TECHNICAL EFFICIENCY ANALYSIS OF PROVINCIAL HOSPITALS UNDER TWO DIFFERENT CONTRACTING MODALITIES IN AFGHANISTAN

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นายเมอร์ นัจมูดดิน

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต

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Thesis Title	TECHNICAL EFFICIENCY ANALYSIS OF PROVINCIAL HOSPITALS UNDER TWO DIFFERENT CONTRACTING MODALITIES IN AFGHANISTAN
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เมอร์ นัจมูดดิน การวิเคราะห์ประสิทธิภาพทางเทคนิคของโรงพยาบาลจังหวัดภายใต้การจัดหาบริการ 2 รูปแบบในประเทศอัฟกานิสถาน. (TECHNICAL EFFICIENCY ANALYSIS OF PROVINCIAL HOSPITALS UNDER TWO DIFFERENT CONTRACTING MODALITIES IN AFGHANISTAN) อ.ที่ปรึกษาหลัก: รศ.ดร.พงศา พรชัยวิเศษกุล, 107 หน้า.

การศึกษามีวัตถุประสงค์เพื่อวัดประสิทธิภาพทางเทคนิค (TE) ในการให้บริการด้านสุขภาพในโรงพยาบาลจังหวัดภายใต้กลไกการทำสัญญาแบบภัยและแบบภายนอกในอัฟกานิสถาน โดยใช้การป้อนข้อมูลเข้า Data Envelopment Analysis (DEA) เพื่อวัด TE ในโรงพยาบาลจังหวัดสิบแห่ง ซึ่งกลไกการทำสัญญาแต่ละชนิดต่อโรงพยาบาลห้าแห่ง และใช้เครื่องมือการจัดสรรต้นทุนแบบ HOSPICAL การวิเคราะห์ค่าใช้จ่ายของโรงพยาบาลเหล่านี้ได้กระทำเพื่อสนับสนุนค่าของประสิทธิภาพทางเทคนิค (TE)ร่วมกับค่าKPIsอื่นๆ ผลการศึกษาพบว่าในโรงพยาบาลห้าแห่งที่ใช้การทำสัญญาแบบภายในค่าใช้จ่ายเฉลี่ยต่อเตียงต่อวันเท่ากับ 20.3 ดอลลาร์สหรัฐ และต้นทุนผู้ป่วยนอก โดยเฉลี่ยเท่ากับ 3.1ดอลลาร์สหรัฐต่อครั้ง และค่าเฉลี่ย BOR เท่ากับ 81% มีความยาวเฉลี่ย ALOS 3.1 วัน ในทางตรงกันข้ามโรงพยาบาลอีกห้าแห่งที่ใช้การทำสัญญาแบบภายนอกค่าใช้จ่ายโดยเฉลี่ยต่อวันต่อเตียงเท่ากับ 23.8 ดอลลาร์สหรัฐ ต้นทุนเฉลี่ยผู้ป่วยนอกเท่ากับ 1.9 ดอลลาร์สหรัฐต่อครั้ง โดยค่าเฉลี่ย BOR และALOS ของโรงพยาบาลเหล่านี้เท่ากับ 68% และ 2.9 วัน จากการวิเคราะห์ DEA เผยว่าโรงพยาบาลที่อยู่ในการศึกษา 6 แห่งจาก 10 แห่งของโรงพยาบาลที่ศึกษา มีค่าประสิทธิภาพทางเทคนิค (TE) 100% ซึ่งประกอบด้วยรูปแบบสัญญาละ 3 แห่ง คะแนนเฉลี่ย TE สำหรับโรงพยาบาลห้าแห่งที่ใช้การทำสัญญาแบบภายในคิดเป็น 0.94 ในขณะที่คะแนนเฉลี่ย TE สำหรับอีกห้าโรงพยาบาลที่ใช้สัญญารูปแบบภายนอกคิดเป็น 0.96 ซึ่งแสดงถึงโรงพยาบาลที่ใช้สัญญารูปแบบภายนอกมีประสิทธิภาพสูงกว่า ผลสรุปของการวิเคราะห์แบบถดถอยโทบิทชี้ให้เห็นว่าจากห้าตัวแปรอิสระ (BOR, ALOS, ต้นทุน/OPD, ต้นทุน/เตียง-วัน และ ตัวแปรหุ่นสำหรับรูปแบบสัญญา) มีการถดถอยตรงกันข้ามกับค่าสัมประสิทธิ์ทางเทคนิคของโรงพยาบาล มีเพียง BOR และต้นทุน/OPD ต่อครั้ง เท่านั้นที่มีค่าความสัมพันธ์เป็นบวก แต่ไม่มีตัวแปลใดที่มีนัยสำคัญเลย ซึ่งอาจจะเกิดจากกลุ่มตัวอย่างที่น้อยเกินไป

สาขาวิชา เศรษฐศาสตร์สาธารณสุขและการจัดการบริการสุขภาพ ลายมือชื่อนิสิต .....

ปีการศึกษา 2555 ..... ลายมือชื่อ อ. ที่ปรึกษาวิทยานิพนธ์หลัก .....

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KEYWORDS: TECHNICAL EFFICIENCY/DATA ENVELOPMENT ANALYSIS/PROVINCIAL HOSPITAL/CONRACT-IN AND CONTRACT-OUT/AFGHANISTAN

MIR NAJMUDDIN: TECHNICAL EFFICIENCY ANALYSIS OF PROVINCIAL HOSPITALS UNDER TWO DIFFERENT CONTRACTING MODALITIES IN AFGHANISTAN. ADVISOR: ASSOC. PROF. PONGSA PORNCHAIWISESKUL, Ph. D., 107pp.

The study aimed to measure the Technical Efficiency (TE) of delivering health services in provincial hospitals under the contracted-in and contracted-out modalities in Afghanistan. Input oriented Data Envelopment Analysis (DEA) was employed to measure the TE in the ten provincial hospitals, five from each contracting modality. Using the HOSPICAL cost allocation tool cost analysis of these hospitals was carried out, in order to support the TE score, with other KPIs. The results showed that in the five contracted-in hospitals the average cost per bed day was US$20.3 and each OPD costed on average US$3.1/visti. The average BOR found 81% with the average length of 3.1 days ALOS. On the other hand the averge cost of each bed day was US$23.8 in the five cotracted-out hospitals, the average OPD cost was found US$1.9/visit in the five contracted-out hospitals. The overall average BOR and ALOS for these hospitals were 68% and 2.9 days. DEA analysis revealed that out of 10 hospitals in the study 6 of them were efficient with the TE of 100%; 3 from each contracting modality. The average TE score for the five contracted-in hospitals was 0.94, while average TE score for the five contracted-out hospitals was 0.96, which shows relatively higher efficiency in the contracted-out modality hospitals. Results of the Tobit regression analyses indicated that from the five independent variables (BOR, ALOS, Cost/OPD, Cost/Bed day and dummy vairable for contracting type) that were regressed against the technical efficiency scores of the hospitals, only BOR and cost/OPD visit had positive relationship. But none of them was quite significant, which could be due to small sample size.

Field of Study: Health Economics and Health Care Management Student's Signature……

Academic Year: 2012 Advisor's Signature……

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CONTENTS

Page

Page

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

LIST OF ABBREVIATIONS

ALOS	Average Length of Stay
BHC	Basic Health Center
BOR	Bed Occupancy Rate
BPHS	Basic package of Health Services
CHC	Comprehensive Health Center
CRS	Constant Return to Scale
CSO	Central Statistics Office
DEA	Data Envelopment Analysis
DH	District Hospital
DMU	Decision Making Unit
EPHS	Essential Package of Health Services
EU	European Union
HMIS	Health Management Information System
HOSPICAL	Hospital Cost Allocation Tool
HRP	Hospital Reform Project
KPI	Key Performance Indicator
MoPH	Ministry of Public Health
NGO	Non-Governmental Organization
NHA	National Health Accounts
PH	Provincial Hospital
SE	Scale Efficiency
TE	Technical Efficiency
USAID	United States Agency for International Development
VRS	Variable Return to Scale
WB	The World Bank

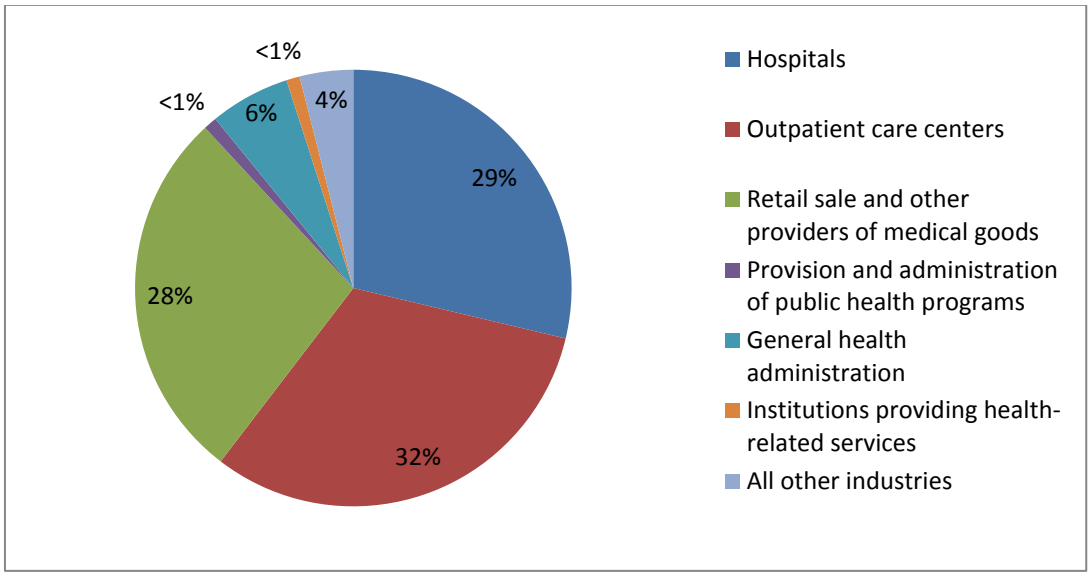
CHAPTER I
INTRODUCTION

1.1 Problems and Significance

Hospitals are the important and major health care providers in countries. Running hospitals consumes a large portion of the health expenditure in any country. Despite allocating a large portion of resources to hospitals, their costs are increasing and health care needs are also rising. The resulting gap between the devoted and available resources urges countries to explore new ways of financing and increasing the efficiency of hospital operations.

According to the recent Afghanistan National Health Accounts (NHA) 2008/09 report, 29 % of total health expenditure (THE) has occurred at hospital level; of which 78% was paid by the patient at the time of receiving care (out of pocket). This includes spending at private and public hospitals. Total spending on hospitals during fiscal year 2007/2008 was US $306,161,881 (MoPH, Afghanistan National Health Accounts 2008/09, 2011).

Fiqure1. 1: Breakdown of Health Expenditure By Provider, 2008-2009



Source: Afghanistan NHA 2008/09

Given the large share of spending in the health sector that is consumed by hospitals, it is important to monitor the efficiency with which services are provided.

Ministry of Public Health (MoPH) faces a situation in which it is expected to respond to the growing burden of disease, in order to rationalize service delivery systems, to regulate the quality and cost of services, and meet these demands despite declining donors' financing in the coming years. It is clear that as the economy continues to struggle and the population grows the challenges of providing health care to all increases.

This is an area of concern to policy-makers and it is necessary to develop a system for monitoring the efficiency of this segment of the health sector.

The MoPH strategic plan of 2011-2015 has ten strategic directions. In two of them there are strategic objectives and priority interventions showing the attention to hospitals which are mentioned below (MoPH, Strategic Plan 2011-2015, 2011):

STRATEGIC DIRECTION: INCREASE EQUITABLE ACCESS TO QUALITY HEALTH SERVICES

Strategic Objective-2 (SO-2): To Increase the proportion of people having access to hospital services

Priority Interventions:

- Finalize the hospital sector strategy
- Develop a plan of action for the hospital strategy and support its implementation
- Allocate necessary resources to implement the hospital strategy/plan of action and monitor their effective use
- Develop appropriate interventions for cost sharing and cost recovery in public hospitals

Develop and implement a plan for expanding geographical coverage of the Essential Package of Health Services (EPHS)

- Develop a package of services for the tertiary level of care

- Rationalize and increase the number of hospital beds based on identified and documented needs

STRATEGIC DIRECTION: IMPROVE HEALTH FINANCING

Strategic Objective 1 (SO-1): To build MoPH capacity to function within its optimum potential and ensure health economics evidence-based policy decision-making

Priority Interventions:

- Cost BPHS, EPHS and other strategic documents and programs
- Conduct economic evaluations of priority packages and programs
- Study the cost and effectiveness of the contracting-out mechanism and take over gradually the implementation of the BPHS and EPHS based on evidence and capacity of the MoPH
- Continuously analyze data and recommend scaling up of cost-effective interventions
- Develop mechanism(s) that support the private sector and public-private partnerships

MoPH developed EPHS in 2005 to improve the quality of services at secondary and tertiary levels. EPHS has defined the types, functions, and required resources of hospitals at each level. Recently, MoPH has developed the hospital sector strategy that amongst other objectives of the strategy aims at hospital autonomy. In addition, it emphasizes the efficient use of available resources and enabling hospitals to raise revenue via cost recovery measures such as a user fee.

Essential Package of Hospital Services (EPHS) as one of the major programs of the Afghanistan Ministry of Public Health (MoPH) aims to provide advance health services at hospitals. It also serves as a primary referral point for the primary health care facilities. This package included the most needed primary health care services that produced great results such as reduction in maternal and child mortality; MoPH

strives to improve the quality of care at hospital level. Hospitals require specialized human and large financial resources (MoPH, The Essential Package of Health Services, 2005).

The Provincial Hospital (PH) in the EPHS is a referral hospitals in the provincial health system, PHs in the most cases are the last referral point for the patients referred from the district levels. In some instances the PH refers patients to the regional or national hospitals. As a complement to the Basic Health Centers (BHC), Comprehensive Health Center (CHC) and District Hospitals (DH), provincial hospital contribute to the reduction of the maternal mortality ratio, infant mortality ratio and other diseases which are the main causes of the high mortality and morbidity in Afghanistan. As per the EPHS standards a provincial hospital can have 75-250 beds.

1.2 Contracting Modalities

In general services of BPHS and EPHS are delivered under the two different contracting mechanism; contracting in with MoPH and contracting out with NGOs.

Contracting out of health services is a formal contractual relationship between the government and a non-government provider to provide a set of services for a specified population. Contracting external management to run public services (contracting in) is a particular type of contracting. In which some lots are managed by government officials with more autonomy than they would otherwise have (Performance-Based Contracting for Health Services in Developing Countries, 2008).

The difference between grants and contracts is on who decides to deliver which services. In grants, it is generally the provider that decides what kinds of services will be delivered, where they will be delivered, and how they will be evaluated.

The provision of health services contracted with NGOs has shown to be a good way for the government to gain and maintain policy leadership. In Afghanistan, MoPH thorough contracting was able to provide direction for the old uncoordinated system; NGOs were given some degree of autonomy while MoPH holds them accountable for delivering the set packages and achieving the national priorities.

Contracting with NGOs was done on a large scale by the MOPH. Around 82% of the entire population lives in districts where primary care services are provided by NGOs under contracts with the MoPH or through funds to the NGOs from a limited number of donors. All grants and contracts focus on delivery of the package of health services defined by the MoPH and adopt the following (Loevinsohn,B., and Sayed, G.D., 2008):

- Assign clear geographical responsibility to the NGOs
- Employ competitive selection of NGOs.
- Promote convergence toward common indicators of success.
- Invoke a credible threat of sanctions if an NGO does not perform well

Contracting to the Ministry of Public Health itself (contracting in), is a scheme known as the Strengthening Mechanism (MoPH-SM) in BPHS and Hospital Reform Project (MoPH-HRP) in the case of EPHS. Under the last mentioned type of contracting the same services are delivered but using the government mechanisms where MoPH staff are contracted similar to NGOs (Palmer,N., Strong,L.,Wali,Ab. and Sondorp,E., 2006).

There are some differences in contracting depending on the source of financing (USAID, WB and EU), but in general there are common approaches. NGOs contracted in the World Bank supported provinces receive lump-sum payments, while USAID funded NGO contracts are budgeting by line item and expenses are reimbursed. EU contracts are cost reimbursement based on achieved benchmarks (Waldman, R., Strong, L. and Wali, A., 2006).

1.3 Research Questions

Is the contracting in or contracting out modality more technically efficient in providing health services in provincial hospitals?

1.4 Research Objectives

Overall Objective:

To identify the technical efficiency (TE) of service delivery at provincial hospitals operating contracted- in or contracted-out (MoPH vs. NGOs) modalities.

The overall goal of this study is: "To contribute to the efficiency of EPHS service delivery and financing as directed and managed by the Ministry of Public Health (MoPH)" and to begin to examine the value for investment in hospital care services under both NGOs (contracting-out) and MoPH contracting in (HRP).

Specific Objectives:

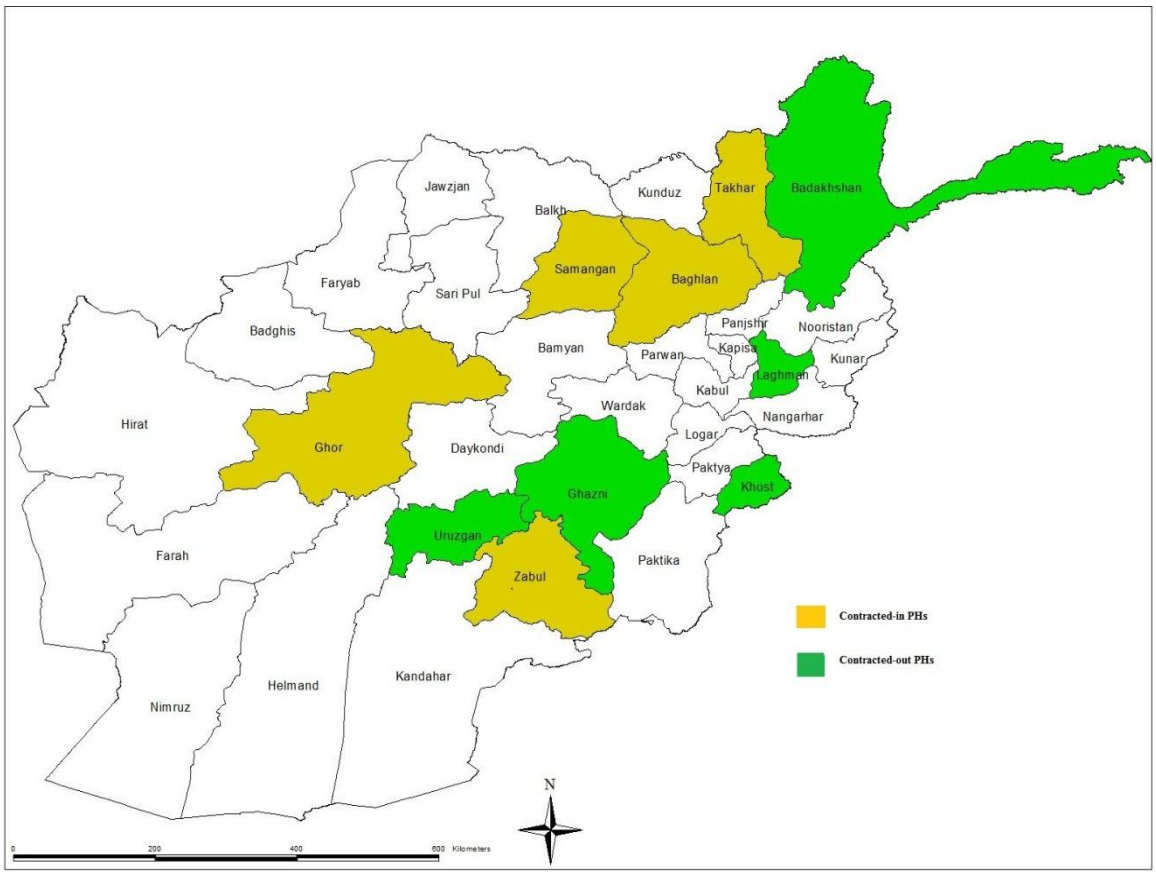
- Examine how efficiently provincial hospitals (MoPH and NGOs) are delivering health care services; and
- Compare costs and outputs between the two modalities

1.5 Scope of the Study

This study targeted ten selected (5 MoPH HRP run- Takhar, Baghlan, Smangan, Ghor and Zabul; and 5 NGO run- Badakhshan, Laghman, Khost, Ghazni and Urozgan) provincial hospitals. The financial, human and workload data of the NGOs run hospitals for the year 1390 (2011-2012) were obtained from the EPHS costing study carried out by the Health Economics and Financing directorate of

MoPH, and the data from the 5 hospitals run by reform project of MoPH collected from the hospital reform (HRP) project office.

Fiqure1.2: Location of Contracted-In and Contracted-Out PHs under study



1.6 Hypothesis (es)

H1: Service delivery is more technically efficient in MoPH operated (contracted-in) provincial hospitals than in NGOs operated (contracted- out) provincial hospitals.

H2: High Average length of Stay (ALOS) has a negative effect on TE

H3: High Bed occupancy rate (BOR) has a positive effect on TE

H4: OPD unit cost is expected to have negative affect on TE

H5: IPD unit cost has a negative effect on TE

CHAPTER II
COUNTRY BACKGROUND

2. 1 Country Profile

Afghanistan is a landlocked country in South-Central Asia. The capital of the country is Kabul. The country has borders with the six different countries, namely, Pakistan, Iran, Tajikistan, Uzbekistan, Turkmenistan, and China. The total land area of the country is 652,290 square kilometers.

Afghanistan is divided into eight regions administratively, namely the North Eastern, Northern, Western, Central Highland, Capital, Eastern, Southeastern and Southern regions. It is also divided into 34 provinces and 398 administrative districts.

The population of Afghanistan for the year 1390 (2011-12) was estimated at 26.5 million, of which 51 percent are male and 49 percent are females. The distribution of population in rural and urban areas showed that of the settled population 5.9 million are living in urban areas while the remaining 19.1 million are living in rural areas, beside this 1.5 million with a nomadic lifestyle (CSO, Afghanistan, 2011/12).

Since the collapse of the Taliban regime in 2001 the Afghanistan economy has improved due to the international assistance and investments. Yet Afghanistan remains one of the poorest countries in the world with a high dependency on international assistances. In 2010 the gross domestic product (GDP) of the country was about US$17 billion; with the estimated US$572 per capita GDP. Around 36 percent of the population lives under the poverty line. Though the Afghan economy has always been based on agriculture, only 12 percent of its total land is arable and less than 6 percent is currently cultivated (MoPH, CSO, ICF, Macro, IHMR, and WHO, 2010).

2.2 Country Health Profile

Before the year 2001 the Afghanistan health care system was functioning poorly, there was little coverage of curative and preventive care due to the civil war, a lack of staff and healthcare provision not being a priority for the government. Health services were fragmented and focused in urban areas; leaving many rural areas and insecure areas under or un-served.

For the last 10 years there have been significant improvements in the health status of the population. According to the Afghanistan Mortality Survey conducted in 2010, there have been considerable changes in health status; Highlights are shown in the table below:

Table 2.1: Afghanistan Health Indicators

Indicator	Value
Total Fertility Rate (TFR)	5.1
Use of Any Method of Family Planning	22%
Antenatal Care (ANC)	68%
Institutional Delivery	42%
Under 5 Mortality Rate (Excluding the South Zone)	97 per 1000 live births
Infant Mortality Rate (Excluding the South Zone)	77 per 1000 live births
Maternal Mortality Ratio	327 per 100,000 live births
Male Life Expectancy	62 years
Female Life Expectancy	64 years

Source: AMS 2010

The health services in Afghanistan operate at three following levels:

1) Primary Care Services i.e. at the community or village level as represented by health posts, CHWs, SHCs, BHCs and MHTs;

2) Secondary Care Services i.e. at the district level, as represented by CHCs and District Hospitals operating in the larger villages or communities of a province; and

3) Tertiary Care Services i.e. the provincial, regional and national hospitals

After 2002, MoPH took the decision, with the support of donors, to change its role to a stewardship role. The Basic Package of Health Services (BPHS) and Essential Package of Hospital Services (EPHS) were developed which resulted in expanding the coverage of health services from 9 percent to around 61-85 percent. Beside the primary health services around 57 percent of the population have access to EPHS Services.

2.3 Basic Package of Health Services (BPHS)

In March 2003, (MoPH) of Afghanistan released the Basic Package of Health services (BPHS), the culmination of a process that determined priority health services to address the population's most immediate needs. This package included the most needed primary health care services at the health post and health center levels of the health system.

BPHS provides a standardized package of health services and to respond to the fragmentation and low coordination of the efforts of different agents. The BPHS comprises of a set of high-impact interventions directed to address the major health problems of the population, highlighting on the health of women and children, the two most vulnerable groups.

With the intention of having a common language between the MoPH and the partners in providing the basic health services under the BPHS, below standardized classifications of health facilities were developed (MoPH, A Basic Package of Health Services for Afghanistan, 2010):

• Health Posts (HPs)

• Health Sub-Centers (HSCs)

• Basic Health Centers (BHCs)

• Mobile Health Teams (MHTs)

• Comprehensive Health Centers (CHCs)

• District Hospitals (DHs)

2.4 Essential Package of Hospital Services (EPHS)

Following the successful implementation of BPHS, in 2005 MoPH added the Essential Package of Hospital Services (EPHS) to the system, focusing on hospitals, improving their facilities, equipment, training staff and by enhancing the referrals between different levels of the health system.

Essential Package of Hospital Services (EPHS) as one of the major programs of the Afghanistan Ministry of Public Health (MoPH) aims to provide advanced health services in hospitals. It also serves as a primary referral point for primary health care facilities.

EPHS has the three main purposes:

1. Identify the standard package of hospital services
2. Provide guidance on staffing, equipment, materials and drugs by hospitals for MoPH, donors, Non-Governmental Organizations (NGOs); and
3. Promote referral system from BPHS to hospitals

In EPHS and BPHS, hospitals according to the size, number of beds, referral population complexity of services and workload are classified into the three following groups (MoPH, The Essential Package of Health Services, 2005):

1. District Hospital (DH) part of BPHS;
2. Provincial Hospital (PH); or
3. Regional Hospital (RH).

2.5 Provincial Hospital (PH)

Provincial hospitals with 75-250 beds are facilities with professional inpatient, outpatient and emergency services for the population in their allotted area. PHs act as a referral source for the provincial health system and have a supplementary role to basic and comprehensive health centers and district hospitals. In some cases if needed PHs refers patients to regional or national hospitals. Where there is no BHC and CHC available, PH outpatient services function as the entry point to the system (MoPH, The Essential Package of Health Services, 2005).

Provincial hospitals also have an important role in collecting data for the Health Management Information System (HMIS), training health professionals, managing community outreach programs and coordinating immunization campaigns in at the province level.

The summary of clinical, diagnostic and administrative services that should be offered in PH is described in the table below:

Table 2. 2: Summary of Services at a Provincial Hospital

Section	Service
Clinical and Diagnostic Services	❖ Inpatient Services ▪ General surgical services (operating theater, anesthesia, recovery room and sterilization services) ▪ General obstetrics and gynecology services ▪ General pediatrics services (including therapeutic, feeding) ▪ General medical services ❖ Emergency Department open and staffed 24 hours/day ❖ Outpatient Services (including vaccinations, basic ear-nose-throat, mental health, eye care and dental services) ❖ Hospital Pharmacy ❖ Physiotherapy Services ❖ Basic Laboratory, blood transfusion services and Blood Bank ❖ Basic X-Ray and Ultrasound Services
Administrative and Support Services	❖ Management and administration team ▪ Finance and accounting ▪ Procurement and medical stores ▪ Human resources ▪ Supervision of all support services and buildings ▪ Security ❖ Central sterile supply ❖ Medical records and HMIS statistics ❖ Kitchen ❖ Laundry and tailor ❖ Waste management and cleaning services ❖ Maintenance services and workshop ❖ Vehicle: transportation for emergencies and transforming patients ❖ Mortuary

Source: EPHS 2005

CHAPTER III
LITERATURE REVIEW

3.1 Basic Concept of Efficiency

The existence of scarcity, results in attention to consider equity and efficiency. *Efficiency* is the success with which an organization uses its resources to produce outputs. That is the degree to which the observed use of resources to produce outputs of a given quality matches the optimal use of resources to produce outputs of a given quality. This can be assessed in terms of technical and allocative efficiency (Steering Committee for the Review of Commonwealth/State Service Provision, 1997).

