Diffusion of High Cost Medical Equipments in Nepal: Implication to Utilization and Access

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Summary

The diffusion of medical technology is the process by which new clinical procedures and devices come into use in health care system. Hospitals, physicians, manufactures, third-party payers, all are factors in the demand for, and adoption and diffusion of, new medical technologies. Without proper management of medical technology diffusion and utilization, it tends to create problems both inefficiencies and inequity, widening the gap between rich and poor for accessing these services. There is inadequate policy and guidelines towards diffusion of high cost medical equipments in Nepal. Without accurate and up-to-date information on diffusion and utilization, the government is in extremely poor position to regulate the market.

This was a cross-sectional descriptive study conducted in both public and private health facilities where the Computerized Tomography (CT) Scanners and Magnetic Resonance Imaging (MRI) services were available. Eighty consumers were taken for interview in the proportion that 50% of them were taking services from the public hospitals, while the rest half were from that of private health facilities. And, 10 in-depth interviews with the service owners, physicians, radiologists, and policy makers at the concerned authorities were made. Data were documented, and managed systematically in the database created in Microsoft Access for the information of service consumers and imported into SPSS 11.5 for Windows for analysis. The consumer characteristics were studies by their general socio-demographic measures (age, gender, economic status, etc.), type of the machines, and type of the ownership of the service providers.

While for the information of the health facility, it was prepared in the spreadsheet of Microsoft Excel and analyzed. Diffusion pattern of CT scanner and MRI was studied by the ownerships of the health facilities (either public or private), and by the location of the services installed. The diffusion trend was studied by the number of services added up by time, and with reference to the bed size of the health facilities.

And for the qualitative information, a more straightforward general inductive approach for analysis of qualitative data was adopted. The analysis was determined by both the research objectives outlined (deductive) and multiple readings and interpretations of the raw data (inductive) and so the conclusion of the qualitative analysis of data produced.

This study had obtained both the technical and ethical approval from Nepal Health Research Council, as we have fully complied with the basic ethical norms, values and standards as guided by the National Ethical Guidelines for Health Research in Nepal, 2001.

CT scanning service has been started from the biggest public hospital (Bir Hospital) in the country since 1987. MRI service is found concentrated only in capital city, while it was about 60% of CT Scanning devices of public and private sector installed in Kathmandu valley only. Private sector introduced first CT Scanning service from Blue Cross (a private nursing home) in 1993. And the gradual increase in diffusion was observed till 2001 with the sharp increment in the trend of CT diffusion observed after 2001. As expected the diffusion was dominated by the private ownerships 13 devices (72% of total 20).

The MRI service was introduced from Birendra Army Hspital in 1991. Blue cross, private nursing home, began MRI service to public in 1993. Tribhuvan University Teaching Hospital (TUTH) started MRI service for public since 2000. It has the same pattern and trend of diffusion as that of CT scanner but in a bit slower pace.

These services were found to be diffused with concentration in small and medium sized health facilities in private sector, while it was observed the trend to be engulfed in the bigger sized hospitals in the public sector.

The majority of the service consumers of the CT scanner and MRI services in Nepal fall under the age group of 20 - 39 years (36.3%) – the median age of 35 years. Male consumers were slightly more than female for the services (53.8% vs. 46.2%). Users of the CT scanner were found dominated in the public sector (57.6%), while the dominance in MRI service (71.4%) was led by private sector. Both for the CT scanner and MRI services, majority of consumers fall in the income level range of NRs. 4,000.0 to 8,000.0 by 55.9% and 42.9% respectively. Among the consumers of CT scanner, 35.6% had their family income of more than NRs. 8,000.0 per month, while the proportion was 38.1% for MRI service consumers. It was around three in every five were found willing to pay NRs. 1,000.0 to 2,000.0 for the services, whereas almost one –fifth of the consumers were found unable to pay more than thousand rupees. It was only the 17.5% of the consumers who seems happy to pay more than NRs. 2,000.0 for such services.

Through the analysis of the qualitative data, it was disclosed that the major reasons for acquiring these services was expressed for the better diagnostic services and also for making profit with service provision among the private sectors. Private sector has claimed that the sector has contributed via many ways with the provision of these services – sharing huge amount of service burden with the public sector, reducing the public expenditure in these high cost devices so the public resources can be diverted into other primary health care services.

The role of trained manpower in the country and health care market is highly realized by the interviewees for the desired pattern of diffusion of the services both in the public and private sectors. This was recognizes as necessary for both fulfilling the magnitude of demand of the services and the ensuring the quality of the services provided. Also, some kick-backs were found expressed rampantly,

> *"There is always pressure to the clinicians working in the private sectors from the management to maximize these services, as these services are the major blocks of their income and so the profit making ..."*

> *"...in some private institutions, there is provision (non-documented) of incentives or commission to the referees who referred the cases from public hospitals, private clinics to these centers where the service of MRI and CT scanner is available. It is up to NRs .500.0 to NRs. 1000.0 for each referral...".*

For ensuring the rationale use, it was suggested establishing a board for controlling the quality of care of these services incorporating both the public and private health service providers. Also, expressed the need of development of qualified manpower on quality control. And, also realized the acute lack of trained manpower for repair and maintenance. The key informants had strongly acknowledged the wants of need assessment of these services, availability of trained manpower, regularity of the services, cost consciousness among the users, service approach (referral and feed back mechanism), technical quality of imaging laboratory, repair and maintenance provision, and quality of the services. And, so the attention was found to be raised about the equitable access of these services to the consumers and rationale use of these high cost medical equipments in Nepal.

Abbreviations

CT	=	Computed Tomography
FGD	=	Focus Group Discussion
GDP	=	Gross Domestic Product
NHRC	=	Nepal Health Research Council
MoH	=	Ministry of Health
MRI	=	Magnetic Resonance Imaging
NPC	=	National Planning Commission
PPP	=	Public Private Partnerships
TUTH	=	Tribhuvan University Teaching Hospital

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Chapter I

Introduction

1.1 Background

Health expenditure gradually climbed-up from 0.63% of GDP in 1991/92 to 1.26% of GDP in 1996/97 and 2.2% of GDP in 2001/02. The recurrent and capital expenditure proportion under Ministry of Health (MoH) is fallen down from 67.97% in primary health care in 1991/92 to 71.02% in 1994/95 and it was climbed up from 23.63% in1991/92 to 28.98% in 1994/95 in Non-Primary Care. And regarding Medical equipment, it was gradually increased as NRs. 0.4 million in 1991/92 to NRs. 2.3 million in 1994/95, and 2.6 million in 2001/02[1, 2, 16]. This could be related to inefficient investment and oversupply of high medical technologies.

After the introduction of the concept of decentralization in early 1980s and initiation of open-market policy in economic policy, private sector is so mushrooming that even health sector do not remained in pure line of public services. Private sector, especially private-for-profit has tried to take the new and benefit related services for the people, and medical technology is the most one.

There are both public and private sectors that provide the services of high cost medical equipment (MRI and CT scanner) in the country.

There is no or very limited experience in medical technology assessment on the pattern of diffusion, utilization and access to care in Nepal. Inadequate policy and towards diffusion and utilization of medical technology could lead to problems on efficiency, equity and sustainability.

1.2 Statement of the problem

After the activation of free market new economy policy and government's focus of programmes decentralization, the National Health Policy, 1991, provides and supports the place for private sector (both private-for-profit and private-non-profit) in health sector and the subsequent health plans of the country (Tenth Five Year Plan, 2003-2007[3], and Second Long Term Health Plan,

19997-2017[4], and Health Sector Strategy: An Agenda for Reform[5]) address the issues public-private partnership, health insurance, privatization and other community participatory health programmes that involve many partners, donors, individuals and making a health sector access to every investors interested. And the country is not monitoring the quality of these organizations as it was planned so for check and balance system to assure the quality health services. There are 74 private health facilities till 1996/97, but there accessibility is not considered since more than 70% of the private facilities are limited within the valley and regarding those outside the valley are only in the major cities like Pokhara, Biratnagar, Nepalgunj, clarifying that there are no or very limited involvement of private sector in rural areas. This indicates the big disparity of health services in the country since more than two-third of total people live in the rural areas.[1,2]

Since the introduction of private health sectors in Nepal, the private sector is in high growth rate. And specialist services are also provided in the sector. Although the concept of public-private partnership is already introduced in Nepal, there is a little known how the partnership works, especially when the private sector is concerned with high cost services like MRI and CT scanning services.

The GDP, per capita income of US$ 220 and a picture depicted by National Planning Commission (NPC) that around 38% of the population of the country are below the line of absolute poverty, it is well understood that huge bulk of population is deprived of high cost health services, even through public hospitals. So, we need to figure out the evidence how the uncontrolled diffusion of high cost equipments widening the gap between rich and poor for accessing these services.

There is no policy instrument formulated governing diffusion till date, and the diffusion is totally driven by market economic situation favoring affluent class of city and the capital city. Discrepancy indices for the high cost medical devices clearly uncover this problem. Poor people given equal health needs are not being adequately access to care.

Without accurate and up-to-date information on diffusion and utilization, the government is in extremely poor position to regulate the market. So, it is a high time need to know the implications to access and utilization of high cost medical devices in current Nepalese health care market.

1.3 Rationale of the study

As the government policy on health is favouring investment of private sectors in health services and the service of the private sector is focused on high cost services, it is a great need to measure the implications of diffusion of high cost medical devices and provide ground on evidence-based policy recommendation.

Also, the investment in these services is increasing and still no regulatory frame is developed based on need and service availability. So, it is of high health priority to gather evidence on diffusion of high cost medical devices, considering towards the broad societal objectives of efficiency, equity and sustainability of these services

- No or very limited studies are done in the field of diffusion high cost medical equipment and its implication in Nepalese health economics.
- Inadequate policy and guidelines towards diffusion of high cost medical equipments in Nepal
- This study expected to provide a more radical solution through policy recommendation.
- One of the strong rationale of this study is to identify a strong signal for cost-containment and rationale use of high cost medical technologies
- Without proper management of medical technology diffusion and utilization, it tends to create problems both efficiencies and inequity.

