



HEL 3950
Master's Thesis in Public Health

**Health Sector Reform and Maternal Health
in Nepal: Analysis of Equity and Efficiency**

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Abbreviation

ANC	Antenatal care
CI	Concentration index
CRS	Constant return of scale
DEA	Data envelopment analysis
DMU	Decision making Unit
EHCS	Essential health care service
FCHV	Female community health volunteer
IMF	International monetary fund
MoHP	Ministry of health and population
NDHS	Nepal demographic health survey
NHSP-IP	Nepal health sector programme –Implementation plan
PNC	Post natal care
P-P-P	Public Private Partnership
SBA	Skilled birth attendant
SDIP	Safe delivery incentive programme
VDC	Village development committee
VRS	Variable return of scale
WHO	World health organization

Summary

Health sector reform is ongoing in many countries to bring out the efficiency, equity effectiveness. Nepal initiated health sector reform, through operational plan, Nepal health sector programme-implementation plan (2004-2009) .The major objective was to achieve millennium development goal through efficient and equitable health system. The government is now on Nepal health sector programme II (2010-2015), but the status of equity and efficiency is still unanswered. The present study was carried to assess the equity and efficiency in the maternal health programme, Priority 1 programme, before and after health sector reform.

The equity analysis was done using data from the Nepal demographic health survey 2001, 2006 and 2011. The data were analyzed using the concentration index, highest-lowest difference, rate-ratio, percentage change. The inequality is determined across wealth, place of residence, administrative region and ethnicity. The result shows that wealth related inequity has decreased (decreasing concentration index) except for the poorest 20 (increased highest-lowest difference). The rural-urban gap is increasing in two indicators: institutional delivery and delivery conducted by skilled birth attendant. The inequality among the administrative region is decreasing. The ethnic and underprivileged populations are utilizing service at slower rate than the privileged population.

The efficiency analysis was done for the year 2001, 2006 and 2011 using the output oriented data envelopment analysis method. The data on input and output indicators were collected from the multiple secondary sources. The technical and scale efficiency were determined for each 75 districts. The result shows that average technical efficiency score has decreased and scale efficiency score has increased after health sector reform. There exists the topographical variation

on the distribution of efficiency score, resulting on the terai having the highest score and mountain the least score. In the year 2010, 22 out of 75 districts were technically efficient.

The narrowing wealth related inequity can be attributed to safe delivery incentive programme.

The rural-urban distance can be attributed to difficult topography , absenteeism of health workers, infrastructure etc. The health access gap among ethnic group exist due to normative issue such as faith, cultural beliefs and the practical reasons such as economic, health service factor etc. The decreasing technical efficiency is due to lack of decentralization, unfilled sanctioned post, absenteeism of health worker, the leakage of resources, unavailability of equipments . The increasing scale efficiency is due to increase in input resources mainly budget after the health sector reform, as most of the scale were increasing in return.

The study recommends the proper decentralization, fulfillment of staff with inclusion of ethnic and underserved population and better procurement of equipment and drugs in health institution.

The study recommends for further research on increasing gap on access of services between poorest and richest population despite of free service and monetary incentives. The study also recommends the efficiency study at different level of health institution and investigating the factors effecting on efficiency

CHAPTER I

INTRODUCTION

1.1 Motivation for thesis

The motivation for the thesis on this topic dates back to winter 2010. One day morning, I was checking the update of health sector documents in internet, where I stocked in the 1st hit, titled - Nepal health sector programme -implementation plan II. Sooner this drag my attention as I was familiar with the Nepal health sector programme -implementation plan (NHSP-IP) I (2004-2009), since my undergraduate course, which was operational plan of health sector strategy. The major objectives of plan were to achieve equity and efficiency in health sector in Nepal. I started and ended with document, but I couldn't trace out the status of major objectives of equity and efficiency. The document highlights the achievement of programme especially in the maternal and child health, its success in track of achieving the millennium development goal (MDG), but at the moment, the question arises in mind, does this ensure that the objectives of efficiency and equity in health sector were achieved? This preliminary question in mind led to the formulation of research question and finally the master's thesis entitled –‘Health Sector Reform and Maternal Health in Nepal: Analysis of Equity and Efficiency’

1.2 Health sector reform in Nepal

The overall development sector is guided by the 5 year comprehensive (recently 3 years interim plan) prepared by the National planning commission. The health sector in Nepal is guided by the health policy 1991, Second long term health plan (SLTHP), health sector strategy: An agenda for reform, operational guidelines on policies and programme drafted after the peoples movement

2006/07 which basically regarded health as human right and declared free health care programme (1).

Health sector reform process in Nepal officially started after the formation of health sector reform committee and series of workshop, joint review since 1999 (2). The health policy 1991 drafted after the restoration of democracy in 1990 pointed its priorities, "to upgrade the health standards of rural population through the primary health care approach" (1). After the 10 years of health policy 1991, the government endorsed, "health sector strategy: An agenda for reform", to address the problems of health sector and to respond the global agenda such as Millennium development goal(MDG). The documented health problems in health sector were under resourced private sector, widening inequalities in health, health care and health financing, inefficiency in public health facilities, unregulated private sector, lack of planning, coordination and ineffective decentralization (2,4)

Nepal has successfully implemented the Nepal health sector programme-implementation plan (NHSP-IP) 2004-2009 and currently on NHSP-IP2 (2010-2015) as the operational plan of health sector reform strategy (3). The NHSP-IP consists of 5 management outputs (sector management, financing and resource allocation, management of physical assets, human resources development, integrated management outputs) and 3 sector programme outputs (prioritized essential health care services(EHCS), decentralized management of health facilities and public private partnership(4) .Government adopts the sector wide approach for donor harmonization and reduce the resource duplication with the recognition that external development partners finance 40% public sector health expenses(3,4).

Thus talking in nutshell, NHSP-IP is the comprehensive operational document which consist of health sector reform, health policy 1991,MDG commitment, governments long term health plan, governance issues etc.. Later on different other programmes such as maternal health, child health, disease control programme were revised according to NHSP.

1.3 Historical overview of health sector reform

World Health Organization have described three generation of health sector reform. The first generation of reform characterized as the cut off the public sector budget including health and encouraging the private sector. The second generation emphasized on the efficiency, human resource reform, management reform, organizational reform including decentralization. The third generation consist of ‘the sector wide approach’. (5)

World Bank and International Monetary Fund (IMF) initiated the Structural Adjustment Programmes (SAP) in developing countries to respond the major economic problems of the late 1970s and 1980s. SAP was combination of monetary, fiscal, institutional reforms. World Bank and IMF set some of the criteria such as currency devaluation, cut off government budget on social sector, rid of excess control of government, encouraging the market competition to get the structural adjustment loan to bail out from debt crisis (6).The government cut off on health budget creates the gap and the private sector came to fulfill this gap.

Later on 1993 World Bank sort out some of the problems in health sector such as misallocation of budget, inequities, inefficiency, exploding cost. (7). Accordingly package of reforms was proposed by world bank/IMF to address these problems of inequities, inefficiencies, in health sector, termed as health sector reforms. (8). Health sector reform consists of combination of five (5) control knobs: financing, payment, organization, regulation and behaviour.

Sector wide approach is basically the donor harmonisation, pooled funding and national ownership. The problems such as duplication of projects, weakening of national ownership and capacity, weakening implementation and effectiveness, unsustainable projects were identified basically due to large number of donor in health sector (9). So to solve these problems, sector wide approach, was initiated as another step of health sector reform

Irrespective of context and element of reform process the objectives of health sector reform is equity, efficiency and effectiveness. Thus health sector reform can also be defined as, "sustained, purposeful change to improve the efficiency, equity and effectiveness of health sector" (10).

1.4 Brief introduction to Nepal and health system organization

1.4.1 Brief introduction of Nepal

Nepal is small landlocked country situated in between china and India with area of 147181 km² and population of about 26.6 million. It is rectangular in shape with mean length of 880 km from east to west and mean breadth of 193 km from north to south. It has diverse topography, with an altitude ranging from 70m to 8848 (Mt.Everest) and climate varying from tundra to polar (11).

Geographically, it can be divided into 3 parts: Mountain, hill and terai (plain land).

Administratively, Nepal is divided into 5 development region, 14 zones, 75 districts. Each district is divided into number of Municipality or Village development committee (VDC) and finally into number of wards in each VDC/ Municipality. Thus wards are the smallest administrative unit. Nepal is the youngest republic country and still in peace process, ending up the decade long conflict, struggling to restructure the country as federal states and drafting the new constitution.

1.4.2 Health system organization in Nepal

There are three department –department of health service, department of drug administration and department of ayurveda under Ministry of health. Department of health service is mainly responsible for planning and implementing preventive, promotive, curative and rehabilitative health services. There are six divisions under the department of health service and five centers with different responsibilities and having degree of autonomy in personnel and financial management. Referring to fig 1.4.2.1, coming down at the regional level (five development region), there are five regional health directorate, responsible for the technical support and supervision of the districts. There are zonal and regional hospitals, at least in each zone (14 zones) with autonomy through the hospital development board.

As in fig1.4.2.1,at the district level, there is district health office or district public health office responsible for implementing the essential health care services, monitors the primary health care centre(PHCC),health post(HP),sub health post(SHP). SHP is first government institutional contact point for essential health care services in each village development committee (VDC). In addition to this SHP monitor and support the activities of female community health volunteer (FCHV), primary health care-outreach clinic (PHC ORC) and expanded programme on immunization clinic (EPI).At least one FCHV serve at least on one ward. Similarly the health post provides same services of SHP in addition to birthing facilities in illaka level (collection of 4-5VDC).At the constituency level, below the district level there is provision of PHCC with focus on curative services. As shown in fig. and described above SHP acts as referral centre for FCHV, PHCC, EPI. Similarly each structure above acts as referral point such as SHP to HP,HP to PHCC,PHCC to district hospital, district hospital to zonal ,regional and central hospitals.

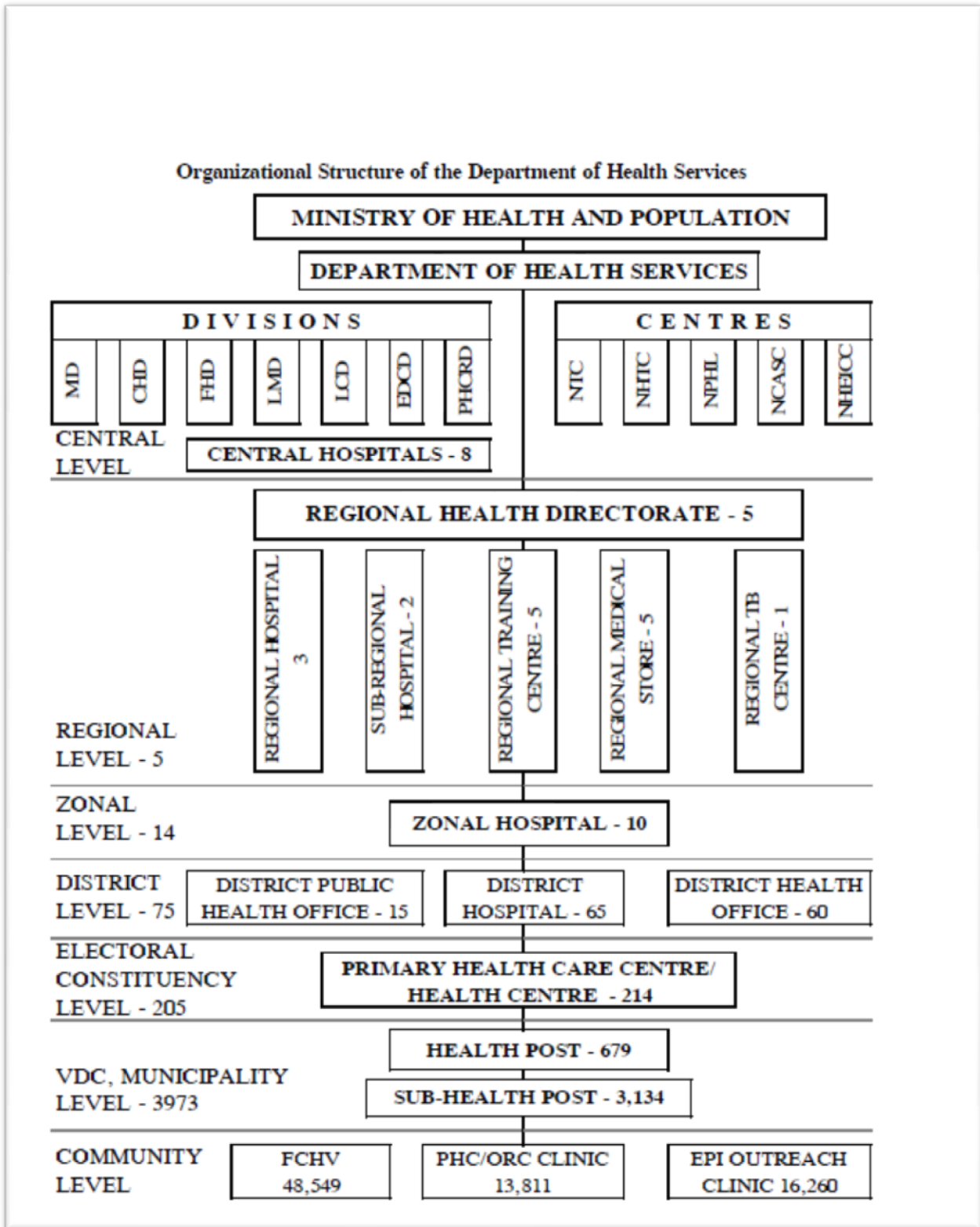


Fig 1.4.2.1: Organizational structure of department of health service

Source: Annual report 2011(1)

1.5 Health sector reform and maternal health in Nepal

Maternal health is priority programme of government consistently over the time. The first five year development plan (1956-61) consists of establishment of maternity hospital, nursing school etc. Family planning and Maternal child health project in 1968 was established as the vertical project to improve maternal health (12). Maternal health is considered as the human right in the five years periodic development plan. The health policy 1991 listed maternal health as one of priority among the primary health services.

