and other external causes is the third leading cause of death (at 83.9 per 100 000 population in 2003) and the fifth leading cause of outpatient morbidity. Alcohol is estimated to be directly involved in some 33% of all trauma and poisoning cases and in 42% of those in the population aged 18 and above.

Traditional medicine is popular and plays a prominent role in the health care economy. Approximately 1235 drugs and bio-preparations are registered for use in Mongolia. However, it is very difficult for the National Inspection Agency to fully monitor imports to screen for counterfeit and unregistered drugs.

"A public health culture dominated by hospitals has left the country with unequal access to quality health services, particularly in rural areas, where there is also a shortage of doctors and other qualified health workers, mostly dilapidated health facilities, and a lack of basic equipment and supplies," said Takako Yasukawa, an ADB Health Specialist.

But resistance is strong to reducing the number of beds and hospitals, not only among health staff and government officials, but also the public, who have become accustomed to spending time in hospital for even minor ailments. The efficiency of the health sector is also hampered by overstaffing and poor staff distribution. There are basically too many doctors based around Ulaanbaatar. Incentives have to be provided for medical staff to stay in rural and remote areas.

Mortality rates are consistently higher in rural than urban areas, indicating that rural Mongolians have not benefited equally from health service improvement.

Major obstacles to attracting and retaining qualified health staff in the rural areas are isolation, the small size of medical practices (reflecting low population density), and lack of up of up-to-date technology, and scant transportation and communications.

Local health centers and hospitals, train health system staff at all levels to improve service delivery, and promote payment arrangements that increase the amount of attention given to the poor. These include a capitation payment, under which service providers receive payment based on the number of population they are responsible for taking care of. The monitoring system that is set up concurrently monitor's actual use of services by the poor and assesses if service providers fill their pro-poor duties as defined in capitation payment contracts. A capitation payment mechanism, contracts and a monitoring system are the tools to ensure needy people's access to, and use of, health services.

On a national as well as provincial and district level, it will strengthen institutional capacity in planning, budgeting, staffing management, evaluation, and coordination. Transparent and accountable management who are well trained will ensure that quality services are delivered to those who need it most, the poor and vulnerable. Changes in management must keep pace with the better services and improvements at grassroots level. That is essential if, in the long term, the country is going to successfully redirect resources to health promotion and disease prevention and quality primary health care.

The quality approach, utilizing continuous improvement processes, is widely recognized as a vehicle for better outcomes in health care. In Mongolia, quality health systems have historically been poorly developed. Within the context of overall health reform, Mongolia has been emphasizing the development of quality systems to improve management, efficiency and clinical outcomes and processes. Mongolia has established a framework for quality assurance with the central Ministry of Health taking a lead role in developing and promulgating materials and organizing training. The focus has been on creating a governing system for quality in the health system with processes instituted at the hospital level and upwards in the health structure. In addition, the Mongolian framework has developed a range of indicators to guide the quality process. The commitment to quality is an integral part of comprehensive reform of the health sector in Mongolia and the principles of the quality approach - continuous improvement, customer focus, involvement of stakeholders, and among others - are currently being implemented across the health sector.

Health policy in Mongolia is based on the provision of universal access to health services. A nationwide network of public hospitals, providing curative services free of charge has been developed historically, and priority given to curative and hospital services (with targets and indicators set accordingly).

Clearly, the existing network of hospitals is not economically sustainable and from a technical point of view does not represent the most cost-effective health care delivery system. The current situation in Mongolia reflects past health policy; patients access specialist services directly often appearing without appointment to the specialist in his office or hospital clinic; hospital beds are used inefficiently with many inappropriate admissions which could be managed more efficiently in a community or ambulatory setting; lengths of stay are unjustifiably long.

As part of the reform process, the hospital sector still needs to be reviewed and rationalized with the aim of creating a more efficient and cost effective hospital system. This major aim is still to be addressed.

The pressure on the hospital could be maintained by developing Performance Agreements with hospital management, explicitly specifying the need to control/restrict inappropriate admissions. The onus would therefore be on management to introduce policies to reduce/eliminate inappropriate admissions and to educate clinicians on clinical standards and protocols to guide admission to specialist services.

CHAPTER III
LITERATURE REVIEW

3.1 Concept of efficiency

Modern efficiency measurement begins with Farrell (1957) who drew upon the work of Debren (1951) and Koopmans (1951) to define a simple measure of firm efficiency which could account for multiple inputs. He proposed that the efficiency of a firm consists of two components; technical efficiency, which reflects the ability of a firm to obtain maximal output from given set if inputs, and allocative efficiency, which reflects the ability of a firm to use the inputs in optimal proportions, given their respective prices. These two measures are then combined to provide measure of total economic efficiency.

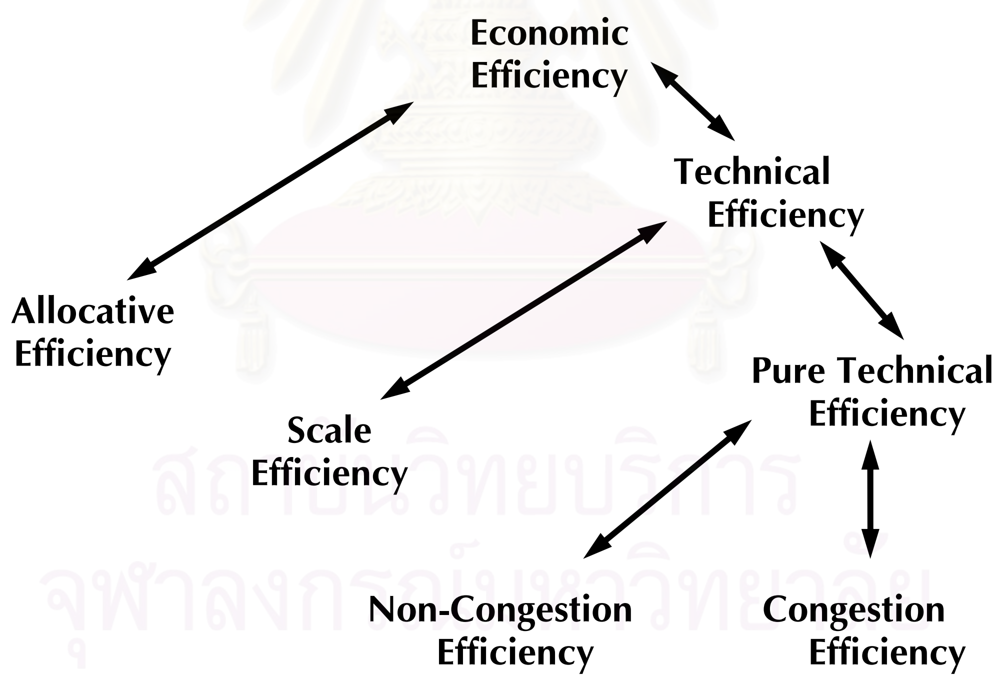

Figure: 3.1 Types of economic efficiency

Productive efficiency refer producing the maximum quantity of output with a given quantity of inputs, or equivalently, producing a given quantity of output with the minimum quantity of inputs. Some time called technological efficiency.

