Cost and Cost Effectiveness of Public-Private Mix DOTS for Tuberculosis Control: A Case Study of District Chitral, KPK

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CERTIFICATE

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DEDICATION

I dedicate this thesis to my family. I am here because of your love and support.

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ABSTRACT

We assessed the cost and cost effectiveness of public private mix (PPM) directly observed treatment short course (DOTS) for tuberculosis control programs in mountainous district Chitral, Khyber Pakhtunkhwa.

The study compared three strategies for the tuberculosis control under DOTS strategy in Chitral. The strategies for tuberculosis control which were included in the study were public sector, Aga Khan Health Service and Green Star Social Marketing.

We collected cost and effectiveness data for all three strategies. Separate standardized questionnaire and interviews were used to collect providers' costs and a questionnaire were generated to collect patient and their escorts' costs. For that 165 patients and their treatment supporter were interviewed. Societal prospective were used to collect cost data. Successfully treated patients were used as a measure of effectiveness. The important sources of data are hospital expenditure records, finance unit and consultation with responsible staff members at district level and national tuberculosis control program Pakistan. To measure cost effectiveness both average and incremental cost effectiveness ratios were used.

The total cost for public sector program was Rs.8134270, Rs.2543959 was estimated for Aga Khan Health Service (AKHS) and for Green Star Social Marketing (GSSM) it was Rs. 587357. The average cost per successfully treated patient were Rs.13119.8, Rs. 41031.6 and Rs. 13052.4 respectively. The average costs of public facility and GSSM nearly equal and we are unable to conclude which program is cost effective. After adding patients and their escorts costs to the total of public facility the GSSM becomes cost effective compared to public facility. In public facility the number of successfully treated patients were high and per patient cost is lower than the two programs. In term of incremental cost effectiveness ratio AKHS was cost effective strategy than GSSM. The average opportunity cost of patient was Rs.464.84.

Table of Contents

List of Tables

List of Figures

Abbreviations

AKHSP	Aga Khan Health Service Pakistan
ACER	Average Cost Effectiveness Ratio
CIDA	Canadian International Development Agency
EDOH	Executive District Officer Health
FIDELIS	Fund for Innovative DOTS Expansion through Local Initiatives to Stop TB
GOP	Government of Pakistan
GFATM	Global Fund for Aids Tuberculosis and Malaria
GSSM	Green Star Social Marketing
ICER	Incremental Cost Effectiveness Ratio
HIV	Human Immune Deficiency Virus
JPRM	Joint Program Review Mission
MCH	Maternal and Child Health
MDR	Multidrug Resistance
PTP	Provincial Tuberculosis Program
PPP	Public Private Partnership
TB	Tuberculosis
WHO	World Health Organization

Chapter 1

1.1. Introduction

Tuberculosis is a chronic communicable illness generally bring about by bacteria**.** Untreated smear-positive pulmonary tuberculosis patient sending out the bacilli is the key source of infection**.** It mostly spreads by air path when the contagious patient expels droplets having the bacilli. It is also transferred by using of uncooked milk holding Mycobacterium bovis (Bates, 1980).

Tuberculosis is considered as a grave international health issue. It is responsible for poor health amid many people every year. In many countries of the world TB is the main cause of death along with human immune deficiency virus(HIV).In 2014, 9.6 million new TB cases were detected among them 5.4 million were men, 3.2 million were women and 1.0 million were children. There were 1.5 million demise because of TB among them 140,000 were children. TB patients can be cured by timely diagnosis and correct treatment and this deaths number can be reduced significantly. Moreover, the prevalence of TB is high in developing countries. As in case of South Asia the number of tuberculosis are very high as compared to other region (Balabanova et al., 2004).

Tuberculosis is considered as the disease of poor. The relationship between TB and poverty is recognized by [(Macroeconomics, 2001), (Gallup and Sachs, 2001)] and many other studies. These findings disclose that many chronic illnesses mostly found in poor counties are a direct consequence of poverty, caused by inadequate sewage treatment, unsafe drinking water, poor cleanliness or substandard housing. According (Hickey, 2006) there are many determinants of TB significant of them are socioeconomic deprivation, poverty, overcrowding and malnutrition. The prevalence of TB is high among the poor, displaced, homeless drug addicts, elderly malnourished and women. The study in Uganda concluded that lack of knowledge about awareness about TB is the well described hurdle to seeking TB diagnostic and treatment services (Obuku et al., 2012).

According to WHO poverty reduction programs can lower the risk of tuberculosis spread and the risk of progression from infection to disease. It can be also helpful in by improving health services and attachment to recommended treatment.

Similarly, Pakistan is ranked 4th among 27 high burden multidrug resistant countries (Zumla et al., 2015). According to world health organization report 2015 Pakistan is categorised 5th between the top twenty two TB loaded nations and account 2/3rd of the TB burden of the Eastern Mediterranean region of world health organization. A nationwide population-based survey estimated TB prevalence 342/100,000 population and incidence 275/100,000 population. Among the reported 3, 16577 new cases of TB, nine percent were children under the age of fifteen in 2014. According to national TB control Pakistan, 55,000 new TB cases are reported each year in Khyber Pakhtunkhwa. Additionally, district TB control officer reported 756 new TB cases in the district Chitral in 2014 (TB report 2014).

Private sector can play a vital role in diagnosing and treating tuberculosis patients which has been recognized and supported by WHO policy framework encouraging partnership between the public and private health sectors (Strategy and Operations Stop, 2001).

This participation of private sectors in the health sector is called public private mix (PPM). PPM has been used as a successful and effective strategy also has financial benefits in controlling TB in developing countries WHO (2006).

In PPM approach, governments generally supply or subsidize the cost of medicines and diagnostics for patients who are treated by private as well as public sector providers. Such an approach can possibly lessen the direct cost of care for TB patients. Additionally, if all health providers follow suitable diagnostics methods and effective referral systems, the reduction in delays associated with health care seeking could help to decrease the direct and indirect costs confronted by patients. Also, this approach also reaches the poor and encourages equity as it has been argued that it is usually the poorest who use private health service providers. Though, there is incomplete information available on the amount to which PPM reaches the poor.

In developing countries majority of the people live in rural areas and have comparatively poor condition of health in contrast to their urban fellows. Their social principals, preferences and living conditions are different from rural people. The distinguishing feature of rural areas are weaker economy, tough and difficult to entrance land and also availability of services and resources are limited (Strassor & Strassor, 2003). Keeping in view the rural background provision of fair, acceptable, globally accessible, reasonable and quality health care facilities is a pressing task for administration internationally (Bodenheimer, 1969).Moreover, governments all over the world are confronting budget limitations and hence spending on health is worldwide problem for decision builder [(Bodenheimer, 1969), (Zergaw, Mariam, & Ali, 2002)]. Similarly, majority of the people of Chitral lives rural mountainous region where excess to health is the main difficulty. Majority of the people are poor do small business ae engaged with services sector. Also, due to the terrain geographical location the transport cost for the patient is relatively high as compared to plain areas. So there is a need of cost effective strategy which can overcome the difficulty of poor patient and lower the financial burden on health system.

DOTS (directly observed treatment, short-course), is the name given to the tuberculosis control strategy recommended by the World Health Organization. There are five basic fundamentals of DOTS;

a- Political assurance with better and continual funding

b- Case detection through quality-assured bacteriology

c- Standardized treatment, with supervision and patient support

d- An operative drug stock and organisation scheme

e- Impact measurement and monitoring and evaluation system

1.2. Research questions:

1-Is Public Private mix DOTS strategy compared to Public sector DOTS strategy in District Chitral for TB control is cost effective?

2-What are the total costs of Public sector, Aga Khan Health Service and Green Star Social Marketing for giving treatment to tuberculosis patient?

3- What are the total cost of patient and their escorts?