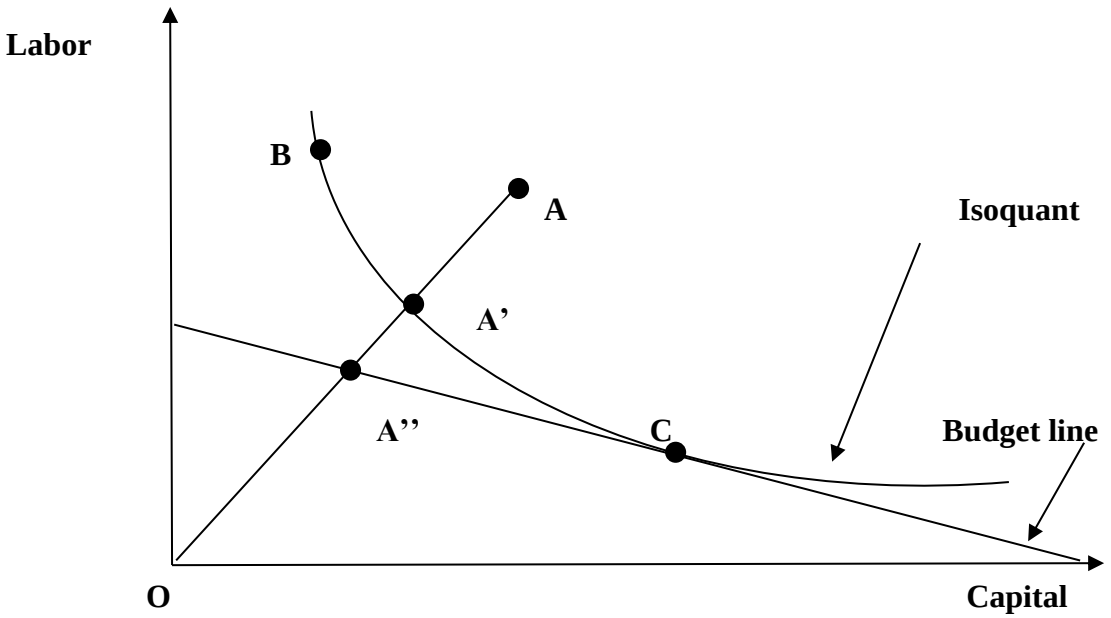
Efficiency is a ratio of the weighted sums of the outputs to the weighted sums of the inputs. The outputs are the products and/or services produced by inputs. The inputs are first the resources used to produce outputs, and second any environmental factors present which affect the outputs (Takondwa Mwase, August 2006).

Technical efficiency is the transformation of physical inputs such as labor services and raw materials into outputs. It is determined by the difference between the observed ratio of combined quantities of an entity's output to input and the ratio achieved by best practice. It can be stated as the potential to increase quantities of outputs from given quantities of inputs, or the potential to reduce the quantities of inputs used in producing given quantities of outputs. *Allocative efficiency* is for any level of production, the use of inputs by a firm in a proportion which minimizes the output cost given the respective input prices (Steering Committee for the Review of Commonwealth/State Service Provision, 1997).

The concept of efficiency can be best explained and conceptualized in a graph. A simple example of two inputs (capital and labor) and one output can be considered in which the required arrangements of the inputs for production of the output can be plotted. The curve that shows the minimum amount of inputs for production of the output is called the isoquant frontier. If a firm produces outputs at a point on the

isoquant curve then it is said to be technically efficient. The line which plots the combination of inputs that has the same cost is the budget line. In Figure 3.1, point A is technically inefficient since larger amount of inputs are used than needed to produce the output at the isoquant level. Point B is a technical efficient one, while point C is cost efficient as the cost of producing the output at this point is lower and its slope (isoquant curve) is tangent to the budget line.

Figure3. 1: Efficiency Concept



Source: Steering Committee for the Review of Commonwealth/State Service Provision, 1997

If a firm changes from point A to C its technical efficiency will increase by OA-OA'/OA and thus its allocative efficiency will improve by OA'-OA''/OA' and also its cost efficiency would increase by the distance OA-OA''/OA.

The efficiency of an organization entails two components: technical efficiency that shows the capability of a firm in attaining the maximum output from the given input. The second component, allocative efficiency reflects the talent of a firm in using the inputs given their prices in optimal proportion. The mixture of these two measures provides the measure of total economic efficiency (Coelli, 1996)

3.2 Input and Output Oriented Efficiency Models

The discussions so far have been input oriented that is, by how much can inputs be reduced while maintaining the same level of output? Similarly the corresponding output-oriented question is important by how much can output be increased while keeping the level of inputs constant? This issue is often more applicable for many government service providers, mainly those supplying human services. This is the case as the community often wants more of these services, while budgetary constraints make it difficult to increase the inputs.

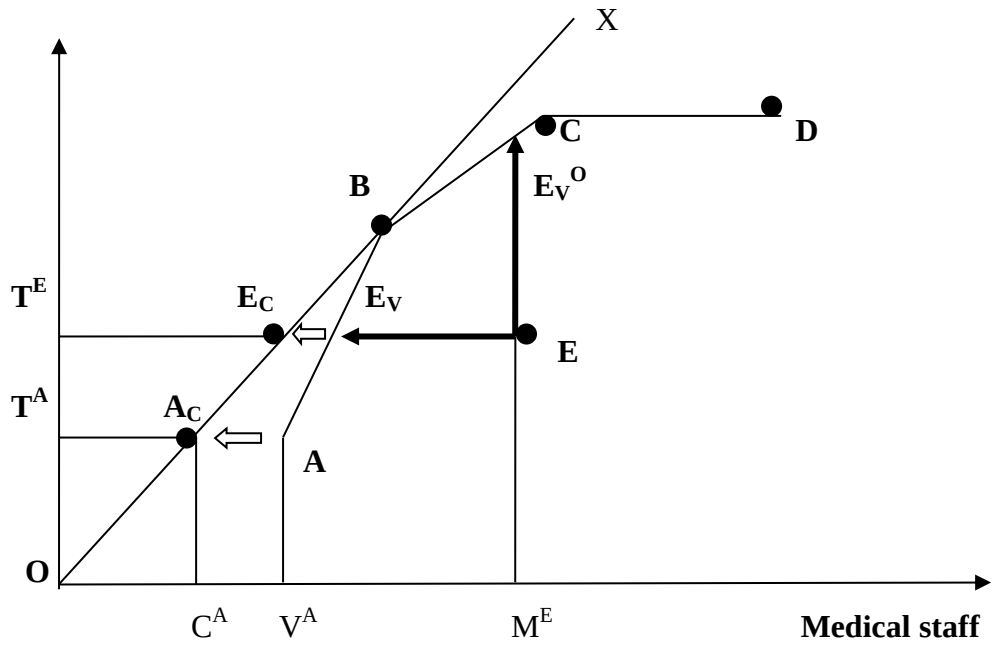
Figure 3.2 an example in which a health facility with one input (medical staff) and one output (treated cases) is considered. The input-oriented technical efficiency score for hospital E is given by the ratio of distances $T^{E}Ev$ /$T^{E}E$. The technical efficiency score for hospital E, using an output orientation is given by the ratio of distances $M^{E}E/M^{E}Ev^{O}$.

If a firm is technically inefficient from an input-oriented perspective, then it will also be technically inefficient from an output-oriented perspective.

However, the values of the two technical efficiency scores typically will be different (Steering Committee for the Review of Commonwealth/State Service Provision, 1997).

Figure3.2: Efficiency Concept

Total treated cases



Source: Steering Committee for the Review of Commonwealth/State Service Provision, 1997

3.3 Hospital Efficiency

The measurement of hospital efficiency is difficult to calculate due to a number of reasons and also it is often argued that health care institutions are not expected to be efficient, as they do not adhere to neo-classical firm optimization behavior. However, considering the issue of limited resources and allocation of a vast amount of resources to hospitals and health care institutions, there seem to be a great need and growing interest in examining efficiency in hospitals (Jacobs, Febuary 2000). Hospital efficiency can be measured by evaluating their input, output and cost. The hospital is taken to be efficient if it produces the optimal outputs from the given

number of available inputs or, if it consume the minimum level of inputs for production of a given amount of outputs.

3.4 Methods for Measuring Hospital Efficiency

There are a number of different methods used for testing efficiency considered either parametric or nonparametric, including

- Ratio Analysis
- Econometric Regression Technique; and
- Data Envelopment Analysis (DEA).

Ratio Analysis: In this method different ratios for a group of comparable hospitals are used in order to discover relations that are atypically high or low. The ration could be cost per patient day, cost per patient, and personnel full-time equivalents per patient (Sherman, Octob.1984).

Econometric Regression Techniques: This technique is used to estimate hospital cost relationships and production relationships. Regression analysis technique is broader than simply ratio analysis as it can accommodate multiple inputs and outputs, but some other problems are faced. The use of least-square regression techniques results in estimates of average (or central tendency) relationships, which are not necessarily efficient relationships. The second problem is that an estimate of the hospital cost function using this technique results in a mean relationship that does not directly locate inefficient hospitals (Sherman, Octob.1984).

Data Envelopment Analysis (DEA): DEA is a linear programming technique that compares a set of an organization's actual inputs used to produce their actual output levels during a common time period. It addresses the limitations related to ratio analysis and regression techniques. With DEA, one can explicitly consider the multiple outputs and inputs of a hospital. Specifically, the multiple outputs reflected

in the case mix and the multiple resources used to produce these services are simultaneously considered to gain an overall evaluation of hospital technical efficiency. In addition, one can incorporate other hospital outputs, such as teaching, research, and community education programs, to gain a comprehensive efficiency measure of hospital performance (Sherman, Octob.1984).

There are some trade-offs between these methods. They have been criticized for their potential for mixing statistical noise and inefficiency particularly when the random error term does not obey the normality assumption. Non-statistical approaches like DEA have the shortcoming of assuming no statistical noise, but have the advantage of being nonparametric and requiring no assumptions about the production frontier. SCF models on the other hand have the attraction of allowing for statistical noise, but have the disadvantage of being parametric and requiring strong assumptions about the inefficiency term (Jacobs, Febuary 2000).

3.5 Data Envelopment Analysis

Data Envelopment Analysis (DEA) a non-parametric mathematical programming approach to frontier estimation, originating from Farrell's (1957) seminal work and popularized by Charnes, Cooper and Rhodes (1978), provides a flexible nonparametric doctrine for empirical production analysis (Kuosmanen, 1999). DEA typically via linear programming calculates the efficiency of an organization within a group relative to observed best practice within that group. The organizations can be whole agencies (for example, the Department of Health), separate entities within an agency (for example, hospitals) or disaggregated business units within the separate entities such as, wards (Steering Committee for the Review of Commonwealth/State Service Provision, 1997).

DEA analyzes the inputs and outputs of service providers, called Decision Making Units (DMUs), and assess their overall efficiency. DEA provides considerable flexibility in data selection. The inputs and outputs can be continuous,

ordinal, or categorical variables. The inputs and outputs also can be measured in different units of analysis.

In DEA the efficiency of homogenous organizations (DMUs), with a multi-factor productivity can be analyzed. The efficiency score, in the presence of multiple inputs and outputs factors, is defined as (Talluri, 2000):

$$\text{Efficiency} = \frac{\text{Weighted sum of outputs}}{\text{Weighted sum of inputs}}$$

Charnes, Cooper and Rhodes (1978) proposed a model which was input oriented and assumed Constant Return to Scale (CRS). Later papers considered other assumptions, such as Banker, Charnes and Cooper (1984) who proposed the Variable Return to Scale (VRS) model (Coelli, 1996).

A firms' production can be either subject to CRS or VRS. In a CRS model if inputs are increased by a specific percentage the outputs also increases by the same percentage. While in a VRS model, if all inputs increase by a certain percentage, outputs increase by an either lower or higher percentage. It can be said that VRS production shows the economies or diseconomies of scale.

3.5.1 DEA Formula

There are numerous different ways to present the linear programming problem for DEA. The simplest general presentation for the version of DEA, where assumptions include constant returns to scale (CRS), and an objective of minimizing inputs for a given level of output (an input-orientated version), proceeds by solving a sequence of linear programming problems.

1. Minimize E_n with respect to $W_1 \ldots W_N, E_n$

Subject to:

$$\sum_{j=1}^{N} W_j Y_{ij} - Y_{in} \geq 0 \qquad i=1,\ldots,I$$

$$\sum_{j=1}^{N} W_j X_{kj} - E_n X_{Kn} \leq 0 \qquad k=1,\ldots, K$$

$$W_j \geq 0 \qquad j=1,\ldots,N$$

This shows that there are *N* organizations in the sample producing *I* different outputs, (*Yin)* denotes the observed amount of output *i* for organization *n* and using *K* different inputs, (*Xkn)* denotes the observed amount of input *k* for organization *n*. The *Wj* are weights applied across the *N* organizations. When the nth linear program is solved, these weights allow the most efficient method of producing organization *n*'s outputs to be determined: The efficiency score for the nth organization. For a full set of efficiency scores, this problem has to be solved *N* times once for each organization in the sample. E_n shows the efficiency score of the nth organization and inorder to get the full set of efficiency scores, the problem should be solved for each organization in the sample (Steering Committee for the Review of Commonwealth/State Service Provision, 1997).

The linear programming problem for an output-oriented, CRS is similar to the above problem, except that it takes the convex combination of observations that uses no more inputs than organization n and produces the maximum amount of outputs.

2- Maximize **F**n $W_1,\ldots, W_N$, Fn

Subject to:

$$\sum_{j=1}^{N} W_j Y_{ij} - F_n y_{in} \geq 0 \qquad i=1,\ldots,I$$

$$\sum_{j=1}^{N} W_j X_{Kj} - X_{Kn} \leq 0 \qquad k=1,\ldots, K$$

$$W_j \geq 0 \qquad j=1,\ldots,N$$

In the input-oriented case, the constant returns to scale technical efficiency score can be decomposed into three components: scale efficiency, congestion efficiency and residual or 'pure' technical efficiency.

The DEA linear programming problem in order to find the scale efficiency under the assumptions of variable returns to scale (VRS) is given by:

3. Minimize Sn $W_1,\ldots, W_N$, Sn

Subject to:

$$\sum_{j=1}^{N} W_j Y_{ij} - Y_{in} \geq 0 \qquad i=1,\ldots,I$$

$$\sum_{j=1}^{N} W_j X_{Kj} - S_n X_{Kn} \leq 0 \qquad k=1,\ldots, K$$

$$\sum_{j=1}^{N} W_j = 1$$

$$W_j \geq 0 \qquad j=1,\ldots,N$$

3.5.2 Advantages and Limitations of DEA

DEA similar to other analysis tools and methods has some advantages and limitations which are outlined in the following:

Advantages:

- DEA can take multiple outputs and inputs for calculations of technical efficiency
- It only requires information on the number of inputs and outputs, not prices;
- Beside efficient firms inefficient ones are also identified by the DEA; and
- It decomposes the technical efficiency to scale efficiency and also recognizes the peer organizations

Limitations:

- DEA is a deterministic rather than statistical technique and its results are sensitive to errors
- It examines efficiency relative to the best practice in the specific sample, and cannot compare the scores of two different studies; and
- DEA scores are sensitive to the specification of inputs and outputs and the sample size.

3.6 Previous Studies on Efficiency and Comparative Efficiency of Hospitals

Many studies have been undertaken in a number of different worldwide using the DEA approach, to look at hospital's efficiency, and to compare the efficiency of hospitals in different settings. The important points' from some of these studies are highlighted below:

(Bhat, V.N., 2005) By using DEA measured the efficiency of health care services delivery in 24 OECD countries. Each country was categorized as one DMU. Physicians, nurses, in- patient beds and pharmaceuticals were considered as inputs and the different age groups were the outputs used in the analysis. The study was

carried out with the assumption of CRS in the DEA method. The result of the study showed that out of 24 countries 8 (Denmark, Japan, The Netherlands, Norway, Portugal, Sweden, Turkey, and the United Kingdom) were on the frontier with the efficiency score of 1 under CRS. Belgium, Iceland, and Australia were found with the lowest CRS efficiency, and the peer countries with an efficiency score of 1 were identified. The study found that institutional arrangements have an influence on efficiency. Countries with public-contract and public-integrated modalities were more efficient than countries with public-reimbursement countries. Countries in which physicians were paid in wages and salaries and countries with capitation have higher efficiency than fee-for-service countries.

(Rundall,J.A., Alexander, and Thomas, G., 1985) Investigated the effect of contract management arrangements on operating performance of public hospitals, in which three performance areas the operating efficiency, service structure and Medicare/Medicaid were considered. A sample of 80 public hospitals under the contract management, 122 traditionally managed public hospitals and 74 hospitals 1-2 years prior to entering the contract management was examined using the ordinary least square method. From the efficiency measures in this study the contract management hospitals indicated more efficient operation in payroll expenses and operating revenue relative to traditionally managed hospitals. It demonstrated less efficient operation by contract management hospitals, as the expenses per patient day was higher. The relationship between the contract management and efficiency outcomes was also examined, which revealed that occupancy rate and admission per bed was higher in contract management hospitals than the pre-contract management hospitals. They pointed out that there is a movement toward greater efficiency in bed occupancy rate and admission per bed in contract management hospitals.

(Mills,A., Hongoro,C., and Broomberg,J., 1997) examined the efficiency of district hospitals in contracting in different settings in South Africa and Zimbabwe. In order to find the unit costs for inpatient, outpatient services and productivity level a detailed cost analysis was done for each of the hospitals in the study. The performance of three contractors and three government hospitals in South Africa were compared in terms of cost and quality. The qualities of services provided were similar

but the costs of contractor hospitals were significantly lower. In contractor hospitals the production costs per inpatient day were below those in the public hospitals. Contractors were able to run district hospital care more efficiently than the public sector, mainly by controlling staff costs and increasing productivity. In Zimbabwe two government operated hospitals were compared with two NGO (non-profit organization) hospitals. Cost analysis results showed that the two government hospitals were more costly than the two mission institutions. It was found that the NGO run hospitals delivered the same services as the government hospitals but at a lower cost. Out-patient recurrent costs were $13 and $6 per visit for the first government hospital and first contracted hospital studied and Z$25 and Z$6 for the second pair of hospitals respectively.

(Sheikhzadeh,Y., Roudsari,A.V.,Vahidi,R.G., Emrouznejad,A.,and Dastgiri S., 2011)studied the efficiency of hospitals in the Azerbaijani Province of Iran. The study aimed to examine the technical, scale, allocative and cost efficiencies. Eleven hospitals in which 6 were from public and 5 from private hospitals sampled for the study and the DEA analysis method was used. The inputs used for analysis were the number of specialist physicians, the number of general physicians, the number of nurses, the number of residents, the number of medical team members with a bachelor degree higher h and number of active beds. The outputs used for the analysis included the number of emergency patients, the number of outpatients and the number of inpatients. Results showed that from the 11 hospitals in the study sample 5 (45%) were technically and scale efficient, 6 (55%) were technically and scale inefficient. From the 6 inefficient hospitals 2 (33%) were public and remaining 4 (67%) were private hospitals. The overall result showed that public hospitals were more technical and scale efficient that the private ones.

(Davwar,P. P, and Wajiga,G., 2010)measured the technical efficiency of hospitals, while considering value judgment in the Plateau State of Nigeria. Microsoft Excel Solver for the DEA was used for the analysis of hospitals data (number of admissions, total number of discharges, average number of physicians, average number of nurses and midwives, number of beds, number of emergency cases and

opinions of the top management staff). The results showed that all the hospitals except for four of them have cases of demand inefficiency it was also found that there is an excess supply of services in respect to demand that resulted to demand inefficiencies in the hospitals operating under the hospital management board. The reason for the low demand was the high number of primary health care clinics and private hospitals providing quick and cheaper services. It was revealed that hospitals have internal efficiency with regard to production mechanisms, while having external inefficiency of either demand or scale. The study concluded that in a hospital under a common regulatory body, an excess supply of hospital services may be due to past decisions of health care policy-makers. Over-sizing of capacity with respect to actual demand has a negative influence on DEA efficiency scores. This particular source of inefficiency can be defined as demand inefficiency.

CHAPTER IV
METHODOLOGY

4.1 Study Design

This is an empirical study using Data Envelopment Analysis (DEA), a non-parametric approach based on linear programming to measure the Technical Efficiency (TE) scores for provincial hospitals under two different contracting modalities. Furthermore for cost analysis of the hospitals, the HOSPICAL tool was used in order to find the outpatient visits (OPD) and inpatient days' unit cost, the Bed Occupancy Rate (BOR) and Average length of Stay (ALOS) performance indicators. Finally the performance indicators were regressed to TE, using Tobit regression model.

4.2 Study Sample

A sample of ten provincial hospitals (5 MoPH run and 5 NGO run) were purposefully selected. Considering that the hospitals must be under the respective contracting mechanism and implement the EPHS during the study period.

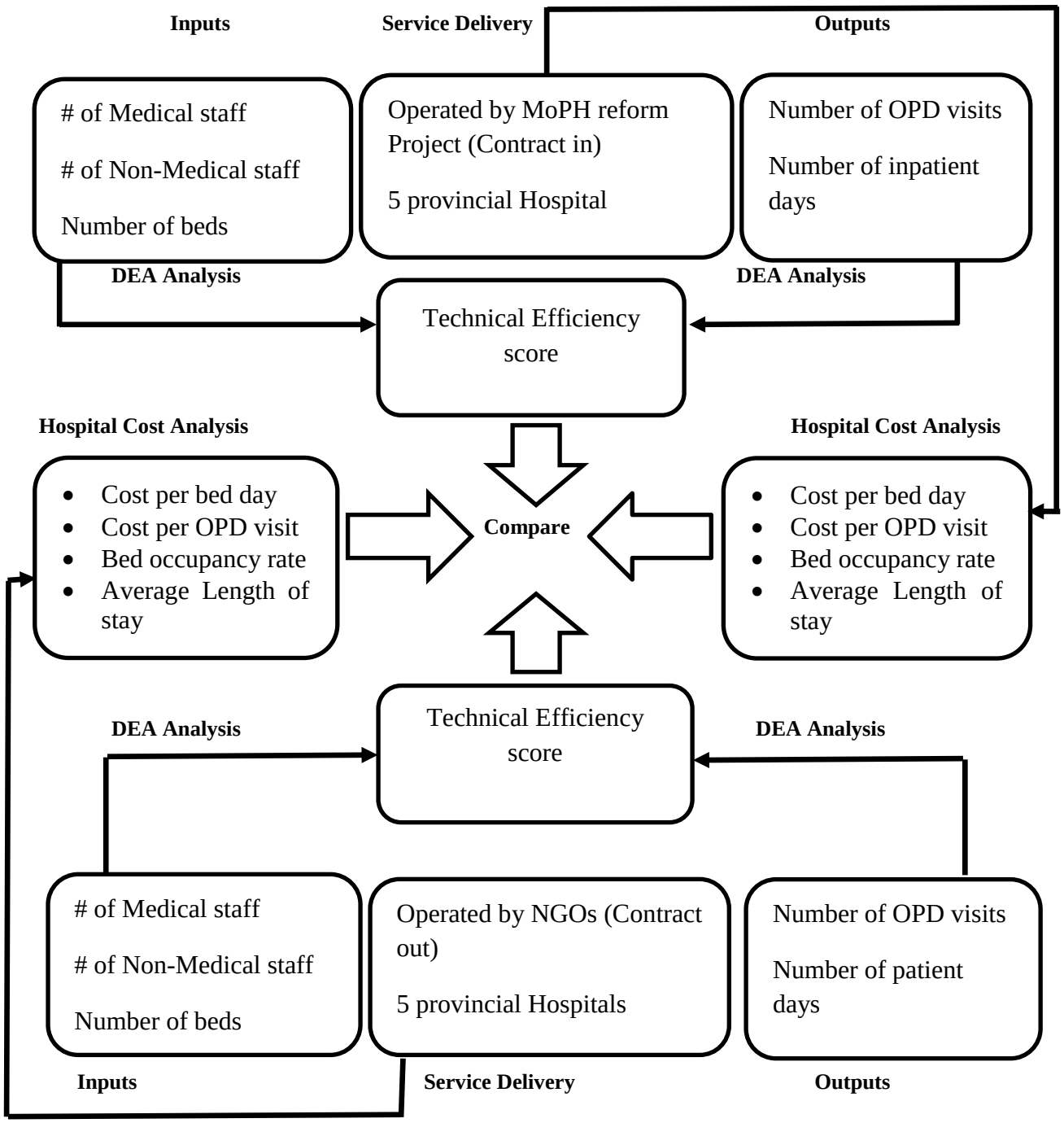
4.3 Type and Source of Data

The financial and workload data for the year 1390 (2011-2012) was sued. Data from the NGO- run hospitals were obtained from the EPHS costing study completed by the Health Economics and Financing directorate of MoPH, and the data from the 5 provincial hospitals run by reform project of MoPH collected from the HRP project office.

4.4 Conceptual Framework

By analyzing the inputs and outputs of the ten provincial hospitals using DEA input oriented method under the CRS assumption the technical efficiency scores were measured. Also in order to find the unit costs for OPD visits and inpatient days and the BOR and ALOS by using the HOSPICAL tool, cost analysis of hospitals was carried out. The following figure shows the overall conceptual framework of the study:

Figure4.1: Conceptual Framework



4.5 Methods of Analysis

4.5.1 Hospital Cost Allocation Tool (HOSPICAL)

The Hospital Cost Allocation Tool (HOSPICAL) is an Excel-based tool that can be used for identifying the total and unit costs and revenue for each department in a hospital. HOSPICAL helps managers analyze the cost information about their hospital services compare cost by departments and improve resource allocation. The main data categories required for HOSPICAL analyses are:

1. General Hospital Data;
2. Utilization Data;
3. Staffing Data;
4. Expenditure Data; and
5. Ancillary Department Statistics.

The costing approach in HOSPICAL is the "step-down" approach, whereby costs are allocated to cost centers. Allocation starts with each cost center's direct costs and then indirect or overhead costs are allocated, to make sure that all costs are borne by the final cost centers. HOSPICAL calculates the average cost per visit for outpatient departments and cost per hospitalization day for inpatient departments. (Management Sciences for Health, 2012).

In order to calculate the cost and KPI factors of the hospitals in this study, data are analyzed using the HOSPICAL Tool. The HOSPICAL tool also analyses the workload data to obtain Bed Occupancy Rate (BOR) and Average Length of Stay (ALOS).

4.5.2 Data Envelopment Analysis (DEA)

The Data Envelopment Analysis method is greatly preferred in efficiency analysis in the non-profit sector, including in health institutions. DEA uses Linear Programming (LP) methods to establish the frontier from sample data. The DEA computer program (DEAP version 2.1) was used to analyze the technical efficiency of selected provincial hospitals (DMUs). The following input and output data were used:

Inputs:

- Number of Medical Staff: (Total number of Doctor, Nurse, Midwifes, Technicians working in the hospital during 2011-2012);
- Number of Non-Medical Staff : (Total number of Non-Technical staff working in the hospital during 2011-2012); and
- Number of Beds: (Total number of active beds during 2011-2012).

Outputs:

- Number of OPD visits: (Total number of outpatient visits recorded during 2011-2012); and
- Number of inpatient days: (Total number of inpatient days recorded during 2011-2012).

Among the input variables, the number of existing hospital beds is used as a proxy for capital while the number of doctors and number of nurses has been used to reflect labor.

DEA was run under the assumptions of constant returns to scale (CRS) and an objective of minimizing inputs for a given level of outputs (an input-orientated version).

Following are the DEA formulas for each of the ten hospitals under the CRS assumption with three inputs and two outputs:

Minimize E_1 with respect to w_1, w_2,… w_{10} an E_1

Subject to:

DMU1 output $1w_1$+DMU2 output$1w_2$ + …+ DMU10output$1w_{10}$ – DMU1output $1 \geq 0$

DMU1 output $2w_1$+ DMU2output$2w_2$ + …+ DMU10output$2w_{10}$ – DMU1output $2 \geq 0$

DMU1 input $1w_1$+ DMU2 input$1w_2$ + … + DMU10 input$1w_{10}$ – DMU1input $1 \leq 0$

DMU1 input 2 w_1+ DMU2 input2 w_2 + … + DMU10 input$2w_{10}$ – DMU1input $2 \leq 0$

DMU1 input 3 w_1+ DMU2 input3 w_2 + … + DMU10 input$3w_{10}$ – DMU1input$31 \leq 0$

$W_1 \geq 0$, $W_2 \geq 0$, $W_3 \geq 0$, $W_4 \geq 0$, …, $W_8 \geq 0$, $W_9 \geq 0$, $W_{10} \geq 0$

4.5.3 Regression Analysis

In order to find out which of the four performance indicators derived from the cost analysis of hospitals, most greatly affects the technical efficiency scores; they were regressed one by one, using the Tobit regression analyses (Porter, 2009).

The TE score of each hospital calculated using DEA was used as the dependent variable. The other indicators affecting DMU performance and are not included in DEA analysis, were the explanatory variables. These independent variables are Contracting Modality, BOR, ALOS and OPD and IPD unit costs.

Rational for the Explanatory Variables:

1. Contracting Modality: Two contracting modalities considered two; contracting in and contracting out, where CONT=1 is contracting in and CONT=0 is contracting out. The existence of some complicated procedures may limit over expenditure and therefore may encourage efficiency in the contracting in mechanism. Also being able to access resources, which contracting out modality could not access to, could help increase efficiency (Wang,W. L., and Yuan,H., 2004).

2. Average Length of Stay (ALOS): The average length of stay variable will also be included as an explanatory variable. The assumption is that patients with longer lengths of stay require more resources. This is because they represent persistent cases that do not improve. As a result hospital with patients of longer length of stay may exhibit lower efficiency scores (Maredza, 2012).

3. Bed Occupancy Rate (BOR): Another determinant of efficiency is the bed occupancy rate. The occupancy rate will be measured by the number of patients in the hospital on a certain day divided by the actual number of beds. High occupancy levels are associated with higher level of efficiency (Maredza, 2012).

4. Out Patient Visit (OPD) Unit Cost: This is the total cost of producing outpatient services divided by the number of outpatient visits in a specific period. The assumption is that hospitals with higher OPD unit cost will not be efficient.

5. Inpatient day (IPD) Unit Cost: This is computed by dividing the number of bed days for a given timeline by the total cost (direct and indirect) of producing inpatient services. It is expected that if hospitals have higher IPD cost, and then they are less efficient.