Technical efficiency; The more usual definition on books that it means production of maximum quantity of output for a given value of a set of inputs or the production of given quantity of output produced with the least cost set of inputs. Sometimes called cost efficiency or operational efficiency.

Social efficiency is the change in the allocation of resources is considered to be socially efficient if the total benefits of those who gain outweigh the total losses of those who lose. Again it is the values of outputs and inputs that are considered.

Efficiency is defined as the ratio of the observed level of attainment of a goal to the maximum that could have been achieved with the observed resources. Normally, outputs are zero when inputs are zero. In health, however, health levels would not be zero if there were no health expenditures that is, no health systems. So to measure the contribution of the health system we have to determine what it achieves in excess of what would be achieved in its absence (the minimum). Accordingly, we define performance as the current level of population health, in excess of the estimated minimum, compared with the maximum achievable level of health given the inputs. Because of the similarity between performance and efficiency, we use the terms interchangeably.

Neither the maximum (frontier) nor the minimum levels of health are observable, so they have to be estimated. Two strategies could be used for estimating the maximum. One involves defining feasible interventions, identifying their costs and outcomes, and choosing those that maximize health for the available resources.

3.2 Hospital efficiency

In health care system, researchers measured outputs in terms of “number of treatment provided” or “number of in patient days”. However, these are only intermediate outputs. Effectiveness is concerned with the degree to which outputs (treatment) produce improved outcomes for the patients. In health care the issue of effectiveness is of crucial importance when considering efficiency.

Hospital managers in provider units are likely to focus on costs efficiency; tried to find ways of reducing the cost without reducing activity levels, or increasing activity levels without significantly increasing cost.

3.3 Previous study on hospital efficiency

Valdmanis (1990) applied the data envelopment technique to the estimate technical inefficiency in two groups of hospital in 1982, one representing 33 nonprofits and the other 8 public hospitals in Michigan. His measures indicated that the nonprofits achieved on 86,6 percent of technically efficient use of inputs while the public hospitals performed better, achieving 98.5 percent or very near frontier efficiency.

Register and Bruning (1987) also applied the data envelopment method, in this case to a sample of U.S hospitals including 300 nonprofits, 36 public, and 121 for-profit hospitals. These authors found a somewhat lower level of technical efficiency on average for the entire sample than did Valdmanis. Average efficiency for the Register and Bruning sample was 72.4 percent. These authors further found that there was no significant difference between hospitals by type of organization: nonprofits, for-profits, and government hospitals. They also found that competition levels, as measured by firm concentration ratios, had no significant effect on technical efficiency.

The study of hospitals efficiency in Italy, 2000, found policy makers are increasingly interested in developing performance indicators that measure hospital efficiency. These indicators may give the purchasers of health services an additional regulatory tool to contain health expenditure. They using panel data, this study compares different parametric (econometric) and non-parametric (linear programming) techniques for the measurement of a hospital's technical efficiency. The comparison was made using a sample of 17 Italian hospitals in the years 1996-9. The result was highest correlations are found in the efficiency scores between the non-parametric data envelopment analysis under the constant returns to scale assumption (DEA-CRS) and several parametric models. Correlation reduces markedly when using more flexible non-parametric specifications such as data envelopment analysis under the variable returns to scale assumption (DEA-VRS) and the free disposal hull (FDH) model. Correlation also generally reduces when moving from one output to two-output specifications. This analysis was suggest that there is scope for developing performance indicators at hospital level using panel data, but it is important that extensive sensitivity analysis is carried out if purchasers wish to make use of these indicators in practice.

As Allen et al (1997) pointed out the flexibility of DEA may be brought into question when it is considered that the correct evaluation of the relative efficiency of hospitals may require the consideration of the value judgments which can restrict the acceptable ranges of variation of the input and output weights. These ranges can vary according to the perspective of the analysis. At one extreme, a hospital management perspective can be adopted.

The study of hospitals efficiency in UK, 2000, found there has been increasing interest in the ability of different methods to rank efficient hospitals over their efficient counterparts. The UK Department of Health has used three cost indices to benchmark NHS Trusts. This study uses the same dataset and compares the efficiency rankings from the cot indices with those obtained using Data Envelopment Analysis and Stochastic Cost Frontier Analysis. The study concludes that each method has particular strengths and weaknesses and potentially measure different aspect of efficiency. Several specifications should be used to develop ranges of inefficiency to ac as signaling devices rather than point estimates. There appears to be a large amount of random "noise" in the study which suggests that there are not truly large efficiency differences between Trusts, and savings from bringing up pooper performance would in fact be very modest.

3.4 Method to access efficiency

Data Envelopment Analysis (DEA) is a nonparametric method in operations research and econometrics for multivariate frontier estimation and ranking.

Among the different solutions, we can find a nonparametric method called Data Envelopment Analysis (DEA), which is a linear programming methodology to measure the efficiency of multiple Decision Maker Units (DMUs) when the production process presents a structure of multiple inputs and outputs.

Some of the benefits of it are:

- (i)There is no need to explicitly specify a mathematical form for the production function.
- (ii) It has proven to be useful in uncovering relationships that remain hidden for other methodologies.
- (iii)Capable of handling multiple inputs and outputs.
- (iv)It can be used with any input-output measurement.
- (v)The sources of inefficiency can be analyzed and quantified for every evaluated unit.

With the intention of being consistent with microeconomic production theory and when being conscious of the existence of inefficiencies in the production processes, frontier techniques have been developed during the last 30 years.

Evidence from empirical analysis of hospital efficiency using DEA several times on the same set of data, Grosskopf and Valmanis suggest that public hospitals are more technically efficient than are nonprofit and private ones. Also using DEA, found no differences between nonprofit and public hospitals when comparing technical efficiency. Ozsan, Luke and Haksever and Ozkan and Luke observed that US government hospitals tend to be more efficient, and for profit hospitals less efficient, than other hospitals. Chirikos and Sear conclude that for-profit hospitals are technically less efficient when they perform in less competitive markets.

In the DEA methodology, formerly developed by Charnes, Cooper and Rhodes (1978), efficiency is defined as a weighted sum of outputs to a weighted sum of inputs, where the weights structure is calculated by means of mathematical programming and constant returns to scale are assumed. In 1984, Banker, Charnes and Cooper developed a model with variable returns to scale.

Data Envelopment Analysis (DEA) has been recognized as a valuable analytical research instrument and a practical decision support tool. DEA has been credited for not requiring a complete specification for the functional form of the production frontier nor the distribution of inefficient deviations from the frontier. Rather, DEA requires general production and distribution assumptions only. However, if those assumptions are too weak, inefficiency levels may be systematically underestimated in small samples. In addition, erroneous assumptions may cause inconsistency with a bias over the frontier. Therefore, the ability to alter, test and select production assumptions is essential in conducting DEA-based research. However, the DEA models currently available offer a limited variety of alternative production assumptions only.