1.3. The Study Objectives:

The study objectives are as follow:

1) To estimate the total costs of public facility for treating tuberculosis patients in Chitral.
2) To estimate the total costs of private programs for treating tuberculosis patients in Chitral.
3) To determine effectiveness of each programs for treating tuberculosis patients.
4) To calculate the patients out of pocket expenses and opportunity cost while attaining TB treatment.
5) To calculate and contrast the cost-effectiveness of the three programs (public facility, Aga Khan Health service and green star social marketing) for treating TB patients.

1.4. Hypothesis:

The hypothesis of this study is summarized as follows:

$H_{0;}$ PPM DOTS is not cost effective intervention for TB treatment in Chitral

$H_{1;}$ PPM DOTS is cost effective intervention for TB treatment in Chitral

1.5. Organization of the Study

The study is comprised of six chapter. Chapter one deals with, introduction, research questions, objectives of the study, hypothesis. Chapter two introduces the description of different alternative tuberculosis programs which provide TB treatment services in the District Chitral. Chapter three provides the brief review of literature and background of the study. Chapter four is about methodology and data. Chapter five describes results and discussion of the study. The last chapter is devoted to conclusion, recommendations and limitations of the study.

Chapter 2

2.1. Description Tuberculosis Programs

In this section we have given the description of National Tuberculosis Program (NTP), provincial tuberculosis program, district tuberculosis control program and we have also discussed the AKHS, and GSSM.

2.1.1. The National Tuberculosis Control Program

Before going to any partnership with other party the NTP needs firmly set DOTS program which have the ability to offer support like technical and logistic that are essential for execution of partnership programs.

The NTP in Pakistan has a huge sum of very competent experts executing the TB programs at countrywide and local level efficiently and achieved hundred percent DOTS coverage at district level and also applauded by WHO. It has also its strong system at district and foundation level.

2.1.1.1 Administration and technical capacity of program

With the help of other organizations and government funds, NTP has reinforce its human resources setting the posts of Finance Officer, Research Coordinator, Sociologist, Technical Officer and National Program Officers. It has also set an organised infrastructure and has improved its ability in chief technical areas like research, finance and information technology and reference laboratories.

Also, the NTP has strong management system as it is demonstrated by its achievement in DOTS extension and also acknowledged at local and global conferences. Its main responsibilities are to manage total programs comprising policy planning, decision making and coordination with ministry of health, line ministers, and provincial TB programs, local and global associates. The NTP also has better financial administration for government and donor aided funds. The main bases of money managed by the finance department are public segment fund, United States Agency for International Development (USAID), Global Fund

for Aids Tuberculosis and Malaria (GFATM), Fund for Innovative DOTS expansion through Local Initiatives to Stop TB (FIDELIS), Canadian International Development Agency (CIDA) and Joint Program Review Mission (JPRM) (Ahmed and Mann, 2006).

Moreover, the main function of the technical unit of NTP is to provide technical ideas to the countrywide program on developmental events. It also gives technical inputs to the provinces and districts by arranging inter provincial and inter district gatherings four times a year. Additionally, it supervise and monitor different programs through twenty five National Program officers employed at regional levels. The program officers are also responsible to coordinate, give technical support and monitor program actions in a group of districts in their area. They also visit designated diagnostic centres randomly and conform the TB DOTS actions.

The NTP has complete and effective recording and reporting system and reports are assembled at district, provincial and at national level. These reports are examined for case notification rates and treatment consequences. A cell is established at national level and with the backing of German leprosy and TB relief association is accountable for compiling and examining. The NTP has a solid research unit and accomplished many studies along with international research institutions and is also responsible in encouraging local study on TB associated subjects.

The NTP has also Reference Laboratories Unit controlled by national program officer reference laboratories. There are a network of laboratories in the country. There is one top laboratory at national level, four provincial laboratories and two at regional level one is in Azad Jammu and Kashmir and the other is in the Northern Areas. The core responsibility of the unit comprise training laboratory technicians, working in diagnostic centres and executing quality assurance mechanisms including the standardization of training, procurements and services. The unit also monitors the standard of other diagnostic centres. The unit also makes connections between diagnostic centres and reference laboratories.

The program gives training and has modules to different kinds of staff like paramedics, doctors, laboratory technicians, supervisors and lady health workers. The program has trainers in the provinces and districts. The program also give education through print media

by printing and distributing materials to provinces, districts and other facilities (Ahmed and Mann, 2006).

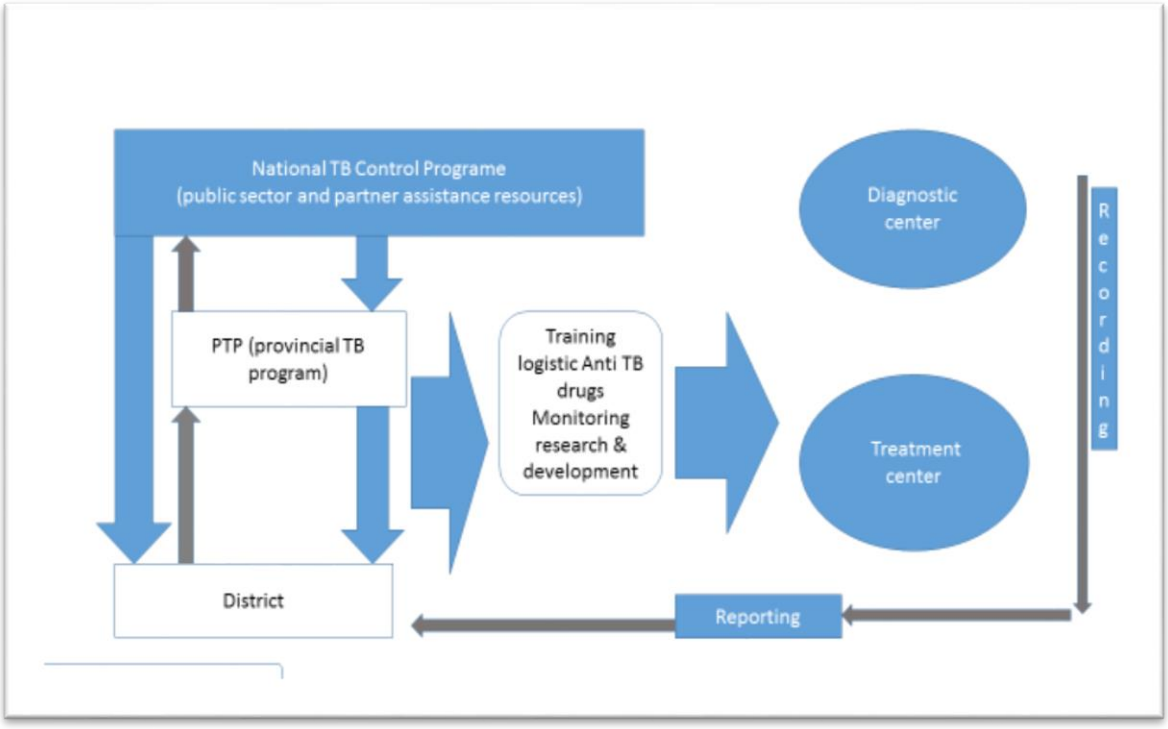
2.1.1.2. National Tuberculosis Program Operational Ability

The NTP runs its operation by defining roles and responsibilities at different level. The table below gives the description.

Roles and responsibilities of the TB control programme		
At National Level	**At Provincial Level**	At District Level
Policy preparation **Rules** **Technical assistance** **Resource generation** **Coordination/ Advocacy** **Monitoring evaluation** **Research and development**	**Planning** **Security funds** **Technical assistance to districts in implementing DOTS** **Monitoring & Supervision**	**Planning and implementing unit of DOTS** **Securing funds** **Management and reporting/ recording** **Guaranteeing public contribution in DOTS execution** **District level supervision**

The procedure via which the NTP delivers technical and monitoring backing to the provincial programmes and district and provides logistic and anti TB drugs to the districts through the PTPs is presented in the next page

Figure 2.1 Support of National TB program in Public Sector



(Ahmed and Mann, 2006)

1.4. TB Control Programmes at Provincial Level

Administratively, Pakistan is demarcated into 4 provinces adding Islamabad Capital Territory, Northern Areas and Federally Administered Tribal Areas. Every province has autonomous health department with preventive and curative systems. The head of provincial TB control program is Provincial Manager and in Sindh it is headed by director.