1.4 Objectives

1.4.1 General Objective

The general objective of the study was to shed light on profiles of diffusion, utilization and user characteristics of high cost medical technologies in Nepal. The study covers two investigation devices namely CT scanner and MRI.

1.4.2 Specific Objectives

The specific objective of the study were:

1. To present the diffusion pattern and trend by CT Scanner and MRI by public and private ownership, bed size or institutional capacity and its location;
2. To explore the factors affecting utilization of CT Scanner and MRI in terms of annual throughput that reflects spare capacity and sub-optimal uses;
3. To present the user profile in terms of education, household income, household affordability, age/sex, residence, and insurance scheme

1.5 Research questions

The following three were the major research questions of this study:

1. What is the diffusion pattern and trend of high cost medical devices by public and private ownership, institutional capacity and its location in?
2. What is the state of utilization of high cost medical devices in terms of annual throughput in Nepal?
3. What is the state of access of high cost medical devices in Nepal in terms of consumer characteristics?

1.6 Research variables

Dependent variables

- Diffusion of high cost medical devices
- Utilization and access of high cost medical devices

Independent variables

- Ownership of health institutions e.g. public and private
- Bed size
- Institutional capacity (manpower skill) and other services available in the facility
- Annual throughput
- Consumer characteristics: age, sex, education, income, health expenditure, insurance scheme

1.7 Operational definitions

Diffusion

Diffusion of medical technology is the process by which new clinical procedures are devices come into use in the health care system in a particular settings. It is historical topic, as old as medicine itself, and is a marketing theory that predicts the pattern of adoption of new products, with specific characteristics of the product determining the rate of diffusion. Here in the current study, the diffusion of CT scanner and MRI services has been studied for its trend and pattern by ownership, location, and capacity of the heath care facility.

Annual throughput

Annual throughput is an indicator that tells us the level of utilization and vice versa under utilization and spare capacity. Here in this study, it is estimated by the discussion made with technical persons and clinicians, policy makers; and is expressed in terms of maximum annual productivity of MRI and CT scanning cases. Besides, utilization rate of the MRI and CT scanner is also studied so to reflect implication of the spare capacity of the machines.

High cost medical devices

There is no clear-cut conceptual definitions found for 'high cost devices'; however, a number of studies has mentioned the 'high cost devices' or sometime, 'high cost technologies' to recognize the imaging medical devices, like Magnetic Resonance Imaging (MRI), Computerized Tomographic Scanners (CT), Extra-corporeal Shock Wave Lithotrips (ESWL), Mammography, Positron-Emission Tomography (PET), etc. These devices are also found naming as 'big ticket' services in number of scientific literatures. Here, in this study, only, MRI and CT scanning devices are studied to be as 'high cost devices'. It is named so, as simply it has larger economics implications in the health care market in any settings.

Chapter II

Literature review

2.1 Introduction

The major objective of this chapter is to explore the issues related to diffusion of high cost medical equipment and its associated factors for its access and utilization raised by other studies. This includes the magnitude of such services and their implications in health service access and utilization.

Albeit the findings of the different studies have been reviewed, the study design and methods adopted by the studies have not been analyzed since this is beyond the purpose of this literature review.

2.2 Methods of literature search

The literature search had been started since the middle of February 2003 through end of February 2004. Basically, it was done by two ways. The first was the reviewing of printed materials, including journals, and books. Most of the printed materials had been searched from the library of Institute of Medicine. The second approach was the Internet search, and Pub Med was the major search engine used, and the citations were managed via Reference Manager version 10.0. The key words used while making search were diffusion, medical equipments, MRI, CT Scanner, high cost technology, and Nepal.

The diffusion of medical technology, the process by which new clinical procedures and devices come into use in health care system, is an historical topic, as old as medicine itself. Hospitals, physicians, manufactures, third-party payers, and all are factors in the demand for, and adoption and diffusion of, new medical technologies. The history of the CT Scanner's diffusion illustrates the problems that can result from the lack of coherent strategy to control the diffusion of major medical technologies. Some of these problems are now appearing in the diffusion of MRI.[6]

Medical Technology provides accurate diagnosis and leads to specific treatments if it is properly prescribed according to clinical indication. However due to imperfect market and if most technologies were owned by for-profit private sectors, there is a high tendency towards inefficient consumption and waste of resources. High charge for services is inaccessible for the poor and uninsured persons. As capital depreciation dominates cost structure of theses technologies and if private-for-profit dominates the market, there is a tendency to maximize profit and break-even in shortest period by increasing throughputs through various market strategies.[7]

Researchers generally agree that medical technology has contributed rising health care costs and per capita income is correlated with the level of health care spending. Influences on adoption and consequent diffusion rate are very different for different health technologies. It is not all clear that diffusion pattern relate well to an optimum time rate. This is an important implication for technology gatekeepers in health care.[8]

In Thailand, the general trend of diffusion of CT scanner and MRI Scanners are dominated by private sector, especially small for-profit hospitals. Their diffusion was determined by economic affluence favoring Bangkok and Central Region.[7]

There has been a rapid influx of high cost medical technologies into the Korean hospital market. This has raised concerns about the changes it will bring for the Korean health care sector. Some have questioned whether this diffusion will necessarily have positive effects on the health of overall population. Some perverse effects of uncontrolled diffusion of technologies have been hinted in recent literature. For example, there is a problem of increasing inequity with the adoption of expensive technologies. Utilization of most of the expensive high technology services is not covered by National Health Insurance Schemes. Examples of such technologies are Ultra Sonic, CT Scanner, MRI, Radiotherapy, EKG etc. As a result, the rich can afford expensive technology services and while poor cannot. This produces gradual evolution of classes in health service utilization.[9]

A study conducted by Asian MRI Group revealed that there are observable problems in terms of efficiency, equity, and quality of MRI services and higher share of the country's health resource devoted to expensive high-technology devices.[10]

Chapter III

Methodology

3.1 Study design

It is a cross-sectional descriptive study comprising of both quantitative and qualitative research variables and its data.

3.2 Study area

Initially, the study was designed to cover the entire country, however, for so many reasons we finally confined only in the Kathmandu valley, which represents all most 90% of the service coverage in this issue of health service provision.

3.3 Study population

Both the public and private health facilities where the CT Scanning and MRI services are available and its owners, including physicians, were the targeted study population for the interview for health facility aspect of the research objective.

Planners, policy makers, radiologists, managers, and owners of the CT Scanner and MRI services were taken for the in-depth interview for their perspective in understanding the diffusion and its implication in the country.

And, the consumers of these services (CT Scanner and MRI) in both public and private sectors were also the study population who were coming for these services at the time of data collection.

3.4 Sampling

Regarding CT Scanner and MRI, all most all health facilities where the defined services are available (approximately 12), was selected for the study purpose. Whereas simple random

sampling method was adopted to select the consumers of the defined services who meet the eligible criteria.

Estimated sample size of users, $n = (t^2 pq)/d = 123$

Where, t = Confidence level (1.96)

P = proportion of patients who use high cost medical technologies = 0.2 (approximately)

q = (1-p), d = Precision = 0.05

Considering the design effect and sampling error, about 150 users was be selected for the study purpose. However, because of the research proposal was approved with budget cut and the situation of social unrest in the country, we could not incur the health facilities with CT scanner and MRI services besides the Kathmandu valley.

And, thus, finally we selected only 80 service consumers comprising both public and private sectors in the valley with the sample of 40 from each.

3.5 Data collection methods

Information were documented from three different study subjects in the period November 2003 to February 2004.

First, hospital records, and patients' monitoring cards and other available information were reviewed from the health facilities where the CT Scanner and MRI services were available both in public and private sectors.

Consumers of these services from the health facilities at both public and private were interviewed with the help of semi-structured questionnaire.

And in-depth interview with the service owners, physicians, radiologists, and policy makers at the concerned authority were made. Altogether, 10 in-depth interviews were made, and it was lasted around 1 hour for each interview to be completed.

Initially, Focus Group Discussion (FGD) was planned instead of in-depth interview with the service owners, physicians, radiologists and policy makers at national level (representing both

public and private sectors). But because these people were found usually very busy and other reasons prevalent in the country (social unrest, tightened security in the valley) making people together could not be succeed. And thus, we did in- depth interview with them, provided pre-information of change in data collection methodology to the Nepal Health Research Council.

3.6 Instrumentation

Hospital and health facilities records, accounts and records sheets were the major tools reviewed.

Service owners, physicians, radiologists, and policy makers were interview with the help of pre-tested in-depth interview guidelines.

Similarly the pre-tested interview guidelines in the form of semi-structured questionnaire were administered to the service consumers.

3.7 Pre-testing

The questionnaires, interview guidelines and recording sheets were pre-tested in Model Hospital and Tribhuvan University Teaching Hospital, and some amendment were made. The information pre-tested is not included in the main data of this research work.

3.8 Data management and analysis

All necessary data were documented and organized systematically. Necessary editing was done on the spot by research assistants and in the evening by the researchers themselves. High level of attention was paid so as to maintain the consistency and accuracy of the information documented. Coding was done by the researchers themselves, and the date was entered into Microsoft Access for the information of service consumers and imported into SPSS 11.5 for Windows for analysis.

While for the information of the health facility, it was prepared in the spreadsheet of Microsoft Excel and analyzed.

And for the qualitative information, a more straightforward general inductive approach for analysis of qualitative data was adopted. The analysis was determined by both the research objectives outlined (deductive) and multiple readings and interpretations of the raw data (inductive). In the primary mode of analysis, categories were developed from the raw data into a framework that captures key themes and processes judged to be important to the researchers. For this the interviews were transcribed in Nepalese language and translated into English. The entire analysis of qualitative data was done by both the researchers independently and also jointly so as to ensure the trustworthiness of findings to be triangulated enough with the quantitative findings in this study. Also the feedback from participants in this study and potential users of the research findings were obtained and incorporated in deriving the categories and so the conclusion of the qualitative analysis of data produced.

