COST-EFFECTIVENESS ANALYSIS OF 4RH AND 6EH IN THE CONTINUATION PHASE OF TB TREATMENT IN AFGHANISTAN

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science Program in Health Economics and Health Care Management
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ประสิทธิผลของการใช้โปรแกรม 4RH และ 6EH ในการรักษาวัณโรคระยะต่อเนื่องในประเทศอัฟกานิสถาน

นายคาลีมูลาห์

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
สาขาวิชาเศรษฐศาสตร์สาธารณสุขและการจัดการบริการสุขภาพ
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คาลีมูลาห์ : ประสิทธิผลของการใช้โปรแกรม 4RH และ 6EH ในการรักษาวัณโรคระยะต่อเนื่องในประเทศอัฟกานิสถาน. (COST-EFFECTIVENESS ANALYSIS OF 4RH AND 6EH IN THE CONTINUATION PHASE OF TB TREATMENT IN AFGHANISTAN) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ดร.นพพล วิทย์วรพงศ์, อ.ที่ปรึกษาวิทยานิพนธ์ร่วม: นพ. พิรัส ประดิษฐวณิช, , 114 หน้า.

วัตถุประสงค์: เพื่อดำเนินการวิเคราะห์ต้นทุนประสิทธิผลของ 4RH และ 6EH จากมุมมองของผู้ให้บริการในระยะความต่อเนื่องของการรักษาวัณโรคในอัฟกานิสถาน ในปีค.ศ. 2011-2012

วิธีการ: การวิเคราะห์ต้นทุนประสิทธิผล หลักการที่ถูกนำมาใช้ คือ วิธีการวิเคราะห์ต้นทุนแบบจากล่างขึ้นบน (bottom-up) ซึ่งถูกนำมาวิเคราะห์โดยการใช้โปรแกรม EXCEL เพื่อการหาต้นทุนต่อหน่วยของการรักษาผู้ป่วยวัณโรคด้วย 6EH ในปีค.ศ. 2011 และด้วย 4RH ในปี 2012 นอกจากนี้ตัวชี้วัดผลลัพธ์ (ประสิทธิผล) คือ จำนวนของการรักษาผู้ป่วยที่ประสบผลสำเร็จในการรักษา ต้นทุนต่อประสิทธิผลของการรักษาสามารถหาได้จากราคาค่าใช้จ่าย

ทั้งหมดของการรักษาต่อจำนวนผู้ป่วยที่ประสบความสำเร็จในการรักษา การวิเคราะห์ถูกดำเนินการใน 3 ระดับ 1.ระดับการของหน่วยบริการสุขภาพ 2.ระดับจังหวัด และ 3.ระดับประเทศ

ผลลัพธ์: จากมุมมองของผู้ให้บริการในระดับชาติ พบว่าต้นทุนรวมของการรักษาผู้ป่วยวัณโรคด้วย 6EH ที่ได้ดำเนินการแล้วในปีค.ศ. 2011 คือ 7,327,648 ดอลลาร์สหรัฐ และจำนวนผู้ป่วยวัณโรคที่ได้รับการรักษาในปีนั้นเท่ากับ 28,167 ราย และจำนวนผู้ป่วยที่ได้รับการรักษาที่ประสบผลสำเร็จเท่ากับ 12,601 ราย ดังนั้นอัตราส่วนต้นทุนประสิทธิผลสำหรับการรักษาผู้ป่วยที่ประสบผลสำเร็จเท่ากับรายละ 582 ดอลล่าร์สหรัฐ ถึงอย่างไรก็ตาม ต้นทุนรวมของการรักษาผู้ป่วยวัณโรคด้วย 4RH โดยการทำโครงการนำร่องในปีค.ศ. 2012 คือ 5,786,582 ดอลลาร์สหรัฐ และจำนวนผู้ป่วยทั้งหมดที่ได้รับการรักษาในปีนั้นเท่ากับ 29,578 และจำนวนของผู้ป่วยวัณโรคที่ได้รับการรักษาที่ประสบผลสำเร็จเท่ากับ 11,959 ราย ดังนั้นอัตราส่วนต้นทุนประสิทธิผลสำหรับการรักษาผู้ป่วยวัณโรคที่ประสบผลสำเร็จเท่ากับรายละ 484 ดอลลาร์สหรัฐ กับความแตกต่างของต้นทุนต่อหน่วยต้นทุนประสิทธิผล 98 เหรียญใช้น้อยกว่ากับ 4RH (65 เหรียญ) และอัตราส่วนการวิเคราะห์ ที่ระดับหน่วยบริการสุขภาพ แต่สำหรับการรักษาระดับจังหวัดแตกต่างโดยพบว่า การรักษาด้วย 6EH (121ดอลล่าร์สหรัฐต่อราย) มีต้นทุนประสิทธิผลด้อยกว่าเมื่อเทียบกับ 4RH (103 ดอลล่าร์สหรัฐต่อราย) ที่ระดับหน่วยบริการสุขภาพ ได้แก่ Basic Health Center, Comprehensive Health Center และ District Hospital อัตราส่วนต้นทุนประสิทธิผล เท่ากับ 192, 64 และ 90 ตามลำดับในปีค.ศ. 2011 และเท่ากับ 142, 45, และ 56 ตามลำดับในปีค.ศ. 2012

ผลสรุป: ผลลัพธ์ของการศึกษาแสดงให้เห็นว่า การรักษาด้วย 4RH มีต้นทุนประสิทธิผลมากกว่าการรักษาด้วย 6EH ในทุกระดับการรักษา การวิเคราะห์ความอ่อนไหวพบว่าการเปลี่ยนแปลงค่าใช้จ่ายภายใต้การรักษาด้วย 4RH เพิ่มขึ้นถึง 100% แต่อย่างไรก็ตามยังราคาถูกกว่า การรักษาด้วย 6EH ทำให้ได้ข้อสรุปว่าการรักษาวัณโรคระดับชาติควรเปลี่ยนมาเลือกใช้การรักษาแบบ 4RH แทนที่การรักษาแบบ 6EH ถึงแม้ว่าปัจจุบันราคายังไม่แตกต่างกันมากนักแต่ในอนาคตถ้าราคายาเพิ่มขึ้น ต้นทุนต่อประสิทธิผลการรักษาด้วย 4RH ก็ยังคงดีกว่า

สาขาวิชา เศรษฐศาสตร์สาธารณสุขและการจัดการบริการสุขภาพ ลายมือชื่อนิสิต .....

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KEYWORDS: COST EFFECTIVENESS TB 4RH 6EH TREATMENT

KALEEMULLAH: COST-EFFECTIVENESS ANALYSIS OF 4RH AND 6EH IN THE CONTINUATION PHASE OF TB TREATMENT IN AFGHANISTAN. ADVISOR: NOPPHOL WITVORAPONG, Ph.D., CO-ADVISOR: PIRUS PRADITHAVANIJ, M.D, FACHE. 114 pp.

Objective: To conduct a cost effectiveness analysis of the 4RH and 6EH TB treatment regimens in Afghanistan in 2011-2012 from the provider's perspective.

Method: The cost effectiveness analysis was conducted. The bottom-up costing method was used in the Excel program to find the unit cost of the one TB patient treated with 6EH in 2011 and with the 4RH in 2012. The outcome (effectiveness) indicator used was the number of successfully treated patients. The cost-effectiveness ratio was subsequently derived by dividing the overall cost of the program by the number of successfully treated patients. The analysis was conducted at three levels i) at the health facility level ii) at the province level and iii) at the national level.

Results: From the provider's perspective at the national level, the total cost of the 6EH TB treatment regimen implemented in 2011 was 7,327,648 USD, and the number of patients successfully treated was equal to 12601, the cost effectiveness ratio was equal to 582 USD. On the other hand, the total cost of the 4RH TB treatment regimen piloted in 2012 was 5,786,582 USD, the number of the total TB patients successfully treated was equal to 11959, and the cost effectiveness ratio was 484 USD. The difference of the CER between the two regimens was 98 USD with 4RH being more cost-effective. The CER values at the province level were 121 USD for 6EH and 103 USD for 4RH, and the CER values at the health facility level for Basic Health Center, Comprehensive Health Center and District Hospital was USD192, USD64, and USD90 in 2011, and USD142, USD 45 and USD 56 for 4RH in 2012.

Conclusion: The 4RH regimen has proved to be more cost effective than the 6EH regimen at all levels of analysis. The sensitivity analysis that assumes changes in the cost of drugs under the 4RH regimen only suggests that, even with a 100% increase in the cost of drugs under 4RH, the CER of 4RH is still lower that of 6EH. This implies that the National TB Program has made right decision in switching from 6EH to 4RH as the latter is not only more cost-effectiveness now but also in the future when the price of drugs may likely to rise, the 4RH regimen would still be more cost-effective.

Field of Study: Health Economics and Health Care Management

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List of Abbreviations

AMS	Afghanistan Mortality Survey
BHC	Basic Health Center
BPHS	Basic Package of Health Services
CDC	Center for Disease Control
CBD	Community-Based DOTS
CER	Cost Effectiveness Ration
CHC	Comprehensive Health Center
CHS	Community health supervisor
DH	District Hospital
DOT	Direct Observation of Treatment
DOTS	The internationally recommended strategy for TB control
DST	Drug Susceptibility Test
E	Eithambitol
EPHS	Essential Package of Hospital Services
FDC	Fixed-dose Combination
H	Isoniazid
ICER	Incremental Cost Effectiveness Ratio
IC	Incremental Cost

IE	Incremental Effects
HIV	Human Immunodeficiency virus
HF	Health Facility
MDR	Multidrug-resistant
MoPH	Ministry of Public Health
NTP	National Tuberculosis Control Program
PH	Provincial Hospital
PHD	Provincial Health Director
PLS	Provincial Lab Supervisor
PTC	Provincial Tuberculosis Coordinator
R	Rifampicin
RH	Regional Hospital
RLS	Regional Laboratory Supervisor
RTC	Regional TB Coordinator
S	Streptomycin
SHC	Sub-Health Center
SS+	Sputum Smear Positive
SS-	Sputum Smear Negative
TB	Tuberculosis

TB PK	Tuberculosis Patients Kit
USAID	U. S. Agency for International Development
WHO	World Health Organization
Z	Pyrazinamide

CHAPTER I
INTORDUCTION

1.1. Rationale

Tuberculosis is a public health problem in Afghanistan. It takes several months to be treated, and it is threat for HIV patients. The long treatment period, multi-drug resistant and TB in HIV patients disproportionately need more resources to be allocated compared to other illnesses. Usually, patient adherence to treatment is low, and less likely to be continued a whole course of treatment appropriately. WHO as leading agency jointly with other partners continually struggle, and introduce new treatment protocols, and interventions for diagnosis and treatment of the TB in all around the globe e.g. recommendation of a Direct Observation Treatment, Short course (DOTS introduced in 1994). These programs cope with TB and decrease the defaulting and resistance against anti TB drugs types and increase cure rate. DOTS encompass five points: 1) the National TB control program ownership with strong government commitment, 2) standardized short-course TB therapy with supervision and patient support, 3) case detection through quality assured laboratories, 4) supply of anti TB drugs in regular basis, and 5) monitoring and evaluation system and impact measurement, with aims to achieve high results of treatment against TB disease.

However, there are an estimated 61000 TB cases happen in Afghanistan, every year, and about to 13000 people die each year because of this illness (NTP, 20120). Further, TB affects both women and men, but the affection rate is high in Afghanistan for women about 67 % compared to man. Which is a concerning issue for the Afghan society in general and for the family, specifically (NTP, 2012). The prevalence and incidence of TB is high in Afghanistan, for example the prevalence is 351/100000 and the incidence is 189/100000 population.