Maternal health is the priority programme of Nepal health sector programme with its commitment to achieve the MDG. Nepal safe motherhood programme is priority health programme of government of Nepal. National safe motherhood plan (2002-2007) was implemented and later revised as safe motherhood and neonatal health long term plan (SMNHLTP) (2006-2017) to achieve the wider participation of stakeholder donor, and implement the health sector reform initiatives (SMNHLTP) (13). Rapid assessment was conducted and the reforms were initiated to increase the access of poor and marginalized people on the reproductive health services. Some of the reform initiatives in maternal health programme were birth preparedness package (BPP), maternity incentives, antenatal incentives, free delivery services (*Aama surakshya*), provision of skilled birth attendants, establishment of basic/comprehensive essential obstetric care (B/CEOC) (1,13).

It is believed as results of these reforms, Nepal is one of the 10 countries, that have already achieved the MDG goal by reducing the maternal mortality rate by 75% between 1990 and 2015 (14). The table below shows the status and target of MDG 5 goal and selected targets.

1.5.1: Status of MDG 5 goal and selected targets

Indicators	Status	Target by 2015	Achievement 2012
Maternal mortality (per 100000)	539 (1996 survey)	240	280 (2006 NDHS)
Delivery conducted in health institution	9 %	30 %	35.3 %
Delivery conducted by SBA	11 %	40 %	36%

Source: NHSP-IP II (3)

1.6 Rationale of study

Nepal has successfully completed the NHSP (2004-2010). The aim of NHSP were to reduce maternal, infant child mortality rates, decrease total fertility rate, increase contraceptive prevalence rate, skilled birth attendance, immunisation etc. There is clear trend of progress in most of these indicator (3,4). Thus, one of the goal of health sector reform to increase the coverage of health service is achieved, whereas two other goal of equity and efficiency are still unanswered. The government is currently on NHSP which tries to build on success of NHSP I. Maternal health remain among the priority programme of both NHSP I and NHSP II. Sustainable financing is one of challenges of Nepal to scale up the successful project piloted at the local level. Government once again repeats to gain better value of each single rupee (rupee as Nepal currency) invested in health (3). But what upon the objectives of achieving efficiency and equity in health sector? There is no document which indicated to these objectives, even the NHSP2 which contain a section of review of NHSP-1 doesn't clearly explain about the equity and

efficiency status before and after the health sector reform. So it is high time to assess the equity and efficiency of health sector.

1.7 Objectives

General Objective:

The broad objective is to assess the implication of health sector reform in maternal health in terms of equity and efficiency.

Specific Objectives:

- To assess the equity in maternal health in Nepal before and after health sector reform in Nepal.
- To assess the efficiency in maternal health before and after health sector reform in Nepal.

1.8 Research question

These are the question which led to initiate this research:

1. Are the health resources used more efficiently than before the health sector reform?
2. How equitable are the maternal health service available after the health sector reform?

However, the above research question on measuring the equity and efficiency poses me a great challenge as master student, because I had no prior extended knowledge on econometrics. I had to learn to apply new methodologies that had not been taught in the MPH programme nor covered in the curriculum. Concentration index and data envelopment analysis (will be discussed later) were the best to address the research question and application of these methodologies were new to me. There was no alternation other than learning and using these techniques,

CHAPTER II

EQUITY ANALYSIS

Objective I: To assess the equity in maternal health in Nepal before and after health sector reform in Nepal.

2.1 Concept

Equity is an ethical concept, based on distributive justice and fairness. Equity can be defined as, "the absence of *unfair* and *avoidable* or remediable differences in health among populations or groups defined socially, economically, demographically or geographically" (15). Based on the literature, Health and equity can be discussed under major three categories : (i) equity in health (ii) equity in health service delivery (iii) equity in health financing (16,17).

Equity in health can be defined as attempt to eliminate disparities in health between the groups that possess different societal positions. The health inequity doesn't represent all inequalities, but the disparities on the basis of income, occupation, education, geographical location, and ethnicity. The health inequalities which are avoidable and unjust are health inequities. Some of inequalities are unavoidable. These inequities are still regarded as equitable inequalities (18).

Thus all inequalities don't imply inequities.

For determining the health differences to be unavoidable (and unnecessary), the following determinants factors need to be analyzed. The differences in health due to biological variation and health damaging behaviour as result of free choices are not considered as health inequity.

Whereas health variation resulting from health behaviour with no personal choice, ill health as result of exposure to unhealthy, stressfull living, health differences due to inadequate access to

essential public services and health related social mobility where sick people move down the societal hierarchies are considered as health inequities (19,20).

Equity in health care can be defined as equal access to available care for equal needs, equal utilization for equal needs and equal quality of care for all. The equal access refers to the absence of conditions where people are unable to use services on the basis of income, race, sex, ethnicity, religion etc (23). The need refers to capacity to benefit or need for ill health (21).

The understanding of need, when comes to the point of resource allocation or priority setting lead to identification of horizontal and vertical equity. Horizontal equity implies allocate equal resources for equal need. For e.g. Universal provision of health care services on basis that everyone need health care at a point. Vertical equity implies allocation of different level of resources for different level of need. For e.g. targeted health programme for poor people, specific programme for specific group of people represents the vertical equity (20, 21, 22).

2.2 Measuring equity in health and health care

Equity is normative concept and it cannot be measured directly, but indirectly by measuring inequalities in health or health care. Health inequalities can be measured between social groups on the basis of socioeconomic position (23). Such inequalities may refer to inequities in health. The key steps involved in measuring and monitoring inequalities are: (i) identification and classification of social groups (ii) identification of health indicators (iii) estimation of disparities (16, 22,24).

Identification of social group: The equity assessment requires the identification of social groups with the different status. In every society people varies on socioeconomic position based on social stratifier such as socioeconomic position, ethnic groups, religion, sex, geographical

differences etc. People with low socioeconomic status, marginalized ethnic communities, female are socially disadvantaged, thus, get less opportunity to be healthy or faces greater health risk. Moreover the selected social stratifier should be policy relevant (23). Similarly classification of social groups should be adequate to represent the contexts that are aimed to measure. For e.g. classifying the people 'Rich' and 'Poor' groups may not represent range of meaningful differences as the five different groups (groups based on quintiles or deciles). Similar consideration need to be made on each social variable (25).

Identification of health indicators: Selection of health indicators must be specific to represent and address the research question. The health indicator should be specific, scientific, ethically acceptable and contain frequency of occurrence (incidence, prevalence) to measure difference in between groups. The health indicators must be policy relevant. Similarly health indicators must be selected in connection to the data sources. The information must be accessible over time across the social group of interest and can be disaggregated at the appropriate level to address the question (25).

Estimation of disparities: Measuring equity requires measuring the size of gaps between the social groups. There are number of method to quantify health inequalities. One of the methods is to compare two extremes-for e.g. the richest and poorest -in relative or absolute terms. The absolute measurement includes the calculation of differences in rates of relevant health indicators between two groups, whereas ratio of rates is computed in relative measurement. But some of literature shows that this method is often used when two groups are compared. One of the lacking point in this method is the measurement between two extreme groups ignores the information contained in the middle groups (20,25). To avoid this, different other composite

methods are used. Some of them are population attributable risk, the slope and relative indices of inequality, concentration curve and index (25).

2.3 Methodology

Data sources

The data used for the equity analysis is based on the Nepal demographic health survey 2001, 2006 and 2011(26, 27, 28).Nepal demographic health survey (NDHS) is nationally representative sample survey. The data used in this study is publicly available.After getting permission, data was taken from internet (<http://legacy.measuredhs.com/login.cfm>).The survey method, sampling frame, and questionnaire were consistent across the survey.

Sampling frame and sample selection

As described in earlier chapter, Nepal is divided into three topographical regions and five administrative regions- each region divided into districts, district into VDC, VDCs into wards.

The cross-section of these administrative and topographical regions is referred as each domain.

Afterward rural-urban stratification in each domain was done and sampling strata was created.

Similarly enumeration area or primary sampling unit was determined as ward in urban areas and sub wards in rural areas. NDHS draws the samples in each survey in two stage. In first stage enumeration Areas were drawn based on probability proportional to size strategy. As Nepal predominantly consists of rural areas, rural-urban was basically 2:1 in each domain. In the second stage, household listing and mapping were conducted in each selected enumeration areas or primary Sampling unit. The required numbers of household were selected on the basis of these sampling frames.

Sample size

The study was confined to 4745 pregnant women and 6978 live birth in 2001, 4066 pregnant women and 5545 live birth in 2006 and 4148 pregnant women and 5391 live birth in 2011. The pregnant women are those who have live birth in last 5 year of preceding the survey and the information on ANC is on last pregnancy and the live birth is also in last five years preceding the survey (26, 27, 28).

Data analysis

Inequities in this study were estimated using the concentration index, percentage difference, rate ratio. Concentration index is often used to quantify the socioeconomic inequality related in health. It is derived from the concentration curve (Fig 2.3.1) and is the twice the area between the line of distribution or observation and the line of equality. The shape of concentration as shown in fig 2.3.1 indicates the nature of inequality. The line of observation that lies below the line of equality resembles the inequities favoring the rich whereas that above the line of equality resembles the inequities favoring the poor (16,17)

The value of CI ranges from -1 to +1, where negative value indicates that health variable is higher among least advantage socio-economic groups, positive value indicates presence of inequity in health variable in favor of non poor, where 0 indicates absence of income related inequality. But in this study only concentration index is used. The concentration curve is presented only theoretical understanding how the concentration index can be produced and presented graphically (17,22,24).

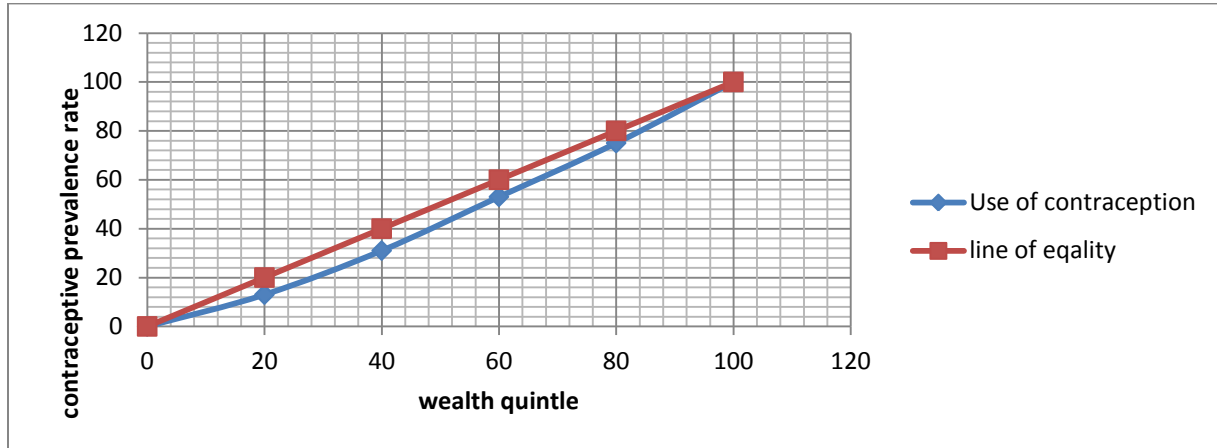


Fig 2.3.1: concentration curve representing contraceptive prevalence rate across wealth quintile

The concentration index (CI) was computed from grouped data for wealth related data, in the Microsoft excel by solving the following equation : (16,22,24):

$$CI = (P_1L_2 - P_2L_1) + (P_2L_3 - P_3L_2) + \dots + (P_{T-1}L_T - P_TL_{T-1})$$

where P= cumulative percent of sample ranked by economic status (for this study cumulative percent of women who gave live birth in last 5 years)

L_p =corresponding concentration curve ordinate (for e.g. percentage of antenatal care visit, delivery in health institution)

T= number of socioeconomic groups (for this study 5 wealth quintile groups)

The wealth quintile group was subdivided into 5 categories (lowest to highest) with consistent method in all survey. The wealth index was calculated using the household assets such as bicycle, car, television, house structure etc which is country specific and principal component analysis. This calculation has been done by principal research agency (*Macro international and New era*) over all three survey.

The ethnic groups were categorized into major 6 groups as appear in most of literature. The *Brahmin /chhetri* are regarded as the advantageous ethnic groups whereas dalits as least advantageous. The comparison made been *Newar* and *JanaJati* wereto check out the inequality within the indigenous groups (*termed as Aadibasi*). Further analysis is done within same definition of, rural urban classification, administrative region. The test of significance for two value were calculated using the p-test and all values were interpreted at the 95% of confidence interval.

2.4 Results

Variation in maternal health indicators according to wealth

Table 2.4.1 Variation in maternal health indicators according to wealth

Characteristic	Year	Lowest	Second	Quintle Middle	Fourth	Highest	Absolute difference (highest -lowest)	Concentration index
Antenatal care Visit	2001	30.8 %	38.3%	51.5%	52%	80.4%	49.6%	0.17
	2006	50.5%	71.6%	77.10%	85.4%	92.4%	41.9%	0.10
	2011	67.1%	81.5%	90.8%	93.7%	98%	30.9%	0.07
Antenatal care visit by SBA	2001	30.4%	37.9%	50.8%	57.5%	79.5%	49.1%	0.18
	2006	17.7%	30.5%	38.4%	60.7%	84.1%	66.4%	0.28
	2011	33.3%	44.7%	58.3%	77.9%	91.8%	58.5%	0.19
Delivery in health institution	2001	2.0%	2.6%	4.6%	7.7%	32.7%	30.7%	0.53
	2006	4.2%	8.8%	11.6%	20.4%	51.6%	47.4%	0.44
	2011	11.4%	23.3%	35.4%	51.9%	77.9%	66.5%	0.33
Delivery conducted by SBA	2001	3.6%	4.9%	9.9%	14.3%	45.1%	41.5%	0.47
	2006	4.8%	10.1%	12.4%	23.0%	57.8%	53%	0.44
	2011	10.7%	23.7%	35.9%	53%	81.5%	70.8%	0.35

The value for concentration index for all indicators decreases from the years 2001 to 2011. The difference in concentration index between 2006-2011 is higher than those in 2001-2006. This shows the improvement of indicators after the health sector reform. Moreover the concentration index for the indicator antenatal care visit by SBA which increased from 2001-2006 (0.18-0.28) halted and decreased during 2006-2011(0.28-0.29).Whereas the highest-lowest difference for the indicator such as ANC by SBA, delivery in health institution, delivery by SBA has increase during 2001-2006.This shows that the utilization of lowest wealth groups (bottom of population) has not increased. The decreased in the wealth related inequities as shown by concentration index was mainly due to the increase in second and middle income groups.