The traditional DEA framework:

In DEA, the performance of decision making units (henceforth DMUs) is evaluated against an empirical approximation for the production possibility set (henceforth PPS). The PPS is defined as the set of all combinations of inputs and outputs that are attainable given the current production technology. P= {(y, x): y can be produced from x} That set is approximated using a set of observations on inputs and outputs for n DMUs (j=1,…,n). The standard Charnes, Cooper and Rhodes (1978) model is based on the assumption that the true production technology is characterized by constant returns-to-scale (henceforth CRS). For each evaluated DMU, a reference unit is selected from the approximating set. These reference units can be used for efficiency estimation and performance benchmarking purposes. The input-output combination of the evaluated unit relative to that of the reference unit can be used for evaluating the efficiency of past operations and for assessing potential improvements for future operations. The units that constitute the reference unit are potential benchmark partners. In addition, comparing the production process of the evaluated unit with that of the benchmark partners can reveal causes for past inefficiencies and remedies for future improvements. Whereas the structure of the approximating set depends on the assumptions imposed on the production technology and the distribution of observations, the selection of a particular reference unit from that set depends on the preferences of the evaluating manager. It is generally difficult to reliably elicit managerial preferences, and moreover properly incorporate preferences in an optimization problem. However, using certain assumptions about the general characteristics of the preference structure, the decision problem can be simplified. An assumption that is implicit in most DEA models is that the evaluator prefers more over less for the referencing outputs and less over more for the inputs. In our opinion, that is a valid assumption, because the purpose of the reference units is to assess inefficiency and potential performance improvements relative to the production possibilities, and moreover a unit gives a better representation of those possibilities if its outputs are higher and its inputs are lower. If the above assumption holds, all composite units that are dominated by other units, i.e. units that produce more output with the or less input or alternatively consume less input for equal or more output, can be discarded as decision alternatives. Only non-dominated units have to be considered as potential reference units. We will refer to those units as the CCR admissible set.

DEA constructs a piece-wise linear-segmented efficiency frontier based on best practice, with no assumption about the underlying technology but no scope for random error, making it more vulnerable to data errors. DEA has the advantages that it is able to manage complex production environments with multiple input and output technologies like hospitals, bur being a non-statistical method is does not produce the usual diagnostic tools with which to judge the goodness-of-fit of the model specifications produced.

SCF and DEA models can be compared if certain assumptions are made, such as there are no allocative inefficiencies. SCF inefficiencies can then be compared directly to those obtained from DEA. Such a study has been done by Banker, Conrad and Strauss (1986) which paid particular attention to whether there were any similarities between the two approaches in ascertaining returns to scale and technical inefficiencies. The pattern of results on the two methods, though not identical, was generally similar. When scale and technical efficiencies were combined for DEA, the two methods showed broadly similar efficiency scores. However, they argued that the methods might be sensitive to outliers and possible specification, measurement and data errors which could confound comparisons. Thus the verdict still seems to be out as to the degree of convergence between efficiency scores from the different techniques and their relative merits in measuring this.

The inefficiency measured by stochastic frontier analysis may be a combination of technical and allocative inefficiency and without further assumptions the method is unable to separate the two sources (Kooreman, 1994). The distinction between allocative and technical efficiency is important, as they require different policy responses.

The original Charnes, Cooper and Rhodes (1978) paper considered an input-oriented, constant return to scale (CRS) specification, with additional modifications to the methodology including a variable return to scale (VRS) model and an output-oriented model. The Charnes, Cooper and Rhodes (1978) paper reformulated Farrell's original ideas into a mathematical programming problem, allowing the calculation of an efficiency "score" for each observation in the sample. This score is defined as the percentage reduction in the use of all inputs that can be achieved to make an observation comparable with the best, similar observations in the sample with no reduction in the amount of output.

DEA technique was first used to study hospital production in 1986 (Banker, Conrad and Strauss) using data from a sample of hospitals in the US, followed by Grosskopf and Valdmanis in 1987. A number of more recent studies have also employed DEA to measure hospitals efficiency, Magnussen (1996), Hollingsworth and Parkin (1995), Ferrier and Valdmanis (1996), Parkin and Hollingsworth (1997) and Rosenman, Siddharthan and Ahern (1997). In Norway, Biorn, Hagen, Iversen and Magnussen (2002) measure technical efficiency of hospitals to test the hypothesis that hospital efficiency is expected to be greater with activity based funding of hospitals than with fixed budgets. In Northern Ireland, McKillop et al (1999) estimated the technical efficiency of all hospitals.

CHAPTER IV

RESEARCH METHODOLOGY

4.1 Measuring hospital efficiency with DEA

The first is Data Envelopment Analysis (DEA), a linear programming method which enables the measurement of efficiency consistent with the theoretically based concept of production efficiency. DEA typically examines the relationship between inputs to a production process (resources used in a hospital) and the outputs of that process (for example number of patients treated in hospitals). In other words, DEA examines the question: "By how much can input be reduced without changing the output quantities".

DEA can be powerful tool when used widely. A few of the characteristics that make it powerful are:

- DEA can handle multiple input and multiple output models.
- It doesn't require an assumption of a functional from relating inputs to outputs.
- DMUs are directly compared against a peer or combination of peers.

The same characteristics that make DEA powerful tool can also create problems.

- Since DEA is an extreme point technique, noise (even symmetrical noise with zero mean) such as measurement error can cause significant problems.
- DEA is a good at estimating "relative" efficiency of DMU but it converges very slowly to "absolute" efficiency. In other words, it can tell you how you are doing compared to your peers but not compared to a "theoretical maximum"
- Since DEA is a nonparametric technique, statistical hypothesis tests are difficult and are the focus of ongoing research.

- Since a standard formulation of DEA creates a separate linear program for each DMU, large problems can be computationally intensive.

The best way to introduce DEA is via the *ratio* form. For each DMU we would like to obtain a measure of the ratio of all outputs over all inputs, such as $\mathbf{u}'\mathbf{y}_i/\mathbf{v}'\mathbf{x}_i$, where $\mathbf{u}$ is an $\mathbf{M\times l}$ vector of output weights and $\mathbf{v}$ is a $\mathbf{K\times l}$ vector of input weights. To select optimal weights we specify the mathematical programming problem:

$$\max_{u,v} (\mathbf{u}'\mathbf{y}_i/\mathbf{v}'\mathbf{x}_i)$$

$$\text{subject to} \quad (\mathbf{u}'\mathbf{y}_j/\mathbf{v}'\mathbf{x}_j) \leq 1, \quad j=1,2,\ldots, N,$$

$$\mathbf{u}, \mathbf{v} \geq 0 \qquad (1)$$

This involves finding values for $\mathbf{u}$ and $\mathbf{v}$, such that the efficiency measure of the i-th DMU is maximised, subject to the constraint that all efficiency measures must be less than or equal to one. One problem with this particular ratio formulation is that it has an infinite number of solutions. To avoid this one can impose the constraint $\mathbf{v}'\mathbf{x}_i = 1$, which provides:

$$\max_{\mu,v} (\mu'\mathbf{y}_i)$$

$$\text{subject to} \quad \mathbf{v}'\mathbf{x}_i = 1,$$

$$\mu'\mathbf{y}_j - \mathbf{v}'\mathbf{x}_j \leq 0, \quad j=1, 2, \ldots, N$$

$$\mu, \mathbf{v} \geq 0, \qquad (2)$$

where the notation change from $\mathbf{u}$ and $\mathbf{v}$ to $\boldsymbol{\mu}$ and $\mathbf{v}$ reflects the transformation. This form is known as the multiplier form of the linear programming problem.