1.2. TB Treatment Regimens

The National TB control Program of Afghanistan has applied a new six month anti TB treatment regimen, and replaced the previous 8 months upon treating new TB patients since 2013. The new treatment regimen combines four drugs; Rifampicin, Isoniazid, Pyrazinamide and Eithambitol for which the called the Fixed-dose combination (FDC) for the first two months. And the two drug Rifampicin plus Isoniazid combination for the four months (2RHZE/4HR) in the continuation or follow-up phase of TB treatment. With the past treatment regimen the same four drugs were advised in the first two months, and Eithambitol plus Isoniazid were advised for six months (2RHZE/6EH) in the continuation phase of TB treatment. Generally the TB treatment has two phases i) initial phase also called “intensive phase” and ii) follow-up phase also called “continuation phase”.

Shifting the treatment in the continuation phase from 6EH to 4HR was based on the following advantages:

- WHO recommendation, because Afghanistan was the only country in EMRO region using EH in the continuation phase;
- Short duration of treatment 6 months compared to 8 months;
- Lower cost compared to eight months; and
- High number of relapse cases in the eight month regimen.

In fact, in 2009, the World Health Organization (WHO, 2009), advised to all national TB control programs that, the 8 months (2HRZE/6HE) treatment regimen should be phased out, and supported the regimen again in 2010 by issuing an article. Changing of treatment regimen from 6EH to 4RH come with the assurance of the following additional factors at the country level:

- Level of drug resistance in new and previously treated patients;
- Numbers of MDR-TB patients that the program has the capacity to enroll and treat;

- Availability of patient support and supervision

However, treatment of tuberculosis follows some goals e.g., to cure the individual patient, and to slow-down the dissemination of Mycobacterium tuberculosis to others. Therefore, successful treatment of tuberculosis has benefits, particularly for the individual patient and the community as well (CDC, 2003).

Use of Rifampicin particularly in the follow-up phase of TB treatment was supported by clinical trials, where rifampicin is proven more effective in terms of reducing relapse and failure. In this study it is also considered whether is indeed more (4RH) is effective to prevent the relapse/failure compared to the previous treatment regimen (6EH) in real situations. Furthermore, it is essential for future planning, considering the limited resources.

Afghanistan's National TB control Program committed to follow the WHO policy, so they applied the new treatment regimen (2HRZE/4HR), in four out of 34 provinces relatively in a small setting in 2012. This was an initiative to test the feasibility of moving to 6 months regimen instead of existing 8 months on the national scale. After the successful implementation in a one year period, they scaled-up the program to the additional 26 provinces in 2013. However, four provinces (Nangarhar, Laghman, Kunar and Nooristan) still used the 8 months (EH) treatment regimen because of the over stocked availability of the 6EH and under estimation the efficacy of the 4RH.

Additionally, the National TB control Program closely follows the implementation to see further how the outcomes can be assessed, and how successful the new treatment regimen is both technically and economically for the patients and the health program as well, although there has been no formal study on the outcome assessment.

The assumption that, 2RHZE/4RH treatment is better compared to 6EH is untested in the context of Afghanistan. There is still no evidence to support the decision to

change from 6EH to 4RH. It is, therefore, important to investigate whether the new intervention is cost-effective compared the old treatment regimen. This claim is further supported by a study recently conducted in Uganda, where they compared the 6EH and 4RH and found that 4RH is better, but they used estimated values from literature, and the recommended that further studies in real setting need to be conducted to see the generalizability of their study's findings (Yukari C. Manabe1, 2012).

The annual expenditure of Afghan National TB Control Program is approximately USD 13 million. This figure represents 3% of the total Ministry of Public Health (MoPH) regular budget. Sixty five percent of NTP annual expenditure is being financed by international support, however, 32% of required budget are still not available (WHO, 2012). From the patient's perspective diagnosis and treatment of tuberculosis is free of charge to the patient, but for the health system financially and economically in resource-limited settings like Afghanistan it's a huge burden. There is always a necessity to look for cost effective interventions.

Resources are always scarce and they need to be used in the most efficient and effective manner. A cost-effectiveness analysis for comparing costs and outcomes of both treatment interventions should provide a suitable recommendation for decision makers. In assessing the effectiveness of healthcare programs or comparative interventions a cost-effectiveness analysis is one of the useful tools among economic evaluation methods (Drummond.F, 2007). This study aims to provide the reality in the context of Afghanistan and provide suitable suggestions for the program's management.

1.3. Questions of the Study

1.3. 1. Primary question

The primary question of the study is:

- Which treatment regimen is more cost-effective between 4RH and 6EH in the continuation phase of TB treatment from the provider's perspective?

1.3.2. Secondary questions

Secondary questions of the study are:

- What are the costs of 4RH and 6EH in the continuation phase of TB treatment from the provider/NTP perspective?
- What are the associated levels of effectiveness of 4RH and 6EH in the continuation phase of TB treatments?

1.4. Objectives of the Study *1.4.1. General objective*

The general objective of the study is:

- To compare the level of cost-effectiveness of 4RH and 6EH in the continuation phase of TB treatment from the provider/NTP perspective.

1.4.2. Specific Objectives

The specific objectives of the study are:

- To analyze the cost of 4RH and 6EH in the continuation phase of TB treatments, from the provider/NTP perspective.
- To determine the associated effectiveness of 4RH and 6EH in the continuation phase of TB treatment by measuring the number of successfully treated patients.

1.5. Scope of the Study

The cost-effectiveness analysis is from the provider perspective, focusing mainly on one province: Takhar. It covers all cost and outcome data concerned with both treatment regimens: 4 RH and 6 EH. Total 39 BPHS health facilities which are mostly concerned with the TB patients for e.g. 1) 23 Basic Health Center 2) 13 Comprehensive Health Center and 3) 3 District Hospital

Secondary data retrospectively for 6EH in 2011 and for 4RH in 2012 were collected at three levels: 1) at the health facility level, 2) provincial level and 3) the national TB control program at central level. The health facility level actual data were collected from Takhar province only. Provincial level data were collected from all four pilot provinces, including Baghlan, Kunduz, Takhar and Badakhshan. Data at the national TB control program were collected from the central TB control program and its partner organization the BRAC Afghanistan the Principle Recipient (PR) for the TB program implementation in whole country. Additional data were obtained from the Health Management Information System (HMIS) of Ministry of Public Health (MoPH).

1.6. Expected Benefits

The likely contribution of this study is to evaluate the decision of the National TB control program (NTP) and World Health Organization (WHO) in the context of Afghanistan for changing the treatment regimen form 6EH to 4RH, and to create an opportunity for NTP to scale-up the new 4RH to the whole country. Furthermore, the study aim to provide an understanding the unit cost of treatment success of one TB patient and how much cost may have been saved or over spent by shifting to the new one treatment. Likely users of the study will be MoPH, NTP of Afghanistan, and Provincial Public Health Directorate (PPHD) and BPHS implementers in the province, also academics involved in health policy development and reform, health program managers, leaders and health economic researchers.

CHAPTER II
COUNTRY BACKGROUND

2.1. Geography

Afghanistan is located in South-Central Asia on the major route of north-south and east-south. It is a landlocked country. It occupies an area 652,864 square kilometers, with elevations ranging from 258 meters to 7,492 meters. The capital of the country is Kabul. It is administratively divided into 34 provinces and 365 districts. The country is bounded by six different countries, namely, Pakistan, Iran, Tajikistan, Uzbekistan, Turkmenistan, and China. Afghanistan has a long border with Pakistan about 2,430 kilometers, while the smallest is with China about 76 kilometers and has total 26.5 million population (CSO, 2013)

2.2. Economy

Afghanistan has had constant, but fluctuated high economic growth for the last ten years. Real GDP growth averaged 9.2% between 2003 and 2012. In 2012/13 GDP growth reached an estimated 11.8%. The GDP is mainly dependent on agricultural outputs which accounts for one-fourth to one-third annually. The mining sector has been slowly emerging as a source of growth in recent years. However, the share of mining in GDP has remained small: only 0.6% in 2010/11 (Bank, 2013). Compared to the previous year the inflation has decreased from 10.2% to 6.4% in 2012/13. Given the uncertain security status and business atmosphere in the past years, the exchange rate depreciated by 8% in 2012. Furthermore, political and security concerns caused private-sector growth to be limited (Bank, 2013). With a dependence on external donations/aids, Afghanistan remains one of the poorest and least developed countries in the world. The gross domestic product (GDP) at current prices was about US$ 20.50 billion, and the GDP per capita at current prices was estimated at US$ 626 in 2013 (IMF, 2013).

Since 2002, the unemployed population reached about 36% all of which were below the poverty line in Afghanistan. There are shortages of housing, clean drinking water 47%, electricity, and employment (World Bank, 2012). The Afghan government is committed and works continuously with the international community to improve access to basic needs such as schooling, infrastructure development, creation of job opportunity, economic development, and health care as top priorities. Table 1 provides a brief summary of some of the economic indicators of Afghanistan:

Table 1: summary of economic indicators: Afghanistan

Country	Subject Descriptor	Units	Scale	2010	2011	2012	2013
Afghanistan	Gross domestic product, current prices	U.S. dollars	Billions	15	17	20	20
	Gross domestic product per capita, current prices	U.S. dollars	Units	528	576	633	626
	Gross domestic product based on Purchasing-Power-Parity (PPP) per capita GDP	Current international dollar	Units	904	949	1,055	1,070
	Gross national savings	Percent of GDP		26	28	24	22
	Inflation, average consumer prices	Index		29	105	109	117
	Population	Persons	Millions	95	31	32	32
	General government total expenditure	Percent of GDP		30	23	24	26

Source: (IMF, 2013).

2.3. The Policies, Strategies, and Structure of the Health Care System

2.3.1. Health Policy and Strategy

The international community, mainly USAID, the World Bank (WB), and European Commission (EC) together with the Ministry of Public Health (MoPH), has made

tremendous efforts to rehabilitate Afghanistan's damaged health care system (MoPH, 2005).

In 2002, shortly after the establishment of the Transitional Islamic Republic of Afghanistan following the removal of the Taliban regime, a strategy for delivering primary health care services called Basic Package of Health Services (BPHS) was developed at that time consistent with the fact that Afghanistan had worst health indicators around the globe (MoPH, 2005).

The BPHS has been implemented through various mechanisms, like Performance Based Partnership Agreements (PPAs) of the World Bank, Partnership Contract for Health services (PCH) of USAID and Performance Grant Contracts (PGC) of the EU within the framework of government health policy.

In order to complement BPHS services, in 2005 a new policy called the essential package of hospital services (EPHS) was developed and has been implemented accordingly. The policy also describes the hospital structure, services available in the hospitals and the referral system necessary to support BPHS (EPHS, 2005).

The tuberculosis services provision is done under the stewardship of National TB Control Program (NTP). Structurally, it seems a vertical health program at the provincial levels, and it is closely integrated with the package of health services delivered through the primary system at the provincial level to district health facility levels (NTP, 2010). Its services reach all health facilities through BPHS and EPHS implementers according to the below mentioned structure of the Ministry of Public Health (MoPH).

2.3.2. Structure of the Health Care System

Health service provision is done under the two packages; the Basic Package of Health Services and Essential Package of Hospital Services (BPHS & EPHS). The BPHS package is offering the service delivery through Health Posts (HPs), Sub Health Centers (SHCs), Basic Health Centers (BHC), Mobile Health Teams (MHTs), Comprehensive Health Centers (CHCs), and District Hospitals (DHs) (MoPH, 2010). Secondary services are being provided through Provincial and Regional Hospitals as per following descriptions:

2.3.2.1. HEALTH POST (HP): HP is the first contact at community level, comprised of two community health workers, male and female (CHWs), and delivered basic health care services at home level, that work as community HPs. An HP, covers a catchment area of 1,000 to 1,500 people, which is equivalent to 100-150 families. CHWs offer limited curative services, including diagnosis and treatment of malaria, diarrhea, and community based DOTS (MoPH, 2010).