Rural- Urban rate ratio for maternal health indicators

Table 4.1.2 Rural-urban rate ratio for maternal health indicators

	Year	Urban	Rural	Difference	Change (2001-06)	Change (2006-11)
Antenatal care	2001	82.4%	46.6%	35.5% (p*=0.01)	-19.3%	-6.4%
	2006	87.9%	71.7%	16.2% (p*=0.01)		
	2011	93.7%	83.9%	9.8% (p*=0.01)		
Antenatal care by SBA	2001	74.7%	24.4%	50.3% (p*=0.01)	-3.3%	-14%
	2006	84.5%	37.5%	47% (p*=0.01)		
	2011	87.9%	54.9%	33% (p*=0.01)		
Health institution delivery	2001	44.5%	6.6%	37.9% (p*=0.01)	-3.6%	6%
	2006	47.8%	13.5%	34.3% (p*=0.01)		
	2011	71.3%	31.6%	40.3% (p*=0.01)		
Delivery by SBA	2001	50.3%	8.1%	42.2% (p*=0.01)	-5.9%	4%
	2006	50.6%	14.3%	36.3% (p*=0.01)		
	2011	72.7%	32.3%	40.4% (p*=0.01)		

The rural urban variation is decreasing from 2001-2011 for the two indicator ANC visit and ANC visit by SBA. Moreover the change in difference is higher during 2006-2011(14%) than that for 2001-2006(3.3%) for the indicator ANC visit by SBA. However the rural urban variation for indicator health institution delivery is increasing and that for delivery by SBA has not improved since 2006-2011. The above table shows that the difference has increased since 2006 which were in decreasing trend during 2001-2006.

Region wise rate ratio for maternal health indicators

2.4.3 Administrative region wise variation for maternal health indicators

Indicators	Year	Eastern region	Central region	Western region	Midwestern region	Far western region	Difference(Highest - lowest)
Antenatal care	2001	54.3%	52.6%	56.5%	35.1%	33%	23.5%
	2006	81.2%	75.9%	69.1%	61.4%	74.4%	19.8%
	2011	88.9%	83%	85.2%	78.8%	90.5%	7.5%
Antenatal care by SBA	2001	34.1%	26.4%	35.6%	15.5%	22.1%	20.1%
	2006	45.1%	46.4%	50.9%	43.5%	25.9%	25%
	2011	60.7%	56.4%	59.9%	53.1%	61.8%	8.7%
Health institution delivery	2001	9.7%	11.7%	9.4%	3.8%	5.7%	7.9%
	2006	16.6%	24.2%	17.4%	13.6%	8.5%	15.7%
	2011	39.6%	35.7%	38%	29.1%	29%	10.6%
Delivery conducted by SBA	2001	13.3%	12.9%	11.6%	4.1%	7.7%	9.2%
	2006	17.2%	24.7%	20.1%	14.2%	9.6%	15.1%
	2011	42%	35.9%	37.8%	28.7%	30.7%	9.1%

The development wise variation (highest-lowest difference) for the maternal health indicators such as ANC visit ,ANC visit by SBA has decreased after the 2001 but more rapidly during

2006-2011. Moreover the highest- lowest difference for the indicators such as health institution delivery and delivery conducted by SBA which increased during 2001-2006 halted and decreased during 2006-2011.

Ethnicity wise variation in maternal health indicators

Table 2.4.4.1 Ethnic variation in antenatal care coverage

Ethnic groups	2001	2006	2011	Change 2001-2006	Change 2006-11
Brahmin/chhetri	53.3%	79.4%	89.8%	26.1%	10.4%
Terai/madhese	48.2%	76.4%	85.7%	28.2%	9.3%
Dalits	47.8%	71.9%	83.1%	24.1%	11.2%
Newars	66.8%	82.8%	93.7%	16%	11.2%
Janjati	43.2%	66.4%	78.8%	23.2 %	12.4%
Muslim	49%	81.1%	90.7%	32.1%	9.6%
Difference (brahmin-dalits)	5.5 %	7.5%	6.4%	2%	-1.1%
Difference (Newar-janjati)	23.6%	16.4%	14.9%	-7.2%	-1.5%

There has been mixed result for the inequality for the antenatal visit. The difference between brahmin and dalit has slightly increased from 5.5% to 6.4% whereas *Newar-Janjati* difference decreased from 23.6% to 14.9%. However if we compare before and after health sector reform, the Brahmin-Dalit decreased by 1.1% after 2006 which was increasing before whereas the Newar-Janjati difference decreased by 7.2% before 2006 compared to 1.5% after health sector reform.

Table 2.4.4.2 Ethnic variation in antenatal care by SBA

Ethnic groups	2001	2006	2011	Change 2001-2006	Change 2006-11
Brahmin/chhetri	34.8%	57%	70.8%	22.2%	13.8%
Terai/madhesei	25.6%	40.2%	55.9%	14.6%	15.7%
Dalits	24.3%	40.1%	52.2%	15.8%	12.1%
Newars	49.4%	68.4%	90.5%	19%	22.1%
Janjati	21.8%	33.9%	46.6%	12.1%	12.7%
Muslim	23%	31.2%	70.6%	8.2%	39.4%
Difference (brahmin-dalits)	10.5%	16.9%	18.6%	6.4%	1.7%
Difference (Newar-janjati)	27.6%	34.5%	43.9%	6.9%	9.4%

The result of inequalities has been mixed for the antenatal visit by SBA. Brahmin-Dalit difference increased from 10.5% to 18.6% and Newar-Janjati difference increased from 27.6% to 43.9% during the last decade. Moreover, if we breakdown this time period into before and after health sector reform, the Brahmin-Dalit difference increased by 6.4% during 2001-06 whereas 1.7 % during 2006-11. This shows the inequality has been narrowing after health sector reform. However the Newar-Janjati difference increased by 6.9% during 2001-06 and 9.4% during 2006-11. This shows the inequality has widened after health sector reform. The antenatal care visit by SBA has increased by 39.4% for Muslim after 2006 compared to 8.2% during 2001-06.

Table 2.4.4.3 Ethnic variation in health institution delivery

Ethnic groups	2001	2006	2011	Change 2001-2006	Change 2006-11
Brahmin/chhetri	13%	24%	44%	11%	20%
Terai/madhesi	7%	15.1%	37.9%	8.1%	22.8%
Dalits	5.4%	8.6%	27.4%	3.2%	18.5%
Newars	28%	47.8%	68%	19.8%	20.2%
Janjati	6.1%	14%	28.8%	7.9%	14.8%
Muslim	6.4%	12.4%	32.3%	6%	19.9%
Difference (brahmin-dalit)	7.6%	15.4%	16.6%	7.8%	1.2%
Difference (Newar-janjati)	21.9%	33.8%	39.2%	11.9%	5.4%

The inequality for the health institutional delivery increased last decade. The Brahmin-Dalit difference increased from 7.6 % to 16.6% and Newar-Janjati difference increased from 21.9% to 39.2% during 2001-2011. But if we breakdown into before and after 2006, the result is not similar. The Brahmin-Dalit difference increased by 7.8% during 2001-2006 whereas only 1.2% during 2006-11. Similarly Newar-Janjati difference increased by 11.9% during 2006-2011 whereas only 5.4% . The institutional delivery has increased 6 times among dalit, 3 times among Muslim and Terai/madhesi people, almost doubled among Janjati and brahmin/chhetri communities after 2006.

Table 2.4.4.4 Ethnic variation in delivery conducted by SBA

Ethnic groups	2001	2006	2011	Change 2001-2006	Change 2006-11
Brahmin/chhetri	15.6 %	25.5%	45.5 %	9.9%	20%
Terai/madhesi	8.2 %	15.7%	39.3%	7.5%	23.6%
Dalits	6.4%	10.4%	26.8%	4%	16.4%
Newars	31.6%	49.9%	71.6%	18.3%	21.7%
Janjati	7.6%	14.2%	27.7%	6.6%	13.5%
Muslim	7.3%	13.1%	33%	5.8%	19.9%
Difference (brahmin-dalits)	9.2%	15.1%	18.7%	5.9%	3.6%
Difference (Newar-janjati)	24%	35.7%	43.9%	11.7%	8.2%

The ethnic difference for the delivery conducted by SBA has increased during the last decade. The Brahmin/Chhetri-Dalit difference has doubled and Newar-Janjati difference has increased from 24% to 43.9% during 2001-2011. However if we breakdown this time frame into before and after 2006, the result is not similar. The Brahmin-Dalit difference increased by 5.9 % during 2001-2006 whereas 3.6% during 2006-11. Similarly Newar-Janjati difference increased by 11.7% during 2001-2006 whereas only 8.2% during 2006-2011. The delivery conducted by SBA has increased among all the ethnic group during 2006-2011.

CHAPTER III

EFFICIENCY ANALYSIS

Objective II: To assess the efficiency in maternal health before and after health sector reform in Nepal.

3.1 Concept of efficiency

Efficiency generally refers to the relationship between input and output factors. It is defined as the ratio of the observed level of attainment of goal to the maximum that could have been achieved with observed resources (29). The same concept applied to the health care. Efficiency in health care is concerned with the relation between resources (such as capital, manpower, cost, equipment) and either intermediate outputs (such as numbers treated, numbers of services provided) or final outcome (measured in terms of lives saved, quality of life, life expectancy) (30).

Efficiency implies production. Health care efficiency is better understood when we take the health care system as “the production system” comprising the input, output and process.

Input factors: The common factors needed to produce health services are human resources, health institutions such as hospital, health centres, health equipments such as medicine machine, policy, programme and other regulatory documents. However the input factors also includes the factors outside the health sector .The non health care determinants such as income, education, lifestyles are considered as the input factors in health. These factors need to be taken in consideration, but not as fully and clearly as the direct factors plays role in the production

process. So we prefer the use of direct input factors with the consideration of ease of measurement and data availability of direct Input factors.

Outcome factors: The outcome factors may be immediate or long-term outcomes. The immediate outcomes are generally regarded as outcome indicators whereas long term outcomes are called impact indicators. In terms of health sector, the immediate outcome may be considered as healthcare services produced such as delivery attended, children vaccinated, ANC provided. The impact indicators are generally measured in long term of health production process such as increased life year, numbers of death aborted, decreased morbidity.

Process: This is also known as throughput. This is the mechanism which transforms the health resources into health output. The health system is often termed as the 'Black Box' as the production system is unknown, sometime referred to black hole. However, there has been lot of development in this sector which has increased the knowledge of the functioning of health system. (31)

3.2 Measurement of efficiency

There are mainly two measures of efficiency: (a) technical efficiency (b) allocative efficiency. But for this study purpose we are dealing only with technical efficiency. Technical efficiency refers to the use of input resources in most technically efficient way. In context of health care, technical efficient refers to the maximum amount of health care output from the given set of health input or using the minimum input from the given set of output (32). Whereas allocative efficiency is concerned with the selecting among the different technically efficient combinations. It generally depends on the policy objectives.

There are different methods of measuring the efficiency in health sector. Some of them are: (a) ratio analysis (b) Least square regression (LSA) (c) stochastic frontier analysis (SFA) and (d) Data envelopment analysis (DEA) (33). Stochastic frontier analysis and least square regression are parametric analysis method. These are regression based approaches, assume specific functional form and are susceptible to model misspecification. Whereas Non-parametric methods such as DEA, ratio analysis do not require any specific functional form and are not susceptible to model misspecification (34). Among the different methodology to measure efficiency in health sector, DEA has been widely used in measuring efficiency in health sector.

Some of the reasons for using DEA are that it can handle multiple inputs and multiple output and simplicity of the assumptions underlying the method (32,35). In addition to these benefits, where there is insufficient health sector information and specifically when economic data is missing, DEA has been largely used in low- income countries (36). Another reason for using DEA in health performance is the relative measurement among the Decision Making Unit (DMUs). DMUs are the organizations such as hospitals, group practices, districts, states that are subject to evaluation under DEA software. These DMUs are regarded as the productive agencies.

Efficiency determines the performance and performance is the relative concept across the health care system (37) Data envelopment analysis is non parametric method, used to measure the efficiency of the productive organization, termed as the decision making unit (DMUs). It calculates the technical efficiency of given units relative to the other units performance, which produce the same goods.

It takes fractional mathematical form of

$$\text{Max } h_o = [\sum_{r=1}^s u_r y_{rj_o}] / [\sum_{i=1}^m v_i x_{ij_o}]$$

Subject to

$$[\sum_{r=1}^s u_r y_{rj}] / [\sum_{i=1}^m v_i x_{ij}]$$

where $j = 1, \dots, j_o, \dots, n$, $r = 1, \dots, s$ $i = 1, \dots, m$

$$u_r, v_i \geq 0,$$

The given equation calculates efficiency for given DMUs ($J=1, \dots, n$), using the $i=1, \dots, m$ inputs and producing the $r=1, \dots, s$ outputs. The u_i and v_r are weight of the every input and output that the model chooses.

Difference between Technical and scale efficiency

Technical efficiency: It is the relationship between the resources used and output achieved. A technical point is achieved when maximum output is achieved from given source of resources i.e., no waste of resources (30,33).

Scale efficiency: It means how close the production unit is to the optimal scale of production.

Optimal scale of production is achieved when there is constant return of scale (proportionate change in output in respect to input). Sometime the organization may be too large and sometime too small, for the volume of activities, which lead to inefficiency. This inefficiency is measured by the scale efficiency (35,38)

3.3 Methodology

Conceptual framework

Health production function generally occurs in two steps. In first steps there is production of health care service using the health resources .In the second step there is production of health, utilizing the health care produced in earlier stage. The health resources or input factors are doctors, nurses, hospitals, equipments budget. The health care produced are number of antenatal visits, number of patient treated. Such produced health can be measured in terms of decreased mortality, increased life years. For our study purpose, the following input factor represents resource used, output represents health care and impact indicators represents the health.