Models:

1. $TE = \beta_1 + \beta_2$ CONT(Dummy)
2. $TE = \beta_1 + \beta_2$ ALOS
3. $TE = \beta_1 + \beta_2$ BOR
4. $TE = \beta_1 + \beta_2$ OPDC
5. TE $\beta_1 + \beta_2$ IPDC

Where:

TE= Technical Efficiency score

CONT= Contracting Modality(dummy variable, contracting in =1, contracting out= 0)

BOR = Bed Occupancy Rate of the hospitals

ALOS = Average Length of Stay of the hospitals

OPDC = Unit Cost of and Outpatient Visit

IPDC = Unit Cost of and In-Patient Day

4.6: Possible Benefits

This study provides information on technical efficiency of delivering health services in provincial hospitals under the contract in and contract out mechanisms. The revealed information on efficiency can help policy makers in decision making about the mechanism of health service provision in provincial hospitals, using the available resources more rationally. Considering the high dependency of the health services on donors' funds and the possible reduction of funding from donors, this study can help MoPH leadership in deciding the future direction of health services delivery in provincial hospitals.

CHAPTER V
ANALYSES AND RESULTS

This chapter indicates the results of the three main methodological approaches and analysis components of the study, including:

1. Cost analysis
2. DEA analysis
3. Simple two variable regression analysis

5.1. Cost Analysis of the Hospitals

In order to carry out the cost analysis the data required by the Hospital Cost Allocation Tool (HOSPICAL); which are provided in Table 5.1 were collected for year 1390 (2011-2012) from the selected provincial hospitals. The data collected was entered and analyzed using the Excel-based HOSPICAL, which allows users to analyze total and unit costs and revenue for each department within a hospital.

Table 5.1: HOSPICAL Data Requirements

Area	Data Requirements
General Hospital Data	• Hospital organization and cost centers o Structure of administrative, ancillary and clinical departments • Total number of beds and breakdown by department
Statistics(Utilization)	• Utilization statistics broken down by department o Total number of visits for all outpatient departments o Total number of admissions, hospitalization

	days, discharges and deaths for inpatient departments
Staffing	• Complete staff list for facility, including name, function, level, payment source • Determination of cost center associated with each staff • Detailed salary breakdown for each staff, including base salary, allowances, insurance.
Expenditure	• Total number of admissions, hospitalization days, discharges and deaths for inpatient hospitals • Total hospital expenditure, broken down by detailed line item o Expenditures on drugs, salaries, capital costs, other recurrent expenditures • Drug expenditure broken down by ancillary or clinical department
Ancillary Department Statistics	• For each ancillary department, the cost or quantity of ancillary department services broken down by clinical department

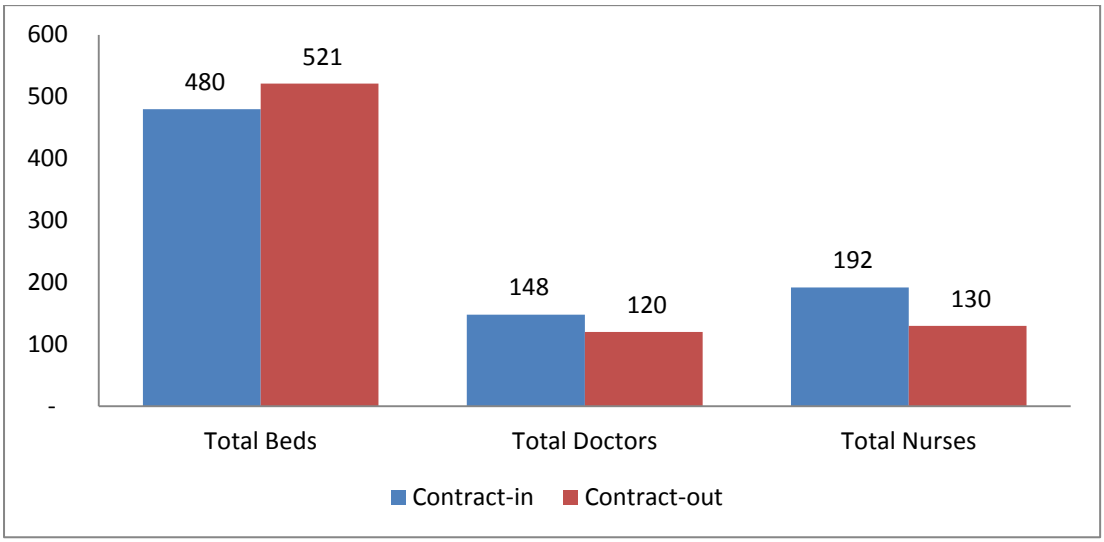
During the year 1390(2011-2012) there were 1001 beds active in the ten selected hospitals(5 contract in and 5 contract out) under the study. In total these hospitals had 1,330,943 out-patient visits, 97,846 admissions and 274,871 hospitalization days served by 1,339 staff. The table below shows the breakdown of the selected hospitals statistics:

Table 5.2: Overall Hospitals' Statistics

Hospital Name	Total Beds	Total OPD	Total Admissions	Total Discharges	Total Deaths	Total Hospitalization Days	Total Staff	Contracting Modality
Baghlan	100	133,937	14,131	14,065	18	35,499	174	Contract in
Ghor	100	76,511	9,699	9,431	179	31,189	119	Contract in
Samangan	80	123,383	5,161	5,139	92	20,917	169	Contract in
Zabul	80	55,655	6,700	6,412	45	20,907	113	Contract in
Takhar	120	140,483	11,852	11,455	630	34,326	142	Contract in
Badakhshan	100	101,639	10,554	9,964	185	30,361	138	Contract out
Ghazni	130	205,355	12,569	12,569	262	36,345	163	Contract out
Khost	100	188,852	14,630	14,593	428	28,577	139	Contract out
Laghman	116	138,099	9,285	8,867	55	23,294	108	Contract out
Urozgan	75	167,029	3,265	3,074	103	13,456	74	Contract out
Total	**1,001**	**1,330,943**	**97,846**	**95,569**	**1,997**	**274,871**	**1,339**	

Total number of beds in the five selected provincial hospitals of the contracted-out mechanism are more than the number of beds in the five contracted-in provincial hospitals. On the other hand the total number of doctors and nurses are higher in the contracted-in provincial hospitals comparing to the five contracted-out provincial hospitals.

Figure5.1 Total Number of Beds, Doctors and Nurses



The cost analysis of the five contracted-in hospitals using HOSPICAL cost allocation tool showed that in year 1390(2011-2012), a total of US $ 4,334,137 was spent in five contract-in hospitals of which US$2,796,34 went to IPD and the remaining US$1,537,796 to OPD services.

Table 5.3: Total, IPD and OPD Cost of the Contracted-in Hospitals

Contracted-in Hospitals			
Hospital Name	**Tot Cost**	**OPD Cost**	**IPD Cost**
Baghlan	$ 967,466	$394,206	$573,260
Ghor	$766,350	$278,371	$487,979
Samangan	$ 926,706	$343,134	$583,572
Zabul	$ 670,560	$219,515	$451,045
Takhar	$1,003,055	$302,570	$700,485
Total	**$ 4,334,137**	**$1,537,796**	**$2,796,341**

The results for the five contracted out hospitals obtained from the EPHS costing study done by HEFD/MoPH using the same tool and method revealed that in total they spent US$4,465,268 in the same year.

Table 5. 4 Total, IPD and OPD Cost of the Contracted-out Hospitals

Contracted- out Hospitals			
Hospital Name	**Total Cost**	**OPD Cost**	**IPD Cost**
Badakhshan	$1,080,976	$ 235,306	$845,671
Ghazni	$881,901	$323,797	$ 558,105
Khost	$897,083	$372,258	$524,824
Laghman	$1,013,062	$324,312	$688,750
Urozgan	$592,246	$219,503	$ 372,743
Total	**$4,465,268**	**$1,475,176**	**$2,990,092**

The analysis indicates that during March 21, 2011 to March 20, 2012 period the the average BOR across all five provincial hospitals, under the contracted- in modality was 81% and the average ALOS was 3.1 days. It was found that the average cost per bed per year was US$7,419 and on average US $3.1 was spend on each OPD visit, Finally the daily average cost of each bed was US$20.3.

Table 5.5 BOR, ALOS and Cost /Bed/Year and /Day and Cost/OPD of Contracted-in Hospitals

Hospital	Overall BOR (%)	Overall ALOS	Cost/ Bed (Y)	Cost/OPD	Cost/Bed (D)
Baghlan	97%	2.5	$5,910	$2.9	$16
Ghor	85%	3.2	$5,741	$3.6	$16
Samangan	72%	4.0	$10,131	$2.8	$28
Zabul	72%	3.2	$7,831	$3.9	$21
Takhar	78%	2.8	$7,484	$2.2	$21
Average	**81%**	**3.1**	**$7,419**	**$3.1**	**$20.3**

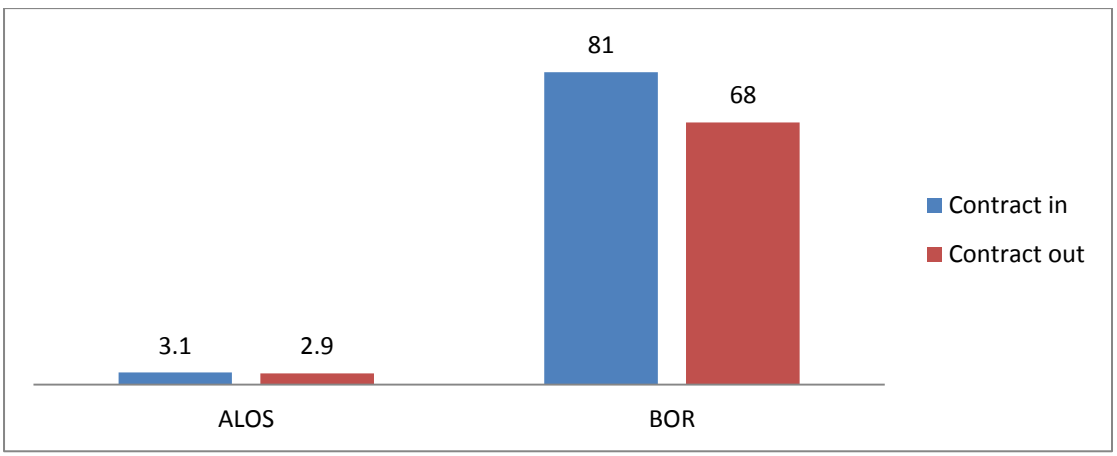
Results of the cost analysis of the five contracted-out provincial hospitals found that during the study period of March 21, 2011 to March 20, 2012, these hospitals had and average overall BOR of 68% and 2.9 days average overall ALOS. An average of US$1.9 was spent on each OPD visit followed by US$8,676 and US$23.6 of each bed per year and per day costs respectively. For the details of cost analysis results of each hospital please refer to Annex A.

Table 5.6 BOR, ALOS and Cost/ Bed/Year and/Day and Cost/OPD of Contract-out Hospitals

Hospital	Overall BOR (%)	Overall ALOS	Cost/Bed (Y)	Cost/OPD	Cost/Bed (D)
Badakhshan	83%	2.9	$10,167	$2.3	$28
Ghazni	77%	2.9	$5,605	$1.6	$15
Khost	78%	2.0	$6,703	$2.0	$18
Laghman	55%	2.5	$10,792	$2.3	$30
Urozgan	49%	4.1	$10,111	$1.3	$28
Average	**68%**	**2.9**	**$8,676**	**$1.9**	**$23.8**

The findings show that the overall BOR of contracted-in hospitals is higher than the contract-out hospital, while in terms of ALOS contracted-out hospitals have shorter overall ALOS compared to the contract-in provincial hospitals

Figure5.2 Overall ALOS and BOR in Two Contracting Modalities



5.2.DEA Analysis

The number of medical staff, number of non-medical staff and number of beds were used as inputs, and the number of OPD visits and number of inpatient (hospitalization) days were used as outputs in this study. The following table shows the inputs and outputs data that were used:

Table 5.7 Inputs and Outputs for DEA Analysis

DMU	Total OPD visits	Total Inpatient Days	Number of Medical Staff	Number of Non- Medical Staff	Total Beds
Baghlan	133,937	35,499	103	71	100
Ghor	76,511	31,189	69	50	100
Samangan	123,383	20,917	99	70	80
Zabul	55,655	20,907	60	53	80
Takhar	140,483	34,326	121	21	120
Badakhshan	101,639	30,361	79	59	100
Ghazni	205,355	36,345	95	68	130
Khost	188,852	28,577	72	67	100
Laghman	138,099	23,294	66	42	116

Urozgan	167,029	13,456	43	31	75
Average	**133,094**	**27,487**	**81**	**53**	**100**

Before running the DEA in order to make sure that whether the calculation be carried out only under the CRS assumption or there is a need for the running the VRS as well, the similarity test was performed among the sample data.

Results of the similarity test (correlation matrix) showed that hospitals are more similar in terms of their inputs and outputs, so DEA was run only under the CRS assumption. Table 5.8 below shows the details of the correlation scores between the hospitals.

Table 5.8 Correlation Matrix

	Baghlan	*Ghor*	*Samangan*	*Zabul*	*Takhar*	*Badakhshan*	*Ghazni*	*Khost*	*Laghman*	*Urozgan*
Baghlan	1.000									
Ghor	0.989	1.000								
Samangan	0.995	0.970	1.000							
Zabul	0.994	0.999	0.978	1.000						
Takhar	1.000	0.986	0.997	0.991	1.000					
Badakhshan	0.999	0.994	0.991	0.997	0.998	1.000				
Ghazni	0.996	0.972	1.000	0.979	0.998	0.992	1.000			
Khost	0.993	0.966	1.000	0.974	0.995	0.989	1.000	1.000		
Laghman	0.995	0.970	1.000	0.977	0.997	0.991	1.000	1.000	1.000	
Urozgan	0.982	0.945	0.996	0.955	0.986	0.975	0.995	0.997	0.996	1.000

The technical efficiency of the 10 selected provincial hospitals (5 contracted-in and 5 contracted-out) were estimated using the input oriented CRS model of DEA described in the section 4.5.2 of chapter 4. DEA was performed one time for all of 10 provincial hospitals (DMUs) under the study, to compare the efficiency scores of the provincial hospitals under the different contracting modalities.

Table 5.9 indicates the DEA/technical efficiency scores (on the scale of 0-1) for all the 10 provincial hospitals under the two different contrading modalities. It was found that in general, the selected hospitals had an average TE score of 0.95.

Table 5.9 DEA TE Scores

No.	Hospital Name	TE	Contracting Modality
1	Baghlan	1	Contract in
2	Ghor	1	Contract in
3	Samangan	0.774	Contract in
4	Zabul	1	Contract in
5	Takhar	0.922	Contract in
6	Badakhshan	0.912	Contract out
7	Ghazni	1	Contract out
8	Khost	1	Contract out
9	Laghman	0.91	Contract out
10	Urozgan	1	Contract out
Mean		**0.95**	

Out of the 10 provincial hospitals included in the analysis, 6 (60%) were technically efficient, whereas the remaining 4 (40%) were technically inefficient. Three out of 6 (50%) efficient hospitals belong to MoPH reform project (contracted-in), and the remaining 3 (50%) are operated under the contracted –out modality. Tow out of 4 (50%) of the technically inefficient hospitals belonged to the contracted-in

(MoPH reform project) modality and the remaining 2 (50%) technically inefficient hospitals were operated under the contracted-out (NGOs) modality. Among the four inefficient hospitals, 2 (50%) had a TE score of less than 90% (all contracted-in). Moreover three (50%) had a TE score of more than 90 %(contracted -out).

Table 5.10 Average TE Score of PHs Under Different Contracting Modalities

Provincial Hospitals(DMUs)	Mean TE score	Mean of Inefficient PHs
Five contracted in provincial hospitals	0.94	0.85
Five contracted out provincial hospitals	0.96	0.91

The average technical efficiency score for the five contracted-in hospitals was 0.94. While the average technical efficiency score for the five contracted-out hospitals was 0.96. In addition, the inefficient hospitals had an average TE score of 85% and 91% in contracted-in and contracted-out hospitals respectively. This implies that on average, they could reduce their utilization of all inputs by approximately 15% and 9% respectively, without reducing outputs. As a result, contracted-out hospitals were found to be relatively more technically efficient than contracted-in ones.

Figure5.3 TE Scores and Mean TE of Different Contracting Modality

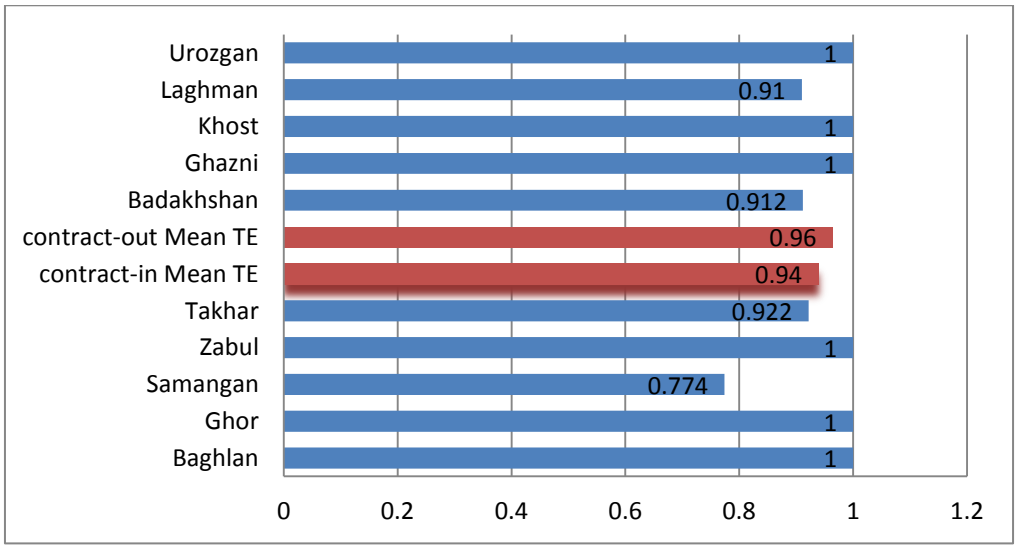


Table 5.11 below contains the peer group for each hospital, the peer weights and the peer count and the number of times this hospital appears in the peer group of other hospitals. It is evident from the peer count column that hospitals number 8,7,10 and 2 appear in peer groups for other hospitals (and thus, are not efficient by default). Also these hospitals are peers for more than other hospitals in the sample, which demonstrates their efficiency.

Table 5 11 TE Score, Peer Group, Weight and Peer Counts

No.	Hospital Name	TE	Peered by	Peer Weight	Peer Count
1	Baghlan	1	1	1	1
2	Ghor	1	2	1	2
3	Samangan	0.774	8 , 10	0.441 , 0.240	0
4	Zabul	1	4	1	0
5	Takhar	0.922	8 , 2 , 7	0.150 , 0.426, 0.388	0
6	Badakhshan	0.912	8 , 2 , 1	0.136, 0.336, 0.375	0
7	Ghazni	1	7	1	2
8	Khost	1	8	1	3
9	Laghman	0.91	10 , 7	0.202 , 0.509	0
10	Urozgan	1	10	1	2

5.3. Resutls of Tobit Regression Analysis

In this third part of the study in order to find which of the four performance indicators derived from the cost analysis of hospitals affects, most greatly affects the technical efficiency scores, they were regressed one by one, using the Tobit regression model.

The TE score of each hospital calculated using DEA was used as a dependent variable. The other indicators, that were found in hospital cost analysis, and which influence hospital performance (and are not included in DEA analysis) were the explanatory variables. The possible factors that can affect hospital efficiency are contracting modality, BOR, ALOS and OPD and IPD unit costs.

Table 5 12 Dependent and Independent Variables Used for Regression Analysis

Hospital	TE score	BOR	ALOS	Cost/OPD	Cost/Bed Day	Dummy for Contract in &out
Baghlan	1	97%	2.5	$2.9	$16.2	1
Ghor	1	85%	3.2	$3.6	$15.7	1
Samangan	0.774	72%	4.0	$2.8	$27.8	1
Zabul	1	72%	3.2	$3.9	$21.5	1
Takhar	0.922	78%	2.8	$2.2	$20.5	1
Badakhshan	0.912	83%	2.9	$2.3	$27.9	0
Ghazni	1	77%	2.9	$1.6	$15.4	0
Khost	1	78%	2.0	$2.0	$18.4	0

Laghman	0.91	55%	2.5	$2.3	$29.6	0
Urozgan	1	49%	4.1	$1.3	$27.7	0

The five independent variables(BOR, ALOS, Cost/OPD, Cost/Bed Day and dummy variable for contracting type) were regressed against the technical efficiency scores of the hospitals using STAT 11. The resulting outputs for the five model are below shown in Table 5.13, for details of the Tobit regression findings please refer to appendixC.

Models:

1. $TE = \beta_1 + \beta_2 CONT(Dummy)$
2. $TE = \beta_1 + \beta_2 ALOS$
3. $TE = \beta_1 + \beta_2 BOR$
4. $TE = \beta_1 + \beta_2 OPDC$
5. $TE = \beta_1 + \beta_2 IPDC$

Table 5 13 Tobit Regression Results of Factors Affecting Provincial Hospitals' Technical Efficiency

Variable	Coefficient	Std. Error	t-Statistic	Probability
BOR	0.2156763	0.418694	0.52	0.619
ALOS	-0.0595341	0.0814432	-0.73	0.483
Cost/OPD visit	0.0114342	0.0760149	0.15	0.884
Cost/Bed day	-0.0200517	0.0098135	-2.04	0.071
Dummy for contract-in & out	-0.0333586	0.1057215	-0.32	0.76

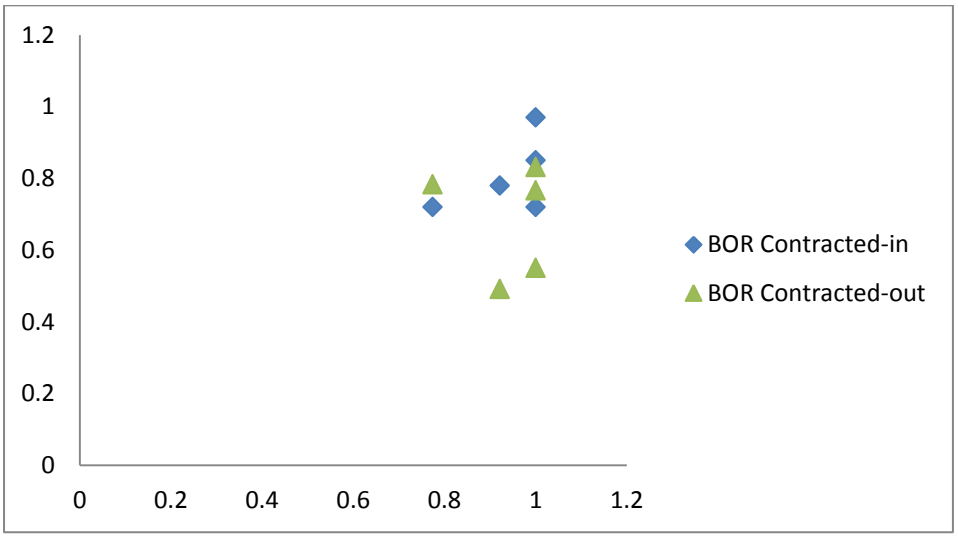
The Tobit regression analysis shows that the coefficient of BOR is positive. It means that by having higher BOR, the technical efficiency scores increases. But the p-value indicates it is not statistically significant. Similarly Cost/OPD visit has a positive coefficient.

In addition, the result of regression analysis reveals that the coefficients of ALOS, Cost/Bed Day and the contracting modality are negative values. It means that having longer stay and higher cost of IPD visits; will result in a decreasing efficiency score.

To further see the relationship of the variables (BOR, ALOS, Cost/OPD, Cost/Bed Day) with the technical efficiency, scatter plot graphs are prepared. Though due to low number of observations, graphs are not so clear.

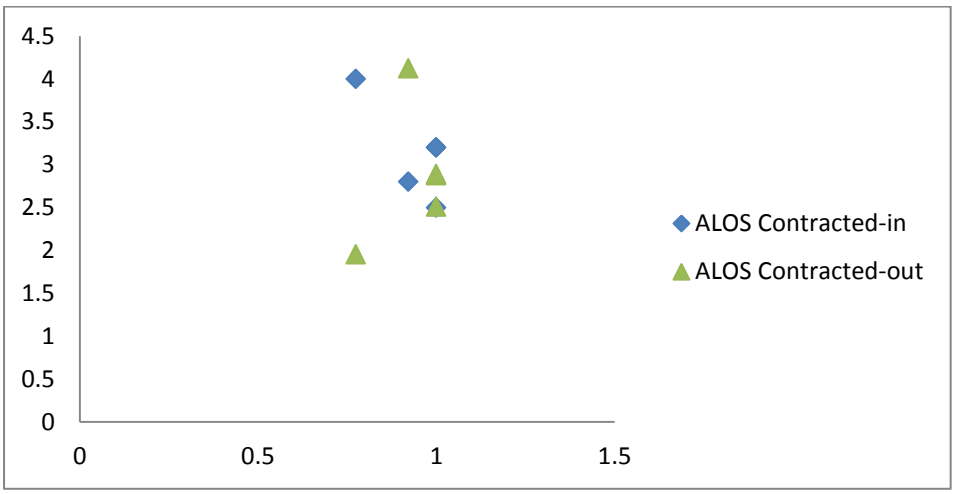
Figure 5.4 below shows that there is positive relationship between the TE and the BOR. High occupancy levels are associated with higher level of efficiency.

Figure5.4 TE and BOR Association



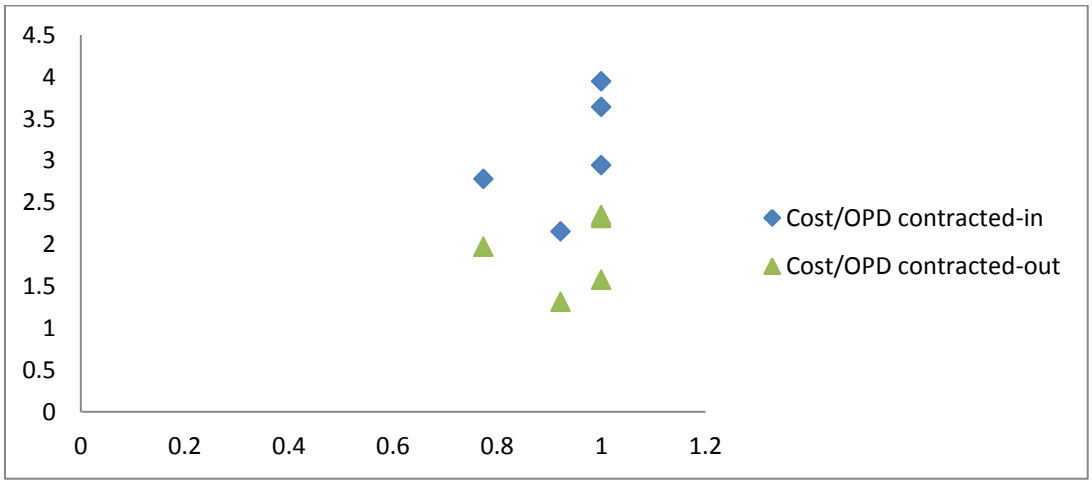
In the below graph in the figure 5.5 it seems to be positive correlation between the TE and ALOS, though what was expected and the results of the Tobit regression model revealed a negative relationship between these two variables.

Figure5.5 TE and ALOS Association



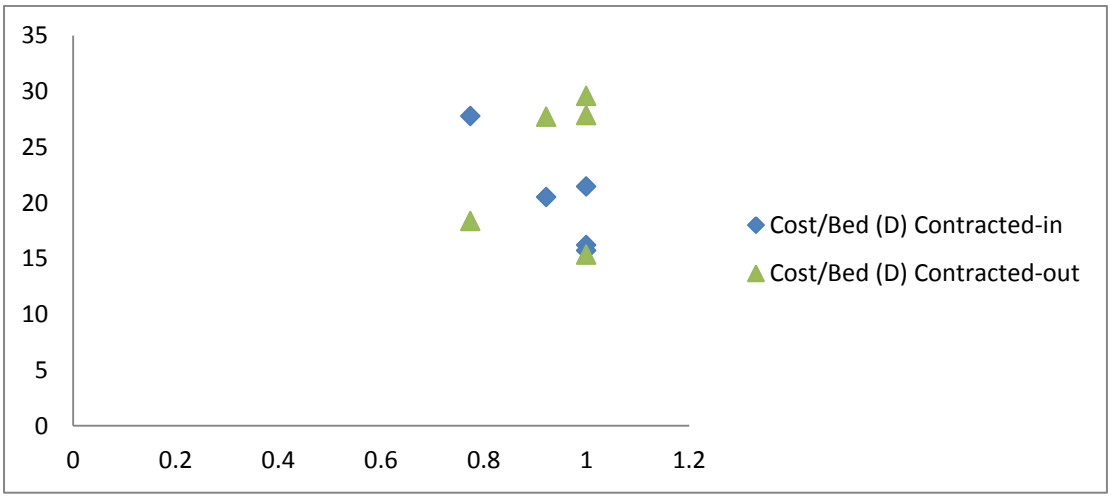
The pattern in the below graph of figure 5.6, reveals a positive correlation, that is, as the cost/OPD visit increases the TE also increases. But TE seems to be some other than the cost of OPD visits, which further studies with more number of observations to verify the cause of higher TE.