3.9 Reliability and validity

The following measures were adopted so as to maintain and increase the reliability and validity of the study:

- Adequate number of study subjects were pre-tested and necessary amendment was made in the tools so as to insure the internal and content validity. Also, the pre-testing helped a lot in taking measures in order to increase the reliability and the contents among the research assistants.
- Interpretation of the research findings were made based on the triangulation of findings and methods from other various studies.
- Research assistants were adequately orientated about administering the tools and its content in depth before pre-testing. And, it also had necessary discussion in the group with the information collected from pre-testing. This increased the inter-rater reliability and also enhance the validity of the tools.
- For ensuring the external validity is maintained, adequate concerned literatures were reviewed; opinions from the experts was obtained; comments from experts were invited and shared between the researchers throughout the research process.
- Timely and adequate monitoring and supervision was done, especially for research assistants with well-defined monitoring and supervision checklist with continuous in touch with NHRC.

3.10 Inclusion criteria

Patients who come to have defined services within the study period were included in the study matched with the sampling technique. And the other potential study subjects who did not fall under he study period were automatically excluded from the study.

3.11 Ethical consideration

An informed consent in verbal was obtained from each research subjects before data collection. For this, before obtaining the informed consent, each and every research subjects were informed of at least purpose of the study, potential risks and benefits of participating, procedure of maintaining confidentiality, and right to not to participate in this study,

And, since the research proposal was approved from Nepal Health Research Council for both technical and ethical aspects it has covered the full ethical norms, values and standards as per the National Ethical Guidelines for Health Research in Nepal.

Chapter IV

Findings

4.1 Results of health facilities

4.1.1 Diffusion pattern

4.1.1.1 Diffusion pattern by public and private ownership

CT Scan service has been started from the biggest public hospital (Bir Hospital) since 1987. The larger portion (72%) of CT Scanners is owned by private sector while both public and private sector equally own MRI (Table 1).

Table 1: Diffusion of high cost medical equipments by ownership

Equipments	Public Sector	Private Sector	Total
CT Scanner	5 (28)	13 (72)	18
MRI	2 (50)	2 (50)	4

Note: Values in the parenthesis indicate percent

4.1.1.2 Diffusion pattern by location

MRI service is concentrated only in capital city. Table 2 showed about 60% of CT scanning devices of public and private sector installed in Kathmandu valley.

Table 2: Diffusion of high cost medical equipments by location

Equipments	Public sector		Private sector	
	Kathmandu valley	Out of valley	Kathmandu valley	Out of valley
CT Scanner	3 (60)	2(40)	8(61.5)	5(38.5)
MRI	2 (100)	0 (0)	2 (100)	0 (0)

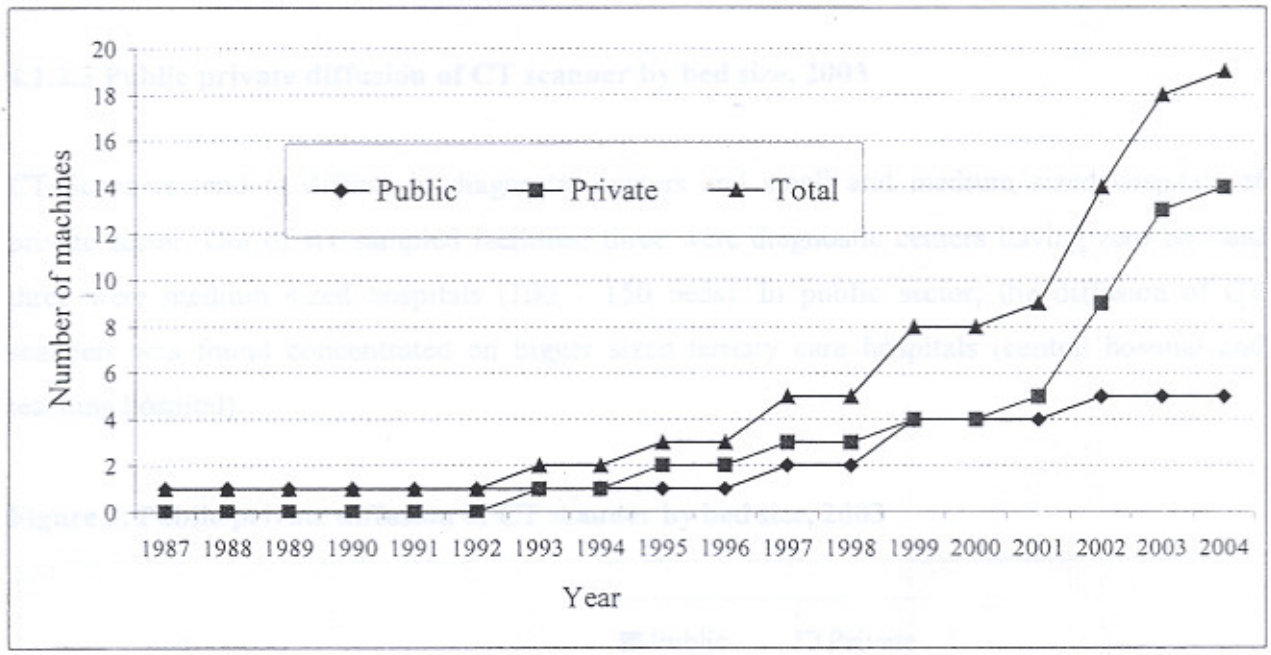
Note: Values in the parenthesis indicate percent

4.1.2 Diffusion trend

4.1.2.1 Trend of CT scanner diffusion 1987-2003

Figure 1 showed that the diffusion of CT Scanner was constant until 1993 and gradual increase after 1997 in public sector. Private sector introduced first CT Scan service from Blue Cross, a nursing home, in 1993. The gradual increase in diffusion was observed till 2001. The sharp increase in diffusion of CT has been observed after 2001. Diffusion was dominated by private ownership with 13 devices (72% of total 20). The average capital investment was NRs 17.4 million.

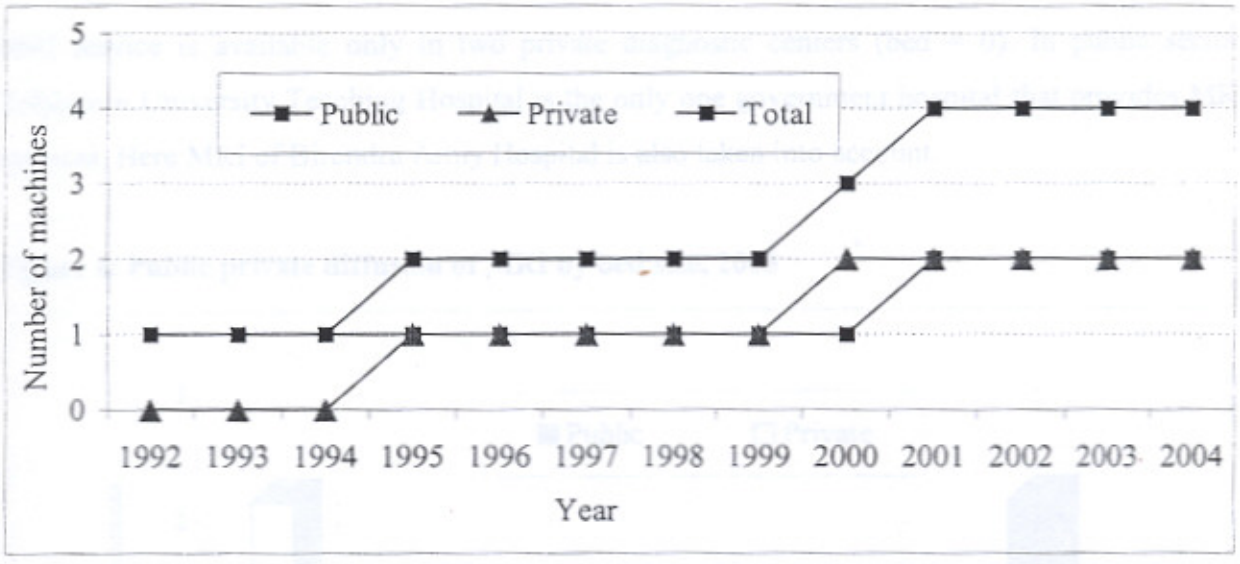
Figure 1: Diffusion of CT scanner by ownership, 1987-2003



4.1.2.2 Trend of MRI diffusion, 1992-2003

The MRI service was first introduced from Birendra Army Hospital in 1991. The service was provided only for Royal Nepalese Army and their dependants. Blue Cross, private nursing home, began MRI service to public in 1993. Tribhuvan University Teaching Hospital (TUTH) started the MRI service for public since 2000.

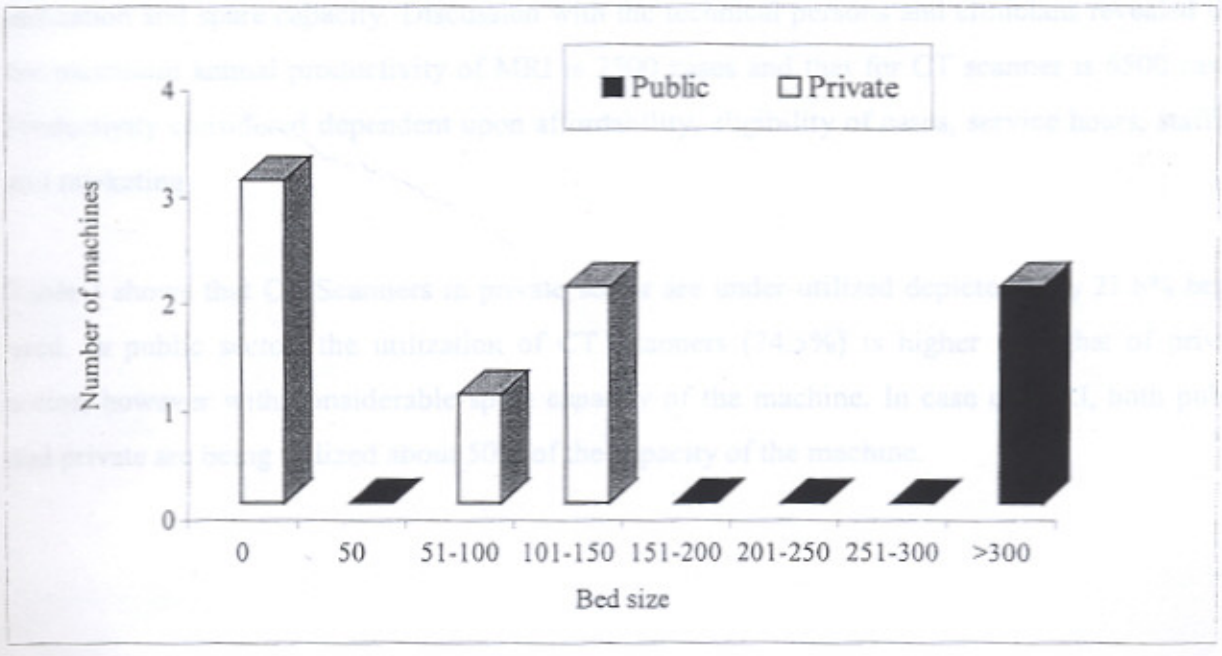
Figure 2: Trend of MRI diffusion, 1993-2003



4.1.2.3 Public private diffusion of CT scanner by bed size, 2003

CT Scanners tend to diffuse in diagnostic centers and small and medium sized hospitals of private sector. Out of six sampled facilities, three were diagnostic centers having zero bed and three were medium sized hospitals (100 – 150 beds). In public sector, the diffusion of CT scanners was found concentrated on bigger sized tertiary care hospitals (central hospital and teaching hospital).