Using the duality in linear programming, one can derive an equivalent envelopment form of this problem:

$$\min_{\theta,\lambda} \theta,$$

subject to

$$-y_i + Y\lambda \geq 0,$$

$$\theta x_i - X\lambda \geq 0,$$

$$\lambda \geq 0, \qquad (3)$$

where θ is a scalar and λ is a Nxl vector of constants. This envelopment form involves fewer constraints than the multiplier form (K+M < N+l), and hence is generally the preferred form to solve. The value of θ obtained will be the efficiency score for the i-th DMU. It will satisfy $\theta \leq 1$, with a value of 1 indicating a point on the frontier and hence technically efficient DMU, according to the Farrell (1957) definition and the linear programming problem must be solved N times, once for each DMU in the sample. A value of θ is then obtained for each DMU.

The CRS assumption is only appropriate when all DMU's are operating at an optimal scale (i.e one corresponding to the flat portion of the LRAC curve). Imperfect competition, constraints on finance, etc. may cause a DMU to be not operating at optimal scale. Banker, Charnes and Cooper(1984) suggested an extension of the CRS DEA model to account for variable returns to scale (VRS) situations. The use of the CRS specification when not all DMU's are operating at the optimal scale, will result in measures of TE which are confounded by scale efficiencies (SE). The use of the VRS specification will permit the calculation of TE devoid of these SE effects.

The CRS linear programming problem can be easily modified to account for VRS by adding the convexity constraint: $N1'\lambda = 1$ to (3) to provide:

$$\min_{\theta,\lambda} \theta,$$

$$\begin{aligned} \text{subject to} \quad & -y_i + Y\lambda \geq 0, \\ & \theta x_i - X\lambda \geq 0, \\ & N1'\lambda = 1, \\ & \lambda \geq 0, \end{aligned} \tag{4}$$

where Nl is an Nxl vector of ones. This approach forms a convex hull of intersecting planes which envelope the data points more tightly than the CRS conical hull and thus provides technical efficiency scores which are greater than or equal to those obtained using the CRS model.

Many studies have decomposed the TE scores obtained from a CRS DEA into two components, one due to scale inefficiency and one due to "pure" technical inefficiency. This may be done by conducting both a CRS and a VRS DEA upon the same data. If there is a difference in the two TE scores for a particular DMU, then this indicates that the DMU has scale inefficiency, and that the scale inefficiency can be calculated from the difference between the VRS TE score and the CRS TE score.

$$TE_{CRS} = TE_{VRS} * SE \tag{5}$$

The DEA weights provide particularly important about the implicit choices made by each hospital in order to appear as efficient as possible in relation to the others. Making the weight attachment process endogenous can thus lead to different input and output weights depending on which hospital is considered. This is one of the strengths of DEA but, at the same time, it is also one of its weaknesses. It is a strength because if a given hospital if found to be inefficient even when the most favorable weights are applied for measuring its efficiency, then there are reasonable grounds to classify it as inefficient. In fact, despite the best weights being selected to maximize its efficiency, a score $e_j < 1$ indicates that a more efficient linear combination of other hospitals exists. It is a weakness because each hospital can obtain a high level of efficiency by choosing the most suitable weights. Hence the efficiency scores calculated for the various decision making unit are not properly comparable as they derive from different weighting process. In this way, however, outliers that focus on just one output (input) while neglecting the rest may appear to be efficient (O'Neill, 1999).

4.2 The Model

All public sector secondary level hospitals (N = 31) were included in the study. Data envelopment analysis (DEA) technique was used to assess technical and scale efficiency. The DEA model used three inputs and two outputs. Panel data for three financial years (2003, 2004 and 2005) was used for the analysis.

The measurement of efficiency in healthcare is a difficult exercise for various reasons including the complex nature of the productive process and difficulty in measuring the ideal output of the sector, i.e. improved health status.

Technical efficiency attempts to address two questions depending on whether it has input- or output-orientation. In output-oriented technical efficiency the focus is on expanding output quantities without changing the quantity of inputs used. On the other hand, input-oriented technical efficiency focuses on reducing input quantities used without changing the quantity of outputs produced.

Inappropriate size of a hospital (too large or too small) may sometimes be a cause for technical inefficiency. This is referred to as scale inefficiency and takes two forms – decreasing returns to scale and increasing returns to scale.

The performance of hospitals may be measured using ratios that mainly measure capacity utilization and frontier techniques founded on micro-economic theory of production. Commonly used ratios include: bed occupancy rate, turnover ratio, turnover interval and average length of stay. Frontier methods of efficiency measurement include linear programming techniques (e.g. data envelopment analysis) and econometric techniques (e.g. production and cost functions). The current study employs data envelopment analysis.

In DEA the efficiency of an organization (district and province hospitals in this case) is measured relative to a group's observed best practice. This implies that the benchmark against which to compare the efficiency of a particular hospital is determined by the group of hospitals in the study and not a value fixed by hospitals outside of the group.

The basic DEA model helps to find answers to questions such as:

(i) Which province or district hospitals are the most efficient?

(ii) If all province and district (secondary level) hospitals are to perform according to best practice (i.e. the efficient peer hospitals), by how much could inputs/resources be reduced to produce the current output levels?

DEA easily accommodates multiple inputs and outputs without the requirement for a common denominator of measurement. This makes it particularly suitable for analyzing the efficiency of hospitals as they use multiple inputs to produce many outputs. Furthermore, it provides specific input and output targets that would make an inefficient hospital relatively efficient. It also identifies efficient peers for those hospitals that are not efficient. This helps the inefficient hospitals to emulate the functional organization of their peers so as to improve their efficiency.

However, like many other empirical methods, DEA has its limitations. First, it produces results that are sensitive to measurement error. For example, if one hospital's inputs are understated or its outputs overstated, it can become an outlier and significantly reduce the efficiency of other hospitals. Second, DEA measures efficiency relative to the best practice within hospitals in the particular sample. Therefore, it is not possible to compare how province and district (secondary level) hospitals in Mongolia perform to those in any other country.