Figure5.6 TE and Cost/OPD visit Association



According to the scatter graph in the figure 5.8 below, there does seem to be a positive/negative correlation between Cost/Bed day and the TE. In other words, the higher the cost/bed day the more tends to TE. Though the finding the in the Tobit module showed that TE and cost/bed day have negative correlation.

Figure5.7 TE and cost/Bed day Association



CHAPTER VI
CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The objectives of this study were to measure provincial hospitals' technical efficiency under two different contracting modalities in Afghanistan in the year 1390(March 2011-March 2012) using the DEA technique and also to identify core performance indicators to support the DEA finding. The three methods (cost analysis, DEA input oriented method and simple two variable regression) were applied to analyzing the data of a sample of 10 provincial hospitals operated both contracted-in and contracted-out modalities.

The cost analysis of hospitals provides an overall view of the cost and outputs in the 10 provincial hospitals during the one year study period. In the five contracted-in hospitals the average cost per bed in year was US$7,419 and each OPD costed on average US$3.1. The average BOR was 81% with average ALOS of 3.1 days . On the other hand the averge cost of each bed per year was US$8,676 in the five cotracted-out hospitals, the OPD cost was US$1.9 in the five contracted-out hospitals. The overall average BOR and ALOS for these hospitals were 68% and 2.9 days, respectively.

The DEA analysis revealed that out of 10 hospitals in the study 6 were efficient with the Technical efficiency of 100%; 3 from each modality group. The average technical efficiency score for the five contracted-in hospitals was 0.94, while the average technical efficiency score for the five contracted-out hospitals was 0.96. This indicates that contracted-out provincial hospitals are relatively more efficient. The study showed that the inefficient provincial hospitals operated under the contracted-in modality, could reduce their inputs by 15 % in order to reach 100% efficiency. The contracted-out inefficient provincial hospitals, with the average TE

score of 91% only need to decrease their utilization of all inputs by approximately 9% without reducing outputs.

The results of the simple two variable regression analysis indicated that from the five independent variables (BOR, ALOS, Cost/OPD, Cost/Bed Day and dummy vairable for contracting type) that were regressed against the technical efficiency scores of the hospitals, only the BOR and Cost/OPD visit had positive relationship with coefficient of 0.215 and 0.011. The remaining three all had negative coefficients. All five factors were not quite significant, which could be due to small sample size.

In conclusion the study results show that the average technical efficiency of five contracted-out provincial hospitals is relatively higher, than the five contracted – in provincial hospitals. While in terms of yearly cost per bed and BOR, contracted-in provincial hospitals had better results(low cost per bed/year and higher BOR), comparing to contracted-out. The finding showed that ALOS and cost/OPD visits are lower in the contracted-out provincial hospitals, which these could be the cause of higher efficiency in the hospitals operating under this modality.

Policy makers in MoPH and hospital managers could use the proceeding information and analyses to improve inefficient hospitals by analyzing the inefficiencies of each hospital. The findings on efficiency and cost analyses can help policy makers in decision making regarding the modality of health service provision in provincial hospitals. It can also aid the rational use of available resources. Considering the high dependency of Afghan health services on donor funds and given the possible reduction of funding from donors in the near future, this study can help the MoPH leadership in deciding on the future direction of health service delivery in provincial hospitals. The findings can help MoPH in determining the future direction for contracting of health services in provincial hospitals.

6.2 Policy Implications

The study demonstrated how well the provincial hospitals are performing. The presence of inefficiency shows that a hospital has excess inputs or lower outputs compared to the efficient hospitals in the sample. This helps policy makers decide, with regard to inefficient hospitals, whether they could transfer the excess doctors, nurses or beds to other needy hospitals.

Four out of the 10 hospitals were not efficient as per the DEA finding, which shows they used more inputs than needed. Furthermore, the excess number inputs (staff and beds) in inefficient provincial hospitals could be shifted to those that have lower numbers inputs. It is worth mentioning that while doing these reallocations the population size of the provinces should be considered.

Higher bed occupancy rate, increases the efficiency of hospitals. Directing attention to maximizing the utilization of hospitals' beds could be one of the solutions for increasing a hospital efficiency level. Resource allocation needs to be carried out as per the identified needs, which can increase the efficiency and rational use of inputs and provide efficient outputs.

6.3 Limitations

Some limitation exists in this study, including the small number of observations. There are only 10 provincial hospitals (observations) included in this study. The reason being that not all of provincial hospitals were implementing EPHS during the study period; some of them were just established in early 2012.

Data availability was another limitation. Although panel data can be used to increase the number of observations and to compare the efficiencies across different years, data was only available from all these provincial hospitals for one year 1390 (March 2011-March2012).

This study focused mainly on the technical efficiency and cost of hospitals. The technical efficiency of hospitals reflects only the operational efficiency in providing services. Calculating economic efficiency, scale and allocative efficiency in hospitals could give better indicators of overall efficiency. Quality of care and efficiency in service provision processes may also be a better measure for hospitals; hospitals offering higher quality of care may require more inputs than those offering low quality of care. Yet given that all of the ten hospitals in this study were providing the same package of services (EPHS) at the provincial level, it is unlikely that there would be any major variance in quality of care.

6.4 Recommendations

The result of this study only indicates technical efficiency, cost and other performance indicators. In order to increase the overall efficiency of provincial hospitals in the future, some policy implications and recommendations can be derived:

Further studies should be conducted on the efficiency of provincial hospitals, by considering other more important inputs and outputs variables and including a greater number of observations.

As result of the costing and DEA showed those contracted-out hospitals which were relatively more efficient had lower length of stay and OPD cost/visit. Therefore focus on better management of the length of stay and OPD visit which are not mostly sever cases can help increase efficiency.

Institutionalization of efficiency monitoring and benchmarking, the hospital efficiency monitoring and benchmarking should be routinely measured and reported annually or possibly every two to three years. This should form part of the national Health Management Information System (HIMS). Considering the sensitivity of this issue for inefficient hospitals, reports should not identify the inefficient hospitals but the results should be reported in other words, they could be reported in classified groups such as good, moderate, fair, and poor depending on the levels of their efficiency scores.

In order to increase hospital efficiency, further studies on allocative efficiency and joint qualitative and quantitative studies would be very helpful for policy makers and hospital managers to improve inefficient hospitals in the proper manner. By calculating the allocative efficiency and comparing the technically efficient levels of inputs, one can determine which input is over or under-utilized relative to their cost minimizing levels.

So as to identify the main determinants of hospital efficiency and inefficiency, and to collect more information on each hospital limitations and causes of inefficiency, integrated qualitative and quantitative studies needs to be undertaken. Information from both qualitative and quantitative studies is valuable for hospital director, hospital management and MoPH and helps to improve inefficient hospital. Moreover efficient hospitals can be used as models of best practice.

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APPENDICES

Appendix A Hospitals Costing Results Details

Baghlan Provincial Hospital

Baghlan provincial hospital is located in Puli Khumri city of the Baghlan province. This hospital has 100 beds and is managed by the Hospital Reform Project (HRP) of ministry of public health. The data reported are from the March 21, 2011 – March 20, 2012 period.

Table: A1 Overall hospital Statistics

Total Number of Hospital Beds:	100
Total Outpatient Visits:	133,937
Total Inpatient Admissions:	14,131
Total Inpatient Discharges:	14,065
Total Inpatient Deaths:	18
Total Hospitalization Days:	35,499
Bed Occupancy Rate (BOR) (%):	97%
Average Length of Stay (ALOS) (days)	2.5

Table: A2 Hospital Staff breakdown

Staff Breakdown	Number	Ratio of Beds per Staff	Ratio of Occupied Beds per Staff
Total Doctors	40	2.5	2.4
Total Nurses	36	2.8	2.7
Total Midwifes	11	9.1	8.8
Total Technicians	16	6.3	6.1
Total Others	71	1.4	1.4

Figure: A3 Bed Occupancy Rate - Inpatient Departments (%)

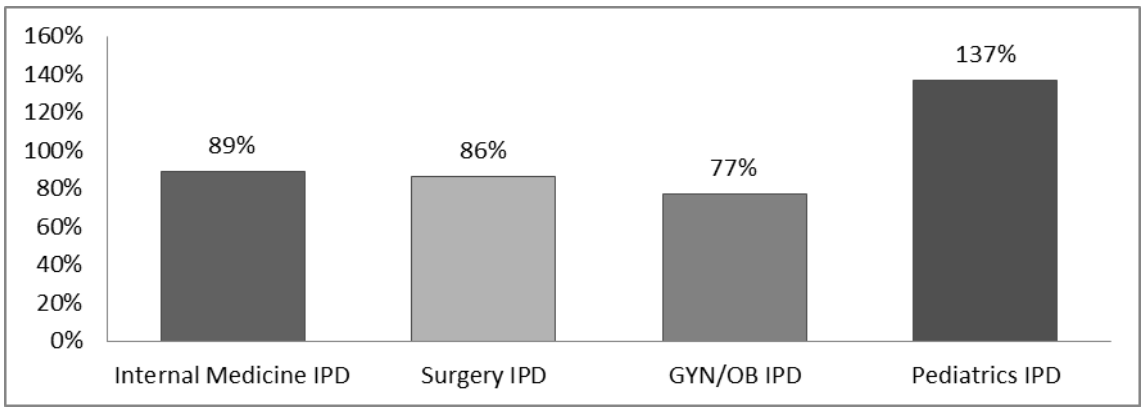


Figure: A4 Average Length of Stay - Inpatient Departments (Days)

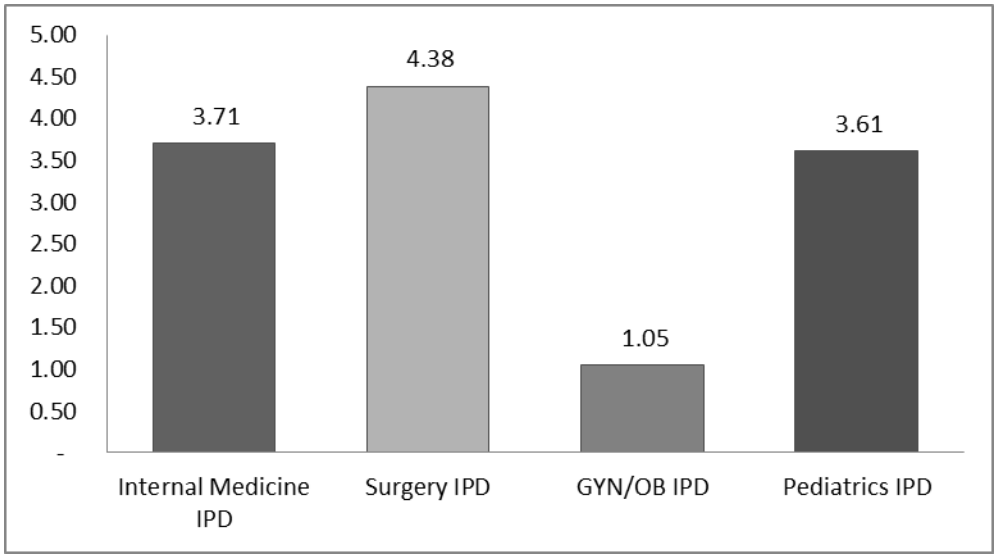


Figure: A5 Hospital cost breakdown by OPD and IPD services

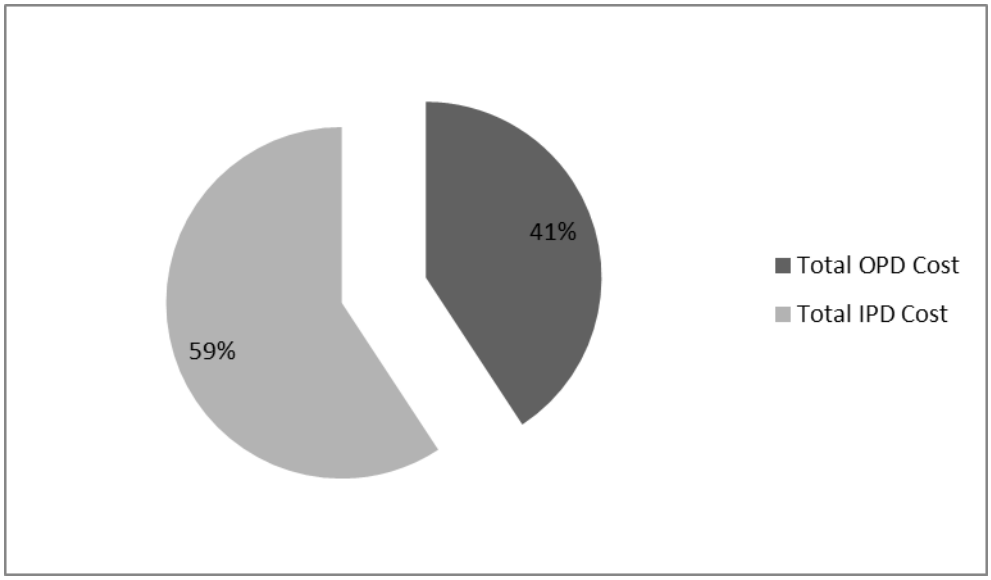


Figure: A6 Hospital cost by cost centers

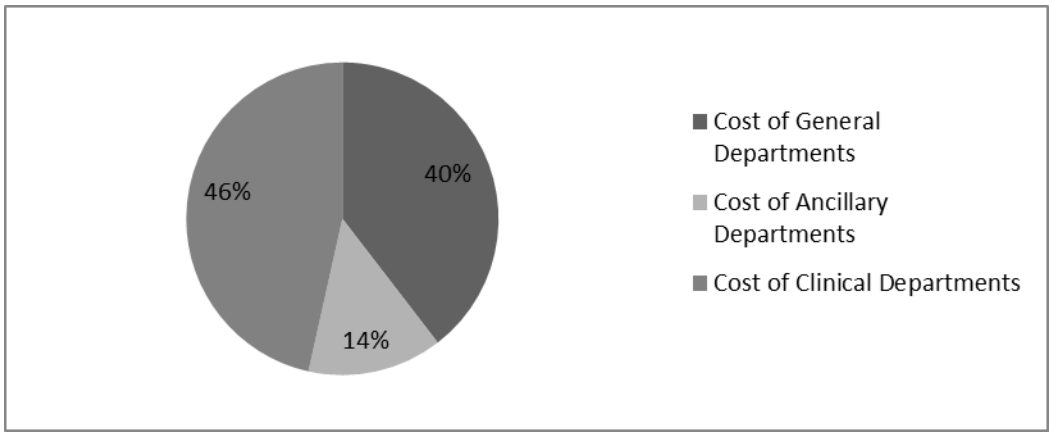


Figure: A7 Cost Per Outpatient Visit or Inpatient Hospitalization Day

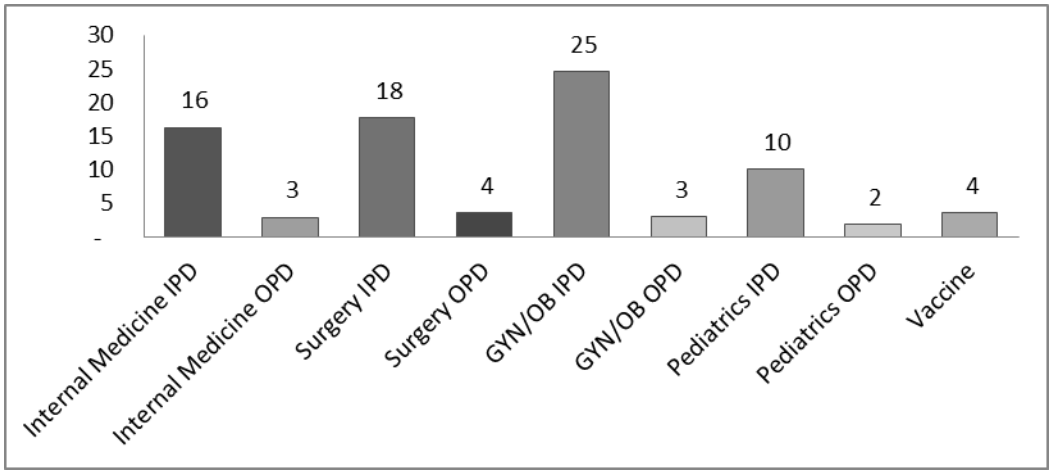
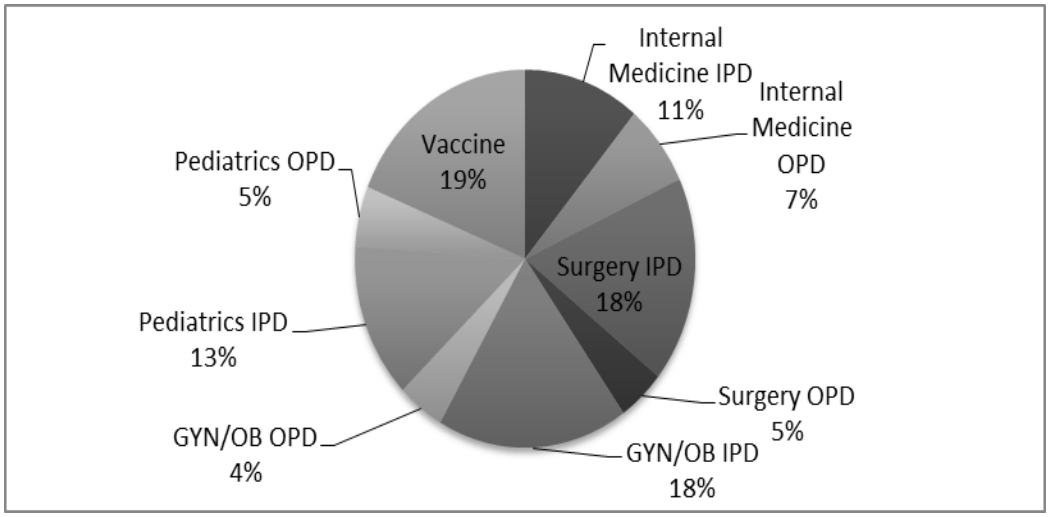


Figure: A8 Total Cost Breakdown by Clinical Department



Ghor Provincial Hospital:

Ghor provincial hospital is located in Cheqcheran city of the Ghor province. This hospital has 100 beds and is managed by the Hospital Reform Project (HRP) of ministry of public health. The data reported are from the March 21, 2011 – March 20, 2012 period.

Table: B1 Overall hospital Statistics

Total Number of Hospital Beds:	100
Total Outpatient Visits:	76,511
Total Inpatient Admissions:	9,699
Total Inpatient Discharges:	9,431
Total Inpatient Deaths:	179
Total Hospitalization Days:	31,189
Bed Occupancy Rate (BOR) (%):	85%
Average Length of Stay (ALOS) (days)	3.2

Table: B2 Hospital Staff breakdown

Staff Breakdown	Number	Ratio of Beds per Staff	Ratio of Occupied Beds per Staff
Total Doctors	10	10.0	8.5
Total Nurses	33	3.0	2.6
Total Midwifes	8	12.5	10.7
Total Technicians	18	5.6	4.7
Total Others	50	2.0	1.7

Figure: B3 Bed Occupancy Rate - Inpatient Departments (%)

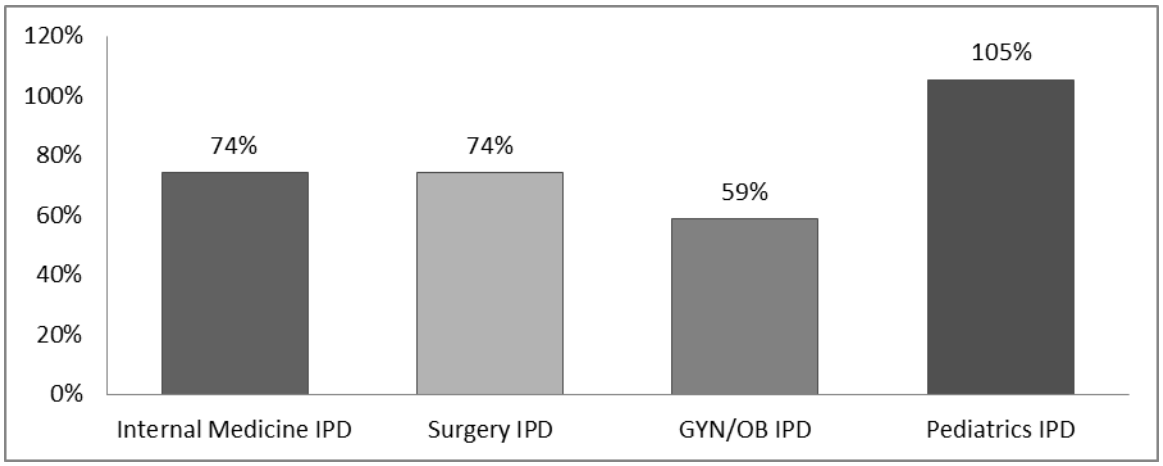


Figure: B4 Average Length of Stay - Inpatient Departments (Days)

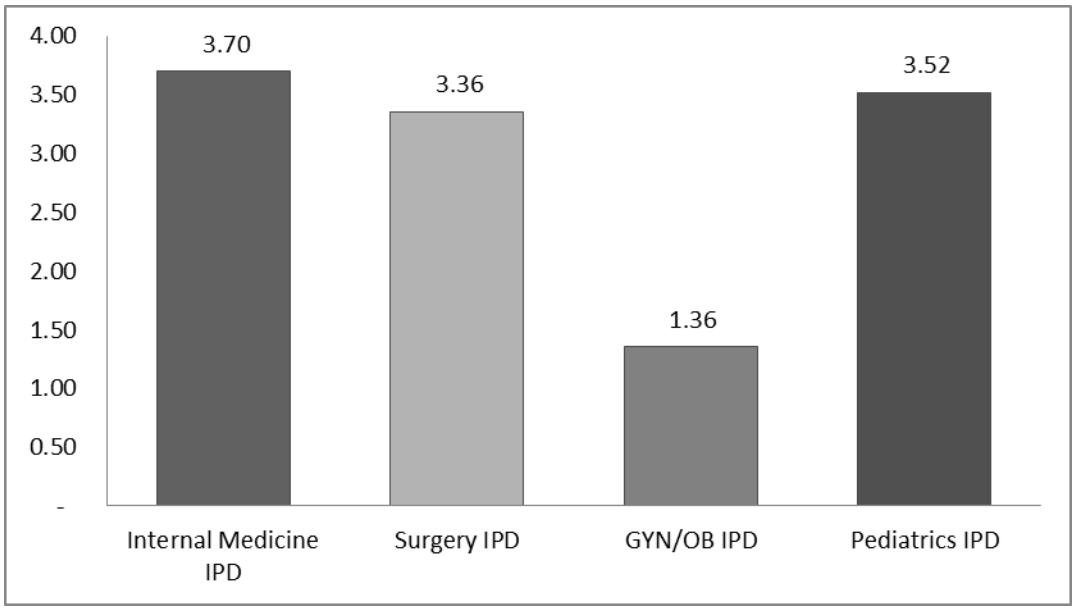


Figure: B5 Hospital cost breakdown by OPD and IPD services

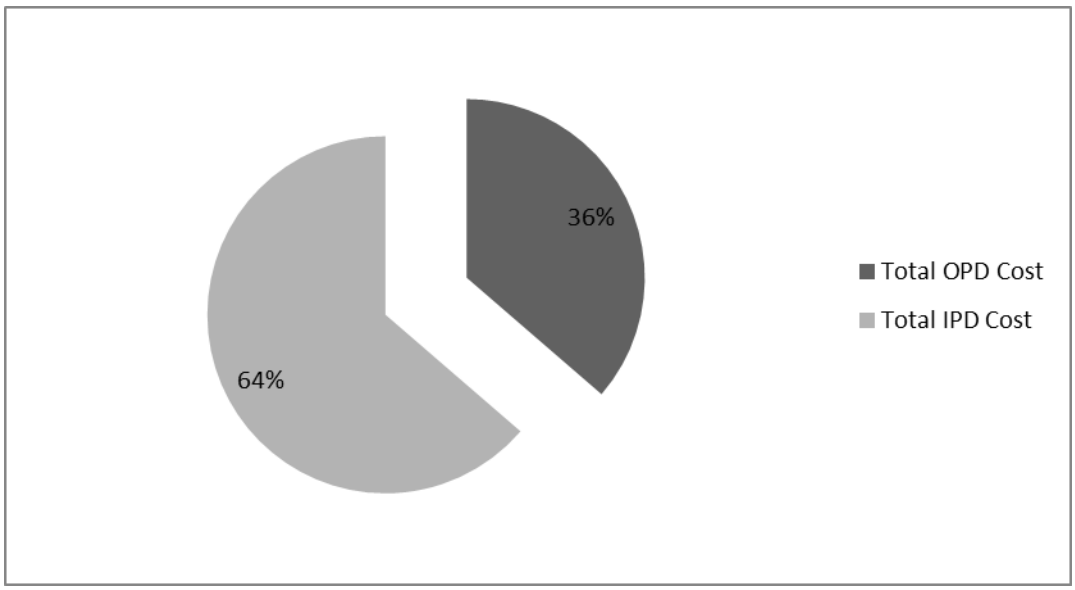


Figure: B6 Hospital cost by cost centers

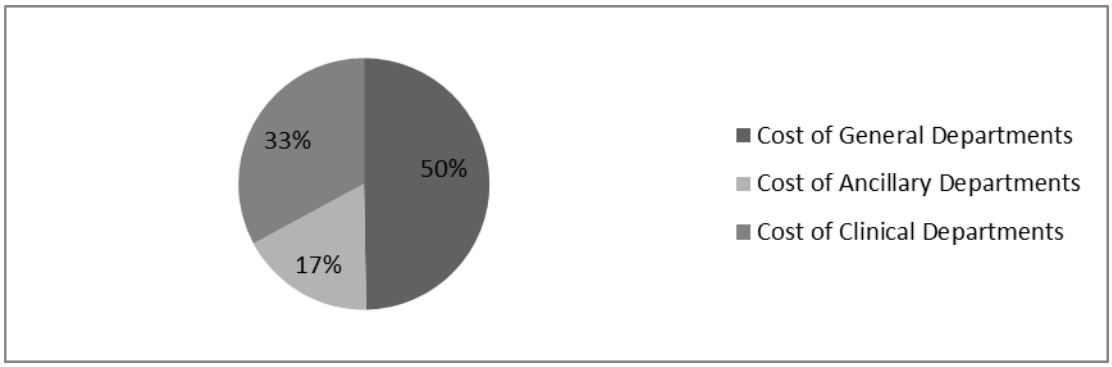


Figure: B7 Cost Per Outpatient Visit or Inpatient Hospitalization Day

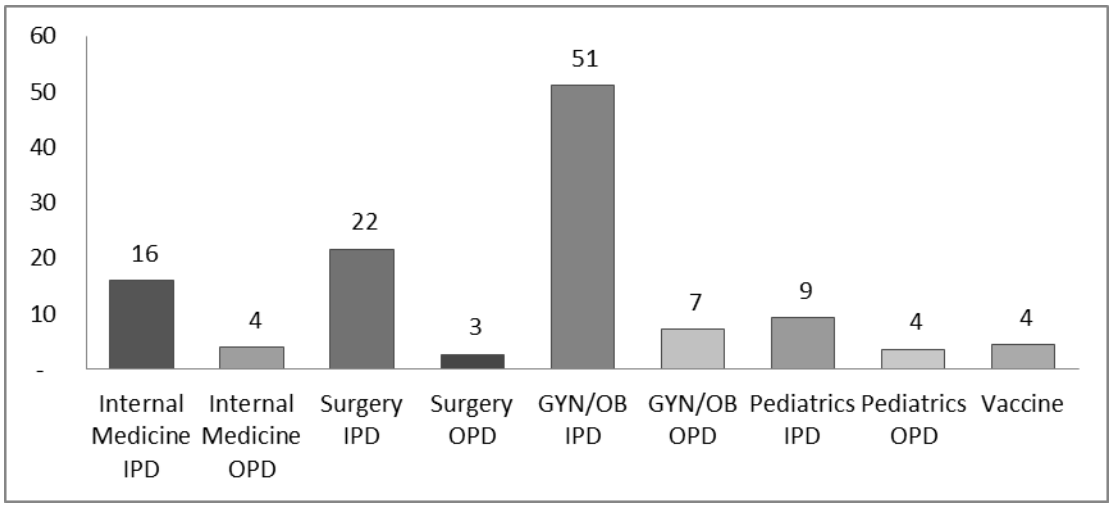
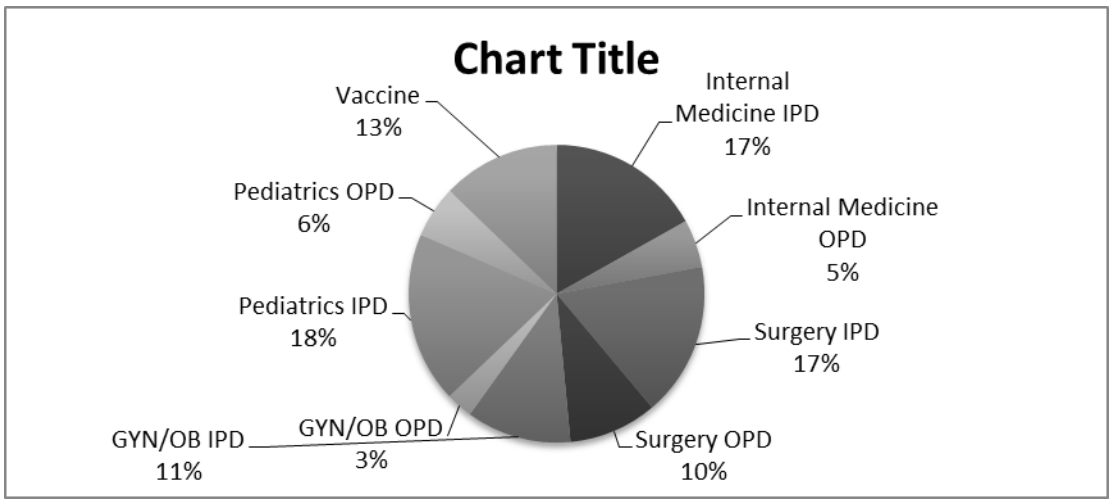


Figure: B8 Total Cost Breakdown by Clinical Department



Samangan Provincial Hospital:

Samangan provincial hospital is located in Aybak city of the Samangan province. This hospital has 80 beds and is managed by the Hospital Reform Project (HRP) of ministry of public health. The data reported are from the March 21, 2011 – March 20, 2012 period.