The important responsibility of provincial programmes is to help districts in the execution of TB DOTS. Its chief responsibility includes the operation of policies and rules also coordinate with the national program and with line departments in the province, ensure supplies and active monitoring.

1.5. District level TB control Program

The TB control program at district level is controlled by executive district health officer and plays important part in TB control by planning and implementing different programmes. They also make linkages with district government. The district TB control team includes Executive District Health Officer, a doctor, a DOTS facilitator and a laboratory expert. However, in KPK District TB officer works as district coordinator. There are two types of facilities which are responsible in the management of TB patients including treatment centres and diagnostic centres. There are 934 diagnostic centres and 4612 treatment centres in Pakistan.

Patients can go treatment centre or diagnostic centre. Moreover, treatment services gives treatment services while diagnostic centres deliver both treatment and diagnostic facilities to the patients also patients my go diagnostic centre directly or be referred from a treatment centre for sputum examination. If the patient is identified as a TB will be sent back to the treatment centre for treatment. The diagnostic centre also evaluates the development of treatment by sputum examination (Ahmed and Mann, 2006).

2.0 Aga Khan Health Services Pakistan and National Tuberculosis Program

Aga Khan Health Services, Pakistan works under Aga Khan Foundation. It is a global NGO functioning in health facilities delivery to the publics in Pakistan. The institute operates several curative and preventive programs. It also operates health centres and community centres all over Pakistan. Its key attention is the northern area. AKHSP was provided a funding in the Global Fund (round 4) to introduction the DOTS plan in their health services. Working under this scheme they have established Diagnostic and Treatment centres.

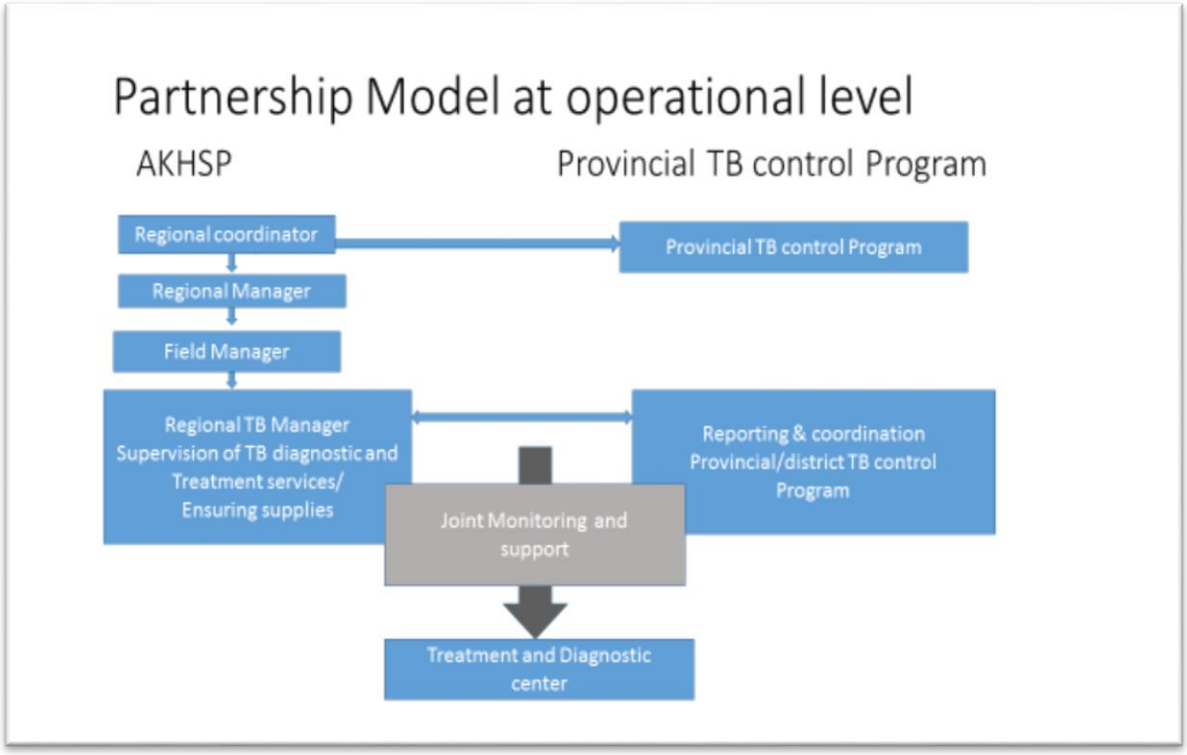


Figure 1.2 Partnership Model at Operation Level

All over Pakistan AKHSP centres deliver TB care under DOTS via a public private partnership. They use electronic TB registers in their facilities. The program is headed by a Regional Coordinator supported by a Field Manager, manages all the actions in the region together with TB control events. The TB Regional Manager is answerable for supervision and monitoring, coordination with TB control programme and reporting from the eighteen centres giving TB services. Each TB centre is accomplished by a doctor (Ahmed and Mann, 2006).

At present, AKHS, P operates 32 health facilities in Chitral, 17 health centres, eight family health centres, four dispensaries and three secondary care facilities. Facilities provide both in-patient services and an extensive community-based outreach program that recruits and trains volunteers to serve as community health workers. AKHS, P efforts serve nearly 60% of the total population of Chitral, estimated at 222,290.

The TB program was incorporated into the ongoing activities of AKHS, P in 1999 in an effort to combat the increasing epidemiological burden of TB in Chitral. AKHS, P began

its initiatives through delivering awareness sessions to communities through CHWs and facility-staff on the importance of early referrals of suspected TB patients for improved diagnosis and follow-up care. In July 2003, AKHS, P Chitral strengthened their ties with the District Health Office-Chitral to expand coverage and quality of district-wide TB control efforts. AKHS, P began working on (DOTS) since 2004.[1]

3.0 Green Star Social Marketing

Population Services International and Social Marketing Pakistan in association with government of Pakistan made green star in Pakistan. They support family planning franchises which are working in rural areas with private clinics and pharmacies. Green star is a partner with NTP. They initiate many initiatives to eliminate TB with the objectives. "to create greater knowledge and provide increased access to high quality TB DOTS information, testing and treatment through a private sector clinic franchise network (Green Star) in five urban areas". Under this partnership they stress on case notification, TB screening through sputum microscopy, TB patient supervision and case management. There is one focal person working in district Chitral. They work in collaboration with the private clinic, laboratories, physicians and district TB program Chitral. The main focus of the GSSM is the lower region of the district where the prevalence of TB high as compared to upper region of the district Chitral. They also work under the DOTS strategy given by WHO. According to their representative awareness session are conducted in different villages to educate the masses about the infectious disease. They also conducted chest camps in diverse public places to identify the infected TB persons. They do diagnostic test and X-ray free of cost from the laboratories.[2]

[1] Health Management Information System Officer AKHS Chitral
[2] Focal person green star social marketing

Chapter 3

3.1. Literature review and Background of the Study

This section comprises a review of the literature related to the study. The key headings contain background of cost effectiveness analysis, cost and its component, literature about PPM DOTS, review of methodologies used by different studies and the last section contain the review of tuberculosis related studies conducted in Pakistan

We know that in an economy resources are limited, they need to be distributed and use in such a way that there over all benefit will be maximum. This is also true for health sector. Economic evaluation is a technique used to assist decision makers how to distribute resources (Briggs et al., 2006) and it is useful method for enhancing policy making by obviously pinpointing suitable substitute (Drummond et al., 2005).