Following three physical inputs were use:

- (i) Number of patient beds
- (ii) Number of physicians
- (iii) Number of nurses

The two outputs we consider were:

- (i) Number of patient days
- (ii) Number outpatient visits

Explanatory variables were:

- (i) Average length of stay
- (ii) Per capita Health budget
- (iii) Number of elderly
- (iv) Urban/Rural

The input–output variable selection in DEA is usually guided by expert opinion, past experience and economic theory and there are no diagnostic checks for model misspecification which is most serious when relevant variables are omitted rather than when irrelevant ones are included. Furthermore, in DEA it is typically required that the sample size is at least three times the number of variables used to characterize production. In our case, the relatively small sample forced us to adopt a simple production model, despite the availability of more detailed data. Because our objective is to measure technical and scale efficiency, we designated as inputs each facility's medical and nursing staff as the main service providers and the number of beds to reflect the capacity to offer care. Two outputs were selected to reflect the overall responsibilities of the hospitals. The outputs were assumed to be non-discretionary, i.e. the hospitals have no control over the number of patients they treat. It is more appropriate to assume that they have control over the utilization of resources and therefore an input-oriented DEA model was adopted.

4.3 Data analysis

The technical efficiency scores are computed using data envelopment analysis programme, version 2.1 (DEAP 2.1) designed by Coelli.

Input-oriented model was used in this study, as we think that the decision is to use decrease the inputs.

4.4 Regression analysis

To identify and evaluate factors on efficiency, the efficiency score for each hospital, calculated using DEA, is used as the dependent variable in regression model, we include four independent variables representing the factors impact on efficiency performance of the hospitals in Mongolia.

We have following hypotheses:

H1: Average length of stay has a positive association with efficiency.

H2: Health budget per head each province and district have positive association with efficiency.

H3: Number of elderly may have negative factor of the hospitals efficiency performance.

H4: Urban secondary level hospitals (district hospital work with more efficiency than provincial general hospitals.

The model we used is:

$$Y_i=\beta_0+ \beta_1 X_{1i}+ \beta_2X_{2i}+\ldots+\varepsilon_i$$

where:

Yi – The technical efficiency of the hospital

X_1 – The average length of stay

X_2-Per capita Health budget

X_3-The number of elderly

β_0-constant

$\beta_1, \beta_2, \beta_3,$ and β_4-the coefficient of the variables

The coefficient $\beta 1$ measures the impact on Y of a one unit increase in $X1$, $\beta 2$ measures the impact on Y of one unit in $X2$ etc.

To identify and evaluate factors of scale efficiency, the efficiency score for each hospital, calculated using DEA, is used as the dependent variable in regression model; independent variables are number of medical doctor, ratio of doctor, nurse and number of hospitals beds which are can represent the size of the hospitals. Then we could know which factors have association with the scale efficiency. Other word we need to know which size of the hospitals work with efficiency and inefficiency.

Following hypothesis we suppose:

H1: Number of medical doctors has positive association with the scale efficiency.

H2: Ratio of medical doctor and nurse has positive association with the scale efficiency.

H3: Number of hospital beds has positive association with the scale efficiency.

The model is:

$$Y_i=\beta_0+ \beta_1 X_{1i}+ \beta_2X_{2i}+\ldots+\varepsilon_i$$

where:

Yi – The scale efficiency of the hospitals

X_1 – The number of medical doctor

X_2- Ratio of Medical doctor and nurse

X_3-The number of hospital bed

CHAPTER V

ANALYSIS AND RESULT

5.1 Description of data

Before proceeding with the analysis, it is interesting to discuss the trends over time in production of treated cases in hospitals. The number of inpatient increased from 4586 to 5205 in district hospitals and from 5929 to 6471 in province hospitals. The outpatient visits, rising from 184375.8 to 189692.7 in district level and from 86185 to 88918 in province hospitals during the period of 2003 to 2005. Inputs to hospitals production also grew during this period. The total number of hospital beds was increasing 127 to 132 in district hospitals but in province hospitals the beds decrease from 223 to 218. The number of medical doctor and nurses, there wasn't any big changes during this period in district and province level hospitals, for example 52 medical doctors were working in provincial hospitals in 2003 and it decrease to 51 in 2005. See the Table 5.1 and 5.2.

5.2 Efficiency result from DEA model

The DEA models estimated for the period from 2003 to 2005 indicate average technical and scale efficiency scores ranking from 0.559 to 1 at the province hospitals and 0.768 to 1 at the district hospitals. A summary of the technical and scale efficiency scores are given in Table 5.3 and 5.4.

District hospitals average TE and SE scores are 0.9154 and 0.9094 in 2003 and efficiency scores increased to 0.9864 (TE) and 0.9441 (SE) in 2005. Max efficiency score was 1 this period and min was the 0,768 in 2003. See the table 5.5.

Province hospitals average TE and SE scores are 0.8932 and 0.9276 in 2003. TE efficiency score increased to 0.9386 and SE efficiency decreased to 0.9413 in 2005. Max efficiency score was 1 this period and min was the 0,559 in 2004. See the table 5.6.

18 (60%) sample district hospitals were found to be technically efficient with a TE score of 1. The remaining 5 (16%) were technically inefficient since they had a TE score of less than 1 but more than 0.90. Five (16%) of the inefficient hospitals had a TE score of less than 0.90, two (7%) less than 0.80. See the table 5.7.

The TE scores in the table 5.8 indicate that throughout the period considered, 22 provincial hospitals were located on the frontier (TE score = 100%). Furthermore, it is revealed that there are hospitals whose TE scores are high. Out of the 63 province sample hospitals, 19 (30%) were found to be technically efficient with a TE score of 1 and 10 (15%) were found to be scale efficient with score 1. The remaining 34 (54%) were technically inefficient since they had a TE score of less than 1 but more than 0.80 and 48 (75%) were scale inefficiency score less than 1 but more than 0.80. Ten (15%) of the inefficient hospitals had a TE score of less than 0.80, five (8%) of the hospitals scale inefficiency is less than 0.80. The overall sample average TE was 91% (standard deviation (SD) = 10%), average SE was 93% (standard deviation=7%) See the table 5.8.

5.3 Input savings

Inefficiency levels ranging from 55.9–100% are observed. This implies that if the inefficient hospitals were to operate as efficient as their peers on the best-practice frontier, the health system could have reaped efficiency gains amounting to 44.1 % of the total resources used in running the hospitals.

Again the results of this study indicate that some of the hospitals operate at technical efficiency levels well below the efficient frontier. The inefficiency levels observed suggest a substantial amount of input savings, which could go a long way in injecting additional resources to the health system to address the backlog of inequities and/or further improve the quality of the available health care. In DEA, the frontier against which the technical efficiency of all hospitals is measured is defined by those hospitals in the group with a TE score of 100%. The hospitals producing on the efficient frontier define the best practice and thus could be regarded as role models. For each inefficient hospital the DEA model has identified efficient hospitals that could be used as comparators. The inefficient hospitals are expected to learn from their efficient peers by observing their production process.