2.3.2.2. HEALTH SUB-CENTERS (HSC): The Health Sub-Center (HSC) is a relatively new type of health facility added to the health structure, it bridges the services gap between HPs and other BPHS levels of service delivery points. The overall objective of establishing HSCs is to increase access to health services for underserved populations those are living in remote areas. A HSC covers a population of about 3,000-7,000. The HSC provides most of the BPHS services that are available in BHCs including TB case detection and referral, and follow up of TB cases in coordination with community DOTS. The HSC is staffed by a male nurse and a community midwife and a cleaner/guard (MoPTH, 2010).

2.3.2.3. MOBILE HEALTH TEAM (MHT): the same like Sub Health Center this facility, newly added to the health structure to ensure access to basic health services in remote areas is the provision of health care services through mobile health teams. Mobile health services are an extension of BHC services; therefore, the services they provide are in most

cases those recommended for a BHC comprised of male health provider (doctor or nurse), female health provider (community midwife or nurse), vaccinator and driver (MoPH, 2010).

2.3.2.4. BASIC HEALTH CENTER (BHC): The BHC is a small facility that offers the services with more complex outpatient care. The BHC supervises the activities of the HPs in its catchment area. The services of the BHC cover a population of 15,000-30,000 people, depending on the local geographic conditions and the population density. The staffing requirements for a BHC are a nurse, a CHW, and two vaccinators. BHC staff has responsibility to follow TB and ensure DOTS, while there is no diagnosis services of TB (MoPH, 2010).

2.3.2.5. COMPREHENSIVE HEALTH CENTER (CHC): The CHC is a higher level of the facility compared to BHC it covers a larger catchment area of 30,000- 100,000 people, offering a wider range of services than the BHC. In addition the CHC is the first health facility level at which TB diagnosis can be made. At CHCs, doctors are able to both diagnose and treat uncomplicated cases of tuberculosis; other staff will ensure adequate follow-up of DOTS patients through other levels of the health system. The facility has limited space for inpatient care, but does have a laboratory. Staff of a CHC outnumber staff of a BHC and include both male and female doctors, male and female nurses, midwives, and laboratory and pharmacy technicians (MoPH, 2010).

2.3.2.6. DISTRICT HOSPITAL (DH): The DH carried-out all services in the BPHS, DOTS is one of the key elements in the BPHS. At the district level, the district hospitals support the NTP in implementing TB control activities at all four health facility levels. It provides diagnosis and treatment for TB cases, especially childhood TB cases for which X-ray examinations and tuberculin skin tests are crucial for adequate diagnosis including the

most complicated cases. The hospital is staffed with female obstetricians/gynecologists, a surgeon, an anesthetist, a pediatrician, midwives, laboratory and X-ray technicians, a pharmacist, a dentist, and a dental technician. Each DH covers an approximate population of 100,000 to 300,000 people dispersed in one to four districts (MoPH, 2010).

2.3.2.7. PROVINCIAL HOSPITAL (PH): The PH is the referral hospital for the Provincial Public Health (PPH) Care System. In essence, the PH differs little from a DH: it offers the same clinical services and possibly a few additional specialty services. PHs aim to reduce the mortality rate of the diseases, including TB. Diagnosis and treatment of TB cases are one of the PH's health service components. In most cases, the PH is the final referral point for patients referred from the districts. In some instances, the PH can refer patients to higher levels of care in the regional hospital or to a specialty hospital (SH) in Kabul (MoPH, 2010).

2.3.2.8. REGIONAL HOSPITAL (RH): The RH is primarily a referral hospital with a number of specialties for assessing, diagnosing, stabilizing and treating, or referring back to a lower-level hospital. The RH provides professional inpatient and emergency services at a higher level than is available at DHs and PHs, yet the overall objective remains the reduction of maternal mortality, infant mortality, and under-5 mortality as well as reduction in other diseases and conditions responsible for high mortality. In addition to diagnosis and treatment of TB cases, the hospitals also use culture and sensitivity testing, sputum examinations, and chest X-rays as laboratory diagnostic tools (EPHS, 2005).

Further, there are a number of specialized hospitals located in Kabul the capital city of the country. They provide education and training for HCWs and act as referral hospitals for the Provincial Hospitals (PHs) and Regional Hospitals (EPHS, 2005)

2.4. Main Death Causes and The Health Indicators

About 35 percent of all deaths in Afghanistan are due to non-communicable diseases like cardiovascular diseases and cancers, up to three in ten are due to communicable diseases and infections including TB. Among females, the leading causes of death are infectious and parasitic diseases (18 %) and cardiovascular diseases (18 %), followed by respiratory infections (15 %) and perinatal conditions (12 %). Furthermore, 77 % of deaths causes in female children under five years are because of respiratory infections, infectious/parasitic diseases, and perinatal conditions (AMS, 2010).

Table 2: Health Indicators

Name of Indicator	Level of Achievement
Total population	29,825,000
Total Fertility Rate (TFR)	5.1
Use of some method of family planning	22%
Antenatal care (ANC)	68%
Institutional Delivery	32%
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 Afghan health sector has made remarkable progress since 2003-2013, after the implementation of the two strategies BPHS and EPHS. The Ministry of Public Health's (MOPH) strong leadership, sound public health policies, innovative service delivery, careful program monitoring and evaluation, and development assistance have led and expansion of functioning health facilities from 496 in 2002 to more than 2,000 in 2013 (HMIS, 2013).

The proportion of health facilities with a skilled female health worker has increased from 25% to 72%. The health management information system (HMIS) indicates more than a five-time increase in the number of outpatient visits, from 0.23 visits per capita per year in 2004 to 1.29 in 2011. As of 2013, there were 13,200 active health posts, 511 health sub-centers, 817 basic health centers, 385 comprehensive health centers, 74 district hospitals, 28 provincial hospitals, 5 regional hospitals, and 26 national hospitals

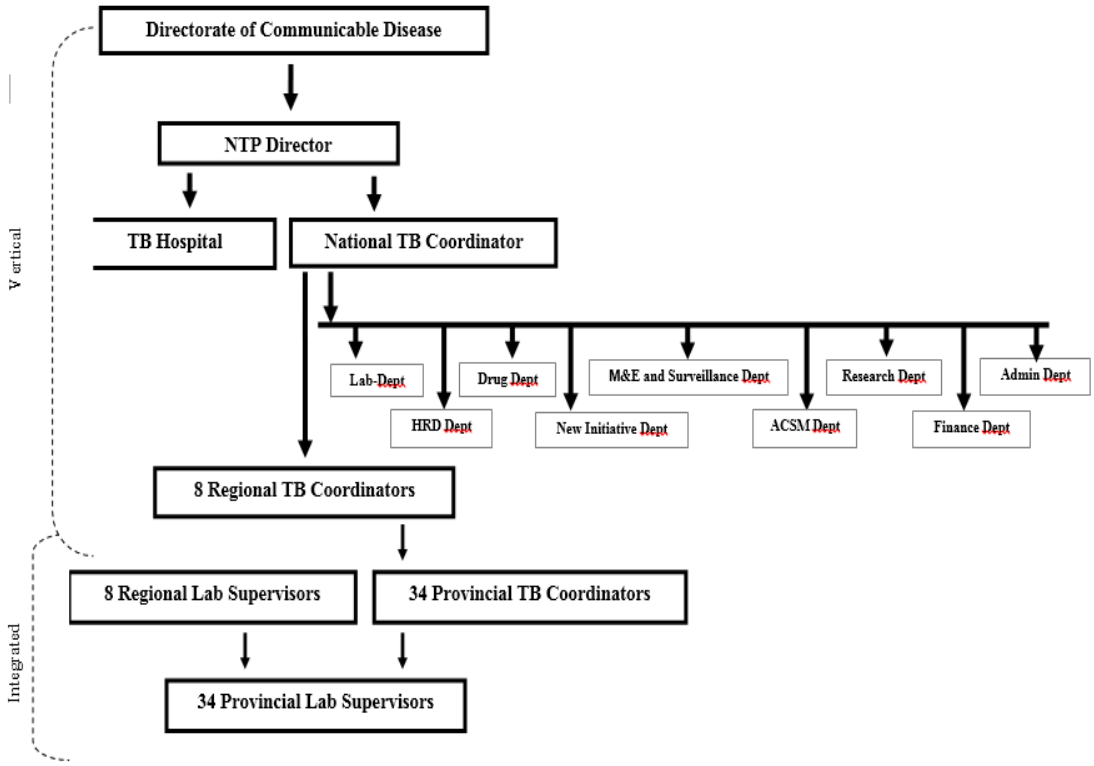
located in Kabul, 200 private health facilities and 96 mobile health teams, throughout the country (HMIS, 2013).

2.5. Tuberculosis in Afghanistan

Since three decades of civil strife, uncertainty, and great population displacement have further aggravated the public health challenges facing Afghanistan. TB continues to be a major health problem, and Afghanistan is among the 22 high-burden countries (WHO, 2012). The regional WHO Stop TB program works with the national TB control program to strengthen and consolidate the provision of comprehensive TB care in the country, with the ultimate goal of achieving universal access to health care services (WHO, 2013). The accomplishment of these goals is in line with the Global Stop TB Plan and the international targets of the Millennium Development Goals (MDGs).

For the successful implementation of the DOTS strategy, there is a strong network of the Regional and Provincial TB Coordinators (RTCs and PTCs) and the Regional and Provincial Laboratory Supervisors (RLSs and PLSs) within the National TB control Program (NTP) Organogram. Population coverage by directly observed treatment, or DOTS, is 97 percent. They are also responsible for coordination of activities with the BPHS and EPHS implementing partners at the provincial level. Furthermore, the National TB Control Program has succeeded to establish a strong network of national and international partners for better coordination and continuing support for its interventions (NTP, 2012). Below figures provide a brief summary of the Afghanistan TB program structure:

Figure 1: Structure of the National TB Control Program



Source: (NTP guideline, 2010)

Figure 1 in above describes the management levels of the Afghan National TB Control Program (NTP) from the central to the peripheral at the health facility levels. The NTP director and his team based in Kabul has a leading role for the TB control program implementation across the country. The Regional TB Coordinators (RTCs) are responsible to coordinate TB activities with the partners at the regional levels, there are total eight regions for the TB control Program implementation in the country. The 3rd level of the TB control Program implementation is the province level. At the provincial level there are 34 Provincial TB Coordinators (PTCs) and 34 Provincial Lab Supervisors (PLSs), they manage and coordinate TB activities with stakeholders at the province level.

2.5.1. The TB Control Package

The Stop TB Partnership Strategy is internationally recommended by the World Health Organization (WHO) for the TB control program all around the globe. It plays a

vital role for the TB control program in Afghanistan. The Millennium Development Goal (MDG) indicate to combat HIV/AIDS, malaria and other diseases, including TB, and to halt and begin to reverse the incidence of these diseases by 2013 (NTP, 2010).

The goal of the strategy is to reduce effectively the global burden of TB by 2015 in line with the Millennium Development Goals and the Stop TB Partnership targets (Partnership, 2006).

2.5.2. The TB Terminology And Its Brief Deifications

Since this is a TB focus study, we might face with some of the terminology throughout reading the document, therefore the following definitions are typically important and related to the study objectives:

TB Case: A TB case is defined as any person in whom TB has been bacteriologically confirmed (SS+) or a person diagnosed by a physician with TB SS–ve or with extra pulmonary TB (NTP, 2010).