There are three most commonly used methods of economic evaluation namely cost utility study, cost effectiveness and cost benefit analysis. (Drummond et al., 2005). Cost effectiveness study is a compare of the costs and effects of definite health care intervention (Walker, 2002, Shiell et al. 2002). All of these technique calculate both costs and effects of health interventions, where costs are in terms of opportunity costs. Opportunity cost can be explained as "the value of a resource in its most favoured alternative use" (Shiell et al., 2002).

There is one thing common to cost effectiveness analysis, cost utility analysis and cost benefit analysis that is cost are calculated in monetary terms. Each cost has to be classified, computed and valuated. Classification defined as discovering the costs that are pertinent for the intervention of interest. Similarly, costs necessarily be quantified, which means we will count the resources which are used in the intervention. For example the number of visits to a doctor or how many test are done. And, valuation means setting the resources which are in use in monetary term (Drummond et al., 2005). In evaluation studies perspectives which were taken play a key role in incorporation of cost. The perspectives may be societal viewpoint, patient viewpoint and provider viewpoint. However, economist commonly give attention to societal perspective. Because it give complete picture all the

resources used. It estimates the effect of intervention on whole society. While in health care perspective only the resources used by health care sector are included (Organization, 2002).

Jamison et al., (2006) commented that when more costs are included in cost effectiveness study then cost per unit of health effect looks to be higher and intervention will come out to be less cost effective. Whereas, when less costs are included, the cost per unit of health gain will be lower showing that the intervention is highly cost effective actually this is not true.

According to (Shaikh, 2015) due to poor performance of the public sector health care system in Pakistan has created a room for private sector and become part in health service delivery irrespective of its quality, high cost and doubtful ethics and medical practice. Accordingly private sector is a reality and is working to fill the gaps and weaknesses in health care delivery to the poor people of Pakistan. They are of the opinion that there is no check and balance in private sector due to the absence of writ of the government. Further, they concluded that private sector play a very pivotal role both in preventive and curative service delivery regardless of their profit making behaviour. There is an opportunity to involve private sector in the health care system by improving there capacities and by introducing regulation in them.

Now a days both public and private health programs work jointly for giving health services. According to (Wang, 2000) the concept public and private can be defined in different methods. Commonly the common segment incorporates institutions or administrations that are funded by government income and that works underneath state budget or authority. While private sector encompasses those administrations and persons functioning exterior the direct command of the government (Bennett, 1991). Mostly private sector working for profit called private enterprise and others work not for profit that are called non-governmental organizations.

In health sector PPM is the official and legal relationships between the two sectors (Goudge, 1999). This combination can be in different form depending on who pays and who provides health services.

The concept of public private Mix DOTS was emerged in reaction to poor NTP achievement in TB case identification (WHO, 2001). In 2000, the NTP facility could only detect twenty one percent of new sputum smear positive TB cases internationally, which decrease the pace to achieve the international target of TB eradicate as given in Millennium Development Goals. (WHO, 2000a; WHO, 2003a). Similarly a few studies exposed the strength of private sector in developing nations to report a maximum of TB cases (WHO, 2001; Uplekar et al., 2001).

The role of PPM DOTS in high TB burden is appreciable, various studies revealed that the PPM DOTS strategy was possible to expand, (WHO 2003a ;). Further, other study revealed that PPM DOTS can offered great treatment achievement and case identification [(Newellet al., 2004; Kumar et al., 2005; Dewan et al., 2006)]. Moreover, PPM DOTS engaging private physicians has revealed to be cost efficient and enhance equity in access [(WHO, 2004b, Floyd et al., 2006) (Lönnroth et al., 2007)].

The study in Africa by (Sinanovic and Kumaranayake, 2006) examined three PPM models of DOT delivery for diverse mark sets like purely communal, public-private office and public-non-governmental organization association. And found that increased community participation and accessibility of cure at workforce were extra reasonable to the non-private segment. The study further revealed public-private models of delivery are more effective than the entirely non private model.

(Yimer et al., 2011) suggested that by expanding PPM DOTS and enhancing the excellence of TB care at both state and non-governmental services can lessens treatment postponement and rises TB case notification.

(Balasubramanian et al., 2006) exposed that in rural areas of south India the rural public-private partnership model were efficient and no need of any extra workforce or any economic motivations.

(Pantoja et al., 2009b) concluded that application of PPM on big scale in an urban background can be cost efficient and can improve treatment outcome and substantially reduce costs incurred by TB patients.

(Lei et al., 2015) summarized that PPM is promising strategy to strengthen global TB care and control, but is affected by contextual characteristics in different areas. The scaling-up of PPM should contain essential commonalities, particularly substantial financial support and continues material input. Additionally, it is important to improve program governance and training for the health providers involved, through integrated collaborative mechanisms.

(Weiss et al., 2008) concluded that partnerships, to be successful, require work, transparency, and a shared set of operating principles among the partners. It is often difficult to be a good partner. They further revealed that Public-private partnerships are increasingly seen as playing a critical role in improving the performance of health systems worldwide, by bringing together the best characteristics of the public and private sectors to improve efficiency, quality, innovation, and health impact of both private and public systems. Partnerships can be an effective force toward achieving these results, they are not a magic solution to the many problems that now face health systems in Asia and around the world.

(Malmborg et al., 2011) concluded that public-private mix PPM has improved case detection and treatment outcomes among patients seeking care with private providers. Evidence on reducing patient costs is inconclusive, there is scope for increasing equity in access to care by systematically engaging private providers who are the primary agents for poor people seeking health care.

There are different methodologies used by different studies on cost effectiveness analysis on TB control. The study in India assesses effectiveness and cost of PPM for tuberculosis elimination when it is applied on huge scale. They used average cost effectiveness ratio as a measure of cost effectiveness. They used successfully treated patient as a measure of effectiveness. Societal view point is used to collect cost data (Pantoja et al., 2009a).

Another study in India compare PPM DOTS with public sector DOTS and found that PPM DOTS as cost effective strategy. They used both average and incremental cost effectiveness ratios as a measure of cost effectiveness. They measured cost data from societal prospective. Structured questionnaire were used to collect patient and their attendant costs.

Successfully completed treatment number is used as a measure of effectiveness (Floyd et al., 2006).

(Hunchangsith et al., 2012) in Thailand used decision analytic modelling to assess different interventions of tuberculosis control programs. They measured health outcomes as disability adjusted life years. They estimated costs taking health care perspective, using ingredient approach. They are of the opinion that due to large uncertainty around health gain they are doubtful whether DOT strategies are more cost effective than self-administered treatment. However, they argue that family member DOT is cost effective strategy.

Another study in Tanzania calculated cost and cost effectiveness of health facility and community based DOT and found that community based DOT is cheaper and more cost efficient in contrast to health facility based DOT. The study valued costs from societal perspective. And patients and supervisor's cost were assessed through structured questionnaire (Wandwalo et al., 2005).

Similarly, cost effectiveness study in Nepal found that community based strategy is more cost effective than family member strategy. They used structured and semi-structured questionnaires to collect cost data (Mirzoev et al., 2008).

In another study in Syria and Egypt cost effectiveness is measured from the societal perspective. Costs were collected using step-down method. Facility based survey and stratified questionnaire is used to measure patient costs. Moreover, cure rate is considered as the measure of effectiveness. Cost effectiveness is measured by dividing total incremental cost by cases cured (Vassall et al., 2002).

The study in Russia and Estonia evaluated the multi drug resistant tuberculosis. They compared the cohort of patient registered according to the guidelines of WHO with previous year patient. They calculated costs from a health system perspective and cures, death averted and disability adjusted life years were used as measure of outcomes and concluded treatment of patient with multidrug resistant can be cost effective but requires further investment (Floyd et al., 2012).

A descriptive and case control study was conducted in Sahiwal district in Pakistan. The study focuses on socio-demographic factors which are accountable for the prevalence of tuberculosis. They are of the opinion that majority of the patient are between the ages of fifteen to forty five year. Further, the study revealed that poverty, congested, bad living condition, lack of proper food, use of raw milk, smoking, addiction, poor housing, absence of health education are prominent reasons in the spread of tuberculosis (Khan et al., 2007).