Table: C1 Overall hospital Statistics

Total Number of Hospital Beds:	80
Total Outpatient Visits:	123,383
Total Inpatient Admissions:	5,161
Total Inpatient Discharges:	5,139
Total Inpatient Deaths:	92
Total Hospitalization Days:	20,917
Bed Occupancy Rate (BOR) (%):	72%
Average Length of Stay (ALOS) (days)	4.0

Table: C2 Hospital Staff breakdown

Staff Breakdown	Number	Ratio of Beds per Staff	Ratio of Occupied Beds per Staff
Total Doctors	37	2.2	1.5
Total Nurses	40	2.0	1.4
Total Midwifes	8	10.0	7.2
Total Technicians	14	5.7	4.1
Total Others	70	1.1	0.8

Figure: C3 Bed Occupancy Rate - Inpatient Departments (%)

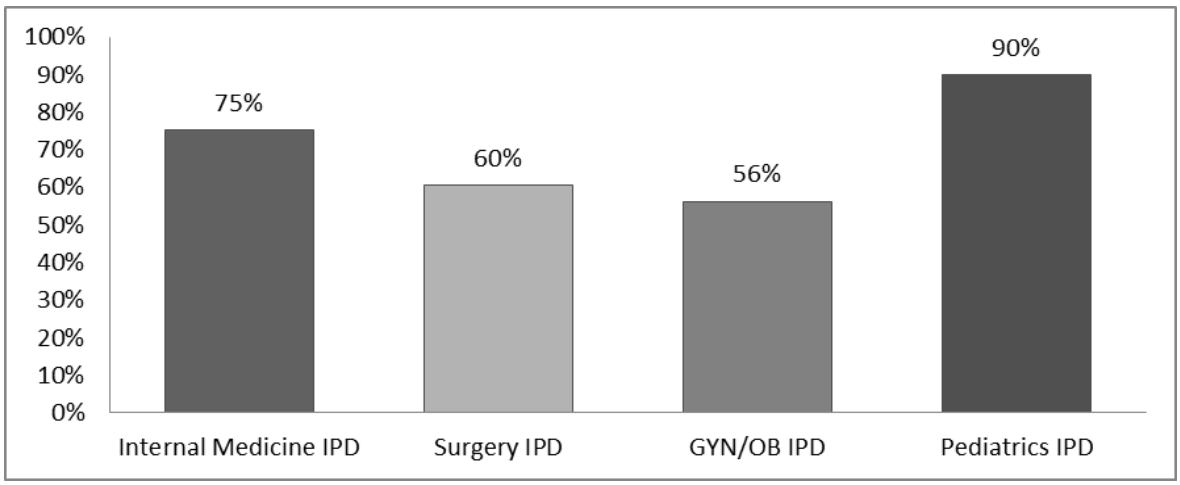


Figure: C4 Average Length of Stay - Inpatient Departments (Days)

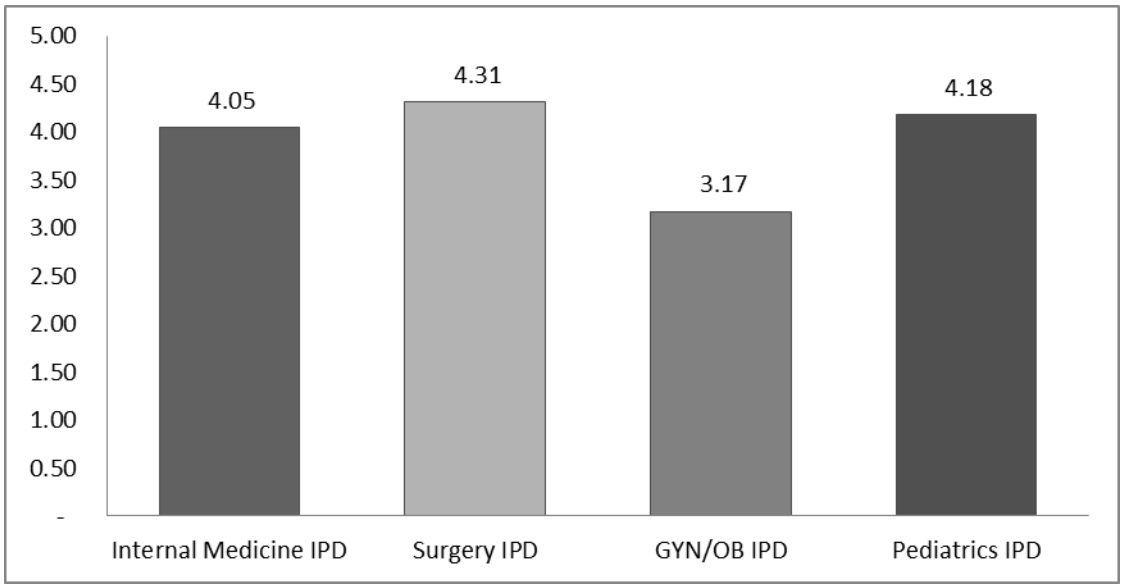


Figure: C5 Hospital cost breakdown by OPD and IPD services

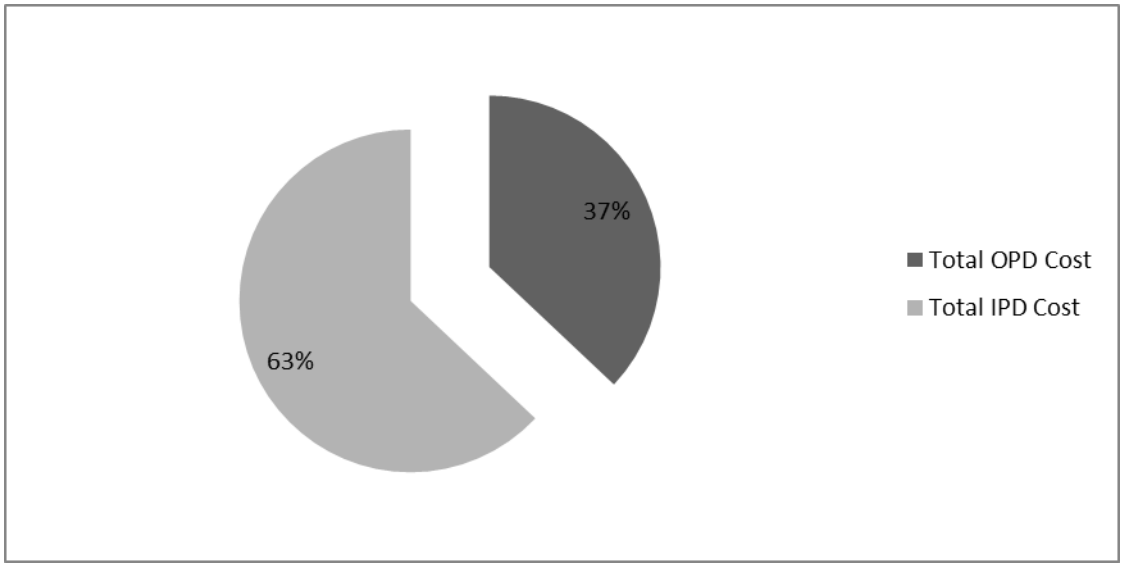


Figure: C6 Hospital cost by cost centers

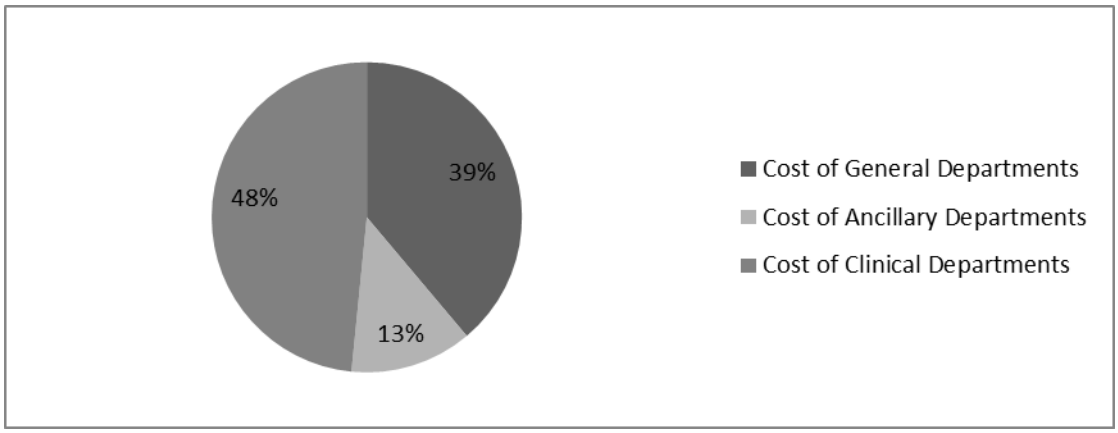


Figure: C7 Cost Per Outpatient Visit or Inpatient Hospitalization Day

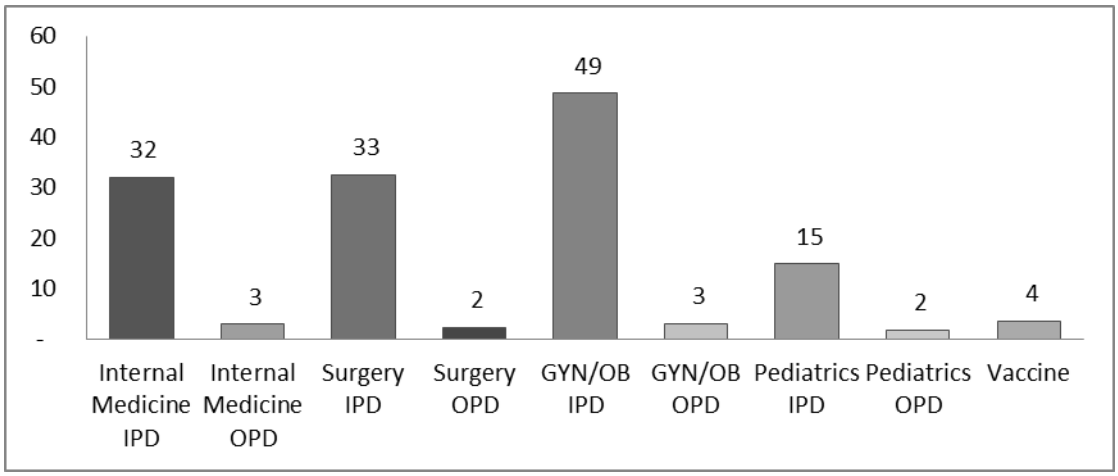
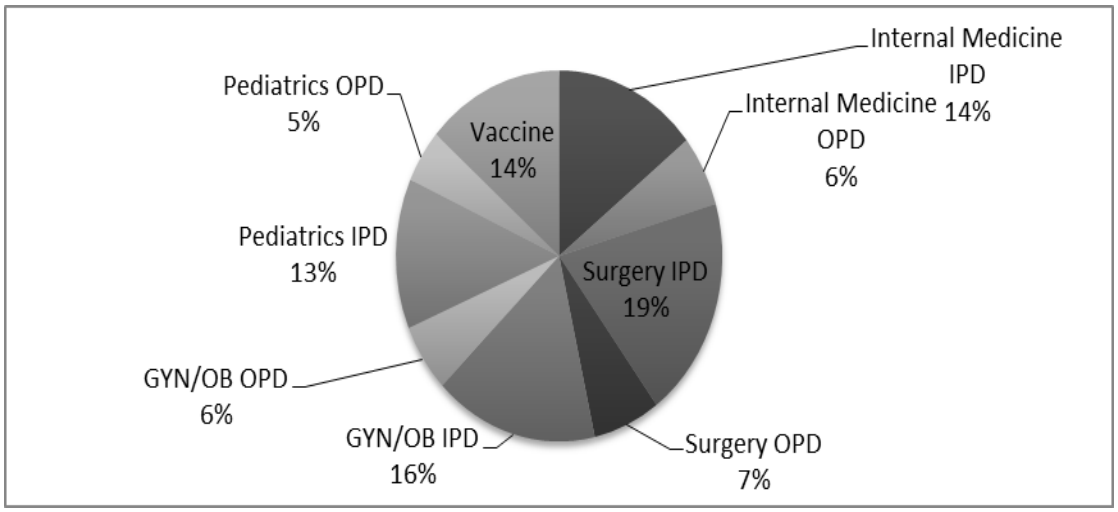


Figure: C8 Total Cost Breakdown by Clinical Department



Takhar Provincial Hospital:

Takhar provincial hospital is located in Taloqan city of the Takhar province. This hospital has 120 beds and is managed by the Hospital Reform Project (HRP) of ministry of public health. The data reported are from the March 21, 2011 – March 20, 2012 period.

Table: D1 Overall hospital Statistics

Total Number of Hospital Beds:	120
Total Outpatient Visits:	140,483
Total Inpatient Admissions:	11,852
Total Inpatient Discharges:	11,455
Total Inpatient Deaths:	630
Total Hospitalization Days:	34,326
Bed Occupancy Rate (BOR) (%):	78%
Average Length of Stay (ALOS) (days)	2.8

Table: D2 Hospital Staff breakdown

Staff Breakdown	Number	Ratio of Beds per Staff	Ratio of Occupied Beds per Staff
Total Doctors	46	2.6	2.0
Total Nurses	50	2.4	1.9
Total Midwifes	10	12.0	9.4
Total Technicians	15	8.0	6.3
Total Others	21	5.7	4.5

Figure: D3 Bed Occupancy Rate - Inpatient Departments (%)

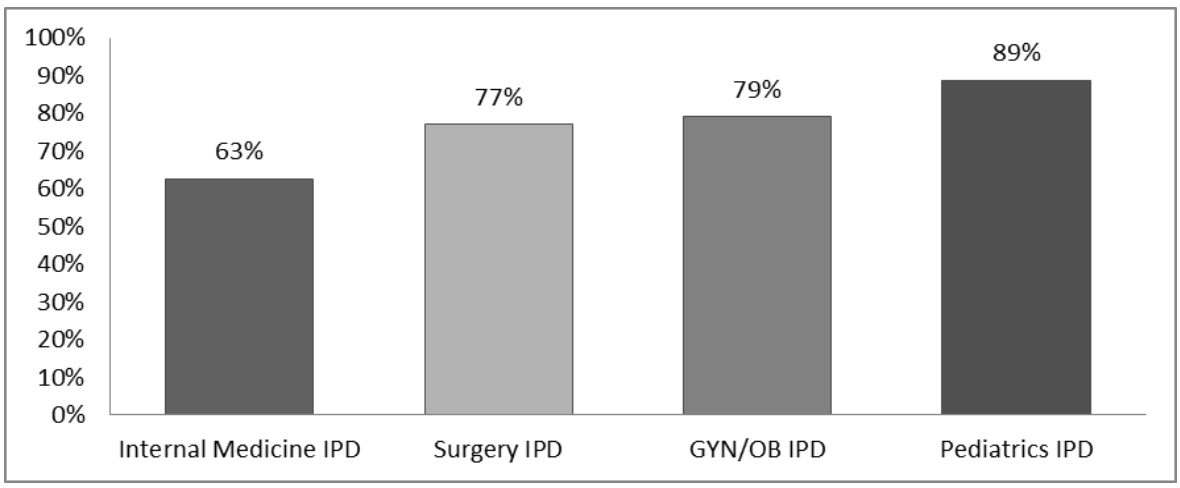


Figure: D4 Average Length of Stay - Inpatient Departments (Days)

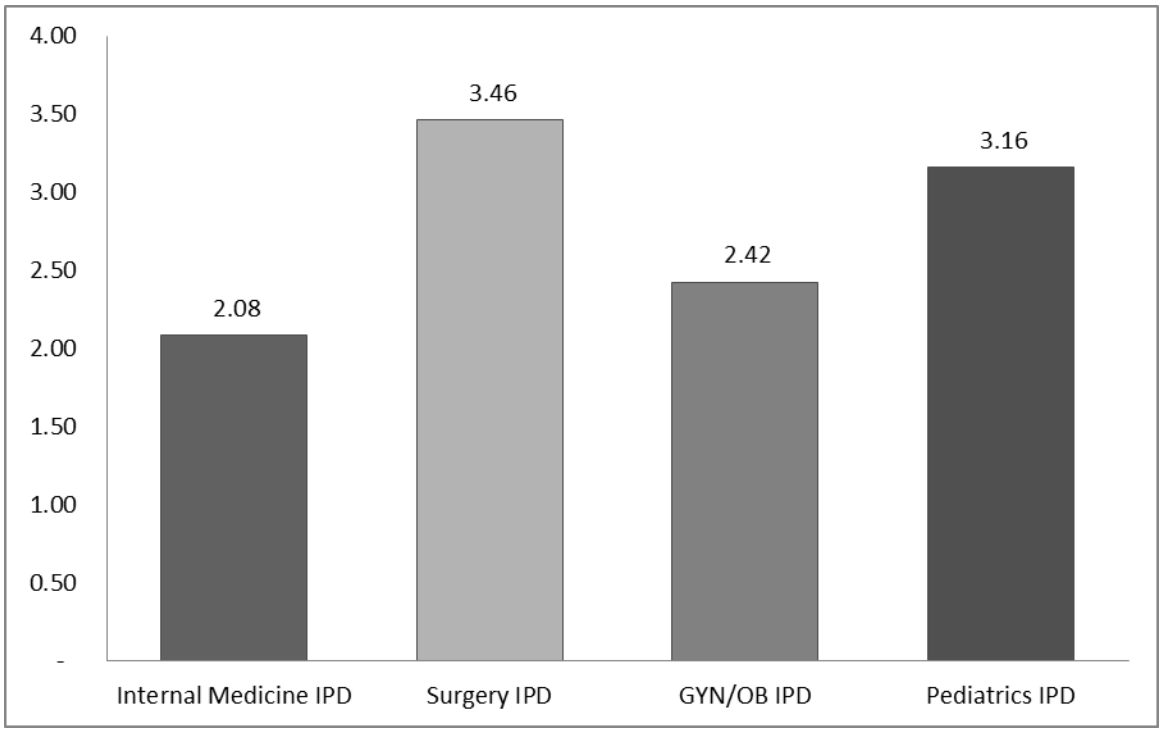


Figure: 5 Hospital cost breakdown by OPD and IPD services

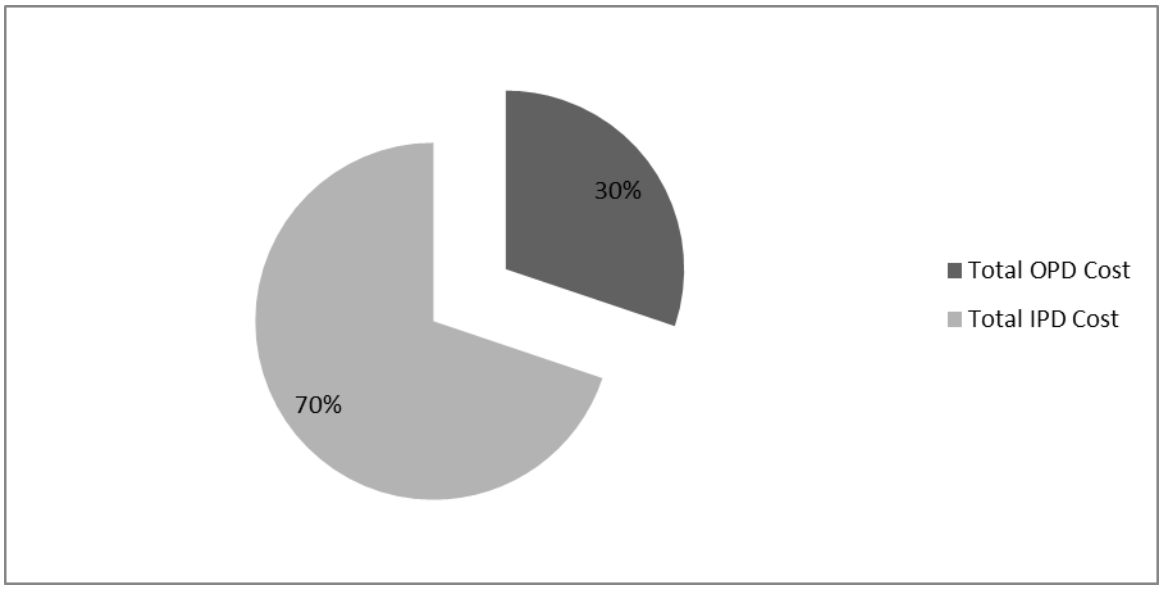


Figure: D6 Hospital cost by cost centers

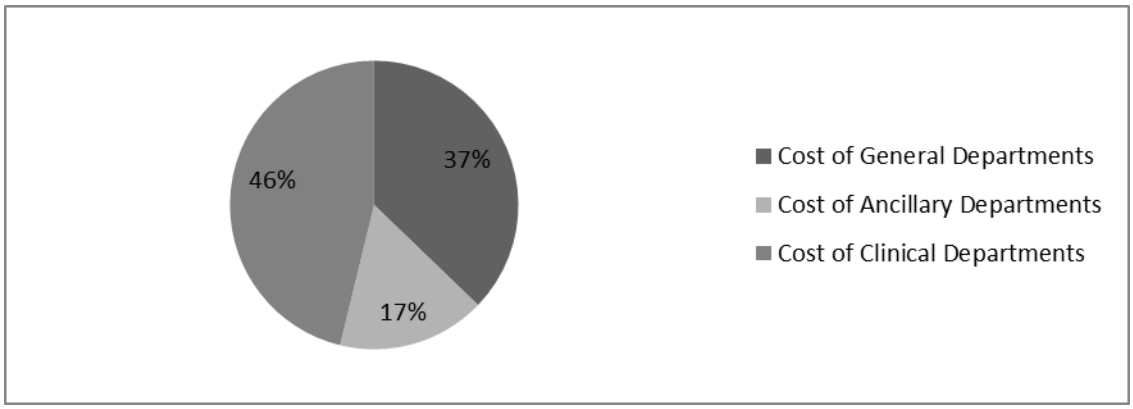


Figure: D7 Cost Per Outpatient Visit or Inpatient Hospitalization Day

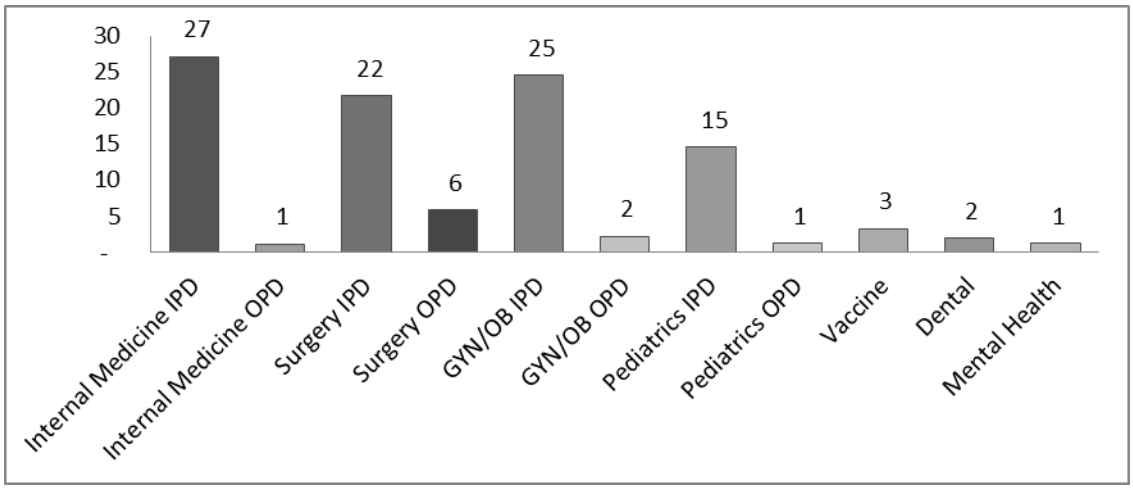
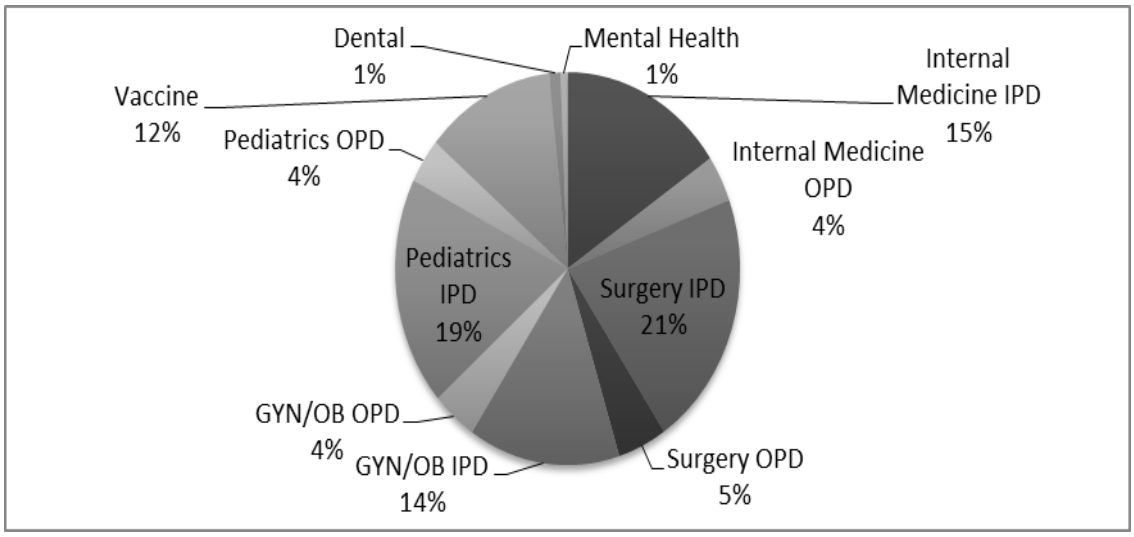


Figure: D8 Total Cost Breakdown by Clinical Department



Zabul Provincial Hospital:

Zabul provincial hospital is located in Zabul province. This hospital has 80 beds and is managed by the Hospital Reform Project (HRP) of ministry of public health. The data reported are from the March 21, 2011 – March 20, 2012 period.