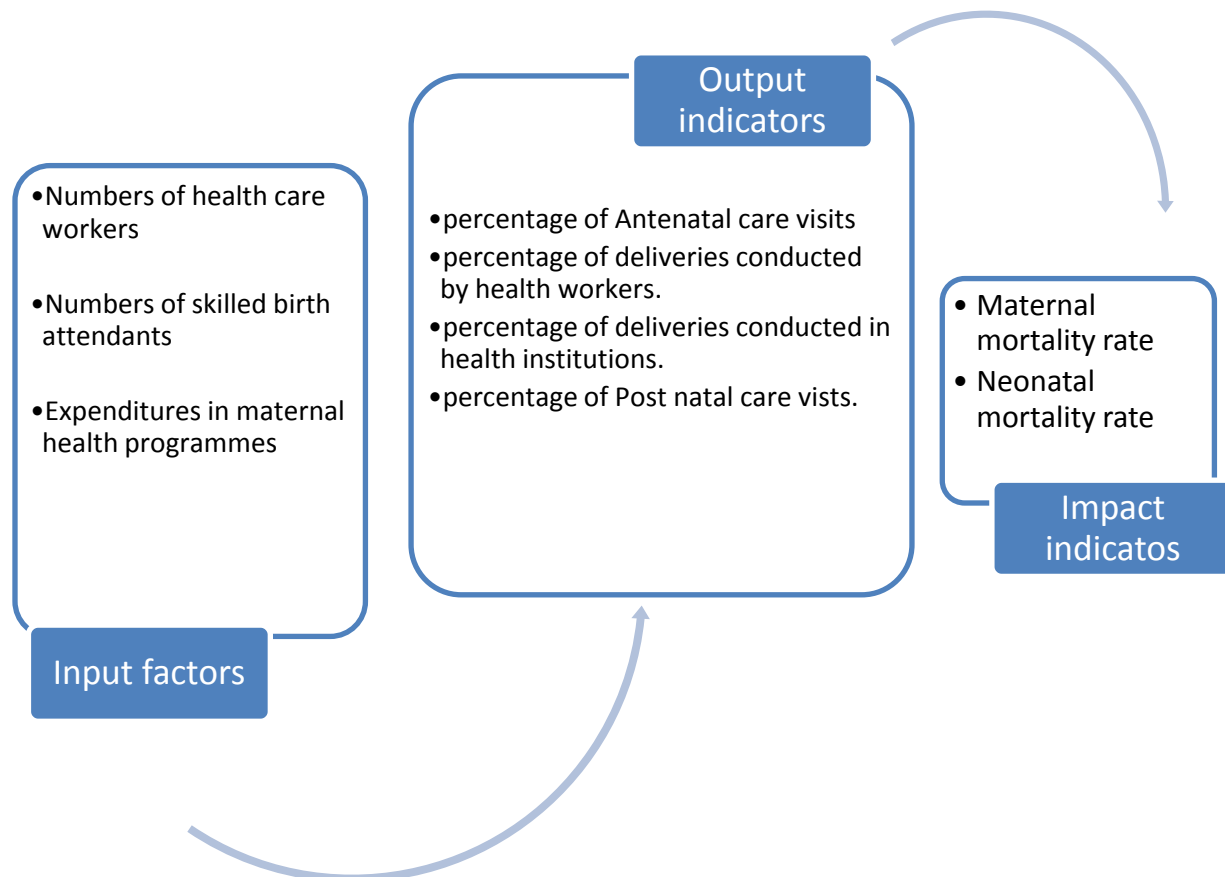


Fig 3.3.1 : Selected input, output and impact indicators of maternal health programme

In this study, health resources such as number of health workers, skilled birth attendants, budget are used to produce health care such as antenatal care visits, post natal care visits, delivery conducted by health worker. In the second set of function, the health care produced was to produce health which are measured as decreased maternal mortality rate, neonatal mortality rate. However, in this study, efficiency was measured in the production of output indicators by using the given input factors. The technical and scale efficiency was calculated for 2001, 2006 and 2010. The year 2006 was taken as the reference point for health sector reform.

Selection of Indicators

Input indicators- The number of doctors, nurses, health institution, FCHV and budget were included as the input indicators. Nurses include the Nursing staff including auxiliary nurses midwife. The doctors and nurses are categorized as the skilled birth attendant. The health institution includes all the government institution including hospital, primary health care centre, health post and sub-health post. The budget included here is under the heading of family planning and safe motherhood programme.

Output indicators- The four health service indicators antenatal visits, delivery by health worker, delivery in health institution and post natal visits. These are the important safe mother indicators included in safe motherhood programme in Nepal.

Data sources

The data for the input variable were collected from the multiple secondary sources. The Number of doctors and nurses for 2001 and 2006 were collected from the report “Nepal district health profile” published by Department of Health service, World Health Organization, United Nation Development Programme (39). The number of doctors and nurses of each district for year 2010

were collected from the publicly available website of (<http://www.e-huris.gov.np/>) Human resource information centre (HuRIC) for the year 2011. The numbers of manpower were based on total sanction post in each district. The budget details were collected from the annual publication of National planning commission on district development programme for each district. The number of health institution, Female community health volunteer and data on each output variable were collected from the annual report published by Department of Health Service (1, 13, 40).

The data collection was really huge work as well as challenging. The best available data were tried from the multiple sources to collect for all the districts.

Data analysis

The data was analyzed using the data envelopment analysis software developed by Joe Zhu (44). Output oriented data model was used. Output oriented model seeks to attain the efficiency by output maximization for given set of inputs. This output oriented model is mostly used in the developing countries where there is shortage of resources, not universal coverage, district level authorities has no control over resources (35). The technical efficiency and scale efficiency was calculated by using the following return of scale (33,38).

Constant return of scale (CRS) —This model usually known as the CCR model measures the overall technical efficiency. This assumes that the proportionate change in input will results in the proportionate change of output, remains independent of scale of operation. This model measures the overall technical efficiency. The output oriented CRS model can be expressed as:

$$\text{Maximize } \phi - \epsilon \left(\sum_{i=1}^m s_{i-} \right) + \left(\sum_{r=1}^s s_{r+} \right)$$

Subject to constraints

$$\sum_{j=1}^n \lambda_j x_{ij} + s_{i-} = x_{io} \quad (i = 1, 2, 3 \dots m)$$

$$\sum_{j=1}^n \lambda_j y_{rj} - s_{r+} = \phi y_{ro} \quad (r = 1, 2, 3 \dots s)$$

$$\lambda_j \geq 0, j=1,2,\dots,n$$

Where ϕ represents the output efficiency, s_{i-} represents the input slacks (minus sign indicates the reduction) and s_{r+} represents the output slacks (plus sign represents the output increase). The slack indicates the inefficiencies proportion.

Variable return to scale (VRS) — This measure the pure technical efficiency. The model assumes the change in input doesn't necessarily results in the proportionate change in output. There is also inefficiency due to the size of the organization. This is measured with the help of pure technical measured in VRS scale and the overall technical efficiency measured in the CRS scale. Scale efficiency can calculate by dividing the constant return to scale by variable return to scale. The sign of variable λ_j indicates the direction of return to scale (either increasing, decreasing or constant).

$$\text{Maximize } \phi - \epsilon \left(\sum_{i=1}^m s_{i-} + \sum_{r=1}^s s_{r+} \right)$$

$$\sum_{j=1}^n \lambda_j x_{ij} + s_{i-} = x_{io} \quad (i = 1,2,3,\dots,m)$$

$$\sum_{j=1}^n \lambda_j y_{rj} - s_{r+} = \phi y_{ro} \quad (r = 1, 2, 3 \dots s)$$

$$\sum_{j=1}^n \lambda_j = 1 \quad (j=1,2,\dots,n)$$

$$\lambda_j \geq 0, (j=1,2,\dots,n)$$

The value of $\phi > 1$, was converted to the range 0 - 1, by taking the reciprocal ($1/\phi$). This has been done for the ease of interpretation by converting efficiency score in between 0 to 1 (35). The maximum value 1 represents the efficient whereas the value less than 1 represent inefficient .

In the next stage, the efficient targets for the technically inefficient DMUs were calculated under the output oriented VRS models. This model calculates the required output increased (also input reduction in some case) for each inefficient DMUs to get into frontier or efficient stage.

$$\text{Inputs } X_{io} = x_{io} - s^{-x}$$

$$\text{Outputs } Y_{ro} = \phi y_{ro} + s_{r-}$$

Interpretation of technical and scale efficiency

The score of technical and scale efficiency can be interpreted as follows: (33,38,41)

Technical efficiency: Suppose the technical efficiency of organization A is 0.75. This means organization is 25% inefficient. This can be interpreted in 2 ways. Organisation can reduce the input utilization by 25% without reducing output. This is input oriented model. Alternately the organization A can increase the output by 25% without increasing the inputs. This interpretation is applicable in the output oriented model.

Scale efficiency: Let's suppose the scale efficiency of organization A is 0.85. This means that the 15% of inefficiency is due to the size of the organization. This implies that there is potential for increasing 15 % of output by using the present capacity, without altering the capacity.

3.4 Results

Table 3.4.1. Technical and scale efficiency score for districts for each year 2001, 2006 and 2010

	2001		2006		2010	
	Technical efficiency	Scale efficiency	Technical efficiency	Scale efficiency	Technical efficiency	Scale efficiency
1.Bhojpur	49.14	77.86	77.29	84.03	33.02	96.88
2.Dhankuta	66.10	85.30	61.74	77.85	67.39	89.03
3.Ilam	63.83	86.12	49.95	89.64	52.47	99.94
4.Jhapa	100	100	100	100	100	100
5.Khotang	66.75	76.03	87.42	93.34	38.67	97.93
6.Morang	100	100	100	100	100	100
7.Okhaldhunga	93.34	58.87	100	71.64	49.16	82.32
8.Panchthar	80.23	75.61	81.08	85.29	44.14	91.38
9.Sankhuwasabha	60.38	69.21	48.94	78.74	38.88	92.30
10.Saptari	100	100	94.72	98.29	76.31	83.48
11.Siraha	97.37	96.87	100	100	100	97.46
12.Solukhumbu	77.90	52.19	92.03	64.16	43.04	82.97
13.Sunsari	81.52	98.69	100	100	100	100
14.Taplejung	44.54	73.32	84.31	78.91	41.25	98.81
15.Terathum	76.52	57.58	100	61.01	32.73	96.82
16.Udaypur	85.91	84.34	73.56	94.48	73.84	99.92
17.Bara	55.36	98.99	100	100	99.30	99.00
18.Bhaktapur	62.79	56.59	100	82.98	99.56	61.80
19.Chitwan	78.78	94.99	100	100	100	100
20.Dhading	72.91	82.62	100	97.28	100	86.63
21.Dhanusha	100	100	100	100	100	85.72
22.Dolakha	43.41	83.10	59.65	90.67	45.03	99.53
23.Kathmandu	100	97.42	100	100	100	100
24.Kavre	83.14	90.81	72.95	97.33	86.75	98.58
25.Lalitpur	100	100	100	100	100	100
26.Mahottari	97.45	97.95	100	100	100	100
27.Makwanpur	77.72	95.51	100	100	51.72	95.31
28.Nuwakot	51.64	99.79	79.41	95.44	40.78	98.76
29.Parsa	59.86	99.78	97.80	97.45	52.07	90.21
30.Ramechhap	74.35	77.17	82.32	81.85	47.58	97.55
31.Rasuwa	63.80	46.71	60.29	47	44.76	47.54
32.Rautahat	48.17	99.15	100	100	100	100
33.Sarlahi	50.62	94.36	100	100	100	100
34.Sindhuli	22.06	84.18	78.82	82.53	57.41	99.62
35.Sindhupalchowk	44.77	92.05	39.01	99.36	41.36	95.63
36.argakhanchi	90.34	90.64	100	92.91	35.70	97.68
37.Baglung	69.29	99.06	59.28	95.52	100	95.98
38.Gorkha	56.96	99.27	73.48	90.29	47.52	97.39
39.Gulmi	70.43	99.16	58.80	96.87	49.01	97.06
40.Kapilvastu	100	100	93.82	99.97	85.01	98.40
41.kaski	100	95.08	100	100	89.29	99.96
42.Lamjung	57.78	91.55	50.54	95.14	51.21	94.54
43.Manang	100	2.00	100	2.01	100	2.59
44.Mustang	100	13.65	44.10	16.61	29.09	22.6
45.Myagdi	78.75	61.39	82.99	74.46	100	100
46.Nawalparasi	81.42	98.27	82.28	99.29	100	92.98
47.Palpa	85.53	98.36	62.16	94.95	100	94.12

48.parnat	78.40	77.37	38.84	88.67	41.59	98.93
49.Rupandehi	99.66	93.86	100	100	100	86.98
50.Syangja	62.87	88.95	64.07	91.77	54.73	96.81
51.Tanhun	69.89	41.65	77.19	86.72	65.60	99.99
52.Banke	83.75	87.95	100	100	82.64	97.92
53.Bardiya	100	78.58	100	100	85.86	96.33
54.Dailekh	81.30	92.72	72.90	99.03	66.02	98.86
55.Dang	87.36	93.75	100	100	78.57	97.61
56.Dolpa	100	13.79	100	39.18	100	25.17
57.Humla	15.66	55.69	91.63	34.65	55.09	56.42
58.Jajarkot	64.53	51.83	85.08	74.93	84.24	76.91
59.Jumla	57.33	59.76	88.81	83.14	55.62	93.18
60.Kalikot	38.67	38.69	100	91.63	100	100
61.Mugu	100	15.92	90.48	52.62	93.39	42.09
62.Pyuthan	100	100	83.20	88.27	67.41	99.86
63.Rolpa	89.13	64.29	66.68	95.70	74.67	97.59
64.Rukum	100	61.74	76.99	95.81	76.73	94.39
65.salyan	50.38	79.03	72.37	96.60	61.77	97.64
66.Surkhet	67.30	98.72	53.50	99.56	57.18	99.89
67.Achham	100	82.74	93.43	98.11	92.64	90.73
68.Baitadi	51.30	87.46	100	100	58.46	94.10
69.Bajhang	55.54	73.42	76.47	96.47	67.40	94.45
70.Bajura	37.89	53.95	89.85	64.11	89.85	69.44
71.Dadeldhura	100	63.90	100	98.63	100	100
72.Darchula	49.98	68.94	100	100	58.67	75.18
73.Doti	61.86	92.42	63.89	98.34	59.10	98.64
74.Kailali	88.90	97.35	89.27	97.90	82.91	97.86
75.Kanchanpur	100	100	100	99.49	100	94.71
Overall efficiency	74.83	79.28	84.04	87.71	72.72	89.73

The technical efficiency has increased from 2001 to 2006 from 74.83% to 84.04% however it decreases again in 2011 accounting 72.72%.The efficiency was increasing before the health sector reform .This implies that the 27% output can be increased without increasing inputs in 2011 whereas it was just 16% in 2006. Whereas the scale efficiency has been increasing from 2001 to 2006 and 2011 continuously.The scale efficiency has increased from 79.28% in 2001 to 87.71% in 2006 and 89.73% in 2011.The possible reasons behind these changes are discussed in the next Discussion chapter.