A cross sectional study in Karachi Nazimabad analysed the cost of DOTS borne by TB patient. The study found that majority of the patient were female and poor and the cost of treatment especially travel and time has detrimental effect on poor families (Habib and Baig, 2006).

A randomised control trial in Pakistan analysed the outcomes of different DOTS strategies and found that they give similar treatment outcomes (Khan and Walley, 2001).

(Khan et al., 2002) conducted cost effectiveness analysis with clinical trial study in three cities of Pakistan. They studied three interventions namely, family member DOTS, health workers DOTS and DOTS without direct observation. Further, the study gathered data on costs of health services and patients. They used standardized questionnaire to collect patient costs data. The study used cured patient as measure of effectiveness and the results of the study calculated in term of average cost per cured patients. They used standardized questionnaire to collect patient costs data. The study used cured patient as measure of effectiveness and the results of the study calculated in term of average cost per cured patients. The study concluded that among the three interventions health centred based health workers was least cost effective and self-administered group most cost effective.

The studies revealed above give an intuition into the impotence to do an economic evaluation for tuberculosis patient in less developed region where 42% of the people live below the poverty line.[3]

Additionally, the review of studies establishes that there little work was conducted on the cost effectiveness of public private mix programs for tuberculosis programs in case of

[3] Aga Khan Rural Support Program base line survey 2001

Pakistan. The emphasis of majority of the work conducted for Pakistan has been on socio-demographic and cultural factors, other DOTS strategies which have effect on TB disease. Therefore, this study is an effort to bridge this gab.

Chapter 4

4.1. Methodology and Data

This chapter presents the methodology used in the study. These include the overview of the study area, the perspective of the study, time horizon and study population, components of costs, outcomes, sources of data and its measurement and the measure of cost effectiveness.

4.1.1. **Overview of Study Area**

The study was based on a mountainous district Chitral located in the Northern part of Khyber Pakhtunkhwa, Pakistan between 35° 12' – 36° 50' N Latitude and 71o 2' – 73° 53' E Longitude covering an area of 14,850 km^2. The elevation of Chitral varies from 1,200 m in Arandu to 7,780 m at Tirich Mir. It is a remote and isolated district, borders with Afghanistan and the province of Gilgit Baltistan. It has population of 414000[4]. Chitral is the biggest district of Khyber Pakhtunkhwa province having 20 % of the land mass of the province. Administratively Chitral is divided into two tehsils i.e. Tehsil Chitral and Tehsil Mastuj. The district is divided into 24 Union councils which have been divided into 460 revenue villages. Most of the area lies above 1800 meters and settled farming communities exist at altitudes up to 3,200 meters. The climate is extreme. Residents live in widely scattered and isolated villages ranging from 20 to 500 households. Due to harsh weather conditions and difficult terrain, many of the villages are difficult to reach, especially during the winter months. Agriculture is the main source of livelihood while significant portion of the population are involved in business and service sector. Chitral is famous for its rich culture and ecological wealth and attracts large number of tourists every year. Chitral Gol National Park is one of the famous tourist spots in the district.

[4] District Government estimation of District Population

The annual growth rate is estimated at 2.4%, putting increased pressure on the fragile economy of the area and health status of the population. The literacy rate for adult male is 40.3% and female is 22%. (Census Report, 1998).

Figure 2.1 *Map of Chitral*

4.1.2. Time Duration and Population of the Study

The thesis have involved all kind of tuberculosis except multidrug resistant TB patients of ages one year to hundred years which were registered in 2010 to 2015. One year period was taken for cost data collection.

4.1.3. Perspectives of the study

The study adopted societal perspective. Because it is more comprehensive and include both provider and patient costs. It is also suggested and used in many cost effectiveness studies [(Floyd et al., 2006), (Garber and Phelps, 1997), (Organization, 2002)].

4.1.4. Collection and Source of Cost Data

This study were collected cost data for providers and the patients. Cost data were collected in 2015 for one year in Pakistani rupees. Costing was undertaken retrospectively. The data comprised:

4.1.4.1. Provider Cost

The study included all costs of providers and patients. Provider's costs will be categorized into administration costs, training costs, medicines costs, transport costs, staff salaries, and utilities. For each programs, the average of these categories was calculated and aggregated together to obtain total cost. Wherever possible, ingredient approach of costing was used. In ingredient approach amounts of resources were multiplied by their particular prices to find total cost [(Sinanovic and Kumaranayake, 2006), (Drummond et al., 2005), (Russell et al., 1996)].Moreover, standardized questionnaire and interviews were used for collection provider costs data (WHO 2002).

The major sources of cost data were hospital expenditure record, finance unit and consultation with responsible staff members. Some laboratory equipment and chemicals prices were taken from national TB control program Islamabad.

4.1.4.2. Patient Cost

The study included patient costs in term of travel and transportation, food and lodging costs and opportunity cost (Prado et al., 2011).

4.1.4.3 Calculation of Patients Costs

Patient costs were divided into direct costs and indirect cost. Direct costs is the costs experienced by patients and their escorts while their visit to the TB treatment centre which include treatment, medicines and travel charges. While indirect cost is the opportunity costs include time lost due the participation in the scheme.

A questionnaire was developed and used to collect patients' costs in which we asked about costs on transportation, time lost due to visit treatment centre, food and lodging costs, personal income, number of visits and employment status etc. To collect these information, interview was conducted when the patient or their treatment supporter were at treatment facility for collection of drugs, medical examination or giving sputum test in the intensive or in continuation phase. For children or female patients who are reluctant or unable to give information, separate interview were undertaken from their male companions. Only those patients are interviewed who have completed their intensive phase (two or three month) of treatment. Initial diagnostic costs for patient is not included because it takes time to detect TB in some patient in early stage and also during the interviewing it was observed that it is difficult for the patients to remember previous diagnostic costs. We calculated transport cost of patient by multiplying number of each visits which TB patient or their escorts made during their treatment for disease with total expenses on travelling in each visit. To calculate out of pocket payment, transport cost and food and lodging casts were added and to calculate total patients cost, opportunity costs and out of pocket payments were added. The cost of medicines were not included as TB medicines are given free of cost in all three facilities.

4.1.4.3 Calculation of Opportunity Cost

The basic and concealed notion used in cost measurement of a disease is the opportunity cost which is the value of forgone resources due to bad health, which may be used in different way (Segel, 2006).

Indirect cost is the cost of productivity loss due to ailment which in the form of either mortality or morbidity. In this study indirect costs is the productivity loss due to participation in the treatment scheme and value of days lost be by travelling and waiting to

attain treatment. This study used human capital approach to value productivity loss which value a human being equal to its incomes (Cooper and Rice, 1976, Segel, 2006). To calculate productivity loss this approach multiplies days lost due to ailment with wage rate i.e.

$$Indirect\ costs\ due\ to\ ailment = days\ lost\ due\ to\ ailment\ \times wage\ rate$$

First of all, for calculating days lost we asked patients and their escorts and recorded as days lost.

Secondly, wage rate is needed to value time lost. In case of our data some patients and their escorts are working and can be valued according to their wage rate. For not working individuals we have approximate a wage rate (Tarricone, 2006, Cooper and Rice, 1976). In our data patients and their escorts have different working status. Like employed, unemployed, house wives, students, elderly. To value these working status we used previous similar kind of study estimates (Satti and Khalid).

4.1.5. Types of costs

Types and scope of costs depend on the perspective that a cost effectiveness analysis is taking. A provider perspective will only consider costs that are borne by the provider or health facility. A wider view of costs takes into account a societal cost in which case the analysis values all costs incurred by patients, provider and the society. In particular societal perspective considers the following costs;

4.1.5.1. Cost incurred by health facility

The costs of health programs include administration costs, training costs, medicines costs, transport costs, staff salaries and utilities.