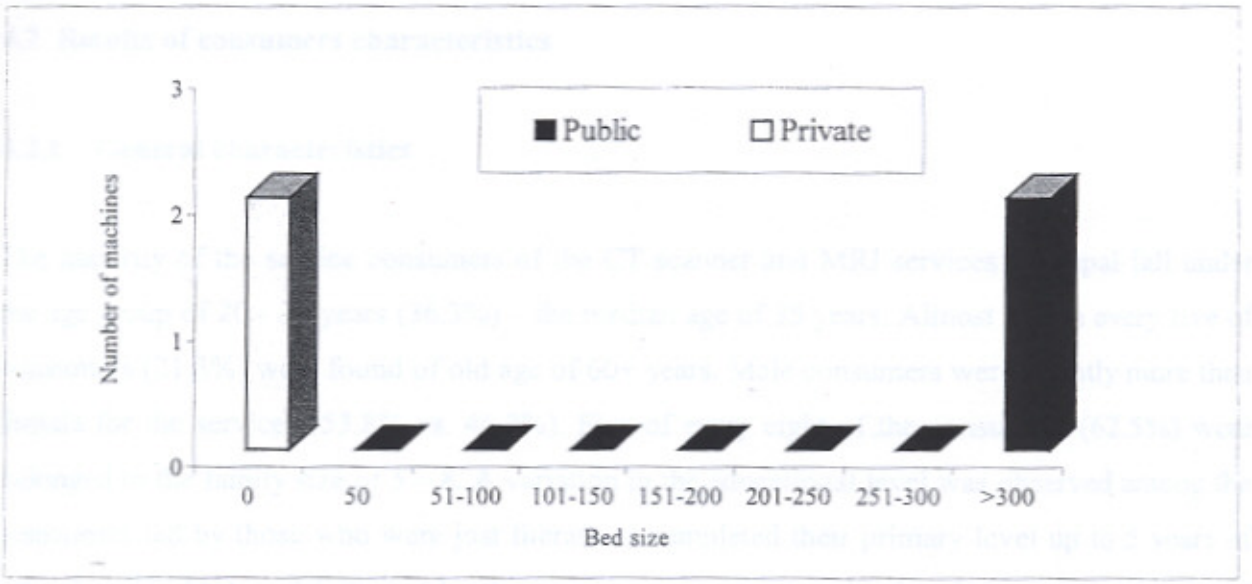
Figure 3: Public private diffusion of CT scanner by bed size, 2003



4.1.2.4 Public private diffusion of MRI by bed size, 2003

MRI service is available only in two private diagnostic centers (bed = 0). In public sector, Tribhuvan University Teaching Hospital is the only one government hospital that provides MRI services. Here MRI of Birendra Army Hospital is also taken into account.

Figure 4: Public private diffusion of MRI by bed size, 2003



4.1.3 Annual throughputs

Annual throughput is an indicator that tells us the level of utilization and vice versa under utilization and spare capacity. Discussion with the technical persons and clinicians revealed that the maximum annual productivity of MRI is 2500 cases and that for CT scanner is 6500 cases. Productivity considered dependent upon affordability, eligibility of cases, service hours, staffing and marketing.

Table 3 shows that CT Scanners in private sector are under-utilized depicted only 21.6% being used. In public sector, the utilization of CT Scanners (74.5%) is higher than that of private sector; however with considerable spare capacity of the machine. In case of MRI, both public and private are being utilized about 50% of the capacity of the machine.

Table 3: Average annual throughputs, 2003

Device	Public (Average)	Private (Average)	Average
CT Scanner	4890 (74.5)	1406 (21.6)	3148 (48.4)
MRI	1027 (41.1)	1277 (51.1)	1152 (46.1)

Note: Values in the parenthesis indicate percentage of Utilization

4.2 Results of consumers characteristics

4.2.1 General characteristics

The majority of the service consumers of the CT scanner and MRI services in Nepal fall under the age group of 20 - 39 years (36.3%) – the median age of 35 years. Almost one in every five of consumers (21.3%) were found of old age of 60+ years. Male consumers were slightly more than female for the services (53.8% vs. 46.2%). Five of every eight of the consumers (62.5%) were belonged to the family size of 5 – 8. A variation in the educational level was observed among the consumers led by those who were just literate or completed their primary level up to 5 years of schooling (27.5%), and followed by those who never went to school and those who completed their 8 – 10 years in schooling (21.3% of each) (Table 4).

Table 4: General characteristics of service consumers of CT scanner and MRI services (n = 80)

Particulars		Frequency	Percent
Age	0 - 19 yrs	15	18.8
	20 - 39 yrs	29	36.3
	40 - 59 yrs	19	23.8
	60 +	17	21.3
Gender	Male	43	53.8
	Female	37	46.2
Family size	1 - 4	20	25.0
	5 - 8	50	62.5
	9 +	10	12.5
Education level	Illiterate	17	21.3

Literate/primary (1- 5)	22	27.5
Lower secondary (6 - 7)	6	7.5
Secondary (8- 10)	17	21.3
Higher secondary (10 + 2)	6	7.5
University education (12 +)	12	15.0

4.2.2 Users' profile by machines

Albeit the sex ratio among the service consumers of these high cost medical devices in total was not big, there seems a variation among the service consumers of the CT scanner and MRI machines by gender. Three in every five (61.0%) of the consumers of CT scanners were male, while the proportion was read two in every three (66.7%) for MRI consumers (Table 5).

Table 5: Users of machines by gender (n = 80)

Type of machines	Gender	
	Male	Female
CT scanner	36 (61.0)	23 (39.0)
MRI	7 (33.3)	14 (66.7)

Note: Values in the parenthesis indicate percent

CT scanner is dominated in the public sector (57.6%), while the dominance in MRI service (71.4%) is led by private sector (Table 6).

Table 6: Users of machines by type of service provider (n = 80)

Type of machines	Service provider	
	Public	Private
CT scanner	34 (57.6)	25 (42.4)
MRI	6 (28.6)	15 (71.4)

Note: Values in the parenthesis indicate percent

4.2.3 Users' profile by income level

More than three in every five (62.5%) of the consumers reported that they would not earn any direct financial resources, while 21.3% of them had reported that they had earned NRs. 4,000.0 to 8,000.0 per month individually (mean of NRs. 2,393.8). More than half of the consumers (52.5%) had family income level of NRs. 4,000.0 to 8,000.0 per month, followed by 36.3% having the income level of more than NRs. 8,000.0. The median income level of family was recorded NRs. 7,000.0 per month, with mean of NRs. 9,221.3 per month (Table 7).

Table 7: Income level profile of service consumers (n = 80)

Particulars		Frequency	Percent
Personal income/ month	0.0	50	62.5
	<4000.0	7	8.8
	4000.0 - 8000.0	17	21.3
	>8000.0	6	7.5
Family income/ month	<4000.0	9	11.3
	4000.0 - 8000.0	42	52.5
	>8000.0	29	36.3

Note: Values in the parenthesis indicate percent

Both for the CT scanner and MRI services, majority of consumers fall in the income level range of NRs. 4,000.0 to 8,000.0 by 55.9% and 42.9% respectively. Among the consumers of CT scanner, 35.6% had their family income of more than NRs. 8,000.0 per month, while the proportion was 38.1% for MRI service consumers (Table 8).