Table 5.1 Production characteristic and performance indicators District Hospitals

Variable	2003				2004				2005			
	Mean	SD	Max	Min	Mean	SD	Max	Min	Mean	SD	Max	Min
Outpatient visit	184375.8	99387.08	337579	68246	424563	229328.7	688272	150054	189692.7	103823	360524	79909
Inpatient number	4586.3	1800.994	7826	1710	4858.3	2020	8385	1882	5205.7	2322.9	9270	1908
Number of Medical Doctor	53	29.7	105	17	52.9	29.7	108	17	53.1	30.5	105	16
Number of Nurse	55.3	23.5	90	23	55.2	20.5	83	23	56.4	22.5	85	23
Number of bed	127.3	56.2	225	45	127	56	225	45	132.8	52.6	225	45

Table 5.2 Production characteristic and performance indicators Provincial General Hospitals

Variable	2003				2004				2005			
	Mean	SD	Max	Min	Mean	SD	Max	Min	Mean	SD	Max	Min
Outpatient visits	86185.3	36241.8	144948	16293	82672	35411.8	144813	21206	88918.8	37828.6	168495	22904
Inpatient number	5929	2436	10717	1881.5	6188	2429.6	11317	1862	6471	2464	11378	2011
Number of Medical doctor	52	15.8	81	21	51	15.3	81	22	51	14	79	23
Number of Nurse	91.5	35	160	22	90.8	37.7	176	22	93	37	177	24
Number of Bed	223.9	71	372	75	223.5	71.8	382	75	218	68	357	75

Table 5.3 Result of DEA District Hospitals

№	Hospitals Name	2003		2004		2005	
		TE	SE	TE	SE	TE	SE
1	**Nalaikh HP**	1	1	1	0.98	0.973	0.897
2	**Baganuur HC&HP**	1	1	1	1	1	1
3	**Chingeltei HC&HP**	0.846	0.986	1	1	1	0.928
4	**Khan-Uul HC &HP**	1	0.805	1	0.92	0.99	0.918
5	**Songinokhairkhan HC&HP**	0.896	0.975	0.965	0.995	1	1
6	**Bayangol HC &HP**	1	0.917	1	1	1	1
7	**Songinokhairkhan HP**	0.821	0.851	0.821	0.87	0.901	0.872
8	**Khan-Uul HP**	1	1	1	0.994	1	0.906
9	**Sukhbaatar HP**	0.823	0.955	0.919	0.985	1	1
10	**Bayanzurkh HP**	0.768	0.978	0.789	0.999	1	0.92
	Mean	**0.9154**	**0.9467**	**0.9494**	**0.9743**	**0.9864**	**0.9441**
	Max	1	1	1	1	1	1
	Min	0.768	0.805	0.789	0.87	0.901	0.872

Table 5.4 Result of DEA Provincial General Hospitals

№	Province Hospitals	2003		2004		2005	
		TE	**SE**	**TE**	**SE**	**TE**	**SE**
1	Arkhangai	1	1	0.559	0.727	1	1
2	Bayan-Olgii	1	1	1	1	1	1
3	Bayankhongor	0.917	0.983	0.978	0.988	0.988	0.993
4	Bulgan	0.84	0.863	0.831	0.882	0.831	0.87
5	Gobi-Altai	0.975	0.91	0.948	0.912	0.948	0.912
6	Gobisumber	1	0.765	1	0.757	1	0.75
7	Darkhan-Uul	0.953	0.927	1	0.94	1	0.989
8	Dornogobi	0.965	0.91	1	0.953	1	0.957
9	Dornod	0.726	0.993	0.794	0.973	0.921	0.938
10	Dundgobi	0.718	0.81	0.843	0.877	0.84	0.849
11	Zavkhan	0.839	0.88	0.831	0.921	0.916	0.957
12	Orkhon	0.755	0.951	0.957	0.917	1	0.938
13	Uvurkhangai	0.755	0.888	0.85	0.96	0.892	0.967
14	Umnugobi	0.881	0.875	1	0.935	0.898	0.907
15	Sukhbaatar	0.879	0.908	0.915	0.907	0.867	0.902
16	Selenge	0.972	0.99	1	1	1	1
17	Tuv	1	1	0.796	0.913	0.952	0.977
18	Uvs	0.744	0.922	0.738	0.952	0.762	0.959
19	Khovd	0.932	0.991	1	1	0.957	0.995
20	Khuvsgul	0.969	0.998	0.969	0.998	1	1
21	Khentii	0.938	0.917	0.997	0.944	0.939	0.909
	Mean	**0.89**	**0.92**	**0.90**	**0.926**	**0.938**	**0.941**
	Max	1	1	1	1	1	1
	Min	0.718	0.765	0.559	0.727	0.762	0.75

Table 5.5 Descriptive statistic of District Hospitals

Descriptive statistic	2003		2004		2005	
	TE	SE	TE	SE	TE	SE
Mean	0.9154	0.9467	0.9494	0.9743	0.9864	0.9441
SD	0.0943	0.0683	0.0807	0.0439	0.0312	0.0504
Median	0.948	0.9765	1	0.9945	0.901	0.872
Max	1	1	1	1	1	1
Min	0.768	0.805	0.789	0.87	0.901	0.872

Table5.6 Descriptive statistic of Province general hospitals

Descriptive statistic	2003		2004		2005	
	TE	SE	TE	SE	TE	SE
Mean	0.893238	0.927667	0.905048	0.926476	0.938619	0.941381
SD	0.100576	0.066588	0.117334	0.072164	0.069087	0.062928
Median	0.932	0.922	0.957	0.94	0.952	0.957
Max	1	1	1	1	1	1
Min	0.718	0.765	0.559	0.727	0.762	0.75

Table 5.7 Ranking of efficiency district hospitals

Hospitals ranking	2003				2004				2005			
	TE		SE		TE		SE		TE		SE	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
100%	5	50	3	30	6	60	3	30	7	70	4	40
90-99.9%	0	0	5	50	2	20	6	60	3	30	4	40
80-89.9%	4	40	2	20	1	10	1	10	0	0	2	20
<80%	1	10	0	0	1	10	0	0	0	0	0	0
sum	10	100	10	100	10	100	10	100	10	100	10	100

Table 5.8 Ranking of efficiency province general hospitals

Hospitals ranking	2003				2004				2005			
	TE		SE		TE		SE		TE		SE	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
100%	4	19.04762	3	14.28571	7	35	3	14.28571	8	38.09524	4	19.04762
90-99.9%	8	38.09524	12	57.14286	6	30	14	66.66667	7	33.33333	14	66.66667
80-89.9%	4	19.04762	5	23.80952	3	15	2	9.52381	5	23.80952	2	9.52381
<80%	5	23.80952	1	4.761905	4	20	2	9.52381	1	4.761905	1	4.761905
sum	21	100	21	100	21	100	21	100	21	100	21	100

5.4 Determinants of Hospitals efficiency

DEA computations yield a firs-order measure of relative efficiency. What, however, is not known is what explains variations in such efficiency pattern. Hence, a second order analysis is required. The efficiency estimates calculated by DEA are made with the assumption of homogenous inputs and outputs. But, each of these may vary from one hospital to another, and efficiency may be affected by factors representing hospital operating characteristics and other factors such as location which is located in rural area or in urban place, number of elderly who are reach free services and need health services often and budget per head maybe the essential factor that effect the efficiency. Because those selected hospitals are public secondary level hospitals it means all the financing resource are come from the government budget and health insurance fund. But the health budget per capita is different each provinces and districts.

As we early mention in chapter I and II, there is health system of Mongolia has with problems in cost-effectiveness so average length of stay and utilization of bed are essential determinants of the hospitals efficiency.