4.1.5.2. Costs incurred by patient

These include transport costs to the patient, food costs, and opportunity cost of time lost due to illness, cost of user fees such as consultation, diagnostic, hospitalization and any other fees a patient pays to access health care.

4.1.6. Measurement of costs

Perspective of economic evaluation informs the scope of costs that have to be measured for an intervention. The most relevant are direct costs. These costs are valued at market prices. Essentially, valuing costs at market prices reflects the opportunity cost of using the input (Drummond *et al.* 2005). For example, laboratory personnel time can be measured by their remuneration package. Other direct costs such as diagnostic materials can be obtained from the major supplier.

On the other hand, capital costs are valued slightly different. Capital costs do not only reflect opportunity cost of tying resources to equipment but also returns for the investment. As such, the measurement incorporates interest rates reflecting returns from an investment. In addition, as the capital item is being used the value decreases since the capital item wears off, thus the cost measurement also includes depreciation. To capture this, the capital item will be annualize at a given interest rate and an annual cost of equipment will be determine (WHO 2002).

4.1.7. Ingredient approach to costing

The guidelines for cost and cost effectiveness analysis for tuberculosis control of WHO proposed ingredient approach to collect cost data. In this method the following steps are followed to collect cost data. The stages are given below:

1- In the initial stage the important resources which are in use are identified

2- In the second stage the resources which are identified will be quantified

3- The final stage involved the valuation of the resources giving them unit costs or price. Then, these costs are accumulated to obtain total costs.

$$Cost\ of\ A = Number\ of\ units\ of\ A \times Unit\ cost\ of\ A$$

4.1.8 Allocation of shared costs

Shared costs refer to those costs used by different programs in an organization. A staff member may be engaged in different interventions. For example, a lab technician may be involved in carrying out malaria tests, TB tests etc. In such cases, it becomes necessary to measure their time for the particular intervention under investigation, which in this study would be tuberculosis. The best criterion to assess time dedicated to an intervention is to actually record time personnel spend working on TB tests and determine the percentage of time dedicated to the intervention. Interviews with staff members involved also provide a reliable estimate.

Shared costs also include capital items, which are used for other methods. Some capital items are allocated directly to cost centres while others use percentage of staff time dedicated to the intervention.

4.1.8 Effectiveness and its measurement

Economic evaluation deals with ‘inputs’ as well as ‘outputs’, often termed as ‘costs’ and ‘effects’(Drummond et al. 1997).The ‘effects’ measure the effectiveness of interventions through various outcome measures. It is important that the outcome measures used for economic evaluation be related to the programme objectives (Stephanie and James 2010). There are many standard outcomes WHO have given to look the performance of any TB control program. We used the number of cases successfully treated as measure of effectiveness. These outcomes were used by many latest cost effectiveness studies associated with TB control strategies. In our study the important source for effectiveness data was TB 03 register which is available at each TB program offices at district level.

Tuberculosis treatment outcomes are the main indicators for monitoring the progress (success and failure) of TB DOTS programs all over the world. Following are the various treatment TB outcomes:

4.1.6.1. Cured:

A sputum smear positive patient who was sputum smear positive at the time of diagnosis and finished 8 months of treatment and is sputum smear-negative at the end of 7th month of treatment and on at least one previous occasion is considered as cured.

4.1.6.2. Treatment completed:

Any initially sputum smear positive patient who has completed the eight month treatment and had negative smears at the end of intensive phase(two or three months), but with no sputum examination at the end of treatment.

4.1.6.3. Treatment Failed:

Smear positive patients who are sputum smear positive at 5^{th} months or after wards or show positive smear throughout their treatment is considered as treatment failure.

4.1.6.4. Died:

Any patient who dies due to any reason during treatment is considered as died.

4.1.6.5. Defaulter:

A patient who at any time after registration had not collected drugs for consecutive two months or more.

4.1.6.6. Transferred out:

A patients transferred from one register to another TB register.

4.1.6.7. Treatment Success rate

It is defined as the proportion of new sputum positive tuberculosis patient registered under DOTS that successfully completed treatment with or without sign of bacterial cure (Cured and Treatment completed) and is a component of treatment outcome. The higher the TSR, the better the treatment outcome. High incidences of failure, death, and default depict poor treatment outcome (Nwene, 2014).

4.1.7. Cost effectiveness study

Cost effectiveness study is an economic instrument where inputs are calculated in monetary terms and outcomes in natural units (Drummond *et al.* 2005).

To assess whether a new program is cost effective, its costs and consequences required to be contrast with the costs and health consequences of related alternative strategy. The result of cost effectiveness is often calculated in terms of average and incremental cost effectiveness ratios (ICER) (Shiell et al., 2002). Average cost effectiveness ratio (ACER) is obtained by dividing total cost of a program to its total effects. Moreover, The ICER indicates the association between the change in costs and the change in health consequences amid the treatment substitutes underneath study. (Gray et al, 2011 Henderson 2007). According to the formula;

Formula

ICER=additional costs÷ additional benefits in natural units

$$ICER = \Delta C \div \Delta E$$

Where ΔC is the mean costs a ΔE is the mean effects.

We divided the total provider (public, AKHSP, Green Star social marketing) cost to total number of patient successfully treated to get Average cost effectiveness ratio and divided the change in costs and change in consequences (successfully treatment completed) to obtain incremental cost effectiveness ratio.

Average cost effectiveness ratio is calculated by dividing total costs to total outcomes.

4.2. Ethical Considerations

Ethical approval was taken from Department of Health Economics (PIDE). Similarly, discussion was held at district level for approval of study with District TB control officer in government sector and representatives of AKHS and Green Star Social Marketing. Also, patient and treatment supporter were asked for their willing to participate in the interview and their signature was taken during the interview.

Chapter 5

Results and Discussion

By applying the methodology explained in previous chapter the findings of the study are offered to response the research question. The chapter divided into four sections. First section gives general description of TB registered in each program. Second section tells us about the results of the outcomes in different programs. Third section discusses the programs costs, patients and treatment supporters' costs and cost effectiveness results. Last section provide the summary of the results.

The results was based on the patients record from 2010 to 2015.The results of the table 5.1 shows that the total 4270 TB patients registered with the three program in the district. Among them nine percent of the TB patients in the district were aged between five or less than five years. Similarly, 15.2 percent TB patients were aged between six to fifteen years. Further, about half of the patients (45.0 %) in the district were aged between sixteen and forty five years. And about more than 30 percent patients were forty six or above age.

Table 5.1: Characteristics of TB patients in each program (% of total)

Age Groups	Public Facility	AKHS	GSSM	All facilities
5 or less	10.20	0.30	0.60	**9.00**
6-15	16.70	3.70	2.80	**15.20**
16-45	44.70	47.40	46.60	**45.00**
46-60	17.40	26.60	32.60	**18.70**
61 or above	11.00	22.00	17.40	**12.10**
Gender				
Male	72.50	41.30	33.70	**68.50**
Female	27.50	58.70	66.30	**31.50**
Type				
Pulmonary	49.50	70.60	50.00	**51.20**
Extra- Pulmonary	50.50	29.40	50.00	**48.80**
Category				
CAT-I	98.80	98.80	97.80	**98.70**
CAT-II	1.20	1.20	2.20	**1.30**
Total	**3764(88.1)**	**328(7.7)**	**178(4.2)**	**4270**

The table further elucidates that the number of male TB patients is higher than the female TB patients in the district. The number of male TB patients registered with public facility is also high. While in AKHS and GSSM the number of female TB patients is high in caparison to male TB patients. Similarly, the number of female TB patients registered with GSSM is high as compared to AKHS.

Moreover, more than half of the TB patients registered with in the district with different health facilities were pulmonary TB. Within the facilities AKHS has notified highest percentage of pulmonary TB patients as compared to public facility and GSSM. While more than half TB patients in public facility were extra pulmonary. Also, less than two percent of the TB patients were category II (previous treatment for more than four weeks in the past, and found sputum smear positive pulmonary tuberculosis) patients in the district and majority of them were category I (new cases of smear positive pulmonary tuberculosis or seriously ill extra-pulmonary tuberculosis) patients.