Distribution of efficiency scores according to the topographical region

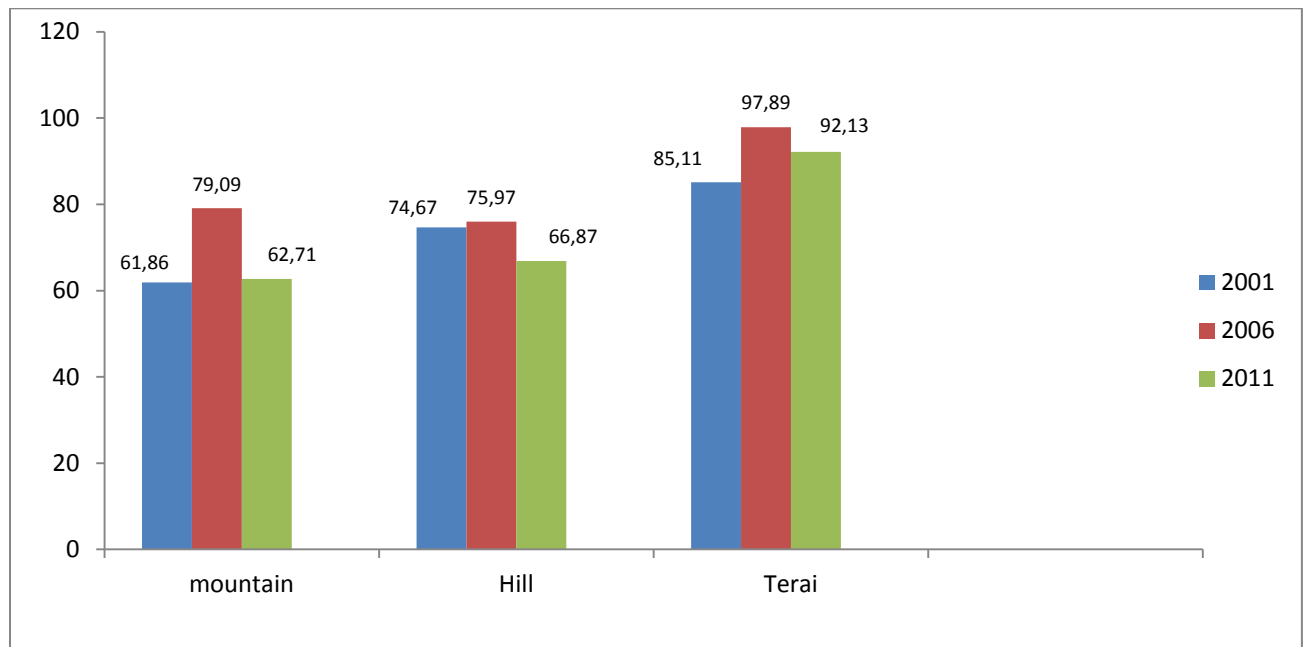


Fig 3.4.1: Distribution of technical efficiency score according to topographical region

The figure shows the average technical score of maternal health programme varies according to topographical region. The technical efficiency score is higher in terai districts each year than the hill and terai. The average technical efficiency score of all region increases from 2001 to 2006 and then again decreases in 2011. The bar denoting year 2011 shows the terai districts in top, hill in middle and mountain districts remain in bottom. However, the gap between mean technical efficiency of terai and mountain districts in 25% compared to the hill and mountain districts i.e., 4%.

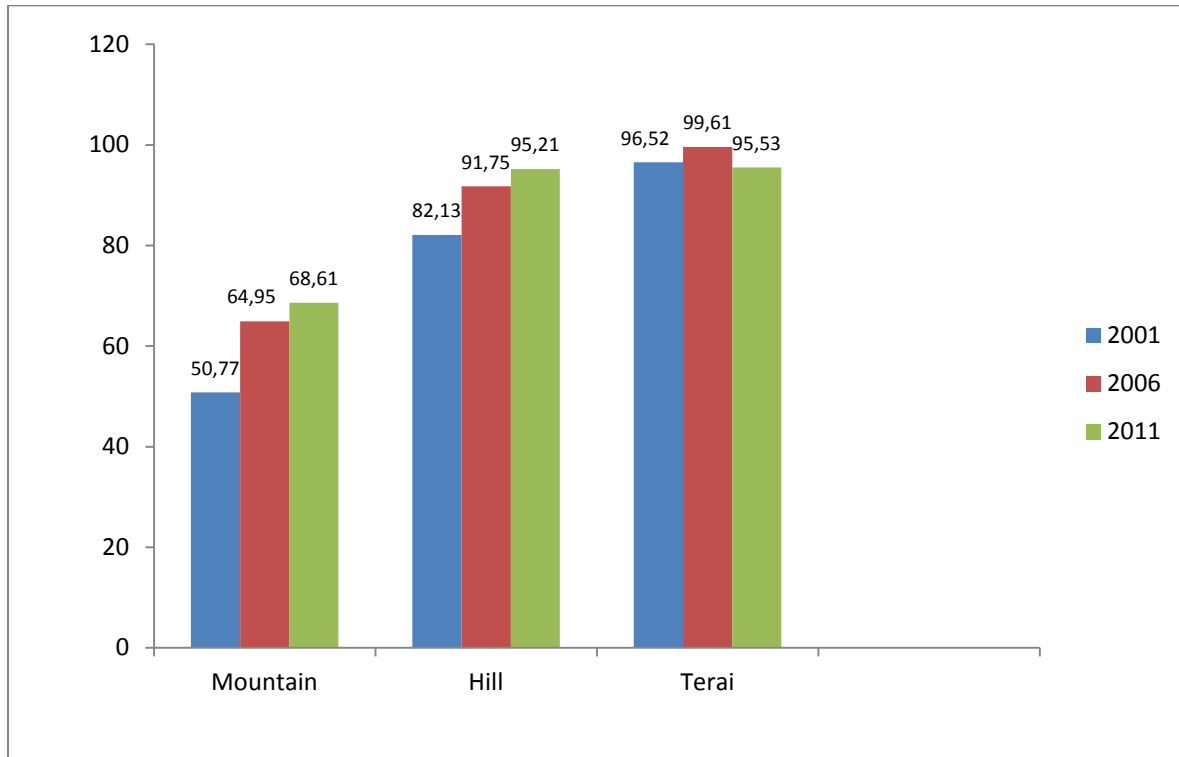


Fig 3.4.2: Distribution of scale efficiency score according to topographical region

The figure shows the average scale efficiency score of maternal health programme varies according to topographical region. The bar diagram above shows that the scale efficiency of maternal health programme of terai district is higher each year than the hill and mountain. The scale efficiency of all the mountains and hilly region is increases from 2001 to 2006 and then in 2011. However, the scale efficiency of terai districts increases from 2001 to 2006 (96.52% to 99.61%) and then falls to 95.53% in 2011.

Table 3.4.2: Output increase and input decrease to make inefficient district as efficient based on 2010

Districts	Doctors	Nurses	FCHV	Health institution	Budget ('000)	ANC Visit	Health institution delivery	Delivery by Health worker	PNC visit
1.Bhojpur	6	72	519	51	13192	9763	1675	4475	5102
2.Dhankuta	6	55	315	35	8412	6512	2513	2994	3503
3.Ilam	7	69	605	48	17901	10227	6130	7196	8014
4.Khotang	5	83	622	66	18082	12101	2697	5927	6422
5.Okhaldhunga	3	44	426	33	14303	6253	2790	3337	3914
6.Panchthar	5	60	394	40	12410	8741	2980	4341	4859
7.Sankhuwasabha	6	58	325	35	11905	8386	3963	4197	4470
8.Saptari	20	107	654	59	32704	23587	13204	12636	10857
9.Solukhumbu	5	48	306	30	11837	6617	3433	3608	4019
10.Taplejung	4	56	429	41	10349	7199	2669	3773	4269
11.Terathum	4	47	379	32	8574	6177	2535	2895	3284
12.Udaypur	5	61	450	43	12679	8629	3033	4575	5173
13.Bara	7	102	858	79	29359	16914	5986	10370	11161
14.Bhaktapur	5	33	189	21	8219	3781	2187	2110	1922
15.Dolakha	5	71	502	53	15369	10706	2181	4857	5300
16.Kavre	5	68	621	50	20509	11594	4798	6563	7396
17.Makwanpur	12	77	433	45	20170	14981	7463	7780	6877
18.Nuwakot	6	73	620	53	20573	12403	5455	7615	8385
19.Parsa	27	112	669	55	36647	24768	15000	12992	11398
20.Ramechhap	4	56	387	39	10474	7771	2110	3560	4024
21.Rasuwa	3	27	194	19	5762	1890	880	991	1133
22.Sindhuli	6	68	495	49	12815	8423	3230	4984	5596
23.Sindhupalchowk	7	75	486	52	17415	12309	2978	6060	6594
24.argakhanchi	5	57	475	40	16859	9978	2936	4447	5268
25.Gorkha	8	82	549	58	16792	11770	2960	6156	6678
26.Gulmi	7	84	622	61	22024	14111	3971	7807	8684
27.Kaski	43	139	922	49	36159	17845	13453	13648	14422
28.kapilvastu	9	105	772	76	26168	17674	2642	8284	9782
29.Lamjung	5	68	515	51	13071	9334	3261	4348	4813
30.Mustang	3	23	144	17	4629	757	368	433	485
31.parbat	4	56	433	41	10327	7119	2766	3803	4297
32.Syangja	7	89	612	66	18339	13169	2614	5308	6243
33.Tanhun	5	64	434	46	13192	9474	2173	4496	5103
34.Banke	16	88	681	48	29542	15330	11218	11816	13391
35.Bardiya	6	52	594	34	22082	10906	5931	5975	6967
36.Dailekh	5	56	606	38	21292	10748	6325	6644	7678
37.Dang	11	70	632	41	26743	15347	9542	9235	9253
38.Humla	3	35	243	25	7822	3245	1828	1969	3000
39.Jajarkot	4	47	270	31	7681	5711	2205	2487	2727
40.Jumla	3	38	413	27	14436	6780	2412	2532	3475
41.Mugu	2	33	216	25	6005	1927	846	997	987
42.Pyuthan	5	64	416	46	12134	9217	1421	3954	4536
43.Rolpa	3	50	405	37	10993	7140	1839	2772	3360
44.Rukum	4	58	387	42	10802	8119	1417	3300	3820
45.salyan	5	63	423	46	11193	8739	2462	3682	3903
46.Surkhet	28	107	495	51	26141	17579	9717	10316	11241
47.Achham	4	46	532	32	19455	8929	4639	4757	5830
48.Baitadi	5	75	630	56	13398	10221	1600	2954	4346
49.Bajhang	4	61	423	45	11598	8510	1893	3779	4238
50.Bajura	3	36	261	25	7873	4160	1562	1745	2078
51.Darchula	3	46	369	33	9981	5675	2701	3010	3548
52.Doti	6	69	568	50	20401	12152	3881	5714	6234
53.Kailali	21	94	898	45	30975	16024	12070	12212	12901
Total	400	3477	25818	2310	867767	537422	110783	138429	123522

The table above shows that the output increase and input reduction to make the 53 technically inefficient DMUs into efficient DMUs. Although the output oriented model implies the possible output increase to make the inefficient DMUs efficient, keeping the input constant. The necessity of input reduction here is due to the slacks which means left over proportion of inefficiencies.

Table 3.4.3 : Summary of change in output and input needed to make inefficient district as efficient

Variable	Initial Value	Required value	Change
Input used			
Doctors	469	400	-69
Nurses	3949	3477	-472
FCHV	33544	25818	-7726
Health institution	2801	2310	-491
Budget ('000)	919165	867767	-51398
Output received			
ANC visit	336554	537422	+200868
Delivery in health institutions	111760	222543	+110783
Delivery by health workers	147987	286416	+138429
PNC visit	189438	312960	+123522

The above table shows the summary of required value of input and output indicators to make the inefficient DMUs into efficient DMUs. The efficient targets are within the target values of the government value of government for each districts (1).

Chapter IV

Discussion

This study has tried to assess the equity and efficiency before and after the health sector reform in Nepal. The result shows the mixed progress in the equity objective whereas the scale efficiency has increased and technical efficiency has not increased after the health sector reform.

Reduction in the wealth related inequities

The present study shows that wealth related inequities in maternal health services have narrowed after the health sector reform. This progress can be attributed to the programmes like safe delivery incentives programme (SDIP) (previously known as maternity incentive programme), free delivery programme (*Aama surakshya karyakram*), ANC incentives programme which came to be effective after 2006. One of the output of NHSP-IP was to increase the access of poor and vulnerable in the essential health care service (EHCS) and maternal health programme remain one of the prioritized programme of EHCS(4). There has been series of development of the demand side financing schemes in the maternal health after 2005 such as SDIP, user fee exemption and four ANC incentives programmes after January 2009 (14). The experience of similar types of demand side financing schemes has been successful in reducing inequities in many developing countries like Bangladesh, Mexico, Honduras to achieve equity in maternal health services(42). But the poorest 20% utilization has not increased in comparison to other population. This is field of further research.