Pulmonary TB: The pulmonary tuberculosis is a common form of TB, which affects the lungs in more than 80 percent of cases. Pulmonary tuberculosis in adults are often SS+ and therefore highly infectious. This type of TB patients who is sputum are positive on direct smear examination are 7 to 10 times more infectious than those who are negative on microscopic examination and positive on culture.

Extra pulmonary TB: This type is defined as a tuberculosis illness of other organs rather than the lungs for e.g. it affects (lymph nodes, pleura, genitourinary tract, bones and joints, peritoneum, and the meninges) but all organs may be affected.

Pulmonary TB Sputum Smear Positive (SS+ve TB): This is defined as any TB suspect in whom pulmonary TB has been bacteriologically confirmed (Partnership, 2006):

Pulmonary TB Sputum Smear Negative (SS-ve TB): This is also defined as any TB suspect in whom pulmonary TB has not been bacteriologically confirmed but for whom a physician has started anti TB treatment with taking into account the following additional points:

- At least two sputum smears negative for acid-fast bacilli
- Chest radiographic abnormalities consistent with active pulmonary TB
- Clinically suspect
- No response to a full course of broad-spectrum antibiotics

New Case: A patient who has never had treatment for TB or who has taken anti-TB medicines for less than four weeks (one month).

Relapse: A patient previously treated for TB who has been declared cured or treatment completed and is diagnosed with bacteriologically positive TB (at least one smear or culture).

Treatment after Default (Recovered Abandonment): A patient who returns to treatment with positive bacteriology following interruption of treatment for one month (28 doses) or more.

Treatment after Failure: A patient who has started on a category II treatment (retreatment) regime after previous treatment has failed (usually category I).

Failure: A patient under treatment who remains SS+ or become SS+ in five months or more after commencing category I treatment, or a patient who is initially SS- before starting treatment and become SS+ after the second month of treatment.

Transfer In: A patient already registered in one health facility who transfers to another health facility to continue his/her treatment.

Chronic Case: A patient who remains SS+ or has again become SS+ after completing a full category II treatment.

Others: Although TB SS- cases and extra pulmonary cases may also be treatment failures, relapses, or chronic cases, these are rare and must be supported by pathological or bacteriological evidence

2.5.3. Initiating TB Treatment

It's deemed necessary to not start tuberculosis treatment without a confirm diagnosis. This is also important to start treatment to the TB SS +ve cases without any delay.

2.5.3.1. COMBINED DRUG OR FIXED-DOSED COMBINATION (FDC)

The National TB Control Program in line with the international standards for the TB treatment has to follow the guideline and use the combined drug as package for treating the TB for the both categories (I & II). The packed drugs have many advantages for the patients and the program, because it prevents drug resistant TB, prescription errors and easy to use.

The drugs' Kits contain a full course of the treatment for a single patient. The same basic principles are behind the constitution of a TB Patients' Kits system: a complete course of treatment should be assured for each patient, the TB Patients' Kits also increase patient adherence. Since medicine stock-outs cause patients to lose confidence in the health system, the TB Patients' Kits assures the TB patient that his or her medicines will be available from start to end of the treatment.

2.5.3.2. ANTI-TB MEDICINE

The standard medicine doses are based on the body weight. The full dose of each drug should be taken at one time on the assigned day from Saturday to Thursday, except Friday and holidays as per below table 3.

Table 3: Summary of anti TB medicine doses

Treatment Regimens	Initial Phase	Continuation Phase
6 months regimen	2 months—56 doses (Saturday to Thursday)	4 months—112 doses
	Daily	Daily
8 months regimen	2 months—56 doses (Saturday to Thursday)	Daily
	Daily	6 months—168 doses

Source: *TB guideline NTP Afghanistan.*

CHAPTER III
LITETRATURE REVIEW

In 2012, a cost-effectiveness study was done in Uganda, on two treatment regimens of TB (Yukari C. Manabe1, 2012). It compared the impact of a continuation phase using 6HE or 4HR on total cost and expected mortality from the Ugandan national health system perspective. The author has applied a decision analysis model for comparing costs and effectiveness, used the estimated data for outcome and cost from existing literatures. Their findings and results show the average total costs of treatment of a new TB case, including drug costs and clinic visits, was $12.77 for 6HE and $13.66 for 4HR. The average total cost of a completed course of treatment regimen, including the cost of drugs, streptomycin administration, clinic visits and TB sputum culture, and adjusted for baseline weight was $110.70. Therefore, the expected average cost of TB treatment in the continuation phase was $26.07 for 6HE, compared to $23.64 for 4HR. The expected cost savings associated with 4HR were $2.42 per patient. Furthermore, this model predicted an expected mortality rate of 13.3% associated with 6HE treatment and 8.8% associated with 4HR treatment. It is worth to mention, in this study they did not calculate an incremental cost-effectiveness, and used estimated data from existing literature. The outcome considered was expected mortality. They recommended for conducting the same type of study to see more evidence to support their findings for the generalizability of the study result.

Further, they analyzed the treatment for MDR-TB as an additional outcome for previously treated patients with unfavorable outcomes, increased the average cost to $65.86 for 6HE and to $53.12 for 4HR. The cost difference between the 6HE and 4HR treatment options reduced to $12.74 per patient. The expected mortality reduced slightly to 13.5% and

8.9%, respectively, and 4HR continued to be the dominant treatment strategy (e.g. lower cost and lower mortality) relative to 6HE.

Another study of cost-effectiveness was conducted alongside a clinical trial at three sites in Pakistan from the societal perspective to establish the costs and effectiveness of different TB treatment strategies currently being implemented for the patients' treatment such as Directly Observed Treatment (DOT) for tuberculosis (MA Khan, 1997) . The methodology used was to assign TB patients randomly to one of three arms: 1) DOTS with direct observation by health workers (at health centers or by community health workers); 2) DOTS with direct observation by family members; and 3) DOTS without direct observation. The authors further divided patients by gender, rural and urban to know the impact of compliance with treatment. They found no statistically significant difference in the cure rate of TB patients and moreover, DOT under the observation the health facility based worker was least cost-effective ($310 per 1 cured patient). The cure rate was 58% compared to 68% with no direct observation and the reason was economically active patients may tend to not come regularly. The self-administered strategy was the most cost effective ($164/cured patient), while DOTS by a community health worker (CHW) had a high cure rate 67%, but it cost ($172/cured patient) slightly higher, further investigation is needed for this approach.

Another study using the same setting as above with the difference in the design a decision analysis model was used and groups were assigned to directly observed therapy (DOT) vs self-administered therapy (SAT) (William J. Burman, 1997). The outcomes for this study were failure rate and relapse. The study sample was two hospitals, municipal hospitals and specialized hospital in treating drug resistant TB. The findings suggested that the DOT and SAT were almost similar in terms of direct cost ($1206 vs. 1221). DOT in fact was more expensive if the patient time, cost were included, while by the inclusion of failure and relapse cost then DOT became less expensive compared to SAT. In conclusion DOT has greater in

patient cost, but more cost-effective compared to SAT, because it achieves a high cure rate in the initial stage and decreased the cost associated with relapse and failure and drug resistance, so DOT is preferred. One of the limitations of the study could be the use of estimated data for both outcome and costs

Also a study was conducted in Bangladesh, one of the 22 TB high burden countries (HBC-TB) in the world (Md. Akramul Islam, 1997). The main objective of the study was to compare TB control treatment in two different settings: one implemented by NGO and the other implemented by the government. The study considered one year data of coasting from patient and a health system perspective (salary, drugs and laboratory supplies) and outcomes of cured rate 84% and 82% of pulmonary SS+ve patients were collected for the NGO's and the government (one hospital each). A method used for cost calculation was simply to divide total cost by total patients cured times total health system cost to find unit cost. The findings shows $64 cost/cured patient in NGO hospital and $ 96/cured patient in government running hospital. In conclusion cured rate was same in both NGO & government, but the NGOs program was 50% cost-effective compare to the government running TB program.

In another study by Xu (2000), analyzed the cost-effectiveness of DOTS and Non-DOTS of Sputum Smear Positive (SS+ve) pulmonary TB, in Beijin of China (Xu. Q, 2000), the author evaluated the cost-effectiveness of the interventions in two aspects: one direct benefit to patients, and another indirect benefit to others through reduced transmission of TB, DALY used as a measure of the unit. The cost calculation was done based on expenses occurred for the patient because of drugs, chest X-ray films, sputum smear and culture. The findings show that one DALY could be saved with a 45.7 Yuan through DOT compared to 471. 4 Yuan with Non-DOT, the study result suggested that DOT was a good control strategy for Sputum Smear Positive patients.

Eventually a study was conducted by Kamolratanakul (1992), the objectives of the study were to compare the efficacy, effectiveness and cost-effectiveness of the three Short-course anti TB programs compared to Standard Treatment Regimen in Thailand (Kamolratanakul. P, 1992). The study design was a historical cohort of sputum smear positive TB patients all male and female above 15 years of age in that specific period. The study was conducted from a societal perspective (provider & patients), the costs considered from the provider perspective were the real costs of services delivery in the five zones. The author used direct distribution method for allocation of overhead costs e.g. the divided all provider costs into two categories: routine service costs (overhead cost of all services), and medical care cost (radiology, laboratory and pharmacy cost). The study found that all Short-course treatment strategies were more cost effective than the Standard Regimen from both perspective patients and provider. While among the three Short-course regimens the combination of INH, Rifampicin and Pyrazinamide for the first two months, and in the continuation phase INH plus Rifampicin regimen was the most cost-effective ($ 70.24 per effectiveness and $ 103. 31 per effectiveness) from the provider and patient's perspective respectively.

From the review of the literatures, I found that some of the cost effectiveness analyses were used the estimated cost and outcome data, and was relatively in a small setting. The studies further, suggested that using provider perspective need to consider actual cost and outcome data rather than the estimated and centralized source for all. Taking into account their recommendations I will use the actual data for my study from all levels of the study areas.