Table 5.2: Treatment outcomes in each facility (% of total)

Outcomes	Public Facility	AKHS	GSSM	All facilities
Died	2.00	1.00	0.60	1.80(75)
Transferred out	0.90	0.00	1.20	0.80(34)
Treatment Failure	0.40	0.30	0.00	0.40(17)
Cured	21.80	39.30	23.30	23.20(953)
Treatment Completed	74.00	59.40	75.00	72.90(2990)
Defaulted	0.90	0.00	0.00	0.80(32)
Total	**3616**	**313**	**172**	**4101**

The table 5.2 explains about 2 patients die due TB in the district and the number of death is high in public facility as compared to other facilities. And, less than one percent TB patients were transferred to other treatment facilities. Also, less than one percent patients reported from each facilities in the district as treatment failed. Similarly, less than one percent patients are reported as defaulted.

Lastly, the table clarifies that nearly a quarter TB patients considered as cured while about three quarters TB patients declared as treatment completed from different health facilities in the district. The TB patients who declared as cured as an outcome in AKHS is higher

than in caparison to public facility and GSSM. In GSSM the number of cured TB patients is higher than public facility. Further, the number of treatment completed TB patients were three quarters in GSSM and near to three quarters in public facility and around three fifth TB patients reported in AKHS as treatment completed which is less than the other two programs.

Table 5.3: Outcomes in public facility by different age group (% of total)

Outcomes	5 or less	6-15	16-45	46-60	61 or above	Total
Died	4.20	8.50	16.90	26.80	43.70	71
Transferred out	15.60	0.00	59.40	12.50	12.50	32
Treatment failure	0.00	0.00	62.50	12.50	25.00	16
Cured	0.40	5.30	59.70	24.20	10.40	790
Treatment completed	13.30	20.60	40.60	15.10	10.40	2675
Defaulted	0.00	15.60	43.80	21.90	18.80	32

The table 5.3 depicts that more than 43 percent of TB patients died in public facility were above the age of sixty one and about more than one quarter TB patients died between the age of forty six and sixty. The dead of infant TB patients in public facility were less than five percent.

In public facility the number of transferred out TB patients whose age were between sixteen to forty five were 60 percent and more than 15 percent transferred out TB patients were infant. And, more than 60 percent TB who declared as treatment failed were between the age of sixteen to forty five and a quarter treatment failed TB patients were above sixty one years. Similarly, nearly 60 percent of TB patients reported cured in public facility were between the ages of sixteen and forty five and about 25 percent cured TB patients were between the ages of forty six and sixty. Less than 15 percent TB patients recorded as treatment completed in public facility were infant. More than 20 percent were between the ages of six to fifteen. More than 40 percent of the TB patients were between the age of sixteen and forty five also more than 15 percent patients were between the age of forty six and sixty. And, more than 10 percent TB patients declared as treatment completed in public facility were above the age of sixty one.

In public facility no infant TB patient was declared as defaulted. More than 40 three percent defaulted TB patients were aged between sixteen and forty five. Similarly, more than 18 percent TB patients reported as defaulted were above the age of sixty one.

Table 5.4: Outcomes in AKHS by different age group (% of total)

Outcomes	5 or less	6-15	16-45	46-60	61 or above	Total
Died	0.00	0.00	33.30	66.70	0.00	3
Treatment failure	0.00	0.00	100.00	0.00	0.00	1
Cured	0.80	2.40	57.70	17.10	22.00	123
Treatment completed	0.00	4.80	40.90	31.20	23.10	186

The table 5.4 shows that in AKHS more than 66 percent TB patients reported as died were aged between forty six and sixty. More than 57 percent TB patients declared as cured in AKHS were aged between sixteen and forty five. 22 percent of the cured TB patients were above the age of sixty one. At least 16 percent of them were aged between forty six and sixty.

Similarly, more than 40 percent TB patients completed their treatment in AKHS were aged between sixteen and forty five. And more than 31 percent patients considered as treatment completed were between the age of forty six and sixty and 23 percent of them were above the age of sixty one. There was no infant TB patients reported as treatment completed in AKHS.

Table 5.5: Outcomes in GSSM by different age group (% of total)

Outcomes	5 or less	6-15	16-45	46-60	61 or above	Total
Died	0.00	0.00	0.00	0.00	100.00	1
Transferred out	0.00	0.00	0.00	0.00	100.00	2
Cured	0.00	5.00	52.50	22.50	20.00	40
Treatment completed	0.00	2.30	46.50	36.40	14.70	29

The results of table 5.5 shows that in GSSM half of the cured TB patients were aged between sixteen and forty five. More than 22 percent cured TB patients were aged between

forty six and sixty. And 20 percent were above sixty one age. Moreover, above 46 percent TB patients notified as treatment completed were aged between sixteen and forty five. Similarly, more than 36 percent were aged between forty six and sixty.

Table 5.6: Outcomes in each facilities with respect to Gender (% of total)

Outcomes	Public Facility		AKHS		GSSM	
	Male	Female	Male	Female	Male	Female
Died	2.30	1.00	1.60	0.50	0.00	0.90
Transferred out	1.10	0.30	0.00	0.00	3.50	0.00
Treatment Failure	0.50	0.40	0.00	0.50	0.00	0.00
Cured	21.50	22.80	42.60	37.20	24.60	22.60
Treatment Completed	73.80	74.60	55.70	61.80	71.90	76.50
Defaulted	0.80	1.00	0.00	0.00	0.00	0.00
Total	**2606**	**1010**	**122**	**191**	**57**	**115**

The table 5.6 shows that in public facility and AKHS the number of dead of male TB patients were higher than female TB patients. As in GSSM the situation is opposite where the number of dead of female TB patients is higher compared to male TB patients. The table also depicts that there were zero TB patients reported as transferred out in AKHS while in public facility and GSSM the number of male transferred out TB patients were higher than female TB patients. Additionally, there was no TB patient reported as treatment failed in GSSM while in public facility and AKHS the number of male TB patients reported as treatment failed were higher than female TB patients. Also, there was no TB patients reported as defaulted in both AKHS and GSSM while in public facility the number of female TB patients reported as defaulted were higher than male patients.

Additionally, in public facility there were more female TB patients reported as cured than male TB patients while in AKHS and GSSM the number of male TB patients considered as cured were higher than female patients. The number of male and female TB patients reported as cured in AKHS were higher in comparison to public facility and GSSM. In all three facilities the number of treatment completed female TB patients were high compared

to male TB patients. In AKHS the number of treatment completed female and male TB patients were lower than other two facilities.

Tab 5.7. Cost Items in Public facility, AKHS, GSSM (in 2015 Rs.)			
Cost Items	**Public Facility**	**AKHS**	**GSSM**
Salaries	77.0	23.6	37.8
Medicines	12.3	2.8	18.2
Transportation	2.6	0.6	4.1
X-ray	2.1	0.5	3.1
Laboratory	6.0	1.4	8.8
Training and Activities	-	55.7	-
Monitoring, Supervision and Operation	-	12.5	-
Equipment	-	3.2	-
Chest Camp	-	-	14.3
Stationary	-	-	0.41
Other	-	-	13.3
Total	**8134270**	**2543959**	**587357**

Table 5.7 shows the costs items of public facility, AKHS and GSSM. It depicts that in public facility salaries of the personal were the major portion in the total. In AKHS and GSSM for medicines, transportation, X-ray and laboratory costs we assumed these costs from reported public facility costs. For this we have calculated average cost in public facility for medicines, transportation, X-ray and laboratory and multiplied these costs on the number of patients in AKHS and GSSM assuming that the costs is same as in public facility. The total of public facility is Rs. 8134270, AKHS is Rs 2543959 and GSSM is Rs. 587357.