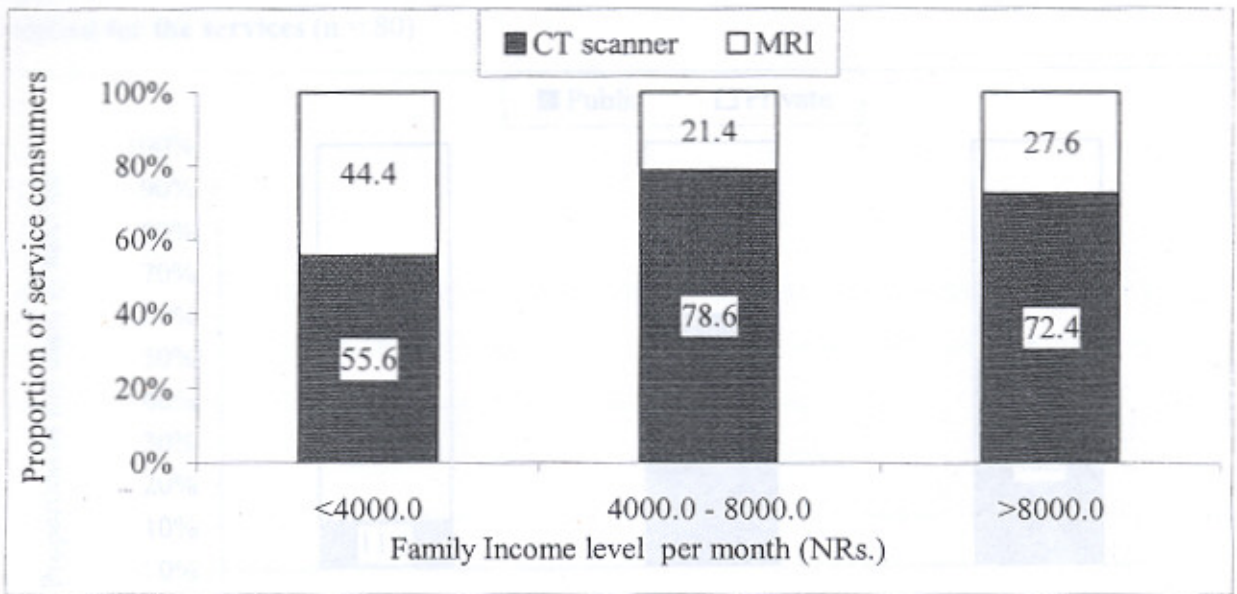
Table 8: Profile of service consumers of machines by income level (n = 80)

Type of machine	Family income level per month		
	<4000.0	4000.0 - 8000.0	>8000.0
CT scanner	5 (8.5)	33 (55.9)	21 (35.6)
MRI	4 (19.0)	9 (42.9)	8 (38.1)

Note: Values in the parenthesis indicate percent

Among the service consumers who had their family income level less than NRs. 4,000.0 per month, 55.6% of them were found taking CT scanning services, while the proportion was 44.4% for MRI service. As the income level has inclined towards NRs. 4,000.0 - 8,000.0 per month, the proportion of consumers of CT scanner also increases, whereas the corresponding figure was found decreasing for MRI among the strata of increasing family income level per month (Figure 5).

Figure 5: Income level profiles of service consumers by machine (n = 80)



As depicted in Table 9, majority of the service consumes, who had their family income level of NRs. 4,0000.0 to 8,000.0 per month, were found visited both public and private health facilities by 62.5% and 42.5% respectively. And, the consumers with the family income level of more than NRs. 8,000.0 per month visiting public and private health facilities were counted to 35.0% and 37.5% respectively.

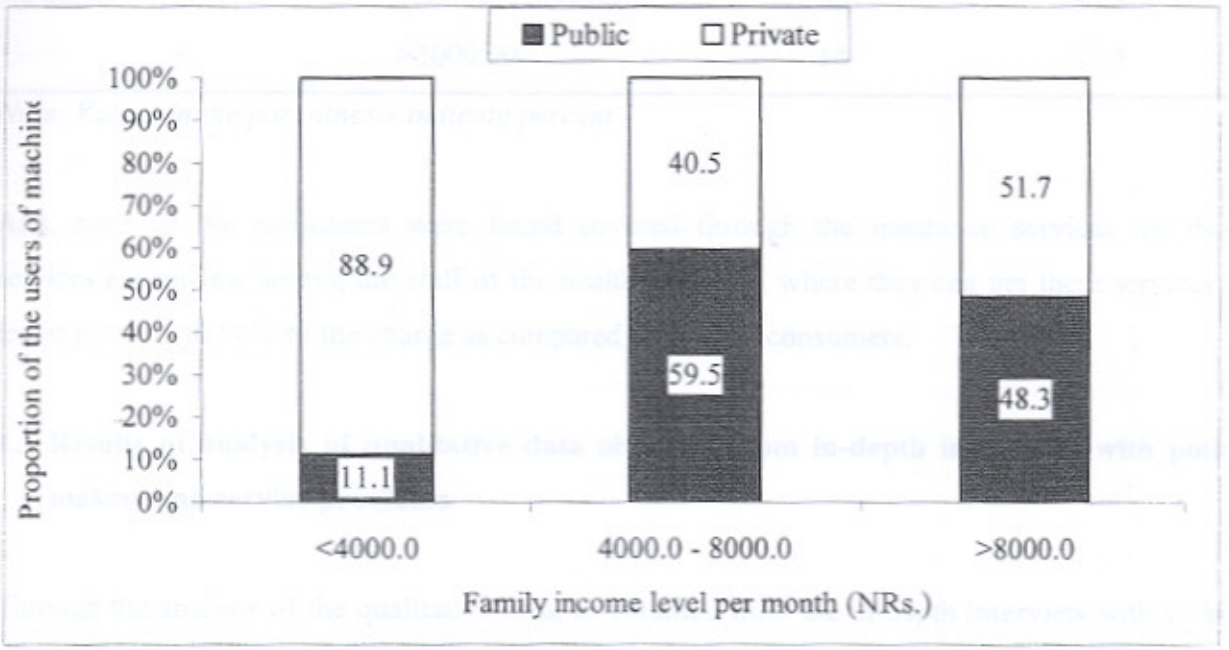
Table 9: Profile of service consumers' visit to type of health facility by income level (n = 80)

Type of ownership	Family income level per month		
	<4000.0	4000.0 - 8000.0	>8000.0
Public (n = 40)	1 (2.5)	25 (62.5)	14 (35.0)
Private (n = 40)	8 (20.0)	17 (42.5)	15 (37.5)

Note: Values in the parenthesis indicate percent

Among the consumers with family income level of less than NRs. 4,000.0 per month, eight of every nine were found visiting private health facilities. And, three of every five of the consumers with average range of family income level of NRs. 4,000.0 to 8,000.0 per month were found visiting public health facilities for the services, whereas the figure was half for visiting the private health facilities for the services as the income level increases to more than NRs. 8,000.0 per month (Figure 6).

Figure 6: Income level profiles of service consumers by type of ownership of health facility visited for the services (n = 80)



4.2.4 Affordability of the service consumers

Consumers were asked to rank the current service charges for public and private sectors into 'very expensive', 'expensive' and 'normal'. Almost three in every five of the consumers thought the current charges are expensive, while around one-fourth of them ranked the charges to 'very expensive'. Also, around three in every five were found willing to pay NRs. 1,000.0 to 2,000.0 for the services, whereas almost one –fifth of the consumers were found unable to pay more than thousand rupees. It was only the 17.5% of the consumers who seems happy to pay more than NRs. 2,000.0 for such services (Table 10).

Table 10: Affordability of service consumers to CT Scanner and MRI services (n =80)

Particulars		Frequency	Percent
Reaction to MRI/CT	Very expensive	21	26.3
Scanner	Expensive	45	56.3
	Normal	14	17.5
Ready to pay for MRI	<1000.00	19	23.8
	1000.00 - 2000.00	47	58.8
	>2000.00	14	17.5
Ready to pay for CT	<1000.00	20	25.0
Scanner	1000.00 - 2000.00	46	57.5
	>2000.00	14	17.5

Note: Values in the parenthesis indicate percent

And, none of the consumers were found covered through the insurance services for these services except few among the staff of the health facilities, where they can get these services in lesser price up to 50% of the charge as compared to general consumers.

4.3 Results of analysis of qualitative data obtained from in-depth interviews with policy makers and service providers

Through the analysis of the qualitative data, as obtained from the in-depth interview with 10 key informants (health facility owners, physicians, radiologists, academicians, and policy makers), we came to the major themes depicted in the following categories.

4.3.1 Acquisition of CT scanner and MRI for the first time

Key interments interviews disclosed the fact of starting the services from the public sectors both for the CT scanner (Bir Hospital, 1987) and MRI (Birendra Army Hospital, in early 90s). In the private sector, CT Scanner was started for the first in Blue Cross Nursing Home in 1993, and MRI was installed in the same institution in 1998.

The major reasons for acquiring these services were gathered for public and private sector separately. It was mainly installed for the diagnostic services that these services were acquired in

the public sector. Besides, it was the need of the big hospitals (e.g. Bir Hospital) for its acquisition. It was stated:

> *"It was responsibility of Bir Hospital, at then, ... to think of the service... since it was the only big public hospital in the country. ... And, the national priority was also laid for acquiring the machine in the Bir Hospital from the government as well".*

Despite the service provision, it was for profit making as well, as revealed by the key informants to be one the major reasons for acquiring these expensive machines in the private sector. Also, it was highlighted to the increasing demand of the services in the private sector as well. It was mentioned,

> *"No matter, whatever could be claimed from the private sector, it is for the profit making purpose for installing these high cost machines in the private sectors."*

> *"Also the government policy (economic and health policies) for favouring the start of such services in the private sectors. However, it is the time to be more responsible for the service to the people by the private sectors.... and, of course, they (private sectors) are providing services to the people...".*

Also, said,

> *"...for the better services to their clients (patients who visited the private health facilities)... and they need to retain patients for other services as well...there is competition going on these service in the private sector...".*

The initial investment costs were estimated to be around NRs. 15 to 20 millions for CT scanner and NRs. 25 to 30 millions for MRI machines. The dominant company of these machines in Nepal was recorded to be HITACHI of Japan. It become difficult to figure out exact investment cost of these machines, since the machines in the public sectors were mainly come in donation, and the detail information could not accessed.

One of the interviewees said,

> *"Majority of the machines installed in the private sectors are of second hand... and there is no harm of acquiring second hand machines, considering the substantial reduction in investment cost...,* and the quality of service output is no more different..."

4.3.2 Diffusion of CT scanner and MRI

We explored some reasons for the diffusion of these services, and found that it was inevitability of these services for diagnosis and better care management of the complicated medical problems. The factors mainly accounted in the interviews were, diagnosis and better care, changing health needs (increasing road traffic accidents, head injuries) increasing awareness of medical personnel and even patients, handling some critical cases.

It was stated by one of the interviewees:

> *"Basically for the better diagnosis of complicated cases..."*

> *"...physicians' advice to these services as rendered 'life-saving-equipments' is also creating pressure for the service* owners, especially in the private sector".

It was claimed that private sector has contributed via many ways with the provision of these services – sharing huge amount of service burden with the public sector, reducing the public expenditure in these high cost devices so that public resources can be diverted into other primary health care services.