In Mongolia public hospitals provide free health services to the population when they covered under health insurance system but for the elderly people health service free. Also these patients are much older than the general patient and have great need for additional staff time and average visit to the hospital is compared to others it would be more. Accordingly, the number of patients who are elderly is expected to have a negative association with efficiency. That is a higher number of elderly in that province or district has the lower efficiency.

We evaluate the secondary level hospitals in Mongolia. This level hospitals divided into provincial and district. Province general hospitals located in rural areas, and district hospitals are in the capital city Ulaanbaatar. Thus the location is expected to have a positive impact on hospital efficiency performance. Budget per head may have positive effect to hospital efficiency performance. Regression analysis result is given in the table 5.9.

Estimated Equation was following:

TE=C(1)+C(2)*ALOS+C(3)*ALOS^2+C(4)*BPH+C(5)*ELDERLY+C(6)*URBAN

Substituted Coefficient is:

TE=1.33397328-0.07037225*ALOS+0.00289206121*ALOS^2+0.00011795556*BPH-4.2007525*Elderly+0.09815431*Urban

Table 5.9 Result of technical efficiency and factors

Variable	Coefficient	Std. Error	T-statistic	Prob
C(1)	1.333973	1.007702	1.323777	0.1819
Average length of stay	-0.070372	0.221538	-0.317654	0.7515
Average length of stay^2	0.002892	0.012135	0.238326	0.8122
Per capita Health budget	0.000118	9.6	1.220322	0.2256
Number of elderly	-4.2	1.6	-2.598040	0.0110
Urban	0.098154	0.028518	3.441798	0.0009

ALOS- average length of stay

BPH-Per capita Health Budget

We observe from the Table 5.9 that the magnitude and sign of the coefficient for the variables budget per head, number of elderly and urban are consisted with expectations. The variables average length of stay wasn't consisted with the expectations.

Average length of stay coefficient is minus so when increase the average length of stay it would be decrease the efficiency, cause resource if fixed so when increase the average length of stay it would be reduce the quality and also decrease the number of patient who expected to stay in the hospitals.

Budget per head has a positive and significant on efficiency, as we expected. So when increase the budget to hospitals it has positive relationship with the efficiency performance. Those selected hospitals are public secondary level hospitals it means all the financing resource are come from the government budget and health insurance fund. But health budget per capita is different each provinces and districts. It wasn't based on capacity or performance. So if we based on performance based budgeting it could be more significant impact on the efficiency.

The coefficient of elderly patient's has negative and significant, confirming the expectation that a high number of elderly who are living that area is negatively associated with efficiency. Number of elderly they are reach free services, need health services often and doctor or nurse spent more time on them. They consume time if compare the adults.

The coefficient of urban also has positive and significant impact on the efficiency, expecting that the efficiency performance has high in urban areas. Location has significant effect on hospital efficiency, one of the reason is urban hospitals serve for the many people, people in urban areas not spread a lot so patients easy to access the hospitals, get more investment from government, also human resources are more skilled and it could be one reason of efficiency.

Result of the scale efficiency's correlation is given the table at 5.10.

Estimated Equation was following:

SE=C(1)+C(2)*MD+C(3)*Nurse+C(4)*Bed

Substituted Coefficient is:

SE=0.86223171+0.001194198*MD-0.007338278*Nurse+0.00010494334*Bed

Table 5.10 Result of scale efficiency and factors

Variables	Coefficient	Std. Error	T-statistic	Prob
C	0.862232	0.038743	22.25520	0.0000
Number of Medical Doctor	0.001194	0.000451	2.645339	0.0096
Ratio of Doctor and Nurse	-0.007338	0.038661	-1.189812	0.8499
Number of hospital bed	0.000105	0.000144	0.726817	0.4692

At the table 5.10 we observe that number of medical doctor has significant and positive association with scale efficiency other two variables which are ratio of medical doctor, nurse and number of hospital bed are not significant on hospital scale efficiency. Number of medical doctor has positive and significant association with the scale efficiency as we expected. The hospital with large number of medical doctor has work with efficiency.

CHAPTER VI

CONCLUSION, LIMITATION AND RECOMMENDATION

6.1 Conclusion

The analysis of efficiency in hospitals can make a major contribution to improving health services. The ultimate aim is to:

I. Identify poorly performing hospitals
II. To understand why
III. To address the underlying causes.

In this study we concentrated on these issues, and show how one can measure technical efficiency relative to best practice using DEA. It demonstrates how this may be applied in the context of the hospital in Mongolia. Compared with the most efficient hospitals within their categories, our result show that district hospitals are highly efficient than province hospitals but efficient scores are relatively close to each other.

Besides, the DEA efficiency measures are not controlling for other factors such as the type of production process or other environment factors that are not included in the DEA. There could be institutional differences across hospitals that may help to explain variation in efficiency. In this study, first we applied models that assume a similar environment or catchments area from which the hospitals drawn its patients. Nonetheless, this may not be the case in reality, and environmental differences are most probable. That's why we did the regression analysis and it was the second step of the analysis. There is little that a hospital can do to rectify this environmental inefficiency, but to recognize that it may exist, it was important when comparing hospitals. Environmental factors that we use only two variables such as location and number of elderly due to lack of data. A topic for further research is to determine how environmental factors (e.g. control and skill of managers) may influence DEA efficiency scores.

Improved and more comprehensive quality measures would be extremely useful as physicians may very well argue they are less efficient (take longer with patients, have longer waiting lists and so on) because they are providing better patient care. Quality variables relating to patient outcomes such as successful operations, diagnoses, morbidity and mortality rates or QALYs gained would be very useful to include in such study. Also need to know types of inefficiency for example at hospital management level (for internal efficiency) or at the health care planning authority level (for external efficiency).

Better data in this respect will add a great deal to understanding of productivity and efficiency over time and will further help to validate the result found in this study.

This research is expected to help hospital management in the following aspects. Knowledge of the cause in hospital operation efficiency can be obtained through the analysis. Possible improvement in operation can indicated. Hospital benchmarking information can be available from such research result to show the competence of specific hospitals. Such information will be helpful to assess the effectiveness of both national health policy and individual hospital management decision in a long-term period, which can add to experience on health care management for future decision making.

6.2 Limitation

Some of the limitation of the empirical analysis (due to the lack of information and quality of hospitals care), this research represents a preliminary attempt to adapt the DEA method to the particular features of the hospitals sector. It analysis the implications of modifying the basic DEA model in order to consider the impact on the measurement of hospital performance of both demand variables and policymaker objectives to be pursued via specific restriction on weights. Both these changes have noteworthy policy implications. Firstly, since measurement of hospital relative efficiency with DEA should be based on particular value judgments, the evaluation process of productive performance should be transparent, with an explicit definition of restrictions on input and output weights according to policy-makers' choices but our case we had chosen of the input oriented DEA. These restrictions are crucial for specification of the DEA model in which the policy maker should be involved, directly or indirectly.