Ethnicity and maternal health services

Ethnicity is one of the important determinants of health. The present study also showed that the ethnicity is one of the important sources of health inequities. As discussed earlier Brahmin/Chhetri is privileged, whereas Terai /Madhesi, Newar, Janjati, Dalit, Muslim are ethnic, marginalized population. The study shows the highest benefit of health service goes to relatively privileged groups such as Brahmin/ Chhetri and Newar, although the gap between ethnic population is decreasing which was otherwise increasing sharply before the health sector reform. Why does the major benefit of health service goes to privileged group? The different reasons might be discussed under practical and normative reasons (as indicated in fig 4.1).The majority of ethnic, low caste people and minorities except Newar engaged in low paid job, non formal economy and often lives in rural area (43).The opportunity cost along with indirect cost (though direct cost of treatment is free of charge) is more than the monetary incentives, where the specialized service is often far worthing single or multiple of days. This might be one of hindrance to receive the service.

In addition to these, there are other practical reasons which can be attributed to health service factors. One of them is lack of recognition of ethnic people issue in the NHSP- IP (2004-2009).NHSP-IP specifies priority as, “*to increase the coverage and raise the quality of the EHCS, with special emphasis on improved access for poor and vulnerable groups*” (4). This plan didn't acknowledge the inequities in health according to ethnicity, so no any adequate targeted interventions were carried to increase their health service access. The second lacking on plan was during early implementation of maternity incentive schemes. The incentives were provided only for the women up to second child birth. This might have resulted in restricted access of the ethnic people in the early phase because of their high fertility (44).

Another health service factor is the attitude and capacity of the health worker. The discriminatory behavior of many health service providers toward the ethnic people might have led to the low access of ethnic people in the health service. (45) For e.g. FCHV need to be encouraged to serve dalits as well as other ethnic groups (44). The behavior on one hand and capacity of health worker and health authority is on another side. The Nepalese society is multilingual, but the health workers are mainly mainstream lingual. The health worker cannot communicate people in their mother tongue, health message from radio, television are also in Nepali language. This language barrier might have also decreased the access of maternal health service. Similar results have been shown by the study conducted in Bangladesh (46). The lack of representation of these underserved indigenous people in decision making and sense of true community ownership of health facilities and programme contribute to the inequity among the indigenous people. Another reason might be limited health service in the rural region. The ethnic people other than Newar live mostly in the rural areas (46). There is limited health service specially the specialized services such as institutional delivery, the specialized manpower, equipments etc. This might also have caused low health status of the ethnic people.

Beside these practical reasons, there are normative reasons that lead to low access of ethnic people in the health service. One of them is fatalism. Fatalism is deeply rooted in Nepalese society and much more in the ethnic people and marginalized groups. They believe the act of birth and death is on the hand of god. This hinders to receive any kind of assistance from health facilities (50). The next possible reason is the fear of erosion of culture. In the study conducted among Rautes (*indigenous community classified as janjati in table*), it has been described that

they do not receive health service because of fear that other communities will intermingle and harm their culture (47)

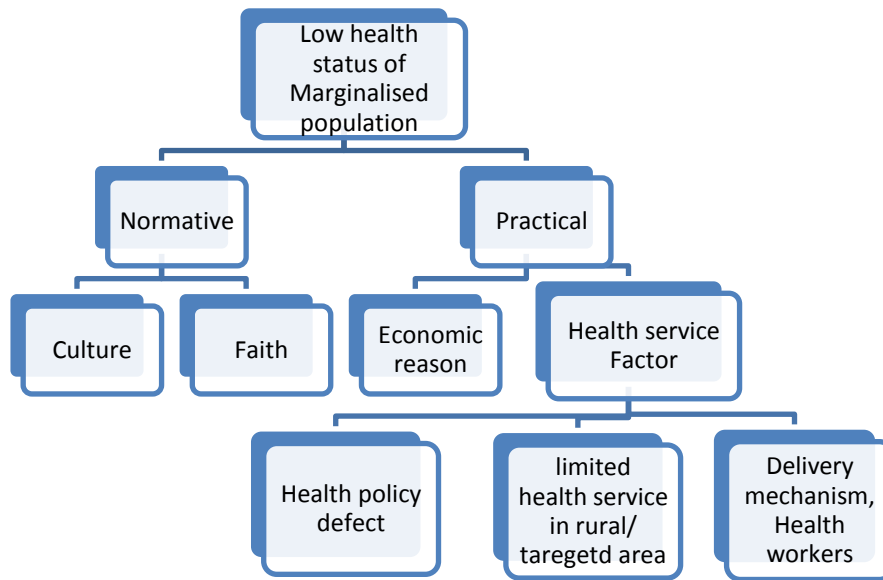


Fig4.1: factors leading to low utilization maternal health services by the ethnic people in Nepal

Moreover, the views toward disease, healing practices, gender roles, cultural *taboos* also determine the health seeking behavior. The different ethnic groups have different opinion on the cause of disease and remedies. Most of them depend on the traditional healer. Similarly the decision making role in family also determine the health seeking behavior. In most of the indigenous society, male are decision maker on issue of health visit, finance (46,47). This might result in low health seeking behavior in society. For e.g. In study conducted among *Raute*, it has been stated that one of male replied as “,... *the birth is natural process....cow, dogs and other animals are giving birth, they may also face difficulties but they never take help of others....women are meant to give birth so they will bear everything in the process.*”(47)

Rural-Urban inequities in maternal health service

This study shows that rural urban difference is one of the important sources of inequalities in maternal health services in Nepal. The inequities in delivery by SBA and institutional delivery have increased after 2006. The results are consistent with the study conducted in other parts of world such as Tajikistan, India (48). There are several factors which might account for this gap. Some of the reported problems are distance to health facility, lack of transportation facilities, poor delivery system and infrastructure, lack of skilled manpower, etc. (49). Several studies have shown that distance to health facilities is one of the important factors leading to low use of maternal health services in the countries like Nepal, Bangladesh, Malawi (50,51,52,53,54,55). Transportation difficulties also remain the serious challenges. Still 15 out of 75 districts remain out of road connection and most roadways in rainy seasons are not operational (56).

The other factors leading to the rural-urban inequities might be poor service delivery system and infrastructure. Some of the research conducted in Nepal has shown that many factors such as poor quality services, unavailability of routine services, lack of drugs, equipments, poor facilities such as bed, water, toilets leads to the poor service coverage in the rural areas (49, 52,57). Similar factors were found as the hindrances to utilize the maternal health services in Nigeria too (54). Another vital factor responsible for rural-urban inequalities might be the lack of skilled manpower-mainly unfilled sanctioned posts, frequent transfer, absenteeism and lack of female staff in rural area. (49,52).

Increasing scale efficiency

The result shows that the mean technical efficiency have decreased after health sector reform.

Whereas mean scale efficiency of maternal health programme has increased since 2001. The fact of increase in scale efficiency might be due to increase in the resources at each year of analysis 2001,2006 and 2011,as most of the scale were increasing returning in scale (see the annexes in which RTS column shows the return to scale), which might add to increase in scale efficiency .

The research conducted by World Bank (58)has shown that the following actions of NHSP has contributed on efficiency and effectiveness are: (i) increase budget on health sector from 5.6% - 7% (ii) increase budget in EHCS to increase allocative efficiency 56%-74% (iii) improve administrative capacity to decrease under spending of health budget 20% -15%. I believe all the above three actions have contributed to increase the scale efficiency.

Decreasing technical efficiency

The study shows that the technical efficiency has decreased during 2006-2011. Mainly decentralization in health sector, optimal utilization of human resource capacity, management reform, financial reforms were the health sector initiatives that aimed to increase the technical efficiency (4,59). Decentralization in Nepal starts after decentralization act 1982, local self governance act 1999 defines the statutory framework and the health policy, programme such as National health policy,SLTHP,NHSP-IP envisioned and proposed decentralization in health sector. However,due to deficiency in policy regarding decentralization leads to implementation in narrowed sense. This was corrected and different measures and actions were proposed in NHSP. The study shows that status of health sector decentralization according to NHSP-IP remained poor due to many factors such as political instability, lack of elected local bodies, lack

of appropriate plans and strategy (59,60).The literature review also shows that the decentralization increases the technical efficiency in the health sector (61).

Second the NHSP-IP targets the optimal utilization of human resources as means of increasing didn't go so exciting. One of the problems is unfilled sanctioned post; the latest figure shows that only 76% of sanctioned post are filled. The retention of health worker remains the major challenge (3) .In one facility based survey, only 64-80% doctors , 68-81% nurses and 81-92% paramedics were available at the time of study period and the study also shows that the situation in the remote district is much worse (3,62).So the NHSP-IP plan of optimal utilization of health worker was not exciting.

Some of the management reform initiative in NHSP-IP, supposed to increase efficiency were public private partnership (P-P-P), physical asset management and procurement (4) . P-P-P was mainly initiated in Nepal to increase the efficiency in health sector via competition and performance based contracts. But the P-P-P didn't go as it was predicted. The major challenges remain the unclear government policies, private sector interest for motives and state intention to shift away the work rather than increasing the competition. Another problem lies with the physical asset management and the procurement of goods. The government claims that due to these problems, health facility run out of drugs, equipment and leakage of government resources. This has certainly resulted in the low service coverage compared to the resources used and hence the efficiency is compromised (3).

Variation in efficiency score

The study shows the great variation of technical efficiency score within Mountain, hill and terai.Terai has the highest and mountain has the lowest efficiency. Similar results were found in

the study conducted among the hospital of Nepal, where hospitals in the mountain were found less efficient than the hill and terai (63). The contributing factor for decreasing technical efficiency has been discussed earlier. The problem related to health manpower is much worse in the remote mountainous districts. There is highly unfilled sanctioned post, retention of the health workers is much more serious in these region (52). These problems might have result in lower technical efficiency in these regions (3, 62). Similarly there is variation in the scale efficiency score. One of the limitations of study is that the factors affecting on efficiency score were not studied due to the time, resource constraint, data unavailability and scope of the work. However considering the efficiency study conducted among the hospital in Nepal, bed occupancy rate, number of beds, outpatient physician ratio were associated with the scale efficiency (63). This study also suggests that the districts with the higher number of doctors, nurses, health institution and bigger amount of budget are scale efficient (63). Thus the scale efficiency of district of terai and hilly region is higher than those of mountain

Saving resources

The result presents the required number of output increase (and in some case) to make the inefficient districts into efficient. The result also clearly shows that no more resources is required to achieve the maternal health programme targets for each districts in case of full utilization of given resources. But the issues remain with the utilization of the resources. The conditions required is the fulfillment of the sanctioned post, retention of health workers, readiness of health institution to provide the service and guarantees of all the financial resources to be channeled in appropriate intervention.

Chapter V

Conclusion and Recommendation

The conclusions of the study are:

1. The wealth related inequities have narrowed down after health sector reform except for the poorest (below 20%) people.
2. The rural-urban differences have increased after health sector reform especially in terms of institutional delivery and delivery conducted by SBA.
3. The utilization of maternal health services of ethnic and marginalized remain at slower rate than the privileged population.
4. The technical efficiency has decreased after health sector reform 84.04 % to 72.72 %, and moreover, districts of mountain and hilly region remain less efficient than districts in terai region.
5. The scale efficiency has increased after health sector reform from 87.71% to 89.73%, which were mainly due to increase of resources after the health sector reform.
6. The efficiency analysis concludes that there is no need to increase resources meet the national target, and the efficiency target can be met with the existing resources. The need is of proper policy and management.

Some of the recommendation to improve equity and efficiency are as follows:

1. Proper implementation of decentralization of health facilities to increase ownership of community and better community planning with adequate representation of indigenous, underprivileged and underserved population.
2. Health manpower: Actions oriented toward fulfillment of sanctioned post, retention of health workers and proper use of technical expertise. Special consideration on the inclusion of diverse ethnic and linguistic people while fulfilling the sanctioned post. Allocation of health workers

who are familiar with the ethnic and linguistic diversity of particular place. Orientation and sensitization of health worker to respect the diversity.

3. Further research to explore the factors that hinder the poorest population to utilize the maternal health service, despite of free of charge in addition to extra financial incentives.

4. Further research to assess efficiency at different level of health institution that would also explore the factors that affect the efficiency, which was limitation of this study.