Table: E1 Overall hospital Statistics

Total Number of Hospital Beds:	80
Total Outpatient Visits:	55,655
Total Inpatient Admissions:	6,700
Total Inpatient Discharges:	6,412
Total Inpatient Deaths:	45
Total Hospitalization Days:	20,907
Bed Occupancy Rate (BOR) (%):	72%
Average Length of Stay (ALOS) (days)	3.2

Table: E2 Hospital Staff breakdown

Staff Breakdown	Number	Ratio of Beds per Staff	Ratio of Occupied Beds per Staff
Total Doctors	15	5.3	3.8
Total Nurses	33	2.4	1.7
Total Midwifes	3	26.7	19.1
Total Technicians	9	8.9	6.4
Total Others	53	1.5	1.1

Figure: E3 Bed Occupancy Rate - Inpatient Departments (%)

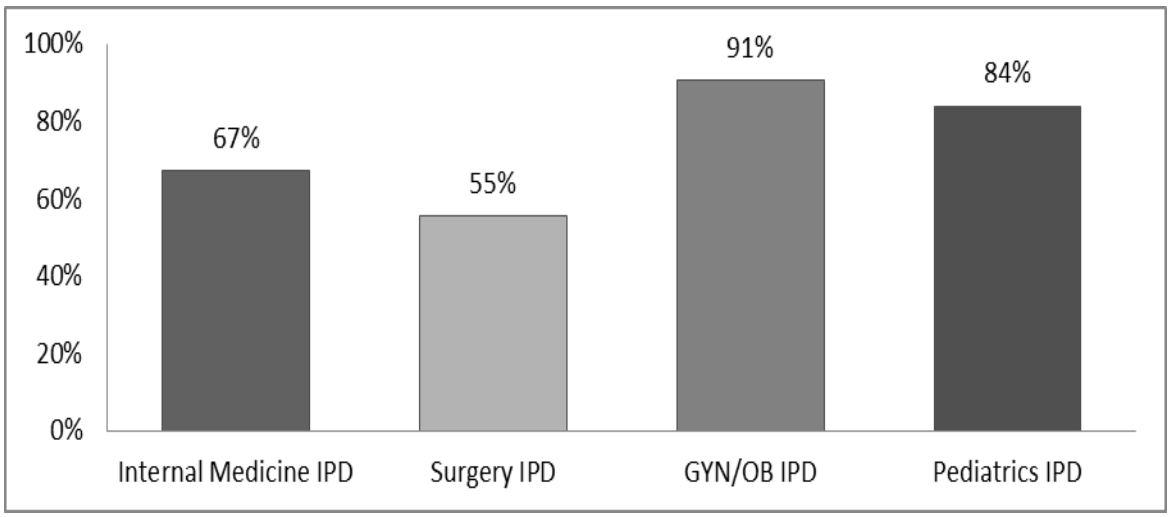


Figure: E4 Average Length of Stay - Inpatient Departments (Days)

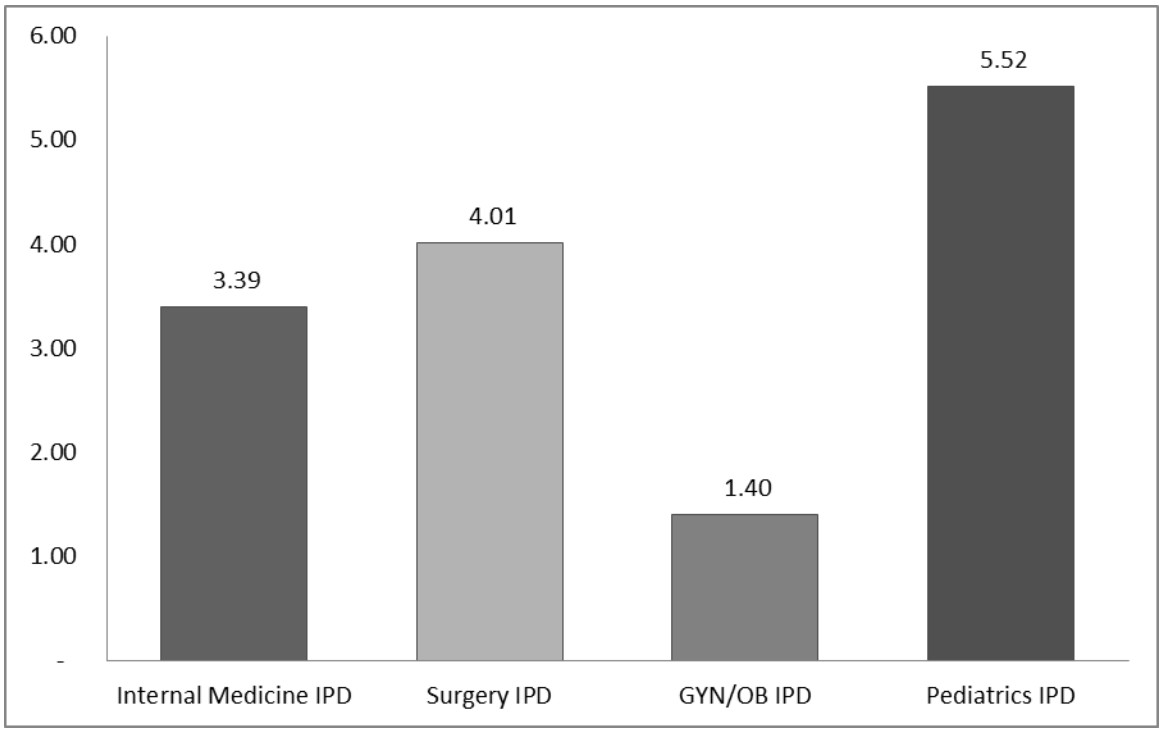


Figure: E5 Hospital cost breakdown by OPD and IPD services

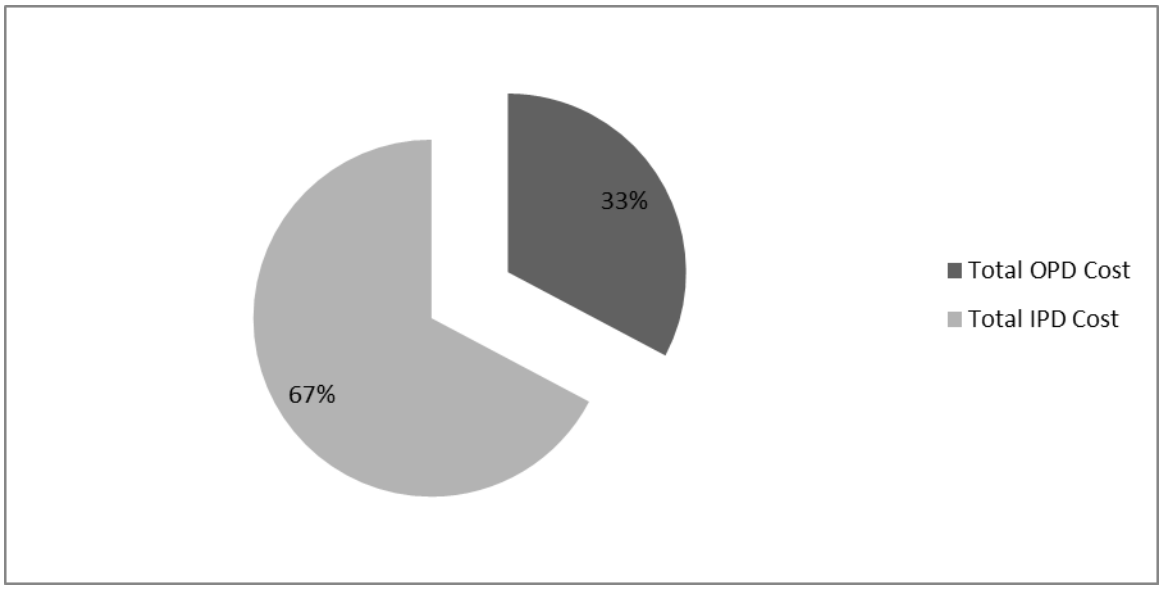


Figure: E6 Hospital cost by cost centers

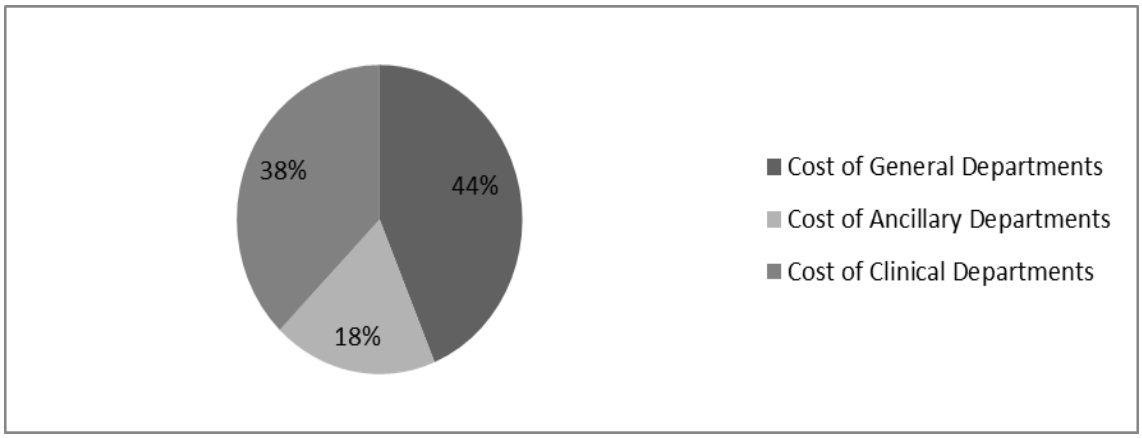


Figure: E7 Cost Per Outpatient Visit or Inpatient Hospitalization Day

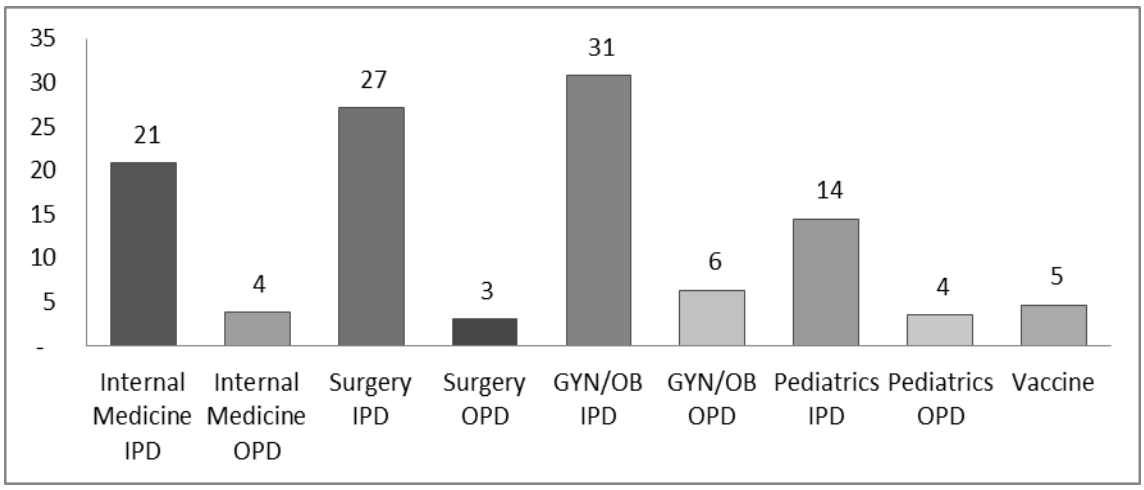
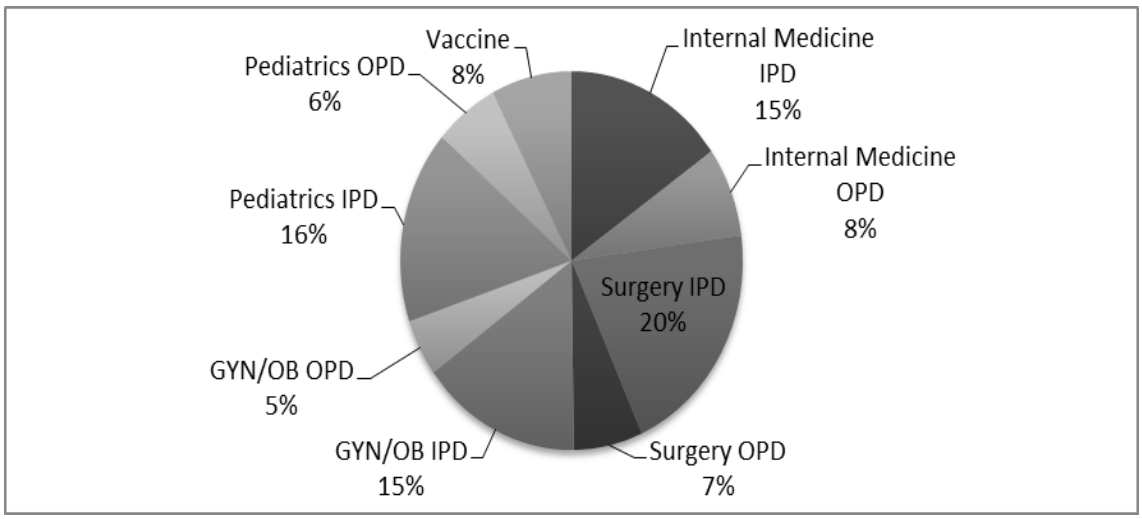


Figure: E8Total Cost Breakdown by Clinical Department



Badakhshan Provincial Hospital:

Bakhshan provincial hospital is located in Faizabad city of the Badakhshan province. This hospital has 100 beds and is managed through contract out mechanism with NGO, under the USAID grant. The data reported are from the March 21, 2011 – March 20, 2012 period.

Table: F1 Overall hospital Statistics

Total Number of Hospital Beds:	100
Total Outpatient Visits:	101,639
Total Inpatient Admissions:	10,554
Total Inpatient Discharges:	9,964
Total Inpatient Deaths:	185
Total Hospitalization Days:	30,361
Bed Occupancy Rate (BOR) (%):	83%
Average Length of Stay (ALOS) (days)	3.0

Table: F2 Hospital Staff breakdown

Staff Breakdown	**Number**	**Ratio of Beds per Staff**	**Ratio of Occupied Beds per Staff**
Total Doctors	26	3.8	3.2
Total Nurses	31	3.2	2.7
Total Midwifes	8	12.5	10.4
Total Technicians	14	7.1	5.9
Total Others	59	1.7	1.4

Figure: F3 Bed Occupancy Rate - Inpatient Departments (%)

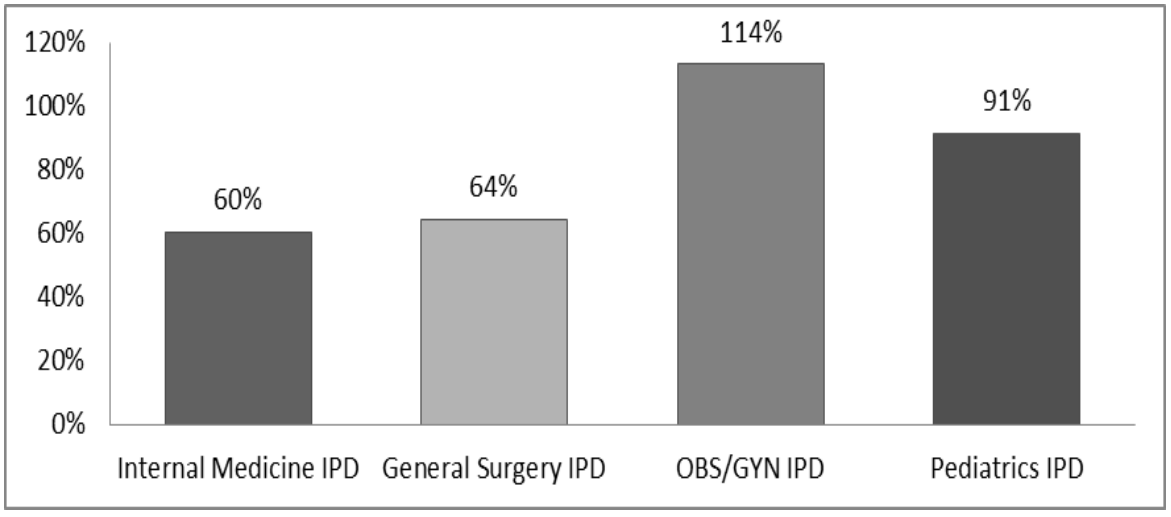


Figure: F4 Average Length of Stay - Inpatient Departments (Days)

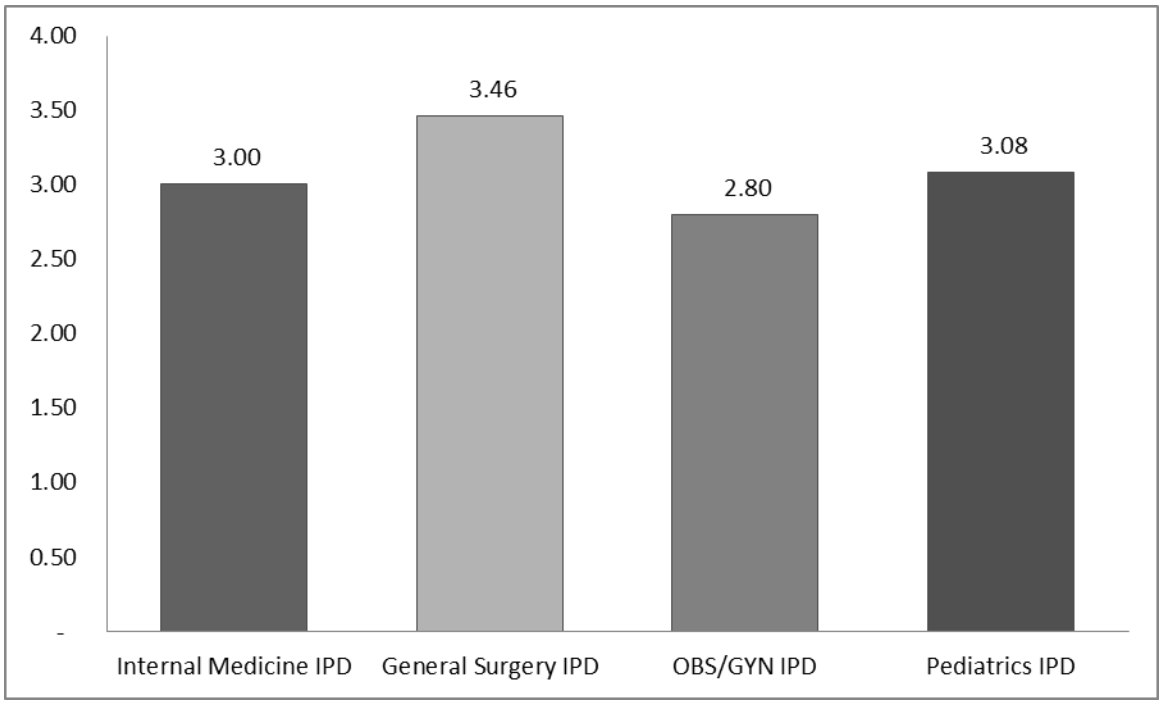


Figure: F5 Hospital cost breakdown by OPD and IPD services

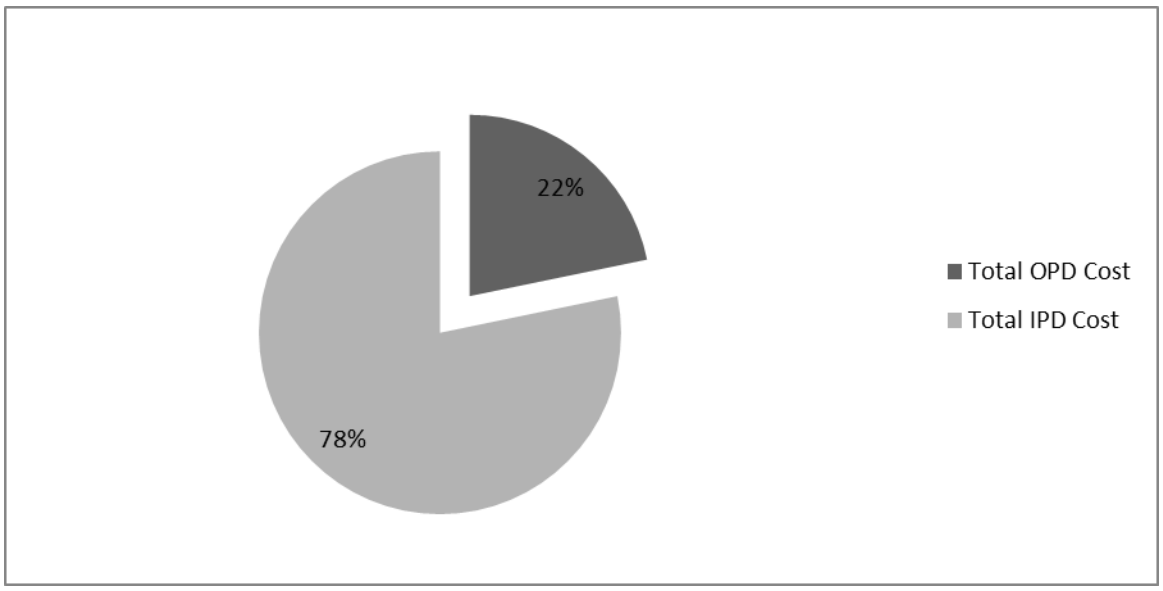


Figure: F6 Hospital cost by cost centers

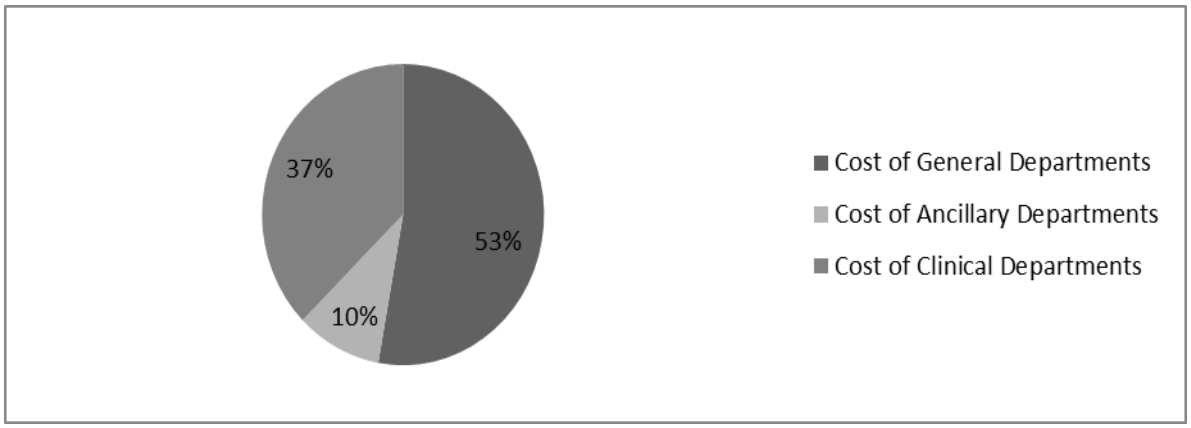


Figure: F7 Cost Per Outpatient Visit or Inpatient Hospitalization Day

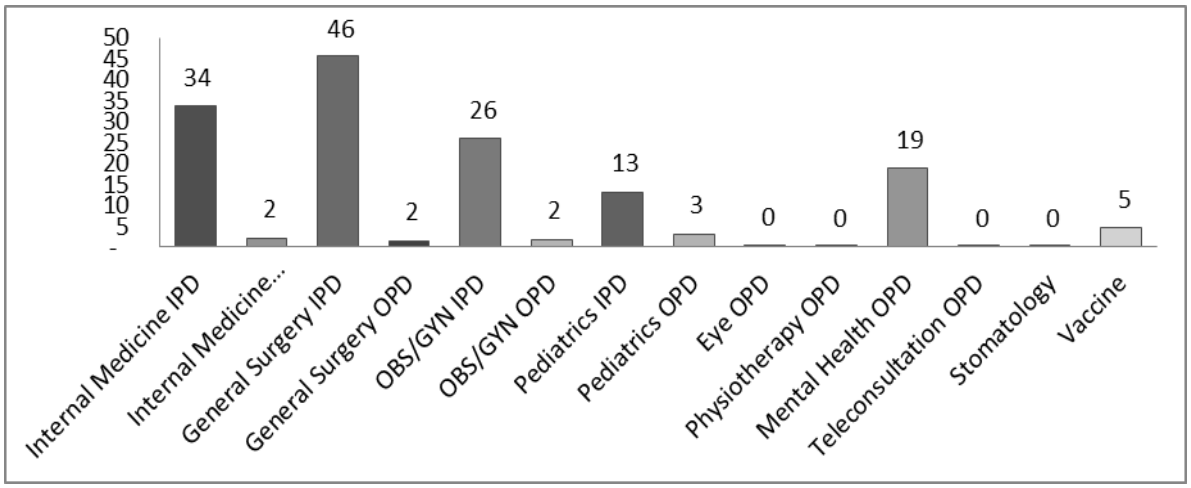
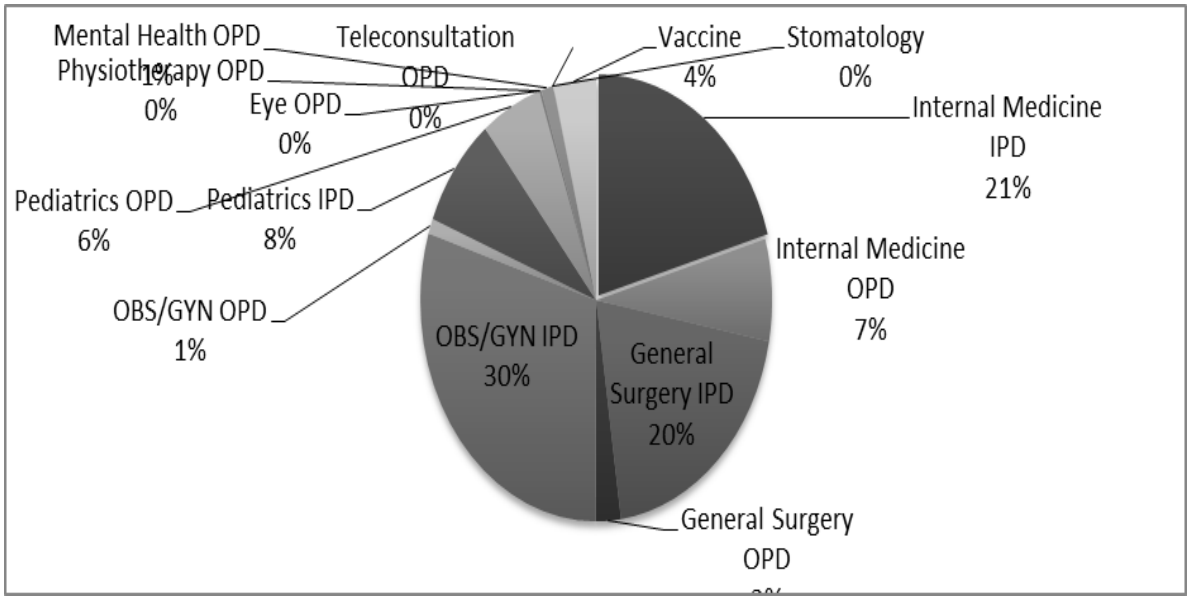


Figure: F8 Total Cost Breakdown by Clinical Department



Ghazni Provincial Hospital:

Ghazni provincial hospital is located in the Ghanzi province. This hospital has 130 beds and is managed through contract out mechanism with NGO, under the USAID grant. The data reported are from the March 21, 2011 – March 20, 2012 period.