CHAPTER IV
CONCEPTUAL FRAMEWORK

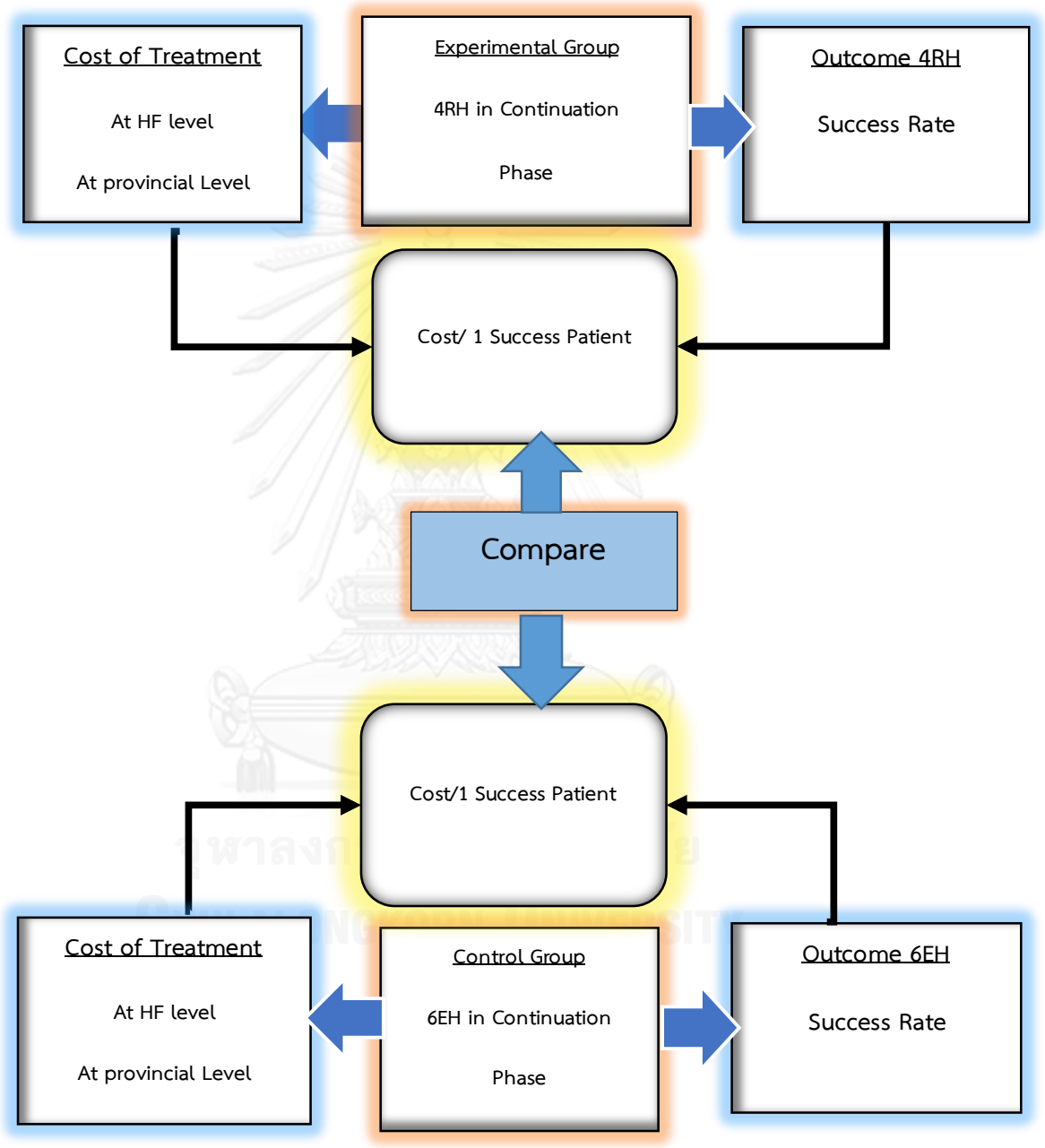
The National TB control program (NTP) under the Ministry of Public Heath (MoPH) of Afghanistan leads the TB control program with the financial support of partners such as; GF, JICA, IC, TB|CARE, UN-agencies, NGOs' and etc. In this study the two treatment methods (regimens) the 2RHZE/4RH and 2RHZE/6EH are compared. Both are managed by the National TB Control Program (NTP), and under both treatment regimens the classification (treatment cohort) of tuberculosis patients that is pulmonary SS+ TB patients. At the end of the treatment there are six outcomes.

The target outcome for this study is the successfully treated (cured/completed rate). But the duration of treatment and outcome and cost are different, i.g. that total peroid for the newly introduced regimen is 6 months (2 months intensive and 4 months continuation) and for old regimen it is (2 months intensive and 6 months continuation).

The figure below 2 illustrates the conceptual framework in this study. Hypothesis employed in this study is that 2RHZE/4RH increase the treatment success rate, decreasing mortality and reducing the cost per outcome compared to 2RHZE/6EH. In other words, 2RHZE/4RH is assumed to be more cost effective.

Figure 2: Conceptual Framework

Perspective: Provider



CHAPTER V
RESEARCH METHODOLOGY

5.1. Cost-effectiveness Analysis

Cost-effectiveness Analysis (CEA) considers the most effective use of limited resources. The technique (CEA) was historically used and it was later the military field, then gradually extended to other fields including health care. (Shepard. S, 1979).

Cost-effectiveness analysis (CEA) assists decision-making by health program managers and policy makers. It analyzes the effectiveness and cost of alternative interventions for achieving specified objectives. Generally the interventions with the lowest cost per unit of effectiveness is the most cost-effective, and accepted as an economic efficiency (R. J. Fryatt, 1997).

According to Shepard. S, (1979), CEA is a mean of summarizing of health benefits and costs used by health programs. So that the policy makers can choose among them. This method is particularly useful in the analysis of preventive health programs, because it provides a mechanism for comparing efforts among different diseases and populations. Cost-effectiveness analysis takes five steps summarized in the table below:

Table 4: summary of five steps need for cost-effectiveness analysis

1. Define the Program - Have comparable to the problem. - Short description of the program which need to be analyzed	2. Calculate Net Costs - Measure gross costs - Measure how much money saved - The value of discount and finally calculates the net value (costs)	3. Calculate Net Health Effects may be treatment success rate
4. Taking The Right Decision by - Individual base considers net costs and net effects. - Choose the right case	5. Do Sensitivity Analysis - Change the uncertain variables and recalculate the cost and effects, see the effects on decision	

Source*:** (Shepard. S, 1979), ***Public Health Report.

5.2. Cost of Healthcare Program

5.2.1. Cost analysis

Costs are value of resources and occur to the agency/entity when paying for resources. Past studies for cost calculation of TB treatment strategies used different methods e.g., direct allocation (summation of the total cost divided by the total numbers of the cases), decision model and stepwise allocation etc. while in this study the bottom-up costing method was used described as follows:

<u>The Bottom-up Costing method</u>

This method of coting intended to find detailed cost information at the service unit level or at the individual client level (TB unit cost). In the unit cost calculation first identified and measure specific items at the service point level, then at the intervention level and then at the entire national program level and summed-up bottom wise (Olsson, 2010). Therefore, in this study, a specific questionnaire was designed and bottom-up cost calculation is applied. We measured the total and unit cost by a direct allocation method at three levels 1) at the health facility level 2) province level and 3) and at the national level as per below described steps.

Step1: the cost data divided generally into the two types (Operating cost and Capital Cost) the operating include: Salary & benefits, training, drug, and other) and the capital cost of all medical and non-medical equipment which were available.

Step 2: TB cost calculated out of the total cost of the health facility (HF) for each one and types of the HFs e.g., at the Basic Health Center (BHC) level, at the Comprehensive Health Center (CHC) level and at the District Hospital (DH) level, by assigning the % of the time spent/used for TB services out of the total time of the medical staff and equipment as well.

Step 3: then summed –up the total cost of the each health facility and divided by the number of the BHCs, CHCs and DHs', in the study to find the average cost at each level of the facility for the TB service.

Step 4: then the average cost of each type multiplied by the total number of each type of the health facilities in the province (Takhar) level, in this case (23BHCs, 13 CHCs and 3DHs).

Step 5: the capital asset depreciated with Straight-line method.

This process completed for 2011 (6EH) in all 3 levels and repeated for 2012 (4RH) with additional step of the NPV of 2012 cost considering 7% discount rate.

5.3. Cost-effectiveness of TB treatment

Health program costs and outcomes can be measured in different ways. With regard to cost effectiveness analysis of the health program more specifically of the TB treatment interventions, there have been studies in the region as well in the rest of the world, clearly indicating the significance of the technique for the right decision making.

The health program outcome can be divided into two types; intermediate and final outcomes. Measuring the final outcomes in some instances need more resources and time and in this study both types of the output are covered. Healthcare programs, may have

many outcomes, including treatment success, screening, detection of suspects, prevented people, complications reduction etc. Alternatively, health interventions are assessed by the incidence, prevalence rates, or improvement of quality of life, or life expectancy, QALY (Quality Adjusted Life-Years) and so on (Quang, 2012).

5.3.1. Cost effectiveness ratio

Under the conventional method of the cost effectiveness analysis, the CER ratio will be calculated in comparing the two TB treatment regimens, and the following formulas and procedures will be completed.

- Total Cost (in each level e.g. The health facility level, province level, and national level for both treatments) = C (Costs)
- The outcome of each treatment regimen (the successfully treated patients) = E (Effectiveness) and
- The Cost Effectiveness Ratio (CER) by using the following formula:
    - $\boldsymbol{CER = (Total\ Cost\ 6EH / (Effectivenes\ (Treatement\ \ Sucees) 6EH}$
    - $\boldsymbol{CER = (Total\ Cost\ 4RH / (Effectiveness\ (Treatmetn\ Sucesss) 4RH}$
    - Comparison CER of 4RH treatment regimen versus 6EH treatment.

Table 5: Summary of calculating CER

	Program B (4RH)	Program A (6EH)
Cost (C)	Cost B	Cost A
Pats. Successfully treated (E)	Effectiveness B	Effectiveness A
Cost/Effectiveness (C/E)	Cost per Patient Successfully treated	Cost per Patient Successfully treated

Source: (Torrance.G)).

5.4. Study Design

This is a retrospective study (pre-post model design) from the provider /NTP view point. Secondary data on costs and outcomes from 3 levels of TB services provision areas were collected for this study described below: The three levels are 1) health facilities level 2) province level and 3) national level.

1. **Health Facilities Level**: For the selection of the health facilities the following two main criteria were considered:
   - The performance of the health facilities (to be functional and provide services to the client regularly)
   - Location of the health facilities (from urban and rural table 6 in below provides information on the location of the health facilities. The health facility level data are collected from one province (Takhar) and the details of each type of facility are provided below:

- **The Basic Health Center (BHC):** The BHC is a small facility that offers the services with more outpatient care. The services of the BHC cover a population of 15,000-30,000 people. BHC staff has the responsibility to follow TB and ensure DOTS, while there is no diagnostic services formally available for TB.

- **Comprehensive Health Center (CHC):** The CHC is a higher level of the facility compared to BHC it covers a larger catchment area of 30,000- 100,000 people. In addition the CHC is the first health facility level at which TB diagnosis can be made. At CHCs, doctors are able to both diagnose and treat uncomplicated cases of tuberculosis; other staff will ensure adequate follow-up of DOTS patients through other levels of the health system.
- **District Hospital (DH):** The DH carried-out all services in the Basic Package of Health Services (BPHS), DOTS is one of the key elements in the BPHS. At the district level, the district hospitals support the NTP in implementing TB control activities at the health facility levels. It provides diagnosis and treatment for TB cases, especially childhood TB cases for which X-ray examinations and tuberculin skin tests are crucial for adequate diagnosis including the most complicated cases.

2. **Province Level:** At the provincial level, TB control team the Provincial TB Coordinator and Provincial Lab Supervisor (PTC&PLS) are directly responsible to follow the TB control program implementation with a focus on supplying necessary TB materials. Further, description of these provinces is given in the (appendix-2 on page 99)
3. **National Level (National TB control Program):** TB service provision is done under the stewardship of the National TB control program (NTP) which covers the whole country (in 34 Provinces). The TB team in Kabul is responsible for planning, organizing, training and controlling the TB program across the country.

Data on cost and outcome from the 3 levels; the health facility, province level and national level are analyzed for both treatment regimens the 2RHZE/4RH in 2012 and 2RHZE/6EH in 2011 accordingly. Below table 6 summarized the location and status of the selected health facilities in Takhar province.

Table 6: The Selected Health Facilities and Location and Road status

Province	District Name	Health Facility ID #	Health Facility Name	Health Facility Type	Status of Road Access	Distance from Center of the Province by (KM)
Takhar	Farkhar	439	Farkhar Hospital	District Hospital	Paved road	20
	Khowaja-Bahawuddin	1709	Khwaja Bahawuddin	Comprehensive Health Center (CHC)	Paved road	85
	Kalafgaan	1696	Chahar Tut	Basic Health Center (BHC)	Unpaved road	38
	Kalafgaan	446	Kalafgan	Comprehensive Health Center (CHC)	Unpaved road	30
	KhowajaGhaar	1161	Hazar Bagh	Comprehensive Health Center (CHC)	Paved road	45
	Baharak	427	Baharak	Comprehensive Health Center (CHC)	Paved road	33
	Taloqan	428	Qol Bars	Basic Health Center (BHC)	Paved road	13
	Taloqan	431	Nahri Chaman	Basic Health Center (BHC)	Paved road	7

A cost-effectiveness analysis (CEA) concept is used to evaluate the costs and effectiveness of 2RHZE/4RH in comparison with 2RHZE/6EH, and “cost per effectiveness” associated with each treatment regimen are computed.