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Annex

Output-Oriented CRS														
DMU No.	DMU Name	Efficiency	Σλ	RTS	Benchmarks									
1	Bhojpur	2.61347	0.501	Increasing	0.115	Saptari	0.036	Dhanusa	0.002	Lalitpur	0.347	Kapilbastu		
2	Dhankuta	1.77338	0.725	Increasing	0.072	Morang	0.011	Dhanusa	0.119	Lalitpur	0.524	Pyuthan		
3	Ilam	1.81890	0.691	Increasing	0.035	Morang	0.009	Dhanusa	0.060	Lalitpur	0.539	Kapilbastu	0.047	Kanchanpur
4	Jhapa	1.00000	1.000	Constant	1.000	Jhapa								
5	Khotang	1.97036	0.689	Increasing	0.043	Dhanusa	0.005	Lalitpur	0.133	Kapilbastu	0.508	Pyuthan		
6	Morang	1.00000	1.000	Constant	1.000	Morang								
7	Okhaldhunga	1.81961	0.315	Increasing	0.098	Morang	0.211	Kapilbastu	0.006	Pyuthan				
8	Panchthar	1.64823	0.504	Increasing	0.058	Morang	0.050	Dhanusa	0.071	Lalitpur	0.201	Kapilbastu	0.124	Pyuthan
9	Sankhuwasabha	2.39245	0.497	Increasing	0.081	Morang	0.080	Dhanusa	0.022	Lalitpur	0.315	Pyuthan		
10	Saptari	1.00000	1.000	Constant	1.000	Saptari								
11	Siraha	1.06010	1.210	Decreasing	0.676	Morang	0.145	Saptari	0.390	Kapilbastu				
12	Solukhumbu	2.45906	0.372	Increasing	0.030	Morang	0.096	Dhanusa	0.004	Lalitpur	0.154	Kapilbastu	0.088	Pyuthan
13	Sunsari	1.24291	0.922	Increasing	0.560	Morang	0.022	Dhanusa	0.124	Lalitpur	0.031	Kapilbastu	0.184	Kanchanpur
14	Taplejung	3.06158	0.488	Increasing	0.008	Morang	0.086	Lalitpur	0.394	Kapilbastu				
15	Terathum	2.26934	0.521	Increasing	0.002	Morang	0.018	Dhanusa	0.052	Lalitpur	0.198	Kapilbastu	0.251	Pyuthan
16	Udayapur	1.38005	0.609	Increasing	0.121	Morang	0.054	Dhanusa	0.191	Kapilbastu	0.244	Pyuthan		
17	Bara	1.82452	0.948	Increasing	0.318	Morang	0.630	Kapilbastu						
18	Bhaktapur	2.81359	0.373	Increasing	0.132	Jhapa	0.036	Morang	0.063	Dhanusa	0.141	Lalitpur		
19	Chitwan	1.33617	0.767	Increasing	0.278	Morang	0.064	Dhanusa	0.339	Lalitpur	0.085	Kanchanpur		
20	Dhading	1.65990	0.503	Increasing	0.154	Morang	0.030	Saptari	0.051	Dhanusa	0.268	Kapilbastu		
21	Dhanusa	1.00000	1.000	Constant	1.000	Dhanusa								
22	Dolakha	2.77154	0.532	Increasing	0.164	Morang	0.170	Kapilbastu	0.198	Pyuthan				
23	Kathmandu	1.02648	1.225	Decreasing	1.225	Lalitpur								
24	Kavrepalanchok	1.32430	0.651	Increasing	0.279	Morang	0.372	Kapilbastu						
25	Lalitpur	1.00000	1.000	Constant	1.000	Lalitpur								
26	Mahottari	1.04759	0.896	Increasing	0.354	Morang	0.063	Dhanusa	0.345	Kapilbastu	0.134	Pyuthan		
27	Makwanpur	1.34700	0.800	Increasing	0.129	Jhapa	0.233	Morang	0.043	Dhanusa	0.394	Lalitpur		
28	Nuwakot	1.94041	1.019	Decreasing	0.106	Morang	0.453	Kapilbastu	0.460	Pyuthan				
29	Parsa	1.67409	0.957	Increasing	0.404	Morang	0.547	Dhanusa	0.006	Kanchanpur				
30	Ramechhap	1.74273	0.559	Increasing	0.052	Morang	0.103	Kapilbastu	0.403	Pyuthan				
31	Rasuwa	3.35482	0.283	Increasing	0.123	Morang	0.053	Dhanusa	0.006	Lalitpur	0.101	Pyuthan		
32	Rautahat	2.09324	1.044	Decreasing	0.406	Morang	0.039	Saptari	0.600	Kapilbastu				
33	Sarlahi	2.09326	1.333	Decreasing	0.285	Morang	1.028	Kapilbastu	0.020	Kanchanpur				
34	Sindhuli	5.38341	0.521	Increasing	0.075	Morang	0.182	Saptari	0.020	Lalitpur	0.245	Kapilbastu		
35	Sindhupalchowk	2.42592	0.735	Increasing	0.127	Morang	0.005	Saptari	0.007	Lalitpur	0.597	Kapilbastu		
36	Argakhanchi	1.22109	0.797	Increasing	0.062	Morang	0.034	Dhanusa	0.005	Lalitpur	0.697	Pyuthan		
37	Baglung	1.45671	0.975	Increasing	0.109	Dhanusa	0.045	Lalitpur	0.282	Kapilbastu	0.539	Pyuthan		
38	Gorakha	1.76823	1.072	Decreasing	0.013	Morang	0.056	Dhanusa	0.061	Lalitpur	0.228	Kapilbastu	0.713	Pyuthan
39	Gulmi	1.43156	0.970	Increasing	0.019	Morang	0.052	Lalitpur	0.343	Kapilbastu	0.556	Pyuthan		
40	Kapilbastu	1.00000	1.000	Constant	1.000	Kapilbastu								
41	Kaski	1.05165	1.141	Decreasing	0.093	Dhanusa	0.781	Lalitpur	0.268	Kanchanpur				
42	Lamjung	1.89023	0.770	Increasing	0.037	Morang	0.047	Lalitpur	0.361	Kapilbastu	0.325	Pyuthan		
43	Manang	49.85271	0.189	Increasing	0.067	Morang	0.036	Dhanusa	0.086	Pyuthan				
44	Mustang	7.32399	0.295	Increasing	0.034	Morang	0.036	Dhanusa	0.054	Lalitpur	0.171	Pyuthan		
45	Myagdi	2.06824	0.370	Increasing	0.042	Morang	0.030	Saptari	0.014	Lalitpur	0.284	Kapilbastu		
46	Nawalparasi	1.24975	0.822	Increasing	0.309	Morang	0.297	Saptari	0.216	Kapilbastu				
47	Palpa	1.18863	1.131	Decreasing	0.115	Morang	0.038	Lalitpur	0.978	Pyuthan				
48	Parbat	1.64833	0.507	Increasing	0.029	Morang	0.019	Saptari	0.037	Lalitpur	0.422	Kapilbastu		
49	Rupandehi	1.06894	1.142	Decreasing	0.533	Dhanusa	0.127	Lalitpur	0.481	Kanchanpur				
50	Syangja	1.78775	0.633	Increasing	0.087	Morang	0.127	Saptari	0.014	Lalitpur	0.404	Kapilbastu		
51	Tanahun	1.69504	0.508	Increasing	0.235	Morang	0.070	Saptari	0.203	Kapilbastu				
52	Banke	1.35743	0.704	Increasing	0.246	Jhapa	0.314	Dhanusa	0.144	Kanchanpur				
53	Bardiya	1.27256	0.500	Increasing	0.500	Morang								
54	Dailekh	1.32641	0.800	Increasing	0.092	Morang	0.708	Pyuthan						
55	Dang	1.22093	0.706	Increasing	0.241	Morang	0.125	Dhanusa	0.076	Kapilbastu	0.264	Kanchanpur		
56	Dolpa	7.24866	0.164	Increasing	0.073	Morang	0.090	Kapilbastu						
57	Humla	11.46322	0.518	Increasing	0.040	Morang	0.014	Dhanusa	0.464	Pyuthan				
58	Jajarkot	2.98929	0.292	Increasing	0.070	Morang	0.042	Saptari	0.020	Dhanusa	0.159	Kapilbastu		
59	Jumla	2.91796	0.426	Increasing	0.072	Morang	0.016	Dhanusa	0.201	Kapilbastu	0.137	Pyuthan		
60	Kalikot	6.68167	0.302	Increasing	0.072	Morang	0.000	Dhanusa	0.009	Lalitpur	0.202	Kapilbastu	0.019	Pyuthan
61	Mugu	6.28106	0.175	Increasing	0.112	Morang	0.063	Kapilbastu						
62	Pyuthan	1.00000	1.000	Constant	1.000	Pyuthan								
63	Rolpa	1.74487	0.400	Increasing	0.118	Morang	0.282	Pyuthan						
64	Rukum	1.61971	0.381	Increasing	0.010	Morang	0.020	Saptari	0.013	Lalitpur	0.337	Kapilbastu		
65	Salyan	2.51128	0.490	Increasing	0.126	Morang	0.034	Dhanusa	0.284	Kapilbastu	0.046	Pyuthan		
66	Surkhet	1.50499	0.874	Increasing	0.219	Morang	0.129	Dhanusa	0.322	Lalitpur	0.204	Pyuthan		
67	Achham	1.20860	0.552	Increasing	0.065	Morang	0.119	Kapilbastu	0.368	Pyuthan				
68	Baitadi	2.22859	0.691	Increasing	0.012	Saptari	0.000	Lalitpur	0.679	Kapilbastu				
69	Bajhang	2.45176	0.427	Increasing	0.053	Morang	0.086	Saptari	0.289	Kapilbastu				
70	Bajura	4.89064	0.285	Increasing	0.085	Morang	0.091	Saptari	0.109	Kapilbastu				
71	Dadeldhura	1.56489	0.382	Increasing	0.109	Morang	0.062	Lalitpur	0.202	Kapilbastu	0.009	Kanchanpur		
72	Darchula	2.90180	0.536	Increasing	0.029	Morang	0.159	Kapilbastu	0.348	Pyuthan				
73	Doti	1.74909	0.851	Increasing	0.046	Dhanusa	0.005	Lalitpur	0.182	Kapilbastu	0.618	Pyuthan		
74	Kailali	1.15539	1.137	Decreasing	0.272	Jhapa	0.190	Morang	0.041	Dhanusa	0.633	Kanchanpur		
75	Kanchanpur	1.00000	1.000	Constant	1.000	Kanchanpur								

		Output-Oriented CRS													
DMU No.	DMU Name	Efficiency	Σ	RTS	Benchmarks										
1	Bhojpur	1.53949	0.394	Increasing	0.131	Morang	0.145	Sarlahi	0.118	Banke					
2	Dhankuta	2.08047	0.311	Increasing	0.183	Morang	0.094	Rupandehi	0.034	Banke					
3	Ilam	2.23314	0.534	Increasing	0.162	Morang	0.128	Rautahat	0.112	Rupandehi	0.132	Baitadi			
4	Jhapa	1.00000	1.000	Constant	1.000	Jhapa									
5	Khotang	1.22543	0.559	Increasing	0.107	Morang	0.060	Rupandehi	0.392	Baitadi					
6	Morang	1.00000	1.000	Constant	1.000	Morang									
7	Okhaldhunga	1.39579	0.333	Increasing	0.145	Morang	0.188	Bara							
8	Panchthar	1.44581	0.467	Increasing	0.102	Morang	0.073	Rupandehi	0.291	Baitadi					
9	Sankhuwasabha	2.59448	0.336	Increasing	0.246	Morang	0.080	Rupandehi	0.010	Banke					
10	Saptari	1.07400	1.065	Decreasing	0.069	Morang	0.590	Bara	0.032	Dhanusa	0.374	Rupandehi			
11	Siraha	1.00000	1.000	Constant	1.000	Siraha									
12	Solukhumbu	1.69335	0.259	Increasing	0.144	Bara	0.079	Dhanusa	0.036	Rupandehi					
13	Sunsari	1.00000	1.000	Constant	1.000	Sunsari									
14	Taplejung	1.50295	0.310	Increasing	0.116	Morang	0.128	Sarlahi	0.065	Banke					
15	Terathum	1.63901	0.263	Increasing	0.208	Sarlahi	0.046	Rupandehi	0.008	Banke					
16	Udayapur	1.43867	0.496	Increasing	0.067	Morang	0.345	Rautahat	0.049	Rupandehi	0.034	Bardiya			
17	Bara	1.00000	1.000	Constant	1.000	Bara									
18	Bhaktapur	1.20503	0.225	Increasing	0.096	Kaski	0.129	Banke							
19	Chitwan	1.00000	1.000	Constant	1.000	Chitwan									
20	Dhading	1.02796	0.434	Increasing	0.089	Jhapa	0.317	Morang	0.028	Rupandehi					
21	Dhanusa	1.00000	1.000	Constant	1.000	Dhanusa									
22	Dolakha	1.84869	0.558	Increasing	0.156	Morang	0.028	Bara	0.129	Rautahat	0.022	Rupandehi	0.223	Baitadi	
23	Kathmandu	1.00000	1.000	Constant	1.000	Kathmandu									
24	Kavrepalanchok	1.40832	0.714	Increasing	0.545	Morang	0.025	Rupandehi	0.143	Baitadi					
25	Lalitpur	1.00000	1.000	Constant	1.000	Lalitpur									
26	Mahottari	1.00000	1.000	Constant	1.000	Mahottari									
27	Makwanpur	1.00000	1.000	Constant	1.000	Makwanpur									
28	Nuwakot	1.31918	0.459	Increasing	0.262	Morang	0.086	Sarlahi	0.111	Banke					
29	Parsa	1.04915	0.721	Increasing	0.010	Jhapa	0.484	Dhanusa	0.227	Rupandehi					
30	Ramechhap	1.48391	0.502	Increasing	0.050	Morang	0.141	Sarlahi	0.025	Rupandehi	0.286	Baitadi			
31	Rasuwa	3.52828	0.207	Increasing	0.061	Morang	0.064	Mahottari	0.018	Rautahat	0.047	Rupandehi	0.018	Dang	
32	Rautahat	1.00000	1.000	Constant	1.000	Rautahat									
33	Sarlahi	1.00000	1.000	Constant	1.000	Sarlahi									
34	Sindhuli	1.53715	0.444	Increasing	0.336	Bara	0.054	Dhanusa	0.054	Rupandehi					
35	Sindhupalanchok	2.57982	0.854	Increasing	0.175	Morang	0.315	Rautahat	0.024	Rupandehi	0.081	Bardiya	0.258	Baitadi	
36	Argakhanchi	1.07622	0.327	Increasing	0.215	Morang	0.113	Banke							
37	Baglung	1.76589	0.590	Increasing	0.273	Morang	0.119	Bara	0.041	Sarlahi	0.157	Rupandehi			
38	Gorakha	1.50708	0.539	Increasing	0.146	Morang	0.243	Sarlahi	0.150	Banke					
39	Gulmi	1.75526	0.640	Increasing	0.204	Morang	0.360	Sarlahi	0.004	Rupandehi	0.073	Banke			
40	Kapilbastu	1.06608	1.009	Decreasing	0.602	Rautahat	0.044	Rupandehi	0.225	Bardiya	0.139	Baitadi			
41	Kaski	1.00000	1.000	Constant	1.000	Kaski									
42	Lamjung	2.07940	0.632	Increasing	0.186	Morang	0.160	Rautahat	0.037	Rupandehi	0.048	Bardiya	0.202	Baitadi	
43	Manang	49.62785	0.123	Increasing	0.054	Morang	0.038	Rupandehi	0.032	Baitadi					
44	Mustang	13.64500	0.125	Increasing	0.044	Morang	0.067	Rupandehi	0.015	Baitadi					
45	Myagdi	1.61806	0.338	Increasing	0.136	Morang	0.186	Sarlahi	0.015	Banke					
46	Nawalparasi	1.22388	0.927	Increasing	0.074	Jhapa	0.389	Morang	0.066	Rupandehi	0.398	Bardiya			
47	Palpa	1.69408	0.697	Increasing	0.292	Morang	0.089	Siraha	0.001	Rautahat	0.016	Rupandehi	0.115	Bardiya	0.185 Dang
48	Parbat	2.90286	0.532	Increasing	0.171	Morang	0.213	Rautahat	0.021	Rupandehi	0.128	Baitadi			
49	Rupandehi	1.00000	1.000	Constant	1.000	Rupandehi									
50	Syangja	1.70050	0.665	Increasing	0.164	Morang	0.056	Rautahat	0.123	Sarlahi	0.055	Rupandehi	0.268	Baitadi	
51	Tanahun	1.49382	0.458	Increasing	0.011	Jhapa	0.268	Morang	0.041	Rupandehi	0.139	Dang			
52	Banke	1.00000	1.000	Constant	1.000	Banke									
53	Bardiya	1.00000	1.000	Constant	1.000	Bardiya									
54	Dailekh	1.38495	0.798	Increasing	0.057	Morang	0.341	Rautahat	0.270	Bardiya	0.131	Baitadi			
55	Dang	1.00000	1.000	Constant	1.000	Dang									
56	Dolpa	2.55178	0.182	Increasing	0.088	Morang	0.095	Baitadi							
57	Humla	3.14876	0.291	Increasing	0.060	Bara	0.042	Rupandehi	0.189	Baitadi					
58	Jajarkot	1.56849	0.326	Increasing	0.173	Morang	0.034	Rautahat	0.061	Rupandehi	0.058	Baitadi			
59	Jumla	1.35421	0.508	Increasing	0.008	Rupandehi	0.165	Bardiya	0.335	Baitadi					
60	Kalikot	1.09128	0.344	Increasing	0.082	Morang	0.006	Rupandehi	0.256	Baitadi					
61	Mugu	2.10013	0.271	Increasing	0.079	Morang	0.016	Rupandehi	0.176	Baitadi					
62	Pyuthan	1.36152	0.503	Increasing	0.164	Morang	0.209	Rautahat	0.052	Rupandehi	0.079	Bardiya			
63	Rolpa	1.56698	0.571	Increasing	0.145	Morang	0.426	Baitadi							
64	Rukum	1.35559	0.470	Increasing	0.137	Morang	0.075	Rautahat	0.039	Rupandehi	0.220	Baitadi			
65	Salyan	1.43031	0.513	Increasing	0.173	Morang	0.019	Rautahat	0.063	Rupandehi	0.258	Baitadi			
66	Surkhet	1.87718	1.119	Decreasing	0.362	Jhapa	0.209	Rupandehi	0.549	Bardiya					
67	Achham	1.09081	0.761	Increasing	0.194	Morang	0.002	Bara	0.565	Baitadi					
68	Baitadi	1.00000	1.000	Constant	1.000	Baitadi									
69	Bajhang	1.35525	0.526	Increasing	0.141	Morang	0.035	Rupandehi	0.349	Baitadi					
70	Bajura	1.73583	0.311	Increasing	0.077	Morang	0.027	Rautahat	0.038	Rupandehi	0.170	Baitadi			
71	Dadeldhura	1.01383	0.478	Increasing	0.105	Morang	0.043	Sunsari	0.330	Bardiya					
72	Darchula	1.00000	1.000	Constant	1.000	Darchula									
73	Doti	1.59143	0.726	Increasing	0.053	Morang	0.125	Rautahat	0.055	Rupandehi	0.138	Bardiya	0.355	Baitadi	
74	Kailali	1.14408	0.722	Increasing	0.126	Jhapa	0.472	Rupandehi	0.124	Dang					
75	Kanchanpur	1.00507	0.318	Increasing	0.020	Jhapa	0.060	Morang	0.238	Rupandehi					