> *"...stops money going outside the country for diagnosis as the quality services are readily available in the country in relatively low costs".*

> *"Private sector has very important contribution in this regard, as the services from the public sector take long time to wait".*

The free market economy of the government has recognized as supportive for the growth of private health care provider with these high cost medical devices, and so the priority paid to the

private sector for health services in the national health care policies as well. However, there are still a lot of rooms to improve for better quality services through private sectors, as expressed,

> *"...government policies should be more liberal towards economic policies so as to better foster the milieu for these high-cost services..." "...by the time, there should be coordinated functional relationship between the private sector and government providers"*

The role of trained manpower in the country and health care market is highly realized by the interviewees for the desired pattern of diffusion of the services both in the public and private sectors. The need was recognized for both fulfilling the magnitude of demand and the ensuring of the quality of the services provided. Informants has expressed,

> *"Trained manpower can create the market healthy and productive". "...can win the trust of consumers..." "... ensure proper utilization of these services, and so the rationale use of the high-cost devices..."*

4.3.3 Need and utilization of CT scanner and MRI (Rationale use of equipments)

Unanimously, almost all the key informants were agreed about the need of these devices, quoting the basic reason for better diagnosis and life saving of the clients who need the services. Also, they did not forget to mention the economic contribution that these services providing both to the consumers and the government. They had a strong feeling that these services are required for the standard of diagnosis and care management of the complicated cases.

One of the informants had expressed,

> *"...utilization level of these services is quite good in the public hospitals, and even not able to provide the services as demanded...".*

> *"...it could be because of increased awareness of both clinicians and consumers.....and due to increased number of trained manpower".*

"...current utilization was heavily dominated by supplier induced demand...it is almost nil from the consumers' side, except in some educated and rich patients....."

Also disclosed,

"There is always pressure to the clinicians working in the private sectors from the management to maximize these services, as these services are the major blocks of their income and so the profit making ..."

"In some private institutions, there is provision (non-documented) of incentives or commission to the referees who referred the cases from public hospitals, private clinics to these centers where the service of MRI and CT scanner is available. It is up to NRs .500.0 to NRs. 700.0 for each referral. "... so it is quite difficult to say how rationale the services are available in the current health care market..."

The interviewee would like to suggest to make the patient friendly service hours (in the morning and evening) for these services in the public hospitals so that people can access the quality services in cheaper price as compared to that of the private. It was further expressed,

"This can contribute the economics of the public hospitals and so the trust will be maintained among the consumers..."

"...for ensuring the rationale use, clinicians are required to orient about these services..."

For ensuring the rationale use, it was suggested to the concerned authority establishing a board for controlling the quality of care of these services incorporating both the public and private health service providers. Also, expressed the need of development of qualified manpower on quality control. Besides, the role of Radiological Society and other such wings were paid priority in policy-making and advocacy while expressing their views by the key informants.

One of the interviewees said,

"Trained manpower is the back bone of rationale use of these medical devices".

4.3.4 Service charge and return of the investment of the devices

It was obtained from the interviews with the key informants that service charge in general is:

For CT scanner,	public:	NRs. 2,000.0 to 2,300.0
	private:	NRs. 2,400.0 to 3,600.0
For MRI,	public:	NRs. 4,600.0 to 5,000.0
	private:	NRs. 6,500.0 to 7,000.0

However, it was found varied heavily as per the parts of the body where the imaging is to be done, and also between the public and private institutions.

The charges of these services were found generally fixed for by the decision made by the board or committee of the particular health institutions. There is no any national level body to fix and monitor the fees for these services, and so found varies between the institutions and they have their own cost assessment and decisions for fixing the fees.

It was claimed by informants from the public hospitals that it was up to 25 – 35 % of the total revenue collected by these services, and the regularity of these services in public hospitals is highly desirable for the economics of both the hospitals and consumers. They depicted the sufficient return to its investment.

However, the informants representing the private institution said,

> *"Private institutions are not for the profit making, but for the services that public hospitals are not capable of fulfilling the current demand of the patients..." "...for reaching to the breakeven point, 3 – 4 cases help a lot..." "...believe, we will be in profit in the long run..."*

4.3.5 Equipment maintenance

Trained manpower for maintenance are available in Nepal. There is one highly qualified technician (M. Tech.) in the country. Besides, the suppliers of the machines provide their own

personnel for maintenance. Usually, it is warranted for few contacted years for the regular maintenance from the suppliers. Informants said,

> *"...the maintenance costs is usually high, ...even goes to NRs. 800 thousands (for CT scanner)..."*

> *"...the labour costs for maintenance accounts around NRs. 150 thousands..."*

Also, said,

> *" ...spare parts are not available in Nepal..." "...and government has no trained manpower... nor the arrangement for maintenance..."*

4.3.6 Consumers' affordability towards these services from providers' perspective

Most of the consumers belong to the lower middle class to upper class people, dominated by general middle class families. And, their affordability was estimated to be around NRs. 2000.0 to 2500.0, while the willingness could be NRs 1000.0 to 2000.0, and even sometime almost nil.

One of the informants from public hospital said,

> *"...self-referral is almost zero, and so less the willingness to pay for these services"*

Another informant from one of the private hospitals said,

> *"...consumers' affordability is good, as reflected that the users' charge is reasonable and there is no complain till date about the charge..."*

4.3.7 Need assessment of high cost technology and policy recommendation

Unanimously, almost all the interviewees agreed that there is no any formal body to assess the need of these services in the country, and also could not found any published report till date regarding the need assessment of these services, availability of trained manpower, regularity of the services, cost consciousness among the users, service approach (referral and feed back

mechanism), technical quality of imaging laboratory, repair and maintenance provision, and quality of the services. This was acknowledged as a young branch of medicine in Nepal, and so a lot of works is needed to take into.

"...these are the services required at immediate decision making points in medical sciences, and so is the practice in both public and private hospitals in Nepal". "...public hospital has better quality as compared to private..."

(Dr. at public hospital)

"...service is irregular and waiting time is relatively longer in public hospital, while the service is very much regular in private institutions and waiting time is virtually none..."

(Dr. at private institution)

The concentration of services in Kathmandu valley was found well recognized by the policy makers and providers at the public hospitals. Considering the equity and access to the general people, it was said,

- *"Services should be made available at least in regional hospital, tertiary care hospitals, at the moment; and need to be expanded to the zonal hospital, based on the other improvement of infrastructure and provision of manpower in such hospitals..."*

"... the role and contribution of private sectors should be well acknowledged and supportive environment should be created for investment by the private sectors in such high cost investments areas..."

Making of Medical Device Act, and its proper enforcement was found well realized. And, importantly, it was desired to harmonize the Consumer Protection Act with the Medical Device Act to be well fitted for the rationale use of these equipments and its optimum utilization.

One of the informants representing public sector said,

"... health insurance scheme can better ensure the accessibility of these services to the general people. ...there should some subsidy in the charge for the poor people..."

Chapter V

Discussion

Diffusion of medical technology is the process by which new clinical procedures are devices come into use in the health care system. It is historical topic, as old as medicine itself, and is a marketing theory that predicts the pattern of adoption of new products, with specific characteristics of the product determining the rate of diffusion. Hospitals, physicians, manufacturers, and patients all are the factors in the demand for, and acquisition and diffusion of, new medical technologies.[6,11] Many studies[7-10,12-13] have identified the implications of access and utilization of these 'big-ticket' services depicting the love-hate relationships with medical technology. Technologies are extolled for saving lives, improving health status, and improving the quality of care. At the same time, it is vilified as one of the dominant factors responsible for the continuing escalation of medical costs. It is not true in every technology, but true on average.[13]

As the current study revealed that both CT Scanning and MRI services had started by the public sector for the first time in Nepal in early 90s. After then it has been found the diffusion trend quite in the public sectors depicting the figure with major portion (72%) of CT Scanners owned by private sector while both public and private sector equally own MRI (Table 1 and Figures 1, 2). This is the similar trend that was observed by other studies conducted in Asia[10], Thailand[7], the USA[13], Barcelona[14], and Canada[15]. As the Figures 1 and 2 showed that the CT scanners were found installed more rapidly since its installation year (the first year of installation), while the MRI was found being adopting the trend more slowly than CT. This kind of trend was also recorded by numbers studies.[7,10-11,14]

Coinciding the findings of other studies,[7,10, 14-15] almost two-third of the CT scanners and cent percent of MRI services were found installed in Kathmandu valley only, urban area (Table 2). Also it was found dominated by the private sector, specifically the for-profit intuitions. By incorporating the results of qualitative data obtained, it seems clear the interest of the for-profit making institutions installing these high cost services. And the quality of the services by the private institutions was found challenged as compared to the public hospitals in terms efficiency, access, and also the rationale use of these devices. This was also reported in the studies by

Sutherland in Canada[15], Jindawatthana in Thailand[7], and by Neumann in the United States[13]. The US study highlighted the inappropriate diffusion of technologies, both underdiffusion of effective and cost-effective technologies, and overdiffusion of ineffective and cost-ineffective technologies contributed by the factors like reimbursement system in the country, professional reward structures, legal considerations, and patient demand. The current study and the study in Thailand[7] succeed in uncovering the backsides of the "kick-backs" existing in the poorly regulated dominant private sector in the developing countries showing the clear picture of irrational use of high cost medical technologies, and so escalating the cost of health services in the developing countries.

It is the public sector where the CT Scanners tend to diffuse in bigger sized tertiary care hospitals (central hospital and teaching hospital). However the diffusion was found concentrated in the diagnostic centers and small and medium sized hospitals in the private sector, even with centers having zero bed (Figure 3 and 4). Similar was the case in Thailand with more that half of the devices clustered in Bangkok, and Central Region[7], and it was reported that highlighted "health region" of the city of Barcelona controlling the majority of medical technologies in Catalonia[14]. It is happening in almost all parts of the world, eventhough most research in health care economics shows that it is more expensive to run for-profit facilities than not-for-profit facilities. The current study could depict the average service charge of CT scanning as NRs. 2,000.0 - 2,300.0 in public, and NRs. 2,400.0 - 3,600.0 in private sectors, while the fee for the MRI services was recorded to be NRs. 4,600.0 - 5,000.0 in public sector, and NRs. 6,500.0 - 7,000.0 in private sector. This shows the difference in the charge for the same services in public and private. In the ground of information obtained from the qualitative data analysis that quality of the services is better in public sectors, private sectors seems just escalating the health services costs of the poor patients. However, the irregularity of services in Bir hospital, and overload of the patients in the public hospitals, it may sometime cost more to the consumers if we need to incur the time cost for waiting the services from the public hospitals. However, this study has not attempted to estimate the cost of such items related to the consumers.