For the outcome measurement the following formulas and guiding points in summarized in table 7 were used to measure and calculate the total treatment success TB patients at the health facility level, the province level and at the nation level.

Table 7: Main Operational Indicators and Its Calculation

Cure rate	***Numerator:* Number of new smear-positive pulmonary TB cases registered in a specified period that were cured**
	Denominator: Total number of new smear-positive pulmonary TB cases registered in the same period x 100
Treatment completion rate	***Numerator:*** Number of new smear-positive pulmonary TB cases registered in a specified period that completed treatment and did not meet the criteria for cure or failure
	Denominator: Total number of new smear-positive pulmonary TB cases registered in the same period x 100
Success rate	***Numerator:*** Number of new smear-positive pulmonary TB cases registered in a specified period that was cured and plus who completed treatment
	Denominator: Total number of new smear-positive pulmonary TB cases registered in the same period x 100
Death rate	***Numerator:*** Number of new smear-positive pulmonary TB cases registered in a specified period that died during treatment, irrespective of cause
	Denominator: Total number of new smear-positive pulmonary TB cases registered in the same period x 100
Treatment failure rate	***Numerator:*** Number of new smear-positive pulmonary TB cases registered in a specified period that are smear positive 5 months or later after initiating treatment
	Denominator: Total number of new smear-positive pulmonary TB cases registered in the same period x 100
Default rate	***Numerator:*** Number of new smear-positive pulmonary TB cases registered in a specified period that interrupted treatment for more than 1 consecutive month
	Denominator: Total number of new smear-positive
	pulmonary TB cases registered in the same period x 100
Transfer-out rate	***Numerator:*** Number of new smear-positive pulmonary TB cases registered in a specified period that were transferred to another basic management unit and for which there is no treatment outcome information
	Denominator: Total number of new smear-positive pulmonary TB cases registered during the same period x 100

Source: (WHO & NTP TB guideline, 2010.

5.5. Population and Sample Size

The study attempts to analyze the unit cost and cost-effectiveness ratios at 3 levels as discussed early in the design part, the population and sample sizes are different at each level as per below explanations:

At the national level: The population and sample size are the entire TB program at national in the country.

At the Province Level: The population are provincial TB offices in the 34 provinces and the sample size is 4 provinces namely; Baghlan, Kunduz, Takhar and Badakhshan for further information see (appendix-2 on page 99).

At the Health Facility Level: The population of the study at the health facility levels are all 813 Basic Health Centers (BHCs), 384 Comprehensive Health Centers (CHCs) and 47 District Hospitals (DHs) present in the country in 2011. The sample size of the health facilities were selected from Takhar province for e.g. 3 BHCs out of 23, 4CHCs out of 13 and 1 DH out of 3 for both treatment regimens the 6EH and 4RH in 2011 and 2012 respectively.

The sampling method used

1) At the Province Level: purposely chose 4 provinces with the pilot program of 4RH treatment as implemented in 2012, for which the data were available.
2) At the Facility Level: this was done in two stages under the purposive sampling method: i) choses Takhar province out of 4 provinces and ii) the choses 8 health facilities out of 39 total in Takhar province based on the early defined criteria mentioned in the design part. The table below provides the percentage and number of the selected health facilities in Takhar:

Table 8: Summary of the selected health facilities in Takhar province and % of sample

Province	Total Districts	# of Total Selected Districts & %	Total # of Health Facilities			Selected # Health Facilities		
			DH	CHC	BHC	DH	CHC	BHC
Takhar	17	6 (35%)	3	13	23	1 (33%)	4 (31%)	3 (13%)

5.6. Data source

Data sources for the cost items were the financial leggier/registers, and annual expenditure reports of National TB Control Program (NTP) at the province level offices, central National TB control program offices and the partner organizations' offices the tool used for data collection are attached in the (appendix-3 on page xiii102). And the sources of the outcome data were the health facilities records and reports, provincial TB control offices, partner organizations and National TB control program in Kabul. All cost data were collected in (Afghani) and then they converted to the USD of that year and later adjusted for the inflation rate. The data were analyzed from the provider's perspective (health system). The tables below summarize the sources and types of the data.

Table 9: Required Data, and Sources of Data

Data required	Study instrument	Source
1- Cost data (Capital, Labor and Material)	Account record/registers available a at provincial level office and central level	Secondary
2- Outcome data: **- No. of Smear sputum positive patients in year (2011, 2012)**	- Surveillance dept. of NTP (TB database) - Provincial level office database, and implementing partner NGOs	Secondary

Table 9 in above provides brief on the data sources and the type of the data which needed for the study analysis.

5.7. Sensitivity Analysis

Moreover, a Sensitivity Analysis will be conducted to see whether changes in some of the key variables; costs or effectiveness would affect the consequences drawn from initial assessment, because many uncertainties involved in costs and outcomes data, for decision making purposes we need to be confident on the results obtain from such analysis.

Therefore, we conducted the sensitivity analysis to see how changes in of key input variable (the drugs cost) affects the result, the input variable is held at its base value and then vary from a base number by 10% and 20%.

CHAPTER VI
RESULTs & DISCUSSION

6.1. General Description

The study compares the cost and effectiveness of the two TB treatment regimens the 4RH and 6EH in the continuation phase, and measures the unit cost per one TB patient. The outcome data for this study are considered to be all TB patients (pulmonary and extra pulmonary) and patients treated successfully in the two years of the study.

The cost data collected in all three levels were in Afghani and were later converted to USD, where 1USD= 48 Afs in 2011 and for 2012 1USD= 51 Afghani, according to the central bank of Afghanistan (Central Bank, 2013). To make both costs comparable the 2012 cost was discounted to the Net Present Value (NPV) taking into account the 7% inflation rate (World Bank, 2012).

Aiming to find both the unit cost as well as cost effectiveness of the 6Eh and 4RH programs, the chapter is structured as follows:

6.2. Health Facility Level

At the health facility level, the total costs and unit costs of TB patients under the two TB regimens the (6EH and 4RH in 2011 and 2012 respectively) are calculated based on data from Takhar province. These are 3 types of health facilities included in the cost calculation: BHC, CHC and DH.

6.2.1. Total and the Unit Cost of TB patient at Basic Health Center (BHC)

The Basic Health Center (BHC) is a small facility that offers outpatient care. BHC covers a population of 15,000-30,000 people (MoPH, 2010). In this study, the cost and outcome data were retrieved from 3 out of 23 Basic Health Centers available in Takhar namely; Chartoot BHC, Nahrichaman BHC and Qoli Bars BHCs. This represents 13% of the total number of BHCs' in Takhar.

A pre-developed structured questionnaire was used for data collection. Cost data includes operating costs and capital costs. The operating cost data encompasses staff salary and benefits e.g. salary of medical doctor, nurse, and community health supervisors (CHS).

The proportion of the time spent for TB program out of the total time worked in office, is allocated to the TB program. Material costs, mostly include drugs used for treating one TB patient. The drug cost of one patient is based on actual drug need for one TB patient for the complete period of treatment (Unit cost X # of tablets X doses X period of treatment). The capital asset cost (medical and non-medical) used for all types of services in the clinic for all patients and the proportion of each equipment used for TB patients were obtained (by approximation) from the health care providers by asking and then calculated.

The cost of capital asset is zero for TB patients at the Basic Health center level, because the BHC provides treatment services only, as there is no diagnostic

service for TB detection. Usually the TB patients are referred to Comprehensive Health Center (CHC) or District Hospital (DH) for diagnosis. A TB patient is referred to BHC for treatment follow-up. Furthermore, if we consider the performance of the BHCs specifically in this case in both years of the study, the average patient treated were 2 per BHC, it indicates that the BHCs are underutilized with the current resources, so no more resources may need to be allocated. In result the zero cost of capital asset is worth and to be justifiable based on the data provided by the health facility staff.

The staff cost of BHC level is calculated based on (monthly salary and benefits) times 12 months multiplied by the % of time spent in the TB program for each individual staff (8months for 6EH and 6months for 4RH), this cost is summed-up for the whole cost of BHC. The same calculation method is used consistently for all 3 BHCs, and then divided by 3, then multiplied by the number of BHCs' in the province. By doing this the total cost for 23 BHCs' in Takhar province is obtained. The calculation is done for 2011 and repeated for the total cost calculation of year 2012 with the additional step of calculating the Net present Value of 2012 cost with the 7% of the discount rate (World Bank, 2012).

In addition, the depreciation cost of the capital asset was calculated using the straight line method $(SL = C/L)$ where SL is denoted for Straight-line, C for current cost of the asset and L is useful life in years (without considering the salvage

value, because of the absence of any standard in this regards). The useful life of fixed asset is taken from the Tax- book of the Ministry of Finance (MoF, 2010). The total cost calculation for each year is presented in the tables (9 &10) below.

Table 10: Total Cost Calculation for TB in BHC level in 2011 (6EH)

Type of Health Facility: Basic Health Center (BHC)

Year: 2011 (6EH)

Currency: USD

Operating Cost		BHC1				BHC2				BHC3			
	Qty	Unit/ month	Yearly	% time for TB	Cost for TB	Unit/ month	Yearly	% time for TB	Cost for TB	Unit/ month	Yearly	% time for TB	Cost for TB
1. Salary& Benefits													
Nurse/Medical Doctor	1	250	3000	5	150	258	3094	5	155	250	3000	10	300
Other staff (CHS)	1	181	2172	10	217	320	3838	10	384	175	2100	15	315
2.TB Drug	2	27	54	100	54	30	60	100	60	30	60	100	60
Sub Total of* Operating Cost	3	**5226**		**421**		**6991**		**598**		**5160**		**675**	
Average** Operating Cost/BHC	3	**5792**				**(TB) 565 ÷ 12*8 (EH) =376**							
Total BHCs Cost*****	23	**133219**				**(TB) 8657**							
Capital Cost***	0												
Total Cost for TB Patients						**8657**							

*Subtotal operating cost BHC= % time used for TB X cost for TB for BHC1+BHC2+BHC3

**Average operating cost BHC= (subtotal cost of BHC1+BHC2+BHC3)/number of BHCs (3)

***Subtotal and average capital cost for BHCs=0 (zero)

****Total BHCs Cost (23) for TB = (Total operating cost for TB + Total capital cost for TB) X Total BHCs

Below table 11 is the continued of the total BHC cost calculation in 2012 when 4RH has implemented in Takhar province.