Output-Oriented		CRS										
DMU No.	DMU Name	Efficiency	Σ	RTS	Benchmarks							
1	Bhojpur	3.12563	1.667	Decreasing	0.116	Sunsari	0.164	Lalitpur	0.222	Myagdi	1.166	Kalikot
2	Dhankuta	1.66636	0.761	Increasing	0.032	Morang	0.047	Sunsari	0.173	Lalitpur	0.508	Myagdi
3	Ilam	1.90691	1.103	Decreasing	0.027	Morang	0.408	Sunsari	0.351	Myagdi	0.316	Kalikot
4	Jhapa	1.00000	1.000	Constant	1.000	Jhapa						
5	Khotang	2.64034	1.213	Decreasing	0.063	Sunsari	0.426	Rautahat	0.723	Kalikot		
6	Morang	1.00000	1.000	Constant	1.000	Morang						
7	Okhaldhunga	2.47086	0.407	Increasing	0.076	Sunsari	0.330	Rautahat				
8	Panchthar	2.47860	0.479	Increasing	0.103	Jhapa	0.030	Sunsari	0.016	Mahottari	0.330	Rautahat
9	Sankhuwasabha	2.78612	0.633	Increasing	0.139	Jhapa	0.054	Sunsari	0.197	Mahottari	0.000	Rautahat
10	Saptari	1.56961	2.354	Decreasing	0.593	Jhapa	0.428	Mahottari	1.333	Kalikot	0.243	Kalikot
11	Siraha	1.02602	1.508	Decreasing	0.617	Sunsari	0.033	Lalitpur	0.291	Mahottari	0.567	Kalikot
12	Solukhumbu	2.80014	0.541	Increasing	0.012	Morang	0.038	Sunsari	0.051	Lalitpur	0.302	Mahottari
13	Sunsari	1.00000	1.000	Constant	1.000	Sunsari					0.138	Kalikot
14	Taplejung	2.45311	1.204	Decreasing	0.184	Sunsari	0.303	Myagdi	0.717	Kalikot		
15	Terathum	3.15488	0.921	Increasing	0.008	Morang	0.063	Sunsari	0.107	Lalitpur	0.024	Mahottari
16	Udayapur	1.35533	1.160	Decreasing	0.005	Morang	0.180	Sunsari	0.111	Lalitpur	0.003	Mahottari
17	Bara	1.01709	0.923	Increasing	0.270	Sunsari	0.652	Rautahat			0.860	Kalikot
18	Bhaktapur	1.62507	0.499	Increasing	0.148	Jhapa	0.051	Morang	0.300	Kalikot		
19	Chitwan	1.00000	1.000	Constant	1.000	Chitwan						
20	Dhading	1.15433	0.532	Increasing	0.324	Sunsari	0.002	Lalitpur	0.205	Mahottari		
21	Dhanusa	1.16650	1.572	Decreasing	1.384	Jhapa	0.189	Sunsari				
22	Dolakha	2.23112	0.828	Increasing	0.041	Jhapa	0.152	Rautahat	0.253	Sarlahi	0.382	Kalikot
23	Kathmandu	1.00000	1.000	Constant	1.000	Kathmandu						
24	Kavrepalanchok	1.16923	0.678	Increasing	0.250	Sunsari	0.379	Rautahat	0.049	Kalikot		
25	Lalitpur	1.00000	1.000	Constant	1.000	Lalitpur						
26	Mahottari	1.00000	1.000	Constant	1.000	Mahottari						
27	Makwanpur	2.02817	0.730	Increasing	0.401	Jhapa	0.313	Mahottari	0.016	Dadeldhura		
28	Nuwakot	2.48242	1.358	Decreasing	0.405	Sunsari	0.090	Rautahat	0.863	Kalikot		
29	Parsa	2.12849	1.768	Decreasing	0.929	Jhapa	0.070	Morang	0.770	Kalikot		
30	Ramechhap	2.15408	1.380	Decreasing	0.159	Sunsari	0.127	Myagdi	1.094	Kalikot		
31	Rasuwa	4.69848	0.482	Increasing	0.021	Morang	0.063	Sunsari	0.043	Mahottari	0.355	Kalikot
32	Rautahat	1.00000	1.000	Constant	1.000	Rautahat						
33	Sarlahi	1.00000	1.000	Constant	1.000	Sarlahi						
34	Sindhuli	1.74824	1.189	Decreasing	0.151	Sunsari	0.205	Lalitpur	0.511	Myagdi	0.321	Kalikot
35	Sindhupalchowk	2.52770	2.017	Decreasing	0.213	Sunsari	0.140	Lalitpur	0.071	Myagdi	1.593	Kalikot
36	Argakhanchi	2.86692	0.660	Increasing	0.042	Sunsari	0.363	Mahottari	0.057	Rautahat	0.198	Dadeldhura
37	Baglung	1.04182	1.469	Decreasing	0.058	Morang	0.138	Lalitpur	1.254	Myagdi	0.019	Kalikot
38	Gorakha	2.16037	1.755	Decreasing	0.014	Morang	0.153	Sunsari	0.243	Lalitpur	0.145	Myagdi
39	Gulmi	2.10202	1.939	Decreasing	0.419	Sunsari	0.038	Rautahat	1.482	Kalikot	1.200	Kalikot
40	Kaski	1.19534	0.878	Increasing	0.110	Jhapa	0.645	Sunsari	0.122	Kathmandu		
41	Kapilbastu	1.12024	1.012	Decreasing	0.726	Mahottari	0.167	Sarlahi	0.119	Kalikot		
42	Lamjung	2.06544	1.637	Decreasing	0.006	Morang	0.197	Sunsari	0.003	Myagdi	1.431	Kalikot
43	Manang	38.51528	0.257	Increasing	0.047	Jhapa	0.068	Mahottari	0.142	Kalikot		
44	Mustang	15.20276	0.312	Increasing	0.018	Morang	0.043	Sunsari	0.082	Lalitpur	0.168	Myagdi
45	Myagdi	1.00000	1.000	Constant	1.000	Myagdi						
46	Nawalparasi	1.07546	2.050	Decreasing	0.190	Jhapa	0.136	Mahottari	1.724	Kalikot		
47	Palpa	1.06245	1.641	Decreasing	0.106	Jhapa	0.085	Sunsari	1.450	Kalikot		
48	Parbat	2.43019	1.182	Decreasing	0.187	Sunsari	0.327	Myagdi	0.668	Kalikot		
49	Rupandehi	1.14960	1.329	Decreasing	1.241	Jhapa	0.088	Sunsari				
50	Syangja	1.88697	1.346	Decreasing	0.060	Jhapa	0.276	Mahottari	0.145	Rautahat	0.025	Sarlahi
51	Tanahun	1.52435	1.041	Decreasing	0.068	Sunsari	0.047	Lalitpur	0.246	Mahottari	0.679	Kalikot
52	Banke	1.23570	0.858	Increasing	0.156	Morang	0.567	Sunsari	0.135	Lalitpur		
53	Bardiya	1.20890	0.642	Increasing	0.017	Jhapa	0.625	Sunsari				
54	Dailekh	1.53191	0.742	Increasing	0.375	Sunsari	0.131	Rautahat	0.236	Dadeldhura		
55	Dang	1.30389	0.785	Increasing	0.303	Jhapa	0.482	Sunsari				
56	Dolpa	3.97276	0.217	Increasing	0.004	Sunsari	0.080	Rautahat	0.133	Dadeldhura		
57	Humla	3.21699	0.327	Increasing	0.098	Sunsari	0.204	Mahottari	0.005	Rautahat	0.020	Kalikot
58	Jajarkot	1.54344	0.388	Increasing	0.019	Jhapa	0.334	Mahottari	0.035	Rautahat		
59	Jumla	1.92936	0.753	Increasing	0.001	Sunsari	0.078	Mahottari	0.047	Rautahat	0.626	Dadeldhura
60	Kalikot	1.00000	1.000	Constant	1.000	Kalikot						
61	Mugu	2.54371	0.241	Increasing	0.014	Jhapa	0.047	Sunsari	0.180	Rautahat		
62	Pyuthan	1.48536	1.023	Decreasing	0.001	Jhapa	0.007	Morang	0.005	Sunsari	0.311	Mahottari
63	Rolpa	1.37212	0.687	Increasing	0.059	Sunsari	0.242	Rautahat	0.386	Kalikot	0.699	Kalikot
64	Rukum	1.38061	0.713	Increasing	0.015	Jhapa	0.163	Mahottari	0.193	Rautahat	0.342	Kalikot
65	Salyan	1.65790	1.193	Decreasing	0.068	Jhapa	0.040	Sunsari	0.114	Mahottari	0.014	Rautahat
66	Surkhet	1.75064	1.021	Decreasing	0.352	Jhapa	0.321	Morang	0.099	Myagdi	0.249	Kalikot
67	Achham	1.18952	0.530	Increasing	0.143	Sunsari	0.387	Rautahat				
68	Baitadi	1.81770	1.452	Decreasing	0.091	Mahottari	0.195	Sarlahi	1.165	Kalikot		
69	Bajhang	1.57067	0.688	Increasing	0.042	Jhapa	0.002	Sunsari	0.351	Rautahat	0.292	Kalikot
70	Bajura	1.60259	0.306	Increasing	0.051	Jhapa	0.049	Sunsari	0.207	Rautahat		
71	Dadeldhura	1.00000	1.000	Constant	1.000	Dadeldhura						
72	Darchula	2.26676	0.404	Increasing	0.075	Sunsari	0.007	Mahottari	0.322	Rautahat		
73	Doti	1.71518	0.671	Increasing	0.176	Sunsari	0.331	Mahottari	0.154	Rautahat	0.010	Dadeldhura
74	Kailali	1.23247	0.838	Increasing	0.171	Jhapa	0.627	Sunsari	0.041	Kathmandu		
75	Kanchanpur	1.05578	0.400	Increasing	0.315	Jhapa	0.064	Morang	0.021	Kathmandu		