Table: G1 Overall hospital Statistics

Total Number of Hospital Beds:	130
Total Outpatient Visits:	205,355
Total Inpatient Admissions:	12,569
Total Inpatient Discharges:	12,569
Total Inpatient Deaths:	262
Total Hospitalization Days:	36,345
Bed Occupancy Rate (BOR) (%):	77%
Average Length of Stay (ALOS) (days)	2.8

Table: G2 Hospital Staff breakdown

Staff Breakdown	Number	Ratio of Beds per Staff	Ratio of Occupied Beds per Staff
Total Doctors	33	3.9	3.0
Total Nurses	37	3.5	2.7
Total Midwifes	5	26.0	19.9
Total Technicians	20	6.5	5.0
Total Others	68	1.9	1.5

Figure: G3 Bed Occupancy Rate - Inpatient Departments (%)

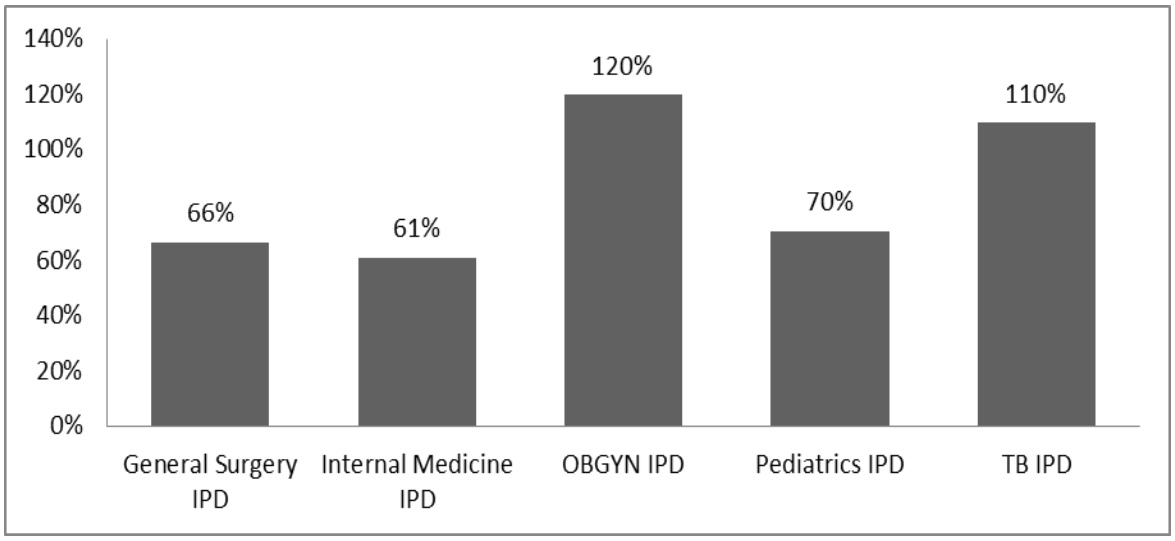


Figure: G4 Average Length of Stay - Inpatient Departments (Days)

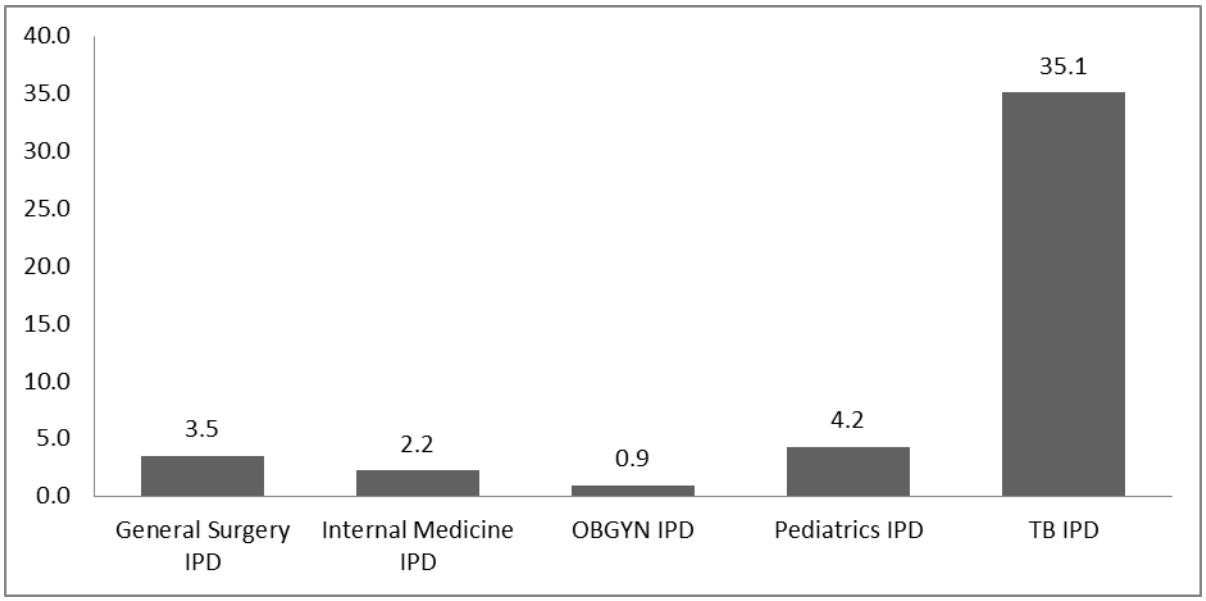


Figure: G5 Hospital cost breakdown by OPD and IPD services

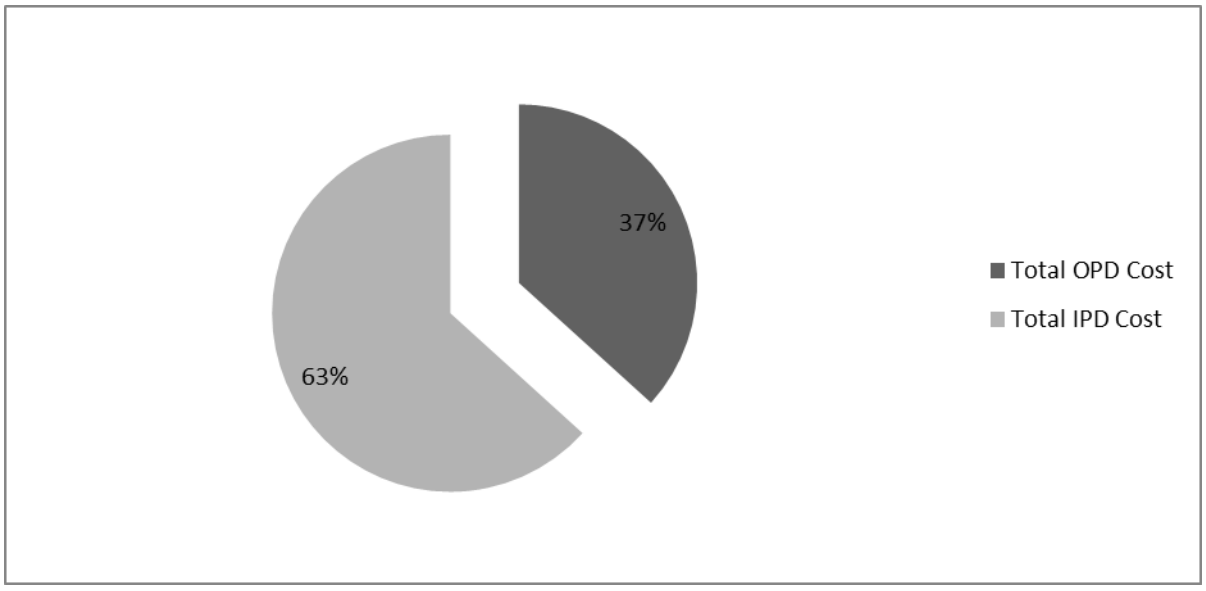


Figure: G6 Hospital cost by cost centers

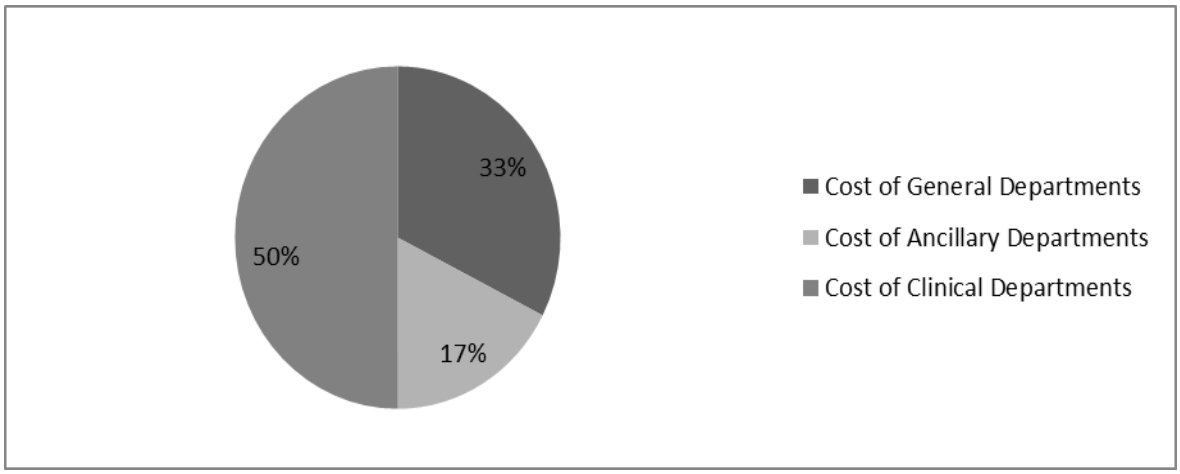


Figure: G7 Cost Per Outpatient Visit or Inpatient Hospitalization Day

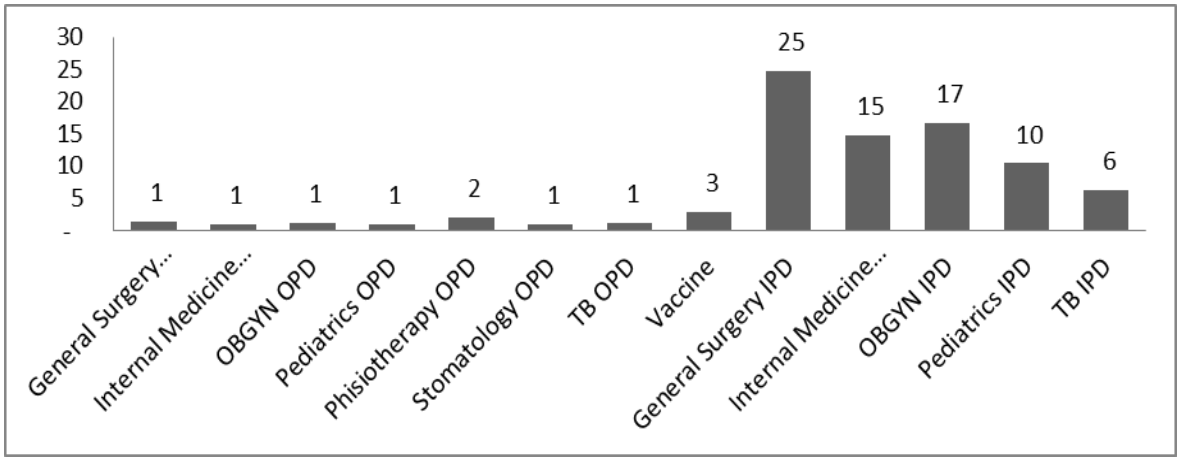
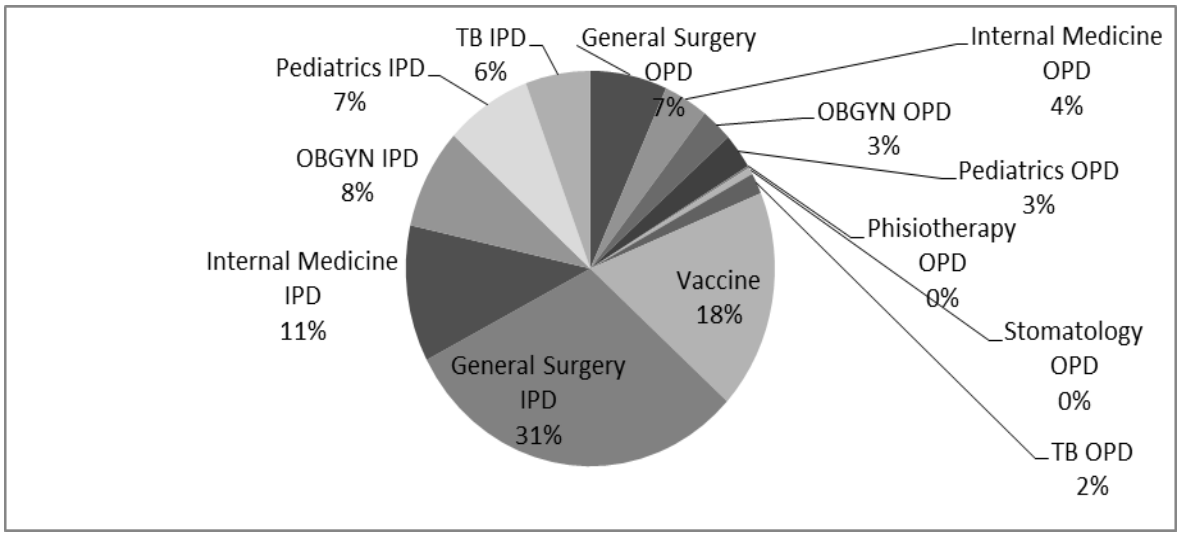


Figure: G8 Total Cost Breakdown by Clinical Department



Khost Provincial Hospital:

Khost provincial hospital is located in khost province. This hospital has 100 beds and is managed through contract out mechanism with NGO, under the USAID grant. The data reported are from the March 21, 2011 – March 20, 2012 period.

Table: H1 Overall hospital Statistics

Total Number of Hospital Beds:	100
Total Outpatient Visits:	188,852
Total Inpatient Admissions:	14,630
Total Inpatient Discharges:	14,593
Total Inpatient Deaths:	428
Total Hospitalization Days:	28,577
Bed Occupancy Rate (BOR) (%):	78%
Average Length of Stay (ALOS) (days)	1.9

Table: H2 Hospital Staff breakdown

Staff Breakdown	Number	Ratio of Beds per Staff	Ratio of Occupied Beds per Staff
Total Doctors	26	3.8	3.0
Total Nurses	25	4.0	3.1
Total Midwifes	10	10.0	7.8
Total Technicians	11	9.1	7.1
Total Others	67	1.5	1.2

Figure: H3 Bed Occupancy Rate - Inpatient Departments (%)

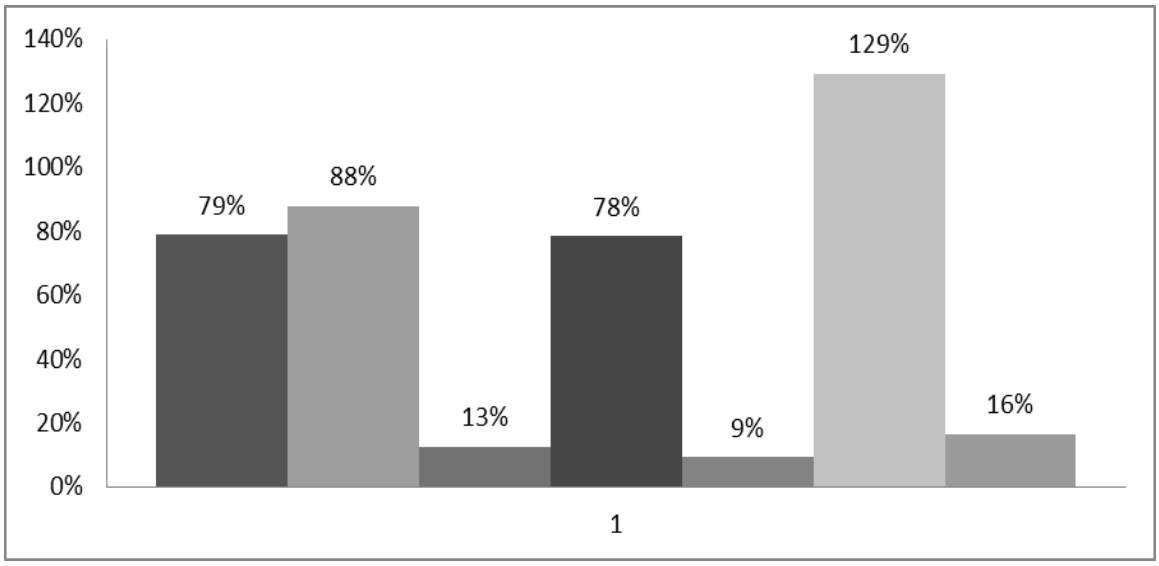


Figure: H4 Average Length of Stay - Inpatient Departments (Days)

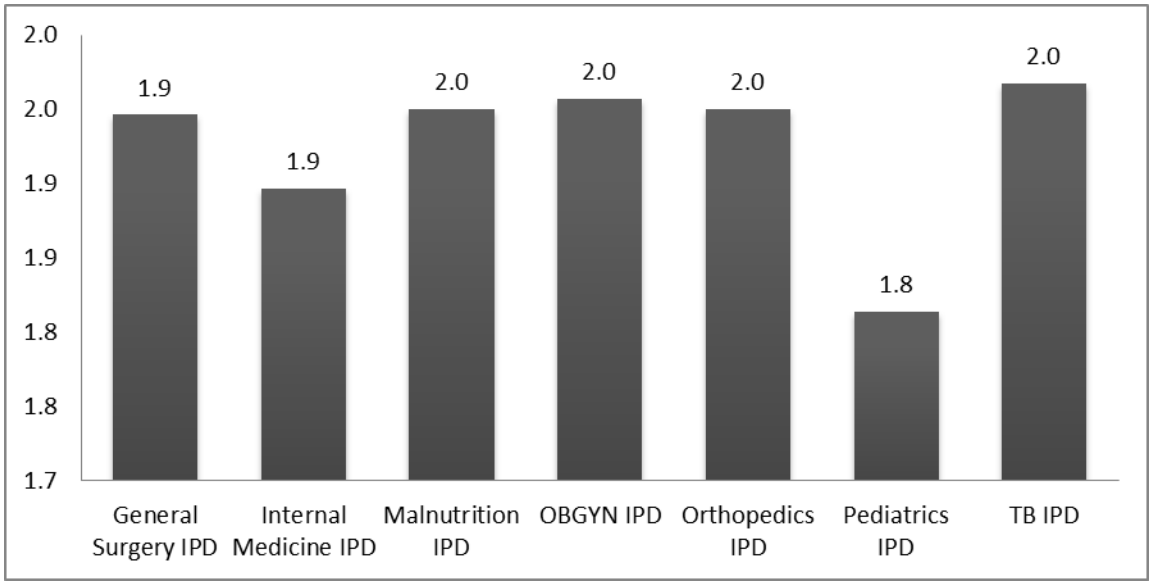


Figure: H5 Hospital cost breakdown by OPD and IPD services

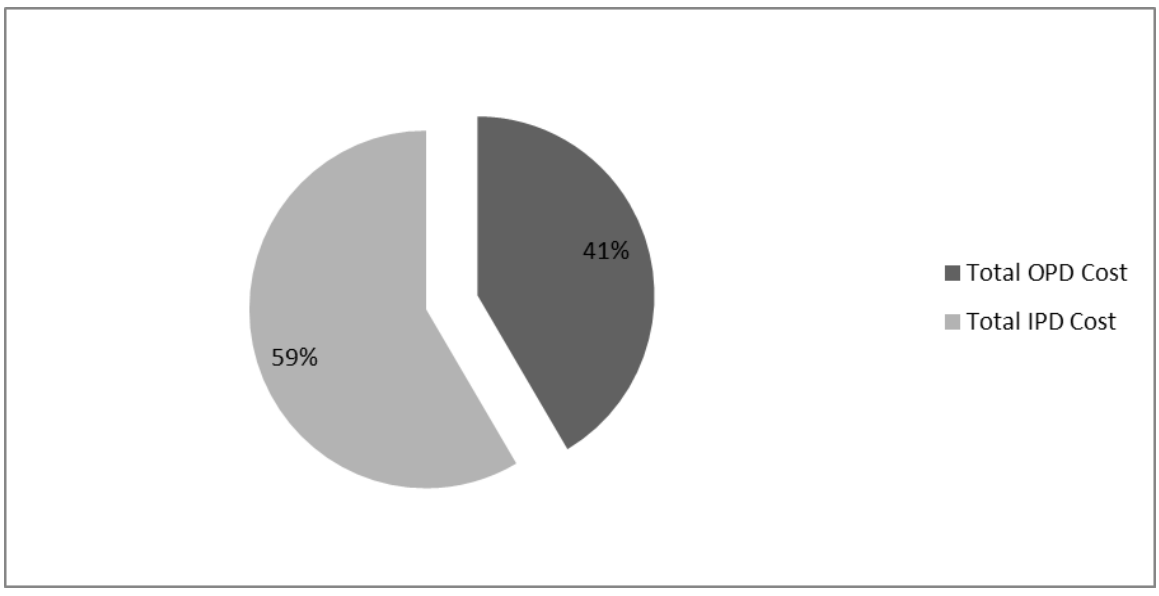


Figure: H6 Hospital cost by cost centers

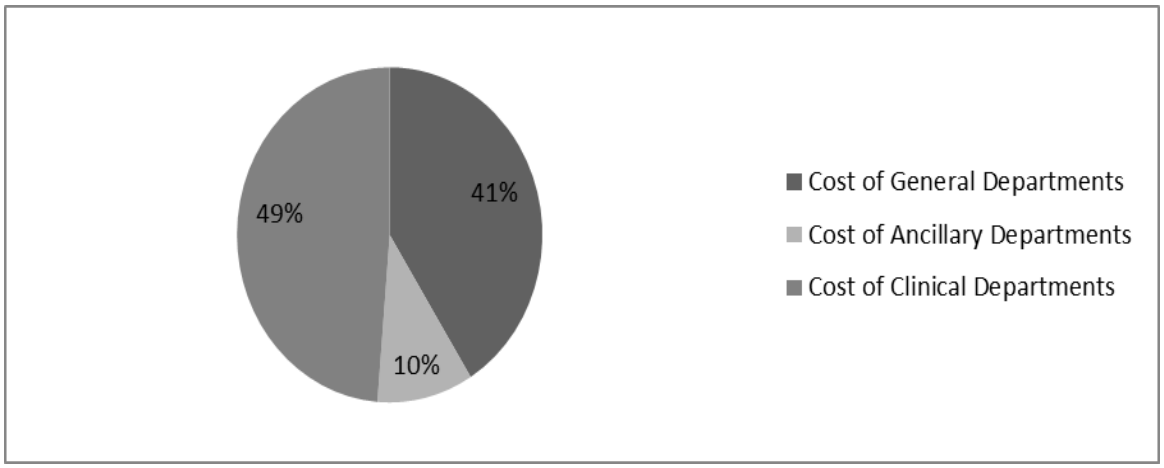


Figure: H7 Cost Per Outpatient Visit or Inpatient Hospitalization Day

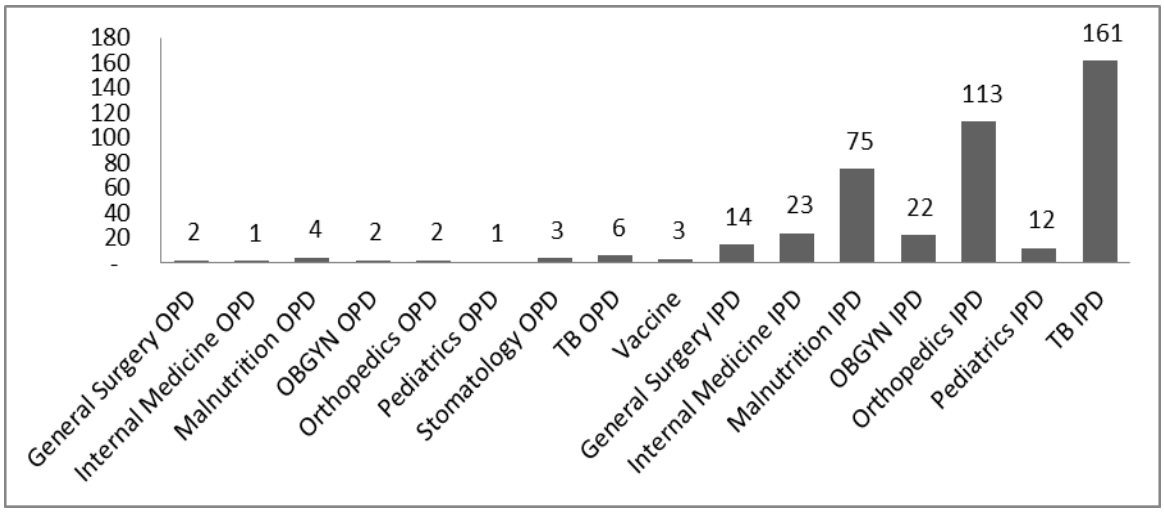
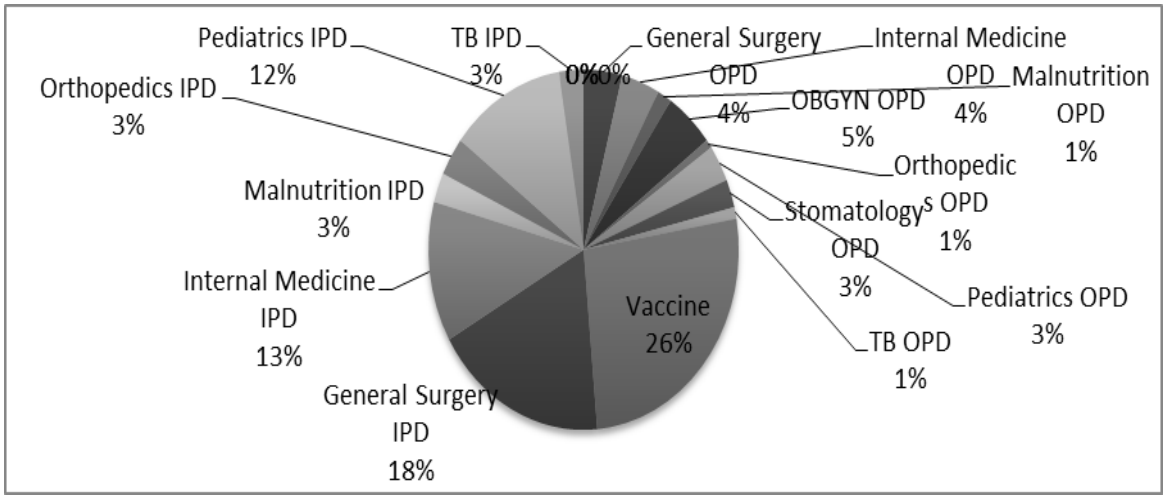


Figure: H8 Total Cost Breakdown by Clinical Department



Laghman Provincial Hospital:

Laghman provincial hospital is located in Mehterlam city of the Laghman province. This hospital has 116 beds is managed through contract out mechanism with NGO, under the EU grant. The data reported are from the March 21, 2011 – March 20, 2012 period.

Table: I1 Overall hospital Statistics

Total Number of Hospital Beds:	116
Total Outpatient Visits:	138,099
Total Inpatient Admissions:	9,285
Total Inpatient Discharges:	8,867
Total Inpatient Deaths:	55
Total Hospitalization Days:	23,294
Bed Occupancy Rate (BOR) (%):	55%
Average Length of Stay (ALOS) (days)	2.6

Table: I2 Hospital Staff breakdown

Staff Breakdown	Number	Ratio of Beds per Staff	Ratio of Occupied Beds per Staff
Total Doctors	20	5.8	3.2
Total Nurses	22	5.3	2.9
Total Midwifes	8	14.5	8.0
Total Technicians	16	7.3	4.0
Total Others	42	2.8	1.5

Figure: I3 Bed Occupancy Rate - Inpatient Departments (%)

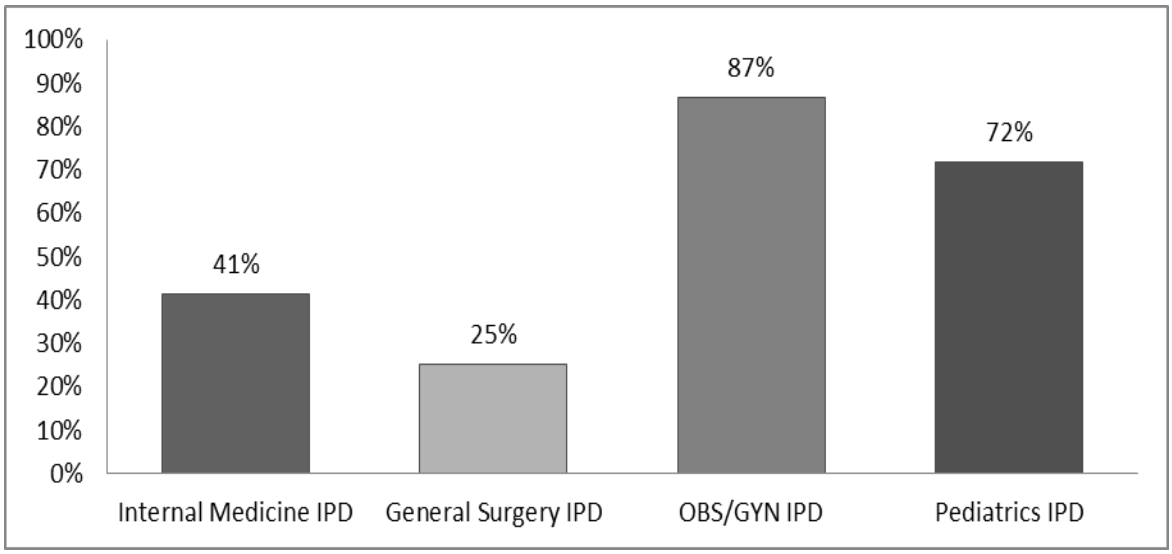


Figure: I4 Average Length of Stay - Inpatient Departments (Days)