Table 11: Total Cost Calculation for TB IN BHC Level in 2012 (4RH)

Type of Health Facility: BHC

Year: 2012 (4RH)

Currency: USD

Operating Cost		BHC1				BHC2				BHC3			
1. Salary& Benefits	Qty	Unit/ month	Yearly	% for TB	Cost for TB	Unit/ month	Yearly	% for TB	Cost for TB	Unit/ month	Yearly	% for TB	Cost for TB
Nurse/Medical Doctor	1	259	3106	5	155	400	4795	5	240	259	3106	10	311
Other staff (CHS)	1	199	2388	10	217	190	2280	10	228	200	2400	15	360
2.TB Drug	2	25	50	100	50	36	72	100	72	36	72	100	72
Subtotal* Operating Cost	-	-	5544		423		7147		540		5578		743
Average** Operating Cost/BHC	1												
			6089				(TB) 568÷12*8 (RH)=284						
Total BHCs'**** Operating Cost	23								13072				
			140057										
Capital Cost***	0												

Total Cost for TB Patients	**6532**
Net Present***** Value (NPV) of 2012 with 7% Discount Rate	**6104**

*Subtotal operating cost BHC= % time used for TB X cost for TB for BHC1+BHC2+BHC3

**Average operating cost per BHC= (subtotal cost of BHC1+BHC2+BHC3)/number of BHCs (3)

***Subtotal and average capital cost for BHCs=0 (zero)

****Total BHCs Cost (23) for TB = (Total operating cost for TB + Total capital cost for TB) X total BHCs

*****NPV 2012 = cost of 2012/ (1+0.07)

Table 12: Unit cost calculation for tb at BHC level in Takhar province for 6eh and 4rh

Year	(6EH) 2011	(4RH) 2012
Total Cost of BHCs for (TB) in (USD)*	**8657**	**6104**
Total TB patients	51	53
Average Cost/1 TB Patient	170	115

*Total Cost/ Total # of TB Patients

Table 12 in above provides information on the unit cost calculation per one TB patient at BHC level where the total cost is taken from the tables (10 &11) in above and divided by the total number of the patients treated by all BHCs in Takhar province under the both treatment regimens in 2011 and 2012. Moreover, looking at the total cost and (resources used for TB) compared to the number of the TB patients treated by BHCs are not efficient. Two TB patient per BHC during the one year period is neither efficiency nor effectiveness, a point to be considered is that the utilization of the BHCs' should be increased from the current status particularly for the TB performance, otherwise it appeared to be not efficient.

6.2.2. The Total and Unit Cost of TB patient at Comprehensive Center (CHC)

The Comprehensive Health Center (CHC) is the higher level of the facility compared to BHC. It covers a larger catchment area of 30,000- 100,000 people (MoPH, 2010. The actual cost and outcome data from 4 out of 13 Comprehensive Health Centers; namely Khowjabahuddin CHC, Kalafgan CHC, Khowaja Ghar CHC and Hazarbagh CHC. These represent 13% of the total number of the CHCs' in Takhar province. The same process described in the earlier subsection (for BHC) is also repeated here. The tables summarized the cost calculation at the CHC level for 2011 and 2012.

Table 13: Total Cost Calculation for TB at CHC level

Type of Health Facility: Comprehensive Health Center (CHC)

Year: 2011 (6EH)

Currency: USD

Operating Cost		**CHC1**					**CHC2**			
1. Salary& Benefits	**Qty**	**Unit/ month**	**Yearly**	**% Used for TB**	**Cost for TB**	**Qty**	**Unit/ month**	**Yearly**	**% Used for TB**	**Cost for TB**
Medical doctor	1	312.5	3750	10	375	12	323	3876	5	337.5
Nurse	1	291	3500	10	350	12	250	3000	15	450
Technician	1	270	3250	5	162.5	12	525	6300	10	630
2.TB Drug	32	27.5	880	100	880	32	27.5	880	100	880
Sub Total of Operating Cost	2							**14056**		**2297.5**
Operating Cost		**CHC3**					**CHC4**			
1. Salary& Benefits	**Qty**	**Unit/ month**	**Yearly**	**% Used for TB**	**Cost Used for TB**	**Qty**	**Unit/ month**	**Yearly**	**% Used for TB**	**Cost Used for TB**
Medical doctor	1	312.5	3750	12	450	12	236.	2833.25	20	566.65
Nurse	1	381.25	4575	60	2745	12	291	3500	30	1050

Technician	1	250	3000	20	600	12	208	2500	20	500
2.TB Drug	32	27.5	880	100	880	32	27.5	880	100	880
Sub Total of* Operating Cost			**12205**		**4675**			**9713**		**2996**
Total CHCs' Operating Cost	4	**11380**		**1767.5**						
Average** Operating Cost/CHC	4	**11838**		**(TB) 2934 ÷12*8 (EH)= 1956**						
Total CHCs' Operating Cost* **	**13**	**153901**		**25428 (TB)**						

..... ***Continued*** *(Part of the above table 12) the capital cost calculation for all 4 CHCs are given in the table below:*

Table 14: Total capital cost calculation for CHCs after the depreciation

Type of Health Facility: Comprehensive Health Center (CHC)

Year: 2011 (EH)

Currency: USD

Capital Cost	Qty	Useful life (Year)	Capital Expenditure CHC1	Qty	Capital Expenditure CHC2	Qty	Capital Expenditure CHC3	Qty	Capital Expenditure CHC4	Cost for TB CHC1	Cost for TB CHC2	Cost for TB CHC3	Cost for TB CHC4
1. Microscope	1	10	25	1	25	1	25	1	25	3	15	5	5

2. Examination table	1	10	10	1	10	2	21	1	10	1	4	2	1
3. Spegmanometer	1	5	5	1	5	2	10	1	5	1	1	2	1
4. Desk	4	10	100	3	75	2	50	3	75	5	4	3	4
5. Shelf	3	10	19	2	13	2	13	3	19	10	8	8	9
6.Chair	3	4	33	6	66	5	55	5	55	13	26	22	22
7. Trolley	1	4	13	1	13	2	26	1	13	4	4	8	4
9. Stand for drip	4	2	200	2	100	2	100	2	100	20	10	10	10
11. Slide Box	2	2	17	4	33	4	33	3	25	13	27	27	20
12. Sputum Kit	1	5	3	3	9	5	15	3	9	3	9	15	9
13. ESR Rock	1	2	9	3	28	4	38	2	19	7	23	28	12
Sub Total of**** Capital Cost	4		**434**		**377**		**384**		**354**	**79**	**129**	**128**	**96**
Average Capital Cost/CHC*****	**4**											**108**	
					387								
Total CHCs' Capital Cost	**13**				**1550**							**1406 (TB)**	
Total CHCs and TB Cost******	**13**				**155451**							**26834 (TB)**	

*Subtotal operating cost CHC= (% time used for TB X cost for TB for CHC1+CHC2+CHC3+CHC4)

**Average operating cost per CHC= (subtotal cost of CHC1+CHC2+CHC3+CHC4)/number of CHCs (4)

***Total operating cost of CHCs (13) = (Average operating cost) X total CHCs

****Subtotal capital cost CHC= (% time used for TB X cost for TB for CHC1+CHC2+CHC3+CHC4)

*****Average capital cost per CHC= (subtotal capital cost of CHC1+CHC2+CHC3+CHC4)/CHCs (4)

******Total Capital cost of CHCs (13) = (Average Capital cost) X total CHCs

******Total CHCs Cost (13) for TB = (Total operating cost for TB + Total capital cost for TB)

*****NPV 2012 = cost of 2012/ (1+0.07)

Note: Table 14 in above provide the descriptions of the capital cost computation for CHC, while the opportunity cost (space used for TB) was not included because it represented a very small amount about 1% as an average for all CHCs out of the total rent of the health facility it ranged from $125 $350 as a total rent for CHCs and the TB used 1% for both 2011 and 2012 years. That is why the cost is not considered in the calculation It is not worth investing a great deal of time and effort considering costs that, because they are small, are unlikely to make any difference to the study result (Drummond 2007).

Table 15 in below provides the detailed of total cost computation for TB patients at a CHC level in the year 2012 when the 4RH treatment applied for treating TB patients in Takhar province.

Table 15: Total Cost of TB Patient at CHC Level in (year 2012)

Type of Health Facility: Comprehensive Health Center (CHC) **Year: 2012 (RH)** **Currency: USD**										
Operating Cost			**CHC 1**					**CHC2**		
1. Salary& Benefits	**Qty**	**Unit/ month**	**Yearly**	**% For TB**	**Cost for TB**	**Qty**	**Unit/ month**	**Yearly**	**% For TB**	**Cost for TB**
Medical doctor	1	324	3882	10	388	12	353	4235	5	212
Nurse	1	306	3671	10	367	12	259	3106	15	466
Technician	1	280	3365	5	168	12	280	3365	10	336
2.TB Drug	32	25	800	100	800	32	25	800	100	800
Sub Total of Operating Cost	2		11718		1724			11506		1814
Operating Cost			**CHC3**					**CHC4**		
1. Salary& Benefits	**Qty**	**Unit/month**	**Yearly**	**% For TB**	**Cost for TB**	**Qty**	**Unit/month**	**Yearly**	**% For TB**	**Cost for TB**

Medical doctor	1	324	3882	12	466	12	324	3882	20	776
Nurse	1	302	3624	60	2174	12	302	3624	30	1087
Technician	1	235	2824	20	565	12	196	2353	20	471
2.TB Drug	32	25	800	100	800	32	25	800	100	800
Sub Total of Operating Cost*	2		**11129**		**4005**			**10659**		**3134**
Average Operating Cost/CHC**	4			**11253**				**(TB) 2669÷12*6=1334**		
Total CHCs' Operating Cost	13					**146288**				
Total CHC Operating Cost for TB***	13					**17843 (TB)**				

...Continued in below (Part of the 13 table in above) the capital cost calculation for the TB patients at a CHC level in 2012 when 4RH is used to treat the TB patients in Takhar Province.

Table 16: Capital cost calculation for CHCs in Takhar province

Type of Health Facility: Comprehensive Health Center (CHC)

Year: 2012 (RH)

Currency: USD

Capital Cost	Qty	Useful Life (years)	Capital Expenditure CHC1	Qty	Capital Expenditure CHC2	Qty	Capital Expenditure CHC3	Qty	Capital Expenditure CHC4	Cost for TB CHC1	Cost for TB CHC2	Cost for TB CHC3	Cost for TB CHC4
1. Microscope	1	10	24	1	24	1	24	1	24	2	14	5	5
2. Examination table	1	10	10	1	1	2	2	1	1	1	0	0	0
3. Spegmanometer	1	5	5	1	5	2	9	1	5	0	1	1	0
4. Desk	4	10	24	3	18	2	12	3	18	1	1	1	1
5. Shelf	3	10	6	2	4	2	4	3	6	3	2	2	3
6.Chair	3	4	10	6	21	5	17	5	17	4	8	7	7
7. Trolley	1	4	12	1	12	2	25	1	12	4	4	7	4
9. Stand for drip	4	2	47	2	24	2	24	2	24	5	2	2	2
11. Slide Box	2	2	8	4	16	4	16	3	12	6	13	13	9
12. Sputum Kit	1	5	3	3	8	5	14	3	8	3	8	14	8
13. ESR Rage	1	2	9	3	26	4	35	2	18	6	21	26	11
Sub Total of Capital Cost****	4		156		180		143		145	79	74	78	50
Average Capital Cost/CHC*****	4			159						60			

Total CHCs' Capital Cost******	4	**638**	**781**
Total CHCs' and TB Cost*******	13	**146926**	**18624 (TB)**
Net Present Value (NPV) of 2012 to 2011 with 7% Discount rate********	13	**18130 (TB)**	

*Subtotal operating cost CHC= (% time used for TB X cost for TB for CHC1+CHC2+CHC3+CHC4)

**Average operating cost per CHC= (subtotal cost of CHC1+CHC2+CHC3+CHC4)/number of CHCs (4)

***Total operating cost of CHCs (13) = (Average operating cost) X total CHCs

****Subtotal capital cost CHC= (% time used for TB X cost for TB for CHC1+CHC2+CHC3+CHC4)

*****Average capital cost per CHC= (subtotal capital cost of CHC1+CHC2+CHC3+CHC4)/CHCs (4)

******Total capital cost of CHCs (13) = (Average Capital cost) X total CHCs

******Total CHCs Cost (13) for TB = (Total operating cost for TB + Total capital cost for TB)

********NPV of 2012 = cost of 2012/ (1+0.07)

Unit cost computation per TB patient is also measured the values are illustrated in table 17 in below for both treatment regimens in two years 2011 &2012. Furthermore, considering the unit cost per one TB patient at the CHCs level compared to the resources used in one year period under the two treatment regimens (cost vs. benefits) seems reasonable and resourceful. In other words the CHCs appeared to be most efficient among the health facilities in the study in term of resource mobilization.