A study in Calgary, Canada[14] in 2000 showed, in contracting out its MRI procedures, that the average cost of using the private facilities was $80 to $100 more per scan than those done in the public hospitals. The cost in Calgary of using for-profit clinics was 21% to 25% more than performing the same service in a public hospital. Similar was the scenario reported in Asia region as well.[7,10] This can also be well predicated in Nepal as well since the current rate of

utilization of the services is below the break-even points, and in the scale of initial investment costs estimated to be around NRs. 15 to 20 millions for CT scanner and NRs. 25 to 30 millions for MRI machines in the country.

Annual throughput is an indicator that tells us the level of utilization and vice versa under utilization and spare capacity. Discussion with the technical persons and clinicians revealed that the maximum annual productivity of MRI is 2500 cases and that for CT scanner is 6500 cases in Nepal. The current study recorded that CT Scanners in private sector were found under-utilized depicted only 21.6% being used. The utilization of CT Scanners (74.5%) is higher in public sector than that of private sector; however with considerable spare capacity of the machine. In case of MRI, both public and private are being utilized about 50% of the capacity of the machine (Table 3).

The majority of the service consumers of the CT scanner and MRI services in Nepal fall under the age group of 20 - 39 years (36.3%) – the median age of 35 years. Male consumers were slightly more than female for the services (53.8% vs. 46.2%). Gender was not found significantly different among the service consumers of the CT scanner and MRI machines (Table 5).

Interestingly, it was recorded that CT scanner is dominated in the public sector (57.6%), while the dominance in MRI service (71.4%) is led by private sector (Table 6). Among the service consumers who had their family income level less than NRs. 4,000.0 per month, 55.6% of them were found taking CT scanning services, while the proportion was 44.4% for MRI service. As the income level has inclined towards NRs. 4,000.0 - 8,000.0 per month, the proportion of consumers of CT scanner also increases, whereas the corresponding figure was found decreasing for MRI among the strata of increasing family income level per month (Figure 5).

Also the consumers with different income level were found seeking services both from the public and private health facilities, depicting a faint glimpse that consumers with family income level of NRs. 4,0000.0 to 8,000.0 per month found visiting public and private health facilities by 62.5% and 42.5% respectively, while the corresponding figure lies to to 35.0% and 37.5% respectively among the consumers with the family income level of more than NRs. 8,000.0 per month (Table 9). This clearly shows that consumers have diversified choices for the services between the public and private health facilities, with different income level. In order to have a picture with significant interpretation regarding the income level and the choices of these high cost

services, as generally expected among the poor people in Nepal, another study with clear objectives to do so is desirable.

Responding to the finding of consumers' affordability and willingness to pay, based on their very subjective ideas, more than four of every five (82.5%) were found the current service charge expensive as per their affordability. Also only around three in every five were found willing to pay NRs. 1,000.0 to 2,000.0 for the services, whereas almost one–fifth of the consumers were found unable to pay more than thousand rupees. And, it was only the 17.5% of the consumers who seems happy to pay more than NRs. 2,000.0 for such services (Table 10). In the target areas where none of the consumers were found covered through none of the insurance scheme for these high cost services, interpreting the findings of analysis of qualitative data, as the current shows, is not an easy task. However, it seems visible that public hospitals are not able to provide the services as demanded because of the various reasons – long waiting time for the services, non-patient-friendly service hours, poor staff motivations, and even poor response to the patients approaching to the public hospitals.

In the private sector, services seem to be well responded to the consumers and in time as well; however, it is obvious that they are charging more to their clients than the consumers' current level of affordability. And, at the same time, the private sectors for the services found polluted by the activities of commissions for the referrals, 'kick-backs' behind the curtain within the facilities, especially for making more money by the 'big ticket' services putting pressure by the management to the clinicians, and radiologists employed in the private institutions. Also the same health personnel working both in public and private health facilities were found practicing some very unlikely unethical practices by making unnecessary referrals to the consumers, and some time, even by not providing the right information to the consumers, making the consumers paying more money not only for the services charge, but also killing more time of the consumers. This generate a serious question pointing out the inequitable accessibility of the services among the consumers and showed a clear picture how rationale the services of the high cost devices are functioning in the Nepal. Health insurance scheme, if included in the benefit package, can better ensure the accessibility of these services to the consumers.

Methodologically, we faced some serious problems in documenting the required information for the study. We found there was not up to date record keeping in private sectors, the also some of the institutions hesitated to provide the financial information about investment cost, total

benefits, and even service quality reports. Maybe, not available, we could not get any information about the cost-assessment of these high-cost medical devices before the procurement done both in private and public health facilities. Also, utilization rate of some of the health facilities could not accessed, thus we could not produce the break-even points, and could not depict the true cost-assessment of these high cost medical devices, and so not able to say clearly the rationale use of these high cost medical devices in ground of economics.

Since this is probably the first study of its kind in Nepal in this Medical technology assessment field, we could not discussed the findings of the current study, and interpret the issues with relevant comparison in Nepalese context. This maybe because, we could not access relevant literatures about consumers' perspective and details in the studies published, and also could see only a very few studies, mostly from the developed part of the world, not allowing us to have a interesting comparison due to heavy difference in socio-economics scenario. However, this study has, definitely, come up with a lot of issues in high cost medical devices from Nepal that can be dealt with by further studies in future.

Chapter VI

Conclusions and Recommendation

A larger portion (72%) of CT Scanners is owned by private sector while both public and private sector equally own MRI, with 60% of CT scanners and 100% of MRI facilities situated in Kathmandu valley. Diffusion of CT Scanner was constant until 1993 and gradual increase after 1997 in public sector. A gradual increase was observed in private sector till 2001, since the first introduced in 1993, and then a sharp increase in diffusion of CT has been observed. Diffusion was dominated by private ownership with 13 devices (72% of total 20). There are only 4 MRI machines in till date, two from each public and private. The diffusion trend of MRI has followed the trend of that of CT scanners, however, in a quite slower pace. Among the owners, both CT scanner and MRI devices were installed with bigger bed sized tertiary care public hospitals, while the installations was made in small and medium-sized hospitals in private sectors.

There is no any formal process of technology assessment in Nepal, and so, no effective mechanism to control kick-backs, and irrational use of medical devices, from both ethical and economic ground.

As capital depreciation dominates cost structure of these technologies are if private for profit dominates the market, there is a tendency to maximize profit and break-even in shorts period by increasing throughputs through various market promotion strategies. Then it is highly plausible that consumption is inefficient due to imperfect market, unilateral information and supplier induced demand. This will further lack behind the government to regulate the health care market, in the serious lacking of information on diffusion.

- With the discussion of stakeholders, Ministry of Health, Nepal Medical Council, should immediately introduce a compulsory appropriate reporting mechanism by the service owners of these high cost devices.

- Ministry of Health, Nepal Medical Council or concerned authorities requires to work in partnership for the formulation of Medical Device Act, for how the diffusion of medical

technology and utilization by the owners could address the current kick-backs, accessibility of the services, equity, and efficiency of the devices, and its sustainability.

- The diffusion must be guided by epidemiological profiles of diseases and health needs of the people.

- For ensuring the rationale use of the services, harmony with the Consumer Protection Act, 2055 BS and Proposed Medical Device Act is strongly recommended.

Uncontrolled diffusion can lead to the mushrooming effect resulting low cost recovery, and hence unhealthy market practices, and thus irrational use of the devices.

- The existence of black incentives or commission for referees and referrals of the cases, resulted by the unhealthy practices should be discouraged by the initiative among the services owners of private sectors and government providers.

In the public hospitals, the fees for the services of these devices are generating 20 – 30% of the total revenue of the hospitals.

- The regularity of these services in public hospitals is highly desirable for the economics of both hospitals and consumers.

Importantly, it is a danger situation to move for high cost services, centered in the cities without creating a cost conscious environment among the service consumers, and always questionable what social and economic benefit can be ensure by uncontrolled poorly regulated private sector that has poor public accountability, and escalating service cost to the consumers.

- However, the role that private sector is playing at the moment where the public sector is virtually not able to increase its expenditure in expensive services, the contribution made by the private sector should be acknowledged, and feasible environment should be provided to the private sector by carefully assessing the medical technology and its cost implications, ensuring the quality services are provided by rationale use.

- Appropriate health insurance scheme, if provided in the benefit package, can better ensure the equitable accessibility of these high cost services to the consumers.

- National guidelines for the regular assessment and monitoring of these high cost medical devices should be developed, and a strong public-private partnerships (PPP) network should be established functionally for its proper execution. The spare capacity of MRI and CT scanners can better utilized by such partnerships.

- National capacity with qualified human resources should be build up in technology assessment, and so for the designing of standard benefit package with these services, by creating a cost-consciousness environment among all the related elements of these services – service providers (owners), consumers, government authorities, policy makers, and researchers.

This is the first study of its kind in Nepal, and still and lot of issues needs to be explored for gathering evidences for better understanding the diffusion of medical devices and its utilization. A further study exploring the cost implications of these high cost medical devices to the service owners, consumers, government, and thus the overall national health economics is required.

- Research in this area should be a priority issue, and the research on how diffusion of high cost medical technology has making implications to the policy frame of health services, determining the trade-off between the quality of the life saved and escalating the health care costs, and to what extent should be measured adequately. Nepal Health Research Council can take a lead recognizing the depth of its necessity and importance in the national health care parlance.