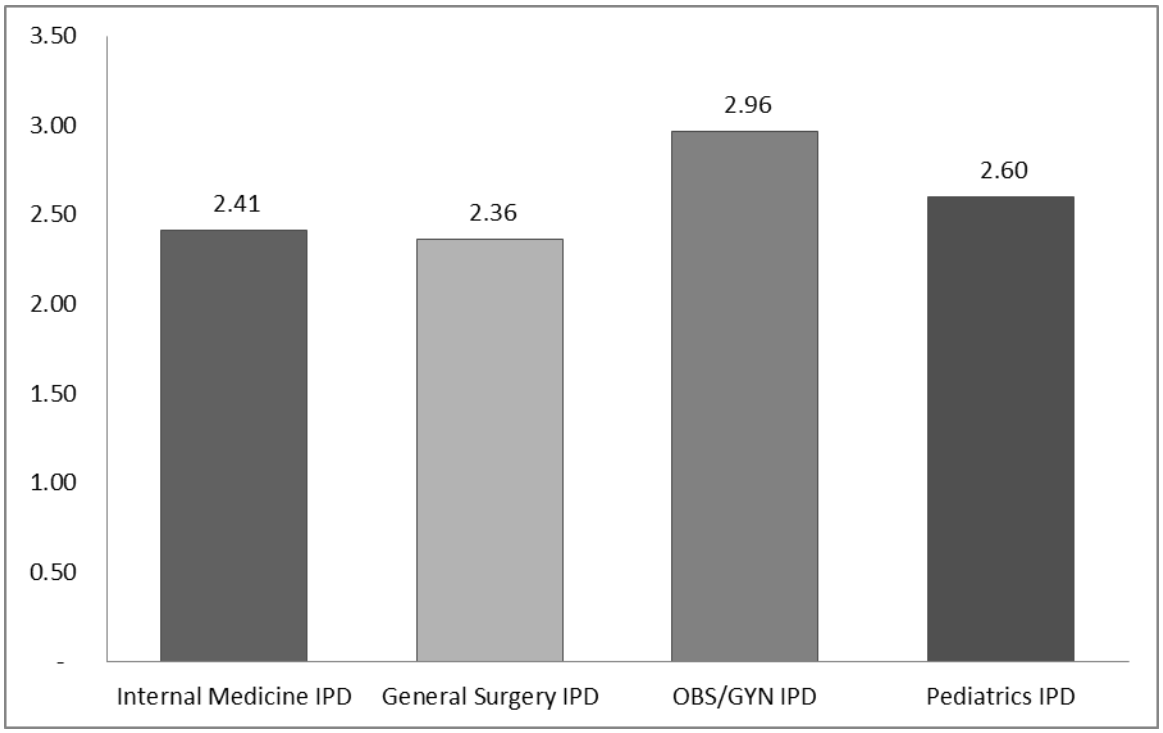


Figure: I5Hospital cost breakdown by OPD and IPD services

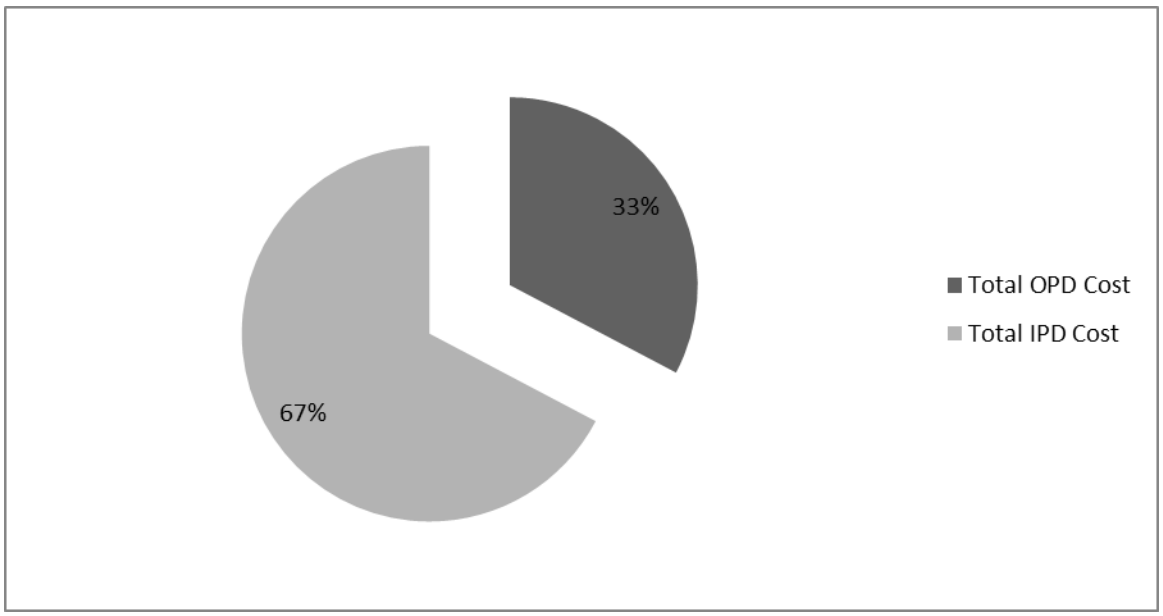


Figure: I6 Hospital cost by cost centers

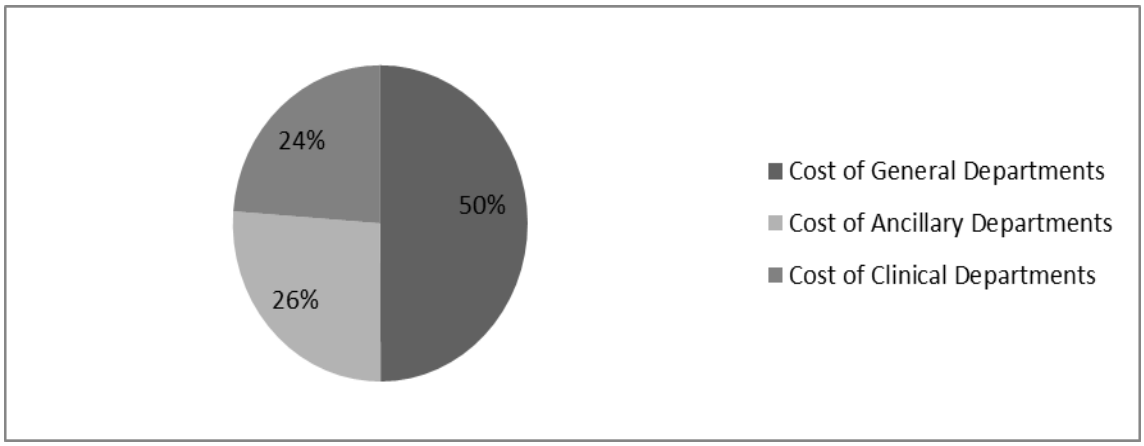


Figure: I7 Cost Per Outpatient Visit or Inpatient Hospitalization Day

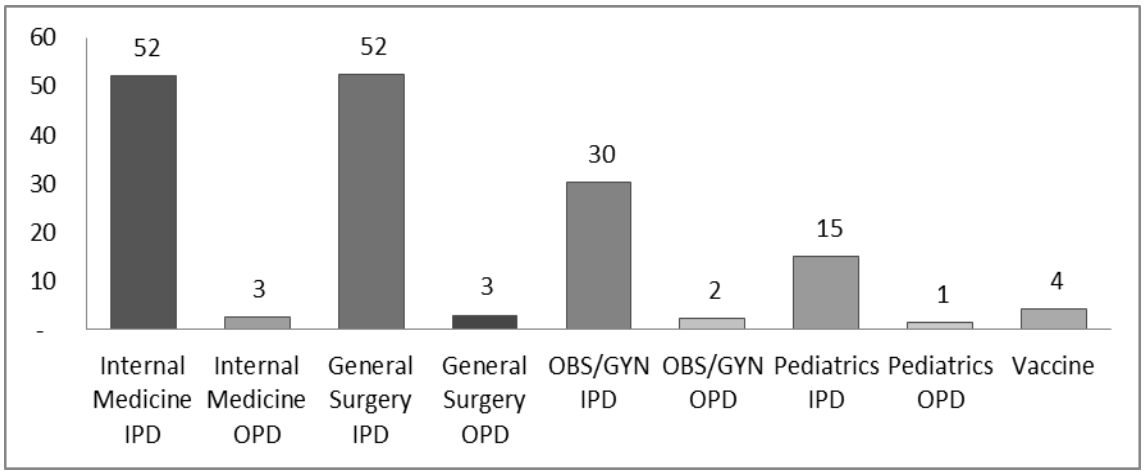
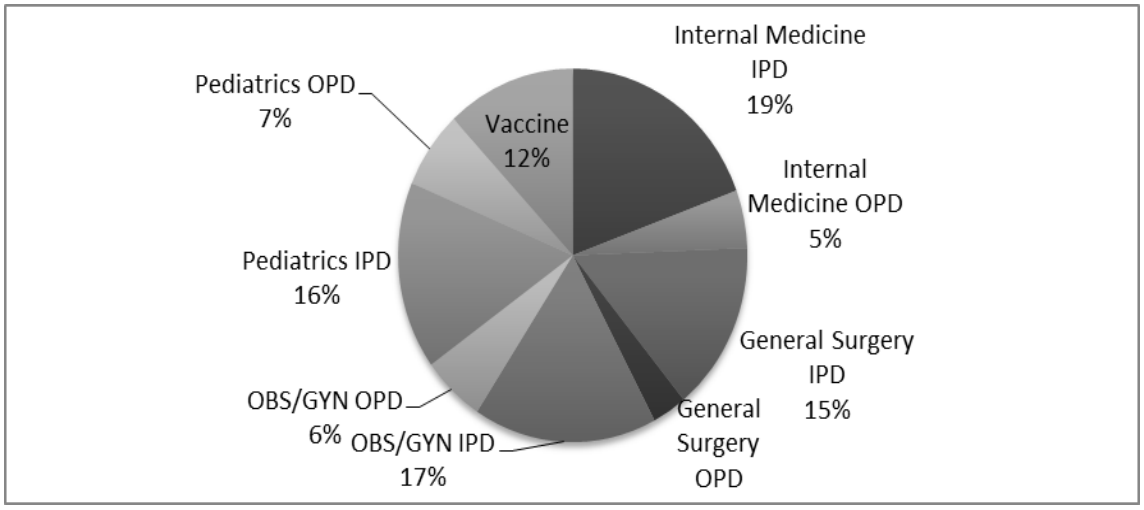


Figure: I8 Total Cost Breakdown by Clinical Department



Urozgan Provincial Hospital:

Urozgan provincial hospital is located in Trinkot city of the Urozgan province. This hospital has 100 beds and is managed by the Hospital Reform Project (HRP) of ministry of public. The data reported are from the March 21, 2011 – March 20, 2012 period.

Table: J1 Overall hospital Statistics

Total Number of Hospital Beds:	75
Total Outpatient Visits:	167,029
Total Inpatient Admissions:	3,265
Total Inpatient Discharges:	3,074
Total Inpatient Deaths:	103
Total Hospitalization Days:	13,456
Bed Occupancy Rate (BOR) (%):	49%
Average Length of Stay (ALOS) (days)	4.2

Table: J2 Hospital Staff breakdown

Staff Breakdown	Number	Ratio of Beds per Staff	Ratio of Occupied Beds per Staff
Total Doctors	15	5.0	2.5
Total Nurses	15	5.0	2.5
Total Midwifes	4	18.8	9.2
Total Technicians	9	8.3	4.1
Total Others	31	2.4	1.2

Figure: J3 Bed Occupancy Rate - Inpatient Departments (%)

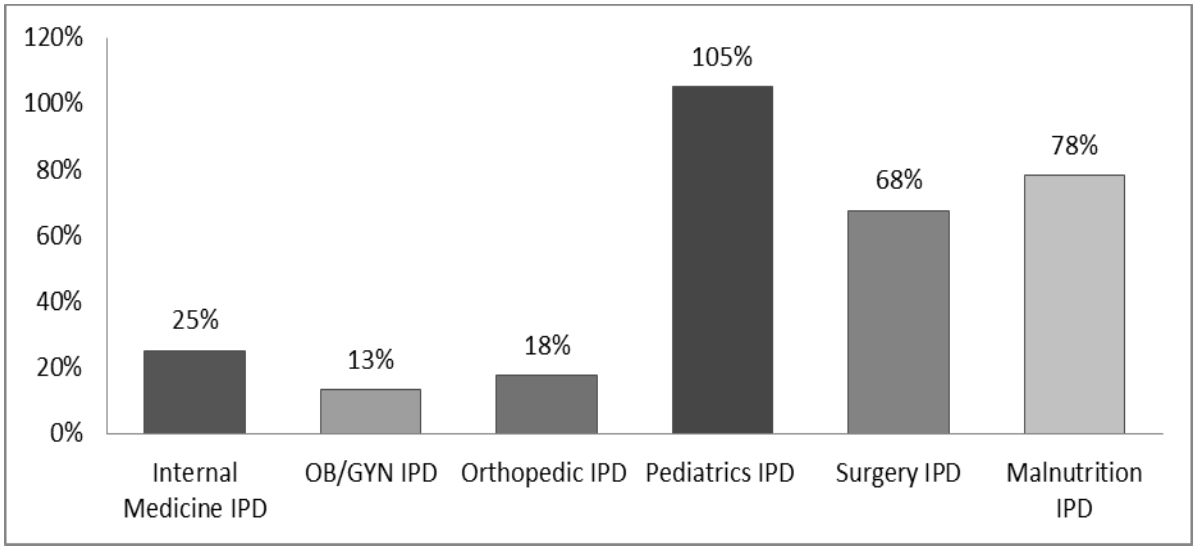


Figure: J4 Average Length of Stay - Inpatient Departments (Days)

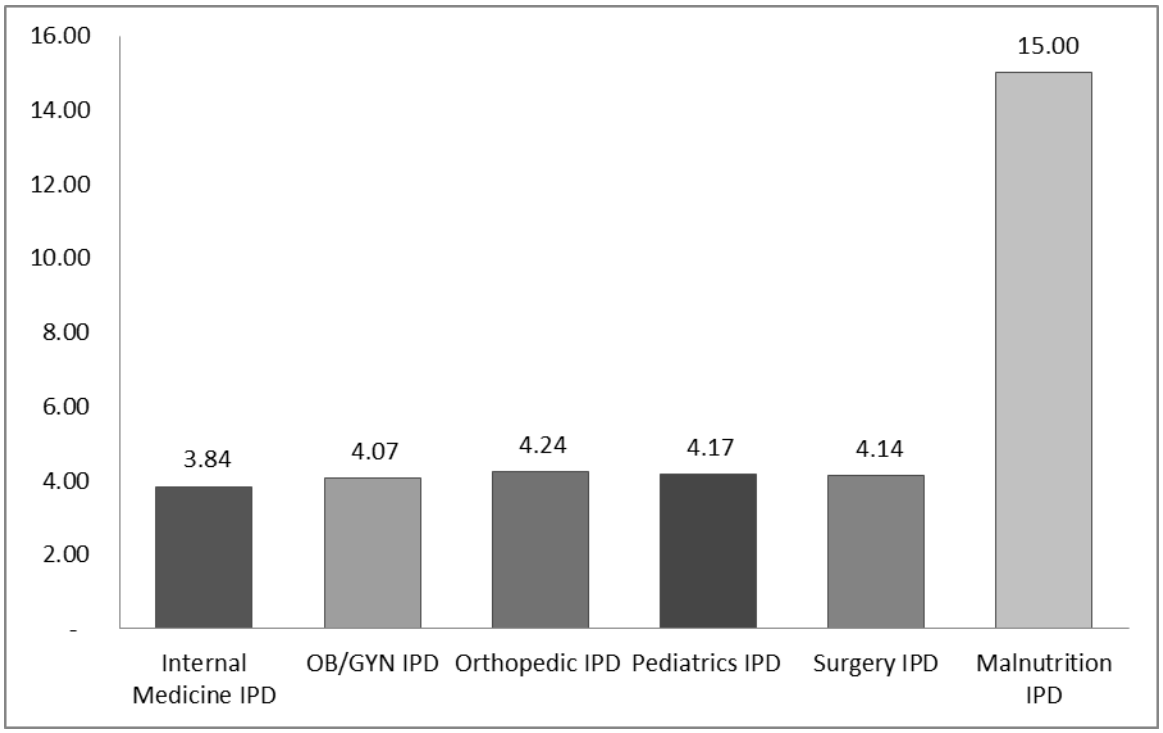


Figure: J5 Hospital cost breakdown by OPD and IPD services

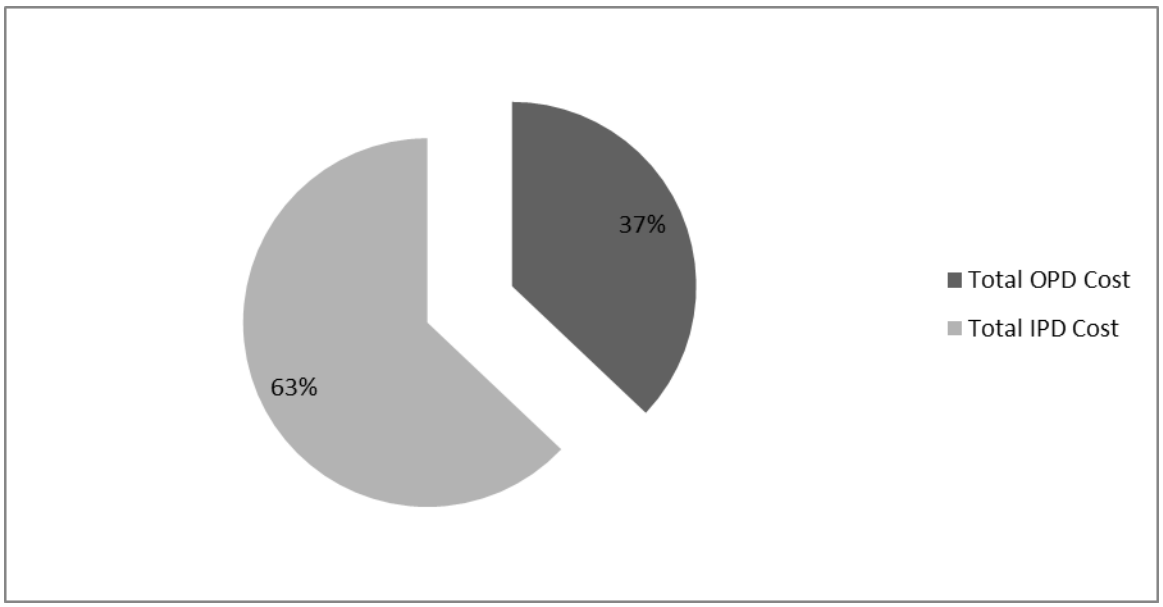


Figure: J6 Hospital cost by cost centers

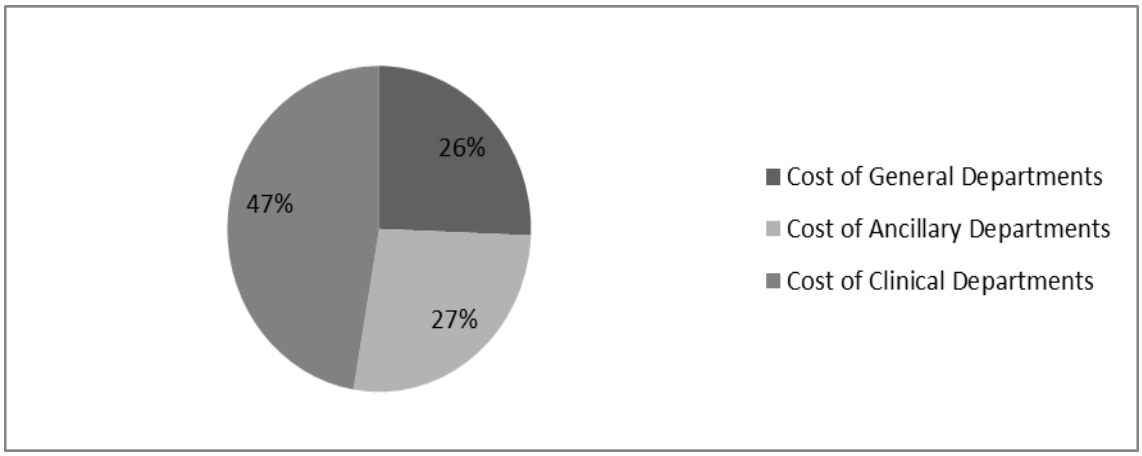


Figure: J7 Cost Per Outpatient Visit or Inpatient Hospitalization Day

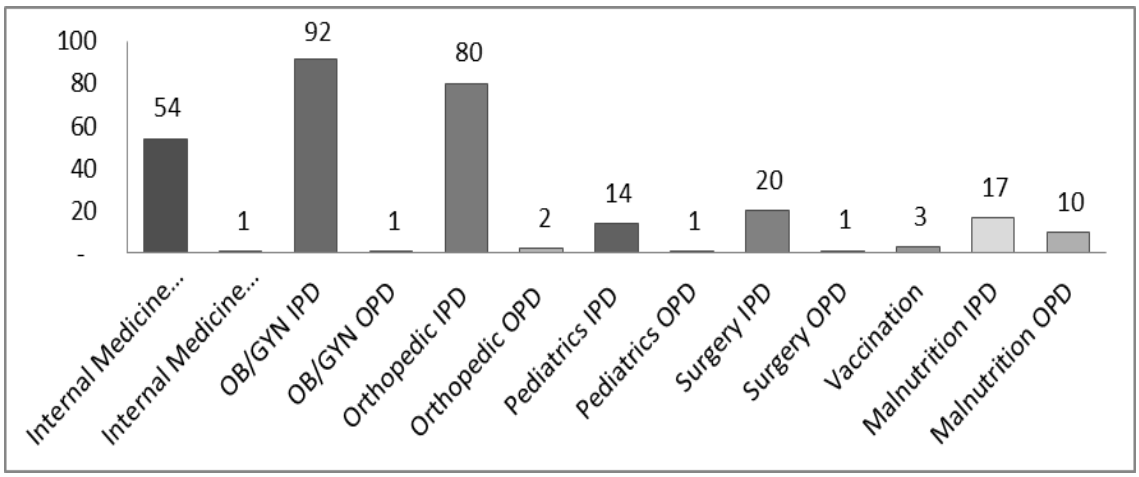
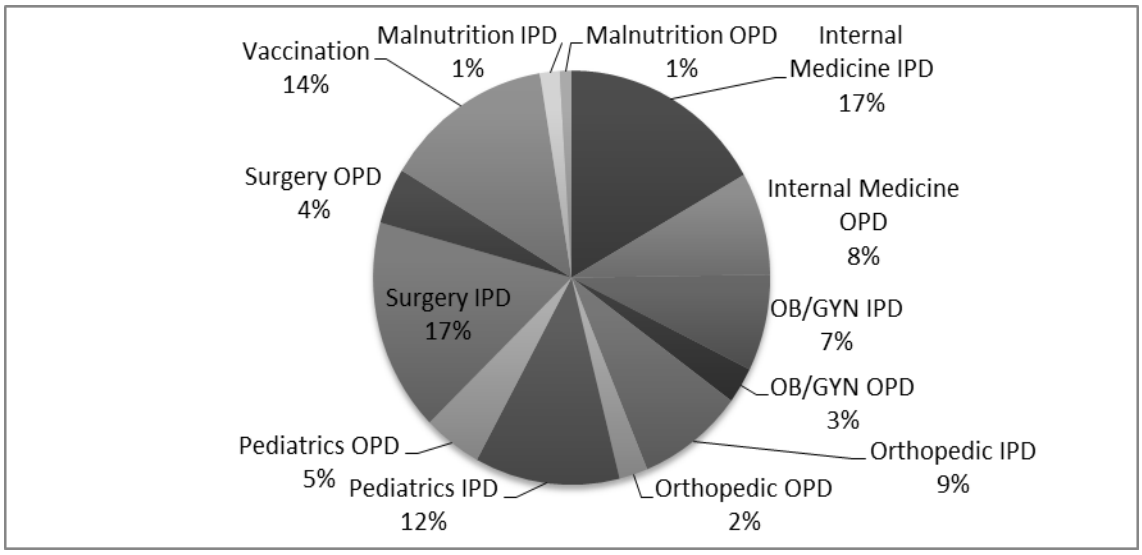


Figure: J8 Total Cost Breakdown by Clinical Department



Appendix B Costing Data Collection Forms

Same forms were used by HEFD for costing of EPHS hospitals

Cost Analysis of EPHS Hospitals				
General Hospital Information March21,2011-March 20,2012(1390)				
No.	**Hospital Information**			**Comments**
1	Name of Hospital:			
A	**Which of the following wards were active during 2012?**	**Yes**	**No**	
2	Internal medicine Inpatient Ward			
3	Internal medicine Outpatient Ward			
4	General Surgery Inpatient Ward			
5	General Surgery Outpatient Ward			
6	Obs/GYN Inpatient Ward			
7	Obs/GYN Outpatient Ward			
8	Children Inpatient Ward			
9	Children Outpatient Ward			
10	Orthopedy Inpatient Ward			
11	Orthopedy Outpatient Ward			
12	Other wards or Departments			
13	Other wards or Departments			
14	Other wards or Departments			
B	**Anciliary departments**	**Yes**	**No**	
15	Laboratory			
16	Radiology			
17	Ultrasound			
18	Blood Bank			
19	Ambulance			
20	Medical store			
21	Other			
22	Other			
23	Other			
24	Other			
C	**Hospital Statistics**			
25	Total Number of Hospital Beds:			
26	Total Inpatient Admissions:			
27	Total Outpatient Visits:			
28	Total Inpatient Discharges:			
29	Total Inpatient Deaths:			
30	Total Hospitatilzation Days:			

Cost Analysis of EPHS Hospitals

Hospital Statistical Information March21,2011-March 20,2012(1390)

No.	Name of Ward / OPD	OUTPATIENT	INPATIENT					Comments
		Visits	Beds	Hospitalization Days	Admissions	Discharges	Deaths	
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

Cost Analysis of EPHS Hospitals				
Information about Revenue/Donations (Except original Budget) for				
No.	Type of Revenue / Help,cash,Mat.	Total Value (USD)	Resource (NGOs,Individuals)	Comments
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				

Cost Analysis of EPHS Hospitals

Total expenditure list of the hospital March21,2011-March 20,2012(1390)

No.	Item	Total expenditure	Department	Comments
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				

Note: All the hospital expenditures in 1390 will be included in this list, including: medicine purchase, consumables, food, instruments, stationary, office equipments, oxeygen and etc

Cost Analysis of EPHS Hospitals

Human Resource Information (Professionals, Non professionals and Other workers) March21,2011-March 20,2012(1390)

No.	Name	Father Name	Grade	Job	Duty Station	Monthly Income						
						Basic salary	Over time	Allowance	Risk allowance	Professional	Cadre	Others
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												

Cost Analysis of EPHS Hospitals

Hospital Pharmacy Information March21,2011-March 20,2012(1390)

No.	Name of the ward	Percentage of distributed medicine		Comments
		Admitted	OPD	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Note: Total OPD and IPD percentage must be 100%.

Cost Analysis of EPHS Hospitals

Laboratory Services Information March21,2011-March 20,2012(1390)

No.	Name of department requested Lab. test	Percentage of the lab test		Comments
		Admitted	OPD	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Note: Total OPD and IPD percentage must be 100%

Cost Analysis of EPHS Hospitals

Laboratory Services Information March21,2011-March 20,2012(1390)

No.	Name of department requested Lab. test	Percentage of the lab test		Comments
		Admitted	OPD	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Note: Total OPD and IPD percentage must be 100%

Cost Analysis of EPHS Hospitals

Radiology Services Information March21,2011-March 20,2012(1390)

No.	Name of departments requested for Radiography	Percentage of the Department		Comments
		Admitted	OPD	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Note: Total OPD and IPD percentage must be 100%.

Cost Analysis of EPHS Hospitals

Blood Bank Services Information March21,2011-March 20,2012(1390)

No.	Name of departments for which blood is distributed	Percentage of Department		Comments
		Admitted	OPD	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Note: Total OPD and IPD percentage must be 100%.

Cost Analysis of EPHS Hospitals

Information regarding Ultrasound services March21,2011-March 20,2012(1390)

No.	Name of departments requested for Ultrasonography	Percentage of the department		Comments
		Admitted	OPD	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Note: Total OPD and IPD percentage must be 100%.

Cost Analysis of EPHS Hospitals

Immunization Information March21,2011-March 20,2012(1390)

Please enter Mass Immunization data for 2012					
	BCG	Measles	OPV	TT	Penta
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					
Total	**0**	**0**	**0**	**0**	**0**

Note: Please add columns if you have any other immunization services.

Cost Analysis of EPHS Hospitals

Information regarding other services provided in hospital March21,2011-March 20,2012(1390)

No.	Name of departments requested for services	Percentage of Department		Comments
		Admitted	OPD	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Please list any additional services on this sheet. If one sheet is not enough, you can add additioinal sheets. The total percentage must be 100%.

Appendix C Regression Results

TE & BOR

. tobit tescore bor, ll(0) ul(1)

```
Tobit regression                                      Number of obs   =        10
                                                      LR chi2(1)      =      0.27
                                                      Prob > chi2     =    0.6029
Log likelihood = -1.5720441                           Pseudo R2       =    0.0793
------------------------------------------------------------------------------
    tescore |      Coef.        Std. Err.       t      P>|t|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
        bor |      .2156763    .418694     0.52    0.619    -.7314754    1.162828
      _cons |      .8687073   .3086994     2.81    0.020     .1703807    1.567034
------------+-----------------------------------------------------------------
     /sigma |   .1452295      .059456            .0107307    .2797284
------------------------------------------------------------------------------
 Obs. summary:         0     left-censored observations
                       4     uncensored observations
                       6      right-censored observations at tescore>=1
```

TE & ALOS

. tobit tescore alos, ll(0) ul(1)

```
Tobit regression                                      Number of obs   =        10
                                                      LR chi2(1)      =      0.51
                                                      Prob > chi2     =    0.4748
Log likelihood = -1.4520115                           Pseudo R2       =    0.1496
```

```
------------------------------------------------------------------------------
   tescore |      Coef.       Std. Err.       t       P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      alos |  -.0595341    .0814432     -0.73    0.483    -.2437713    .1247032
     _cons |   1.203445   .2582961     4.66    0.001     .6191391    1.787752
-------------+----------------------------------------------------------------
    /sigma |   .1375957   .0565953                .0095682    .2656232
------------------------------------------------------------------------------
 Obs. summary:              0    left-censored observations
                            4    uncensored observations
                            6    right-censored observations at tescore>=1
```

TE & Cost/OPD visit

. tobit tescore   costopd, ll(0) ul(1)

```
Tobit regression                                      Number of obs    =       10
                                                      LR chi2(1)       =     0.02
                                                      Prob > chi2      =   0.8797
Log likelihood = -1.6959195                           Pseudo R2        =   0.0067
------------------------------------------------------------------------------
   tescore |      Coef.       Std. Err.       t       P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   costopd |   .0114342    .0760149     0.15    0.884    -.1605234    .1833918
      _cons |   1.001123    .1949255     5.14    0.001     .5601711    1.442075
-------------+----------------------------------------------------------------
    /sigma |   .1478166   .0607344                .010426    .2852073
------------------------------------------------------------------------------
 Obs. summary:              0      left-censored observations
```

4 uncensored observations

6 right-censored observations at tescore>=1

TE & Cost/Bed day

. tobit tescore costbedday, ll(0) ul(1)

Tobit regression Number of obs = 10

LR chi2(1) = 5.75

Prob > chi2 = 0.0165

Log likelihood = 1.165127 Pseudo R2 = 1.6824

---

tescore	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
costbedday	-.0200517	.0098135	-2.04	0.071	-.0422515	.0021481
_cons	1.474296	.2561412	5.76	0.000	.8948647	2.053728
/sigma	.1015501	.0394301			.012353	.1907473

Obs. summary: 0 left-censored observations

4 uncensored observations

6 right-censored observations at tescore>=1

TE & contracting type (Dummy)

. tobit tescore dummyforcontractinout, ll(0) ul(1)

Tobit regression Number of obs = 10

LR chi2(1) = 0.10

Prob > chi2 = 0.7541

Log likelihood = -1.6583176 Pseudo R2 = 0.0287

tescore	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
dummyforco~t	-.0333586	.1057215	-0.32	0.760	-.2725173	.2058001
_cons	1.044583	.0846429	12.34	0.000	.8531078	1.236059
/sigma	.1452172	.0596877			.0101944	.2802401

Obs. summary:		
	0	left-censored observations
	4	uncensored observations
	6	right-censored observations at tescore>=1

BIOGRAPHY

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