Table 17: The Unit Cost Calculation for TB at CHC level for 6EH and 4RH

Year	(6EH) 2011	(4RH) 2011
Total Cost of CHCs for TB in (USD)*	26834	18130
No. of Total TB patients	452	417
Average Cost/1 Patient	59	43

*Total Cost/Total # of the TB patients

6.2.3. Total and Unit cost calculation of TB patient at District Hospital (DH)

District Hospital (DH) carries-out all services in the Basic Health Package of Health Services (BPHS). DOTS is one of the key elements in the BPHS. At the district levels, the district hospitals support the National TB Control Program (NTP) in implementing TB control activities. It provides diagnosis and treatment for TB cases, especially childhood TB cases for which X-ray examinations and tuberculin skin tests are crucial for adequate diagnosis including the most complicated cases. The actual cost and outcome data were retrieved from 1 out of 3 District Hospitals (DH), available in Takhar province, by the name of Farkhar Hospital, representing 33 % of total DHs' in Takhar province. The same process is again repeated in order to arrive the total cost of the TB program at the DH level in Takhar. The calculation is detailed in the tables below.

Table 18: Total Cost Calculation of TB in Takhar in 2011 (6EH)

Province: Takhar			
Year: 2011 (EH)			
Currency: USD			
Type of HF: District Hospital (DH)			
Operating Cost	**Qty**	**Unit/**	**Total Cost for TB**

1. Salary& Benefits		month	Yearly	% Used for TB	
Medical doctor	1	313	3750	10	375
Nurse	1	250	3000	16	480
Technician	2	571	6850	40	2740
2.TB Drug	34	27	918	100	918
Sub Total of Operating Cost*			**14518**		**4513**
Total DHs' Operating Cost**		**3**	**43554**	**(TB) 13539÷12*8=9026**	

Capital Cost	Qty	Unit Price	Total Price	% For TB	Cost for TB	Useful Life	Capital Expenditure	Cost for TB
1. Microscope	2	250	500	30	150	10	50	15
2. Examination table	1	104	104	17	18	10	10	2
3. Spegmanometer	1	25	25	10	3	5	5	1
4. Desk	4	63	250	25	63	10	25	6
5. Shelf	5	21	104	25	26	10	10	3
6.Chair	2	15	29	25	7	4	7	2
7. Trolley	2	52	104	5	5	4	26	1
9. Stand for drip	2	25	50	5	3	2	25	1
10. Scale adult	1	21	21	30	6	2	10	3
11. Freezer	1	393	393	5	20	5	79	4
12. Sputum Kit	2	15	29	100	29	2	15	15
13. ESR Rage	3	19	56	85	48	2	28	24
Sub of Capital Cost* **	**-**	-	**1666**	**-**	**377**	**-**	**291**	**76**
Total DHs' Capital Cost** **			**873**					**228 (TB)**
Total of DHs' Cost	3		**44427**				**(TB) 9026+228=9245**	
Total Cost for TB Patients*** **				**9254 (TB)**				

*Subtotal operating cost DH= (% time used for TB X cost for TB)

**Total operating cost of (3) DHs = (Average operating cost) X total CHCs

***Subtotal capital cost DH= (% time used for TB X cost for TB)

****Total capital cost of (3) DHs = (Average Capital cost) X total CHCs

*****Total DHs Cost (3) for TB = (Total operating cost for TB + Total capital cost for TB)

******NPV of 2012 = cost of 2012/ (1+0.07)

Note: table 18 in above provides cost calculation detailed for both operating and capital for which data were available at the facility, while some costs e.g. space used for TB and X-ray are not included. It is worth to justify that there were neither specific ward nor any record of admitted TB patients in the hospital at the time of data collection, and also the X-rays had not been kept records as TB patients x-ray for pulmonary smear negative patients especially. And from the other hand the cost is missed for both years 2011 and 2012, furthermore, the data extraction for TB patients were difficult while there were no record kept at all so, the data were missing. And also the cost calculation of the laboratory space was 2% used for TB, which account for $12 out of $600 total rental cost of the building, so it was not considered because it is not worth investing a great concern of time and effort considering costs that, they are small, are unlikely to make any difference to the study result (Drummond, 2007).

Table 19 in below provides the total cost calculation, detailed at district hospital level in Takhar province in 2012 when 4RH treatment has been used for treating the TB patients.

Table 19: Total Cost Calculation for TB Patient at DH Level in (Takhar Province in 2012(4RH)

Province: Takhar

Year: 2012 (4RH)

Type of HFs: District Hospital

Currency: USD

Operating Cost	**Qty**	**Unit/ month**	**Yearly**	**% used for TB**	**Cost for TB**
1. Salary& Benefits					
Medical doctor	12	324	3882	10	388
Nurse	12	259	3106	16	497
Technician	12	591	7092	40	2837
2.TB Drug	41	25	1025	100	1025
Sub Total of Operating Cost			**15105**		**4747**
Total DHs' Operating Cost	3		**45315**		**(TB)14241÷12*6(RH)=7121**

Capital Cost	**Qty**	**Unit Price**	**Total Price**	**% For TB**	**Cost for TB**	**Useful Life**	**Capital Expenditure**	**Capital Cost for TB**
1. Microscope	2	235	471	30	141	10	47	14
2. Examination table	1	98	98	17	17	10	10	2
3. Spegmanometer	1	24	24	10	2	5	5	0
4. Desk	4	59	235	25	59	10	24	6
5. Shelf	5	20	98	25	25	10	10	2
6.Chair	2	14	27	25	7	4	7	2
7. Trolley	2	49	98	5	5	4	25	1
9. Stand for drip	2	24	47	5	2	2	24	1
12. Scale adult	1	20	20	30	6	2	10	3
13. Freezer	1	370	370	5	19	5	74	4
12. Sputum Kit	2	14	27	100	27	2	14	14

13. ESR Rage	3	18	53	85	45	2	26	23
Sub Total of Capital Cost	1	-	**1568**	**-**	**354**	**-**	**274**	**72**
Total DHs' Capital Cost	3	-	-	-	-	-	**822**	**215**
Grant Total DHs' Cost	**3**	**-**	-	-	-	-	**46137**	**7335 (TB)**
Total Cost for TB Patients					**7335**			
Net Present Value (NPV) of 2012 with 7%					**6855 (TB)**			

*Subtotal operating cost DH= (% time used for TB X cost for TB)

**Total operating cost of (3) DHs = (Average operating cost) X total CHCs

***Subtotal capital cost DH= (% time used for TB X cost for TB)

****Total capital cost of (3) DHs = (Average Capital cost) X total CHCs

*****Total DHs Cost (3) for TB = (Total operating cost for TB + Total capital cost for TB)

******NPV of 2012 = cost of 2012/ (1+0.07).

After the total cost collection in the tables 18 &19 in above the unit cost per one TB patient at the DHs level in Takhar province is also computed the values are given in the table 20 in below. In addition the unit cost per one TB patient compared to the resources used at DH level is ranked as the second most cost effective health facility in the study result. In terms of resource mobilization the DH remained also cost effective during the study years.

Table 20 illustrates the unit cost calculation at DHs' level in Takhar provinces we simply divided total cost on the number of total TB patients.

Table 20: Unit Cost Calculation of TB Patient at DHs' Level in Takhar Province

Year	(6EH) 2011	(4RH) 2011
Total Cost of DHs' for (TB) in (USD)*	9254	6855
Total TB patients	120	142
Average Cost/1TB Patient	77	48

*Total cost/Total # of TB patients

6.3. Province Level

6.3.1. Total and Unit Cost Calculation at Takhar Province

Under the Two TB regimens the 6EH and 4RH in 2011 and 2012 years, respectively, data were obtained from four provinces, namely; Baghlan, Kunduz, Takhar and Badakhshan these were 4RH pilot provinces.

Cost data consists of two types the operation and the capital asset. The operating cost includes the administrative cost of the two staff: Salary & benefits of the provincial TB coordinator (PTC) and the Provincial Lab Supervisor (PLS), and as well as the training cost of TB related personnel, and other logistic supply. PTC and PLS work specifically for TB control program, so their time (working hours) are 100% devoted to the TB program implementation, planning, organizing and controlling at the province level.

The capital costs include all medical and nonmedical fixed assets which are available in the provincial offices. It should be noted that provincial TB staff are not involved in treating TB patients, so there is definitely no double counting, considering that the health facilities costs are also calculated. The calculation is done for 2011 and repeated for 2012 as well. The additional step of calculating Net Present Value (NPV) of the 2012 cost, considering 7% discount rate (World Bank, 2012) is also taken. Furthermore, the depreciation cost of the capital asset is calculated using straight-line depreciation method as described earlier. Details for Takhar province are provided in the tables 20 & 21 below. Details for the other provinces are included in the (appendix-1 cost calculation of provinces on page 91).

Table 21: Provincial Level Total Cost Calculation for the TB Patients (Takhar Province) in 2011 for 6EH

Province Name: Takhar					
Year: 2011 (6EH)					
Currency: USD					
Operating Cost					
1. Salary& Benefits			**Qty**	**Unit/Month**	**Yearly**
Provincial TB Coordinator (PTC)			1	485	5824
Provincial Lab Supervisor (PLS)			1	324	3882
2. Training			213	147	31324
3. Other cost			12	123	1471
Sub Total of Operating Cost*				**42,500**	
Capital Cost	**Qty**	**Unit price**	**Total Price**	**Useful Life**	**Total of Capital Expenditure**
1. Office Disk	4	59	235	10	24
2. Shelf/Cupboard	3	57	172	10	17
3. Chair	15	22	324	4	81
4. Printer	1	143	143	2	71
5. Computer (Desktop)	1	463	463	3	154
6. Other	2	59	118	2	59
Sub Total Capital Cost**				**406**	
Total Cost (TB)***				**42,906**	

*Subtotal operating cost (Takhar) = (100% time used for TB)

**Subtotal capital cost (Takhar) = (100% time used for TB)

***Total Province cost for TB = (Total operating cost + Total capital cost)

Table 21 in below provides the total cost computation for TB program in the province level for 2012 when the 4RH used as treatment protocol for treating all new TB patients in the province.

Table 22: Province Level Total Cost Calculation for the TB patients (Takhar Province) in 2012 (4RH)

Province Name: Takhar					
Year: 2012 (6RH)					
Currency: USD					
Operating Cost					
1. Salary& Benefits			**Qty**	**Unit/Month**	**Yearly**
Provincial TB Coordinator (PTC)			1	377	4529
Provincial Lab Supervisor (PLS)			1	270	3235
2. Training			140	147	20588
3. Other cost			12	123	1471
Subtotal Operating Cost*				**29,824**	
Capital Cost	**Qty**	**Unit price**	**Total Price**	**Useful Life**	**Capital Expenditure**
1.Office Disk	6	59	353	10	35
2. Shelf/Cupboard	3	57	172	10	17
3. Chair	20	22	421	4	105
4. Printer	1	863	863	2	431
5. Computer (Desktop)	1	431	431	3	144
6. Other	2	69	137	2	69
Sub Total Capital Cost**				**801**	
Grant Total Cost ***