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Annexes

Annex 1: Questionnaire to Health Facility

"Study on Diffusion of High Cost Medical Equipments in Nepal" NHRC

Data no.: ____

Date: 20___/___/___

Name of the health facility: _____

Address/location of the facility: _____

_____

Name of the respondent: _____

1. Personnel information:

SN	Staff category (position)	Speciality (initial and on-going/in-service training received)	Remarks
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

2. Services availability:

What are the current routine services made available from your institution to the consumer party?

Services	Fee for each service:
_____	Rs._____
_____	Rs._____
_____	Rs._____

3. Initial investment:

What is the initial procurement cost (price) of the MRI and /or CT scanner?

☐ Magnetic Resonance Imaging (MRI):

~ Date of procurement: _____/____/____

~ Procurement price: _____

~ Useful life-time: _____

~ Source of procurement made

(band and company name): _____

~ If received in help/donation, source of funding: _____

- date of donation : _____/____/____
- date of service started : _____/____/____

~ Manpower responsible for the service provision at then initially

(basic/initial training of the manpower received): _____

~ Infrastructure made available for establishing the service initially and cost of each:

.....	Rs. .....
.....	Rs. .....
.....	Rs. .....

☐ Computerized Tomography (CT) Scanner

~ Date of procurement: _____/____/____

~ Procurement price: _____

~ Useful life-time: _____

~ Source of procurement made

(band and company name): _____

~ If received in help/donation, source of funding: _____

- date of donation : _____/____/____

- date of service started : _____/____/____

~ Manpower responsible for the service provision at then initially

(basic/initial training of the manpower received): _____

~ Infrastructure made available for establishing the service initially and cost of each:

..... Rs. .....

..... Rs. .....

..... Rs. .....

4. Service trend (*time-series information*):

Provide the following information by different year:

Year of service started / Particulars	19*	19*	19*	1999	2000	2001	2002	2003
1. Staff responsible for the provision of the service								
2. Refresher training received by the staff on MRI/CT scanner								
3. No of the patient served by service of: ☐ MRI ____ ☐ CT Scanner ____								

4. Total no of patients in the year								
5. Fees of the service: ☐ MRI ☐ CT Scanner	 Rs.__ Rs.__							
6. Maintenance/ repair cost								
7. Bed size								
8. Total no of services made available: a) ..... b) ..... c) ..... d) ..... e) ..... f) ..... g) ..... h)								
9. Other…								

5. What is about the service regularity of the MRI/CT scanning in your institution?

☐ MRI:

.....

.....

.....

.....

☐ CT scanner:

.....

.....

.....

.....

6. What are the general conditions that make the service of MRI/CT scanner inevitable to the consumers?

☐	Diagnostic requirement	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
☐	Dr's advice/suggestion	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
☐	Patient's willingness to pay	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
☐	Patient's affordability to pay	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
☐	Other (specify)……..	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

7. If ANY other support for the running the MRI/CT scanning services in your institution?

……

……

……

8. In your opinion, what is the diffusion trend of MRI and CT scanner in Nepal? And what are the factors behind that?

……

……

……

……

Thank you !

Annex 2: Questionnaire to Consumers

"Study on Diffusion of High Cost Medical Equipments in Nepal" NHRC

Data no.: ____

Date: 20____/___/___

1. Age: _____ years 2. Sex: ☐ Male ☐ Female

3. Caste/Ethnicity: _____ 4. Family size: _____

5. Address:

☐ District: _____ ☐ VDC/Municipality: _____

☐ Wad no: _____ ☐ Village/*Tole*:_____

6. Educational status:

☐ Uneducated ☐ Primary (1 –5)

☐ Lower secondary (6 – 7) ☐ Secondary (8 – 10)

☐ Higher secondary (10 +2) ☐ University education (12+)

7. Current Occupation:

7.1 current occupation of Patient:

☐ Employed (Rs. _____/month) ☐ Daily wage (Rs. _____/day)

☐ Business (Rs. _____/month) ☐ Unemployed (Rs. _____/month)

☐ Student ☐ Other (specify)_____

7.2 Overall income of family: (Rs. _____income/month)

Major source of family income (specify)_____

8. Is the current occupation of you AND/OR your family, the only source of your current health expenditure?

☐ Yes ☐ No

If 'No', what is the next source of your current health expenditure? And what is the amount of income/month or annually?

- ..... Rs._____
- ..... Rs._____
- ..... Rs._____
- ..... Rs._____
- ..... Rs._____

9. What is the disease or probable diagnosis you are suffering from?

_____

_____

10. From where and by whom you are referred for the service of MRI and / or CT scanner in this institution?

A) From where?

☐ Self (1st time) ☐ Private hospitals/nursing home

☐ Public hospitals ☐ Doctor's clinic ☐ Other (specify).....

B) By whom?

☐ Self (1st time) ☐ Doctor ☐ Friend

☐ Family member ☐ Relative ☐ Other (specify).....

11. What is the amount of *direct expenditure* you made for the service of MRI and/ or CT scanner in this health institution?

☐ Registration fee: Rs._____

☐ Consultation fee: Rs._____

☐ Fee for MRI and/ or CT scanner: Rs._____

☐ Bed charge: Rs._____

☐ Drugs price: Rs._____

☐ Other investigations (blood, urine, etc.) Rs._____

☐ Other (specify)..... Rs._____

Total Rs._____

12. What are the other kinds of expenditures you made for the service of MRI and/or CT scanner?

☐ No of days you lost your income: _____(*time spent while home to health facility*);
And your average daily income in normal life: *Rs.*_____

☐ Transportation charge (*one-way*) Rs._____

☐ Lodging/fooding charge Rs._____

☐ Accompanying:
Age: _____ *Sex:* _____ *Income level:* *Rs.*_____

☐ Other (specify)..... Rs._____

Total Rs._____

13. What you think about the affordability of the cost of the service of MRI and /or CT scanner?

☐ Very expensive ☐ Expensive ☐ Average/medium
☐ Cheap ☐ Perfect

14. How much are you ready to pay for these services?

☐ For MRI: Rs._____ ☐ For CT scanner: Rs._____

15. How long did you wait for these services in this institution?

_____ minutes/hours (*waiting time for service*)

16. If any other comments or opinion…..?

.....

.....

.....

.....

Thank you !

Annex 3: Interview Guidelines to Policy Makers

"Study on Diffusion of High Cost Medical Equipments in Nepal" NHRC

Date: 20____/____/____

Name of the interviewer: _____

Name of the interviewee: _____

Name/address of the institution
the interviewee associated: _____

1. **Acquisition of MRI and CT scanner for the first time:**

   a. When and where was these services started in Nepal for the first time?
   (Note down either in public or private, document in the name, year, and process of acquisition)

   b. What was the interest of private and pubic institution for acquisition?
   (Note the interest both for private and public institutions separately)

      a) For public institutions,

      b) For private institutions,

   c. What were the basis for initial acquisition?
   (Note down the prominent reasons for acquiring the services)

   d. What was the price of initial investment?
   (*Document both for public and private services, and ensure about the source of funding and the subjective feeling on the price by the owners e.g. expensive, mild or cheap*)

2. **Diffusion of MRI and CT scanner:**

a. How these services diffused in public and private sectors?
(*Be focused about the process how these services get expanded in Nepal*)

b. What are the factors for diffusion?
(*Document the major factors and their role for making the services diffused both in public and private sectors)*

c. On what basis the price varies?
(*Ensure if there any mechanisms, board, committee or any regulations, or just rampant)*

d. What is the extent of burden (service and economic) shared by the private sector?
(*Document the magnitude of the services made in terms of patients served, economics of the people saved, and public expenditure minimized or increased*)

e. What is the role of free market economy for diffusion?
(*Light the role of existence of open market competition among the service holders and role of government policies favouring liberal economics in the health care commodities)*

f. What is the role of trained manpower in image radiology in the diffusion of CT scanner and MRI services in Nepal?

Need and utilization of MRI and CT scanner/Rationale use of equipments:

a. What is the extent of the need of these services at then and now?
(*Document the information regarding the demand of the services in the country as such, at different points of time*)

b. What is the basis for undergoing these investigations?
(*Get the reasons for the prescribing these services and being utilized by the consumers*)

c. What is the basis for making these services inevitable or proposed for economic purpose only by doctors or service providers?

d. Is there any body/commission/committee, monitoring the rationale use of these services and as of quality control?
(*What should be the role of such body if it is desired to be so...?)*

e. What could be the role of trained manpower for making ensure the rationale use of these services in the country?

4. **Cost of the service and return of the investment with reference to life period of the equipment:**

a. What is the cost of MRI and CT scanner investigations in general?
(*Note down in minimum, maximum and average level*)

b. What is the annual income to the service providers by these services?
(*Make sure the whether the service providers in this field are satisfied by the fees for the services or benefit they usually they get*)

c. Do you think the fees of these services are sufficient to return its investment within the useful life period of the equipment?
(*If the response is positive, make sure how is it expected to do so...*)

5. **Equipment maintenance:**

   a. Trained manpower in Nepal?
   (*Document how many, and where (both in public and private sectors) and make proportions)*

   b. Is there any maintenance service availability in Nepal?
   (*If yes, where and how often the services is available*?)

   c. What is the usual maintenance cost for these services in and out of Nepal?

6. **Consumers' affordability of these services from providers' perspective:**

   a. What is the general economic background of the service consumers?
   (*Take the reference of the average income level*)

   b. What is the extent of affordability of the service consumers' party?
   (*Note the magnitude of amount they can afford happily*)

   c. What is the extent of willingness to pay for the services by consumers' party?
   (*Note the magnitude of amount they found willing to pay happily for these services if they need it)*

7. **Need of assessment of high cost technology/ policy recommendation:**

   a. What is the quality of the services in both public and private sector?

(*Measure in terms of availability of trained manpower, regularity of services, cost consciousness among the users, promptness of the services when approached for... and technical quality of imaging lab, and its required items*)

b. Is there any rule or act for price adjustment of these services?

c. Is there any feeling of developing a Medical Device Act, and what it should be?
(*Make sure documenting the information on what it should be if it is to be drafted shortly*)

8. **Any other issue...?**

a. What is the total number of MRI and CT scanning health facilities existing in the country form the very beginning?
(*See how many in public and private sectors, separately*)

.....

.....

Thank you!