Tab. 5.8. Per patient costs in Public facility, AKHS, GSSM (in 2015 Rs.)			
Programs	**Total costs(Rs.)**	**Outcomes**	**Per patients costs(Rs.)**
Public facility	8134270	648	12552.9
AKHS	2543959	63	40380.3
GSSM	587357	45	13052.4

The table 5.8 presents the per patients costs of public facility, AKHS and GSSM. In AKHS per patient cost was high compared to pubic facility as well as GSSM. Further, the table shows that the number of patients were high in public facility and per patient cost in public facility was less in comparison to the other two programmes.

Tab 5.9. Average Cost Effectiveness Ratio and Incremental Cost Effectiveness Ratio				
Programs	**Cost**	**Outcome**	**ACER**	**ICER**
Public facility (without patients& escort costs)	8134270	620	13119.8	10018.5
AKHS	2543959	62	41031.6	13125.07
GSSM	587357	45	13052.4	
Public facility (with patients& escort costs)	84,51,764	620	13631.9	

The table 5.9 suggest that in terms of average cost effectiveness ratio public facility (Rs.13119.8) and GSSM (Rs.13052.4) were the most cost effective program compared to AKHS. There is a slightly small difference between average cost of public facility and GSSM, hence we are unable to conclude which of these two program (public facility or GSSM) is cost effective while in public facility the treatment outcomes(cured and treatment completed) were higher compared to other programs. In this case public facility and GSSM were dominated strategies. By adding patients and their escorts' costs to the total of public facility the average cost of public facility increased. Due to this increased GSSM dominate public facility. Conversely, in terms of incremental cost effectiveness ratio there were Rs.10018.5 additional cost by giving treatment to one additional patients

in AKHS while in GSSM the ratio was Rs.13125.07 which means by treating one extra patients in GSSM there is Rs.13125.07 additional costs. Resultantly, in this case AKHS service is cost effective strategy.

It can be concluded from the results that among the total of 4270 TB patients 45 percent were between the age of sixteen to forty five and 9 percent infected patients were children.30 percent of the TB patients in the district were above forty six year. In the district the number of male TB patients were higher than female. Within the three programs the number of registered female TB patients with AKHS and GSSM were high in comparison to male patients while in public facility the number of male patients is high. Similarly, half of the TB patients in the district were pulmonary TB. Within the health program AKHS has reported highest number of tuberculosis TB. The public facility reported highest number of extra pulmonary TB patients. In the district 98.7 percent of TB patients were category I patients.

In the district among the registered TB patients 1.8 percent died due to TB and the death rate was high in public facility and low in GSSM. The number of transfer out TB patients were less than 1 percent and the percentage is high in GSSM and there was no TB transferred out in AKHS. There was no patient reported as treatment failed in the GSSM. In the district less than one percent TB patients declared as defaulted and no patients reported as defaulted in AKHS and GSSM. In the district 23.2 percent declared as cured and 72.9 percent reported as treatment completed. In AKHS the percentage of cured patients were higher than the other two programs and the percentage of treatment completed TB patients were higher in public facility and GSSM than AKHS.

Additionally, in public facility 43.7 percent death occurred above the age of sixty one and 59.4 percent transferred out patients were between the age of sixteen and forty five. Similarly, 62.5 percent of treatment failed patients were also in this age group. The default rate was also in this age group. There were 25 percent treatment failed TB patients were above the age of sixty one and no treatment failed patients were less than fifteen year of age. In the age group of five or less the percentage of cured TB patients were less than one

in public facility. In public facility 59.7 percent of TB patients were in the age group of sixteen to forty five and treatment completed patients were also high in this age group.

Moreover, in AKHS 66.7 percent of death occurred at the age group of forty six to sixty year. 57.7 percent of the cured patients were in the age group of sixteen and forty five and 40.9 percent TB patients were also in this age group.

Likewise, in GSSM 52.5 percent TB patients reported as cured were in the age group of sixteen to forty five also 46.5 percent treatment completed patients were also on this age group. There was no patients reported as cured and treatment completed in age group of five or less.

Further, the total costs of public facility was Rs.8134270 and the percentage of salaries i.e 77 percent in the total of public facility. The total of costs of AKHS was Rs.2543959 and the total of GSSM was Rs.587357. In public facility per patient cost was Rs.12552.9, in AKHS per patient cost was Rs.40380.3 and in GSSM the cost was Rs.13052.4.We can conclude that per patient cost is lower in public facility compared to other two programs.

Lastly, in term of average cost effectiveness ratio we are unable to conclude between public facility and GSSM which of the program is cost effective. By adding patients and escorts costs to the total costs of public facility it increases the total costs now GSSM is dominant strategy is this case. In term of ICER AKHS was less cost effective strategy. In term of effectiveness public facility have highest number of outcomes compared to other two facilities. Additionally, by adding patients out of pocket expenses and opportunity cost to the total cost of public facility and average cost effectiveness ratio was Rs.13631.9.3 in the public facility. The average income of the patients was Rs.11621 and the average opportunity cost of patient was Rs.464.84.

Chapter 6

Summary, Conclusion, Recommendations and Limitations

The main theme of this chapter is to conclude the analysis of the economic evaluation of different tuberculosis programs. This chapter also contains recommendation to decision makers and other stakeholders based on the results and conclusion. At the end of the chapter limitations of the study are also given.

The present study aimed for evaluation of tuberculosis control programs in district Chitral, KPK. The study was conducted within the standard economic evaluation framework. The study compared costs and effects of tuberculosis programs like public facility and public private mix DOTS facilities (AKHS and GSSM). Further, the study also measured the out of pocket expenditure and opportunity costs of the TB patients using questionnaire.

Base on the results this study concluded that majority 45 percent of the TB patients in the district registered with public and private facilities were in the age group of 16-64 years. Nine percent reported patients were infant and 30 percent TB patients in the district were above the age of forty six. Also, the number of female pulmonary TB patients are high in the district. The results further elucidates that about 88.1 percent patients were registered with public facility. The results showed that the number of tuberculosis patients which completed their treatment from all facilities in the district were 72.9 percent and cured TB patients were 23.2 percent. Within the facilities the percentage of cured patients were higher in AKHS compared to public facility and GSSM and the percentage of treatment completed TB patients were high in GSSM. In term of cured TB patients AKHS was effective facility while in term of treatment completed percentage GSSM was the effective program. Further, the study concluded that the total cost of public facility was Rs. 8134270, in AKHS the total costs Rs.2543959 and GSSM the total costs was Rs.587357. The average cost in public facility was Rs.13119.8 in AKHS the cost was 41031.6 and the average cost per patients treated in GSSM was Rs.13052.4. By inclusion of opportunity cost the average cost per patients treated increased to Rs.13631.9. The average opportunity cost of patient was Rs.464.84.In the total of patients costs transportation have highest share. In term of

ACER GSSM is cost effective strategy by including patient and escorts costs to the total of public facility. Per patients costs is lower in public facility. The ICER between public facility and AKHS was Rs.10018.48 and the ratio was Rs.13125.07 between public facility and GSSM. In this case AKHS is the cost effective strategy.

Recommendations

On the basis of the results it is recommended that due to geographical location and longest access to health facility the transport cost for TB patient is higher hence the public sector needs to extend its treatment for TB up to basic health unit level so the burden on patient can be lower.

Moreover, the private sectors needs to focus on the detection of infected patient as it has more access to vulnerable population especially female and children. This may also reduce the load of TB patients to public facilities. Due to availability of the treatment at the door step of the patients the burden of transportation costs as well as opportunity costs reduce which will be beneficial for the poor.

Limitations of the Study

1- Due to time and resource constrain it could only be possible for us to interview the patients which are registered with government sector.

2- We included limited data on costs of the programs and data on patients which may affect cost effectiveness results. And we assumed amount of some costs item of AKHS and GSSM from public facility which may also affect the cost effectiveness results.

3- As the number of patients both in AKHS and GSSM are fewer than public facility which may affect the results of cost effectiveness study.

4- The cost components in each program is varying it may also change the results.

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