Since there is no all-purpose method for considering the influence of demand and for translating policy-maker objectives into restrictions on weights, these could be fruitful areas of developing for future research.

6.2 Recommendation

1. Rural hospitals work with inefficiency to compare to urban hospitals, therefore we need to train or improve the skill and practice of the rural hospitals medical doctors and nurses.
2. To invest more technique and equipment to the rural general hospitals.
3. To balance or reallocate the medical doctors and nurses to the hospitals with efficiency.
4. A single health service purchasing system financed from public financing should be developed because current financing system from health insurance fund is based on the number of inpatient days and outpatient visits that's why hospital has just intensive to see the patient and sometimes unnecessary patients stay at the hospitals. Meaning is they would like to receive the finance. Other hand it looks that they work with high efficiency.
5. Performance based budgeting should be developed. Then we can control and save the resources.

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APPENDIX

Row data of DEA

#	Provincial Hospitals	Year	Number of OPD	Number of IPD	Number MD	Number of Nurse	Number of Bed
1	Arkhangai	2003	86234	7725.0	46	97	275
2	Bayan-Olgii	2003	137374	8881	62	100	242
3	Bayankhongor	2003	64504	7245	54	77	270
4	Bulgan	2003	40732	4431.5	39	69	169
5	Gobi-Altai	2003	82127	5301	38	87	230
6	Gobisumber	2003	16293	1881.5	21	22	75
7	Darkhan-Uul	2003	85320	10717	74	160	372
8	Dornogobi	2003	67000	3805	39	45	140
9	Dornod	2003	111948	9091	81	159	339
10	Dundgobi	2003	51521	3289	39	66	167
11	Zavkhan	2003	50930	4601	39	71	260
12	Orkhon	2003	128203	9591	76	150	333
13	Uvurkhangai	2003	94261	3040	56	90	200
14	Umnugobi	2003	51784	4035	37	53	142
15	Sukhbaatar	2003	86252	4231	45	93	168
16	Selenge	2003	139317	4333	57	68	210
17	Tuv	2003	144948	5006	71	98	205
18	Uvs	2003	59333	6086	55	116	241
19	Khovd	2003	108775	8428	60	110	245
20	Khuvsgul	2003	131038	7264	68	103	220
21	Khentii	2003	71997	5530	40	89	199
22	Arkhangai	2004	30725	3243	48	99	273
23	Bayan-Olgii	2004	109639	8718	60	78	242
24	Bayankhongor	2004	59119	7530	52	76	253
25	Bulgan	2004	35041	4507	40	66	169
26	Gobo-Altai	2004	77085	5407	39	85	230
27	Gobisumber	2004	21206	1862	22	22	75
28	Darkhan-Uul	2004	91300	11317	73	176	382
29	Dornogobi	2004	66719	3981	31	47	140
30	Dornod	2004	133870	9405	81	161	339
31	Dundgobi	2004	67600	3984	39	69	163
32	Zavkhan	2004	54414	5069	42	73	260
33	Orkhon	2004	137527	10081	74	152	333
34	Uvurkhangai	2004	92094	6446	62	97	207
35	Umnugobi	2004	55749	4828	35	49	142
36	Sukhbaatar	2004	87165	4489	43	87	168
37	Selenge	2004	144813	4984	57	68	210
38	Tuv	2004	87415	5359	53	85	207
39	Uvs	2004	63496	6344	59	115	241

40	Khovd	2004	107408	9037	56	110	245
41	Khuvsgul	2004	131038	7264	68	103	220
42	Khentii	2004	82692	6096	41	90	195
43	Arkhangai	2005	119255	7725.0	49	99	273
44	Bayan-Olgii	2005	115537	9008	59	97	242
45	Bayankhongor	2005	67046	7729	51	83	253
46	Bulgan	2005	36325	4510	40	70	169
47	Gobo-Altai	2005	77085	5407	39	85	230
48	Gobisumber	2005	22904	2011	23	24	75
49	Darkhan-Uul	2005	78289	11378	70	177	357
50	Dornogobi	2005	69943	3858	32	45	140
51	Dornod	2005	137233	9468	71	144	339
52	Dundgobi	2005	57079	4098	40	67	153
53	Zavkhan	2005	64285	5803	42	73	235
54	Orkhon	2005	168495	10461	79	170	319
55	Uvurkhangai	2005	107412	6151	61	104	205
56	Umnugobi	2005	43687	4161	38	49	140
57	Sukhbaatar	2005	83977	4197	45	86	168
58	Selenge	2005	140389	5433	52	75	200
59	Tuv	2005	128772	4816	53	85	197
60	Uvs	2005	67498	6625	60	116	241
61	Khovd	2005	93468	8630	56	112	253
62	Khuvsgul	2005	119814	8773	68	120	220
63	Khentii	2005	68803	5651	41	83	189

#	Hospitals Name	Year	Number of OPD	Number of IPD	Number of MD	Number of Nurse	Number of bed
1	SHD HP	2003	320400	4180	20	30	115
2	SHD HP	2004	68500	4276	20	29	115
3	SHD HP	2005	79201	4499	18	27	115
4	HUD HP	2003	80432	4137	17	23	65
5	HUD HP	2004	80140	4112	17	23	65
6	HUD HP	2005	50640	4760	16	23	115
7	SBD HP	2003	230540	6712	25	44	180
8	SBD HP	2004	218450	7730	25	39	180
9	SBD HP	2005	456854	8683	25	38	185
10	BZD HP	2003	50640	7826	30	48	225
11	BZD HP	2004	78540	8385	31	51	225
12	BZD HP	2005	50360	9270	29	53	225
13	BZD HC and HP	2003	320859	4940	82	47	210
14	BZD HC and HP	2004	869936	4523	82	47	210
15	BZD HC and HP	2005	389581	4612	84	38	210
16	SBS HC and HP	2003	223801	8450	51	38	125
17	SBS HC and HP	2004	564968	3879	54	35	125
18	SBS HC and HP	2005	230892	4572	58	38	125
19	Nalaikh HP	2003	68246	4617	55	66	135
20	Nalaikh HP	2004	150054	4565	55	69	135
21	Nalaikh HP	2005	79909	4247	57	79	135
22	BND HC and HP	2003	80617	4758	55	90	135
23	BND HC and HP	2004	196853	4829	57	72	135
24	BND HC and HP	2005	83216	4869	57	73	135
25	CD HC and HP	2003	217648	4772	83	82	167
26	CD HC and HP	2004	657956	5023	82	83	167
27	CD HC and HP	2005	224389	5577	89	85	167
28	KUD HC and HP	2003	201560	2266	64	60	68
28	KUD HC and HP	2004	503683	2424	65	60	68
30	KUD HC and HP	2005	200613	2563	66	63	68
31	SHD HC and HP	2003	337579	4885	105	78	138
32	SHD HC and HP	2004	350560	5357	108	77	138
33	SHD HC and HP	2005	360524	5681	105	78	138
34	BGD HC and HP	2003	200605	1710	76	32	45
35	BGD HC and HP	2004	688272	1882	69	49	45
36	BGD HC and HP	2005	189505	1908	69	45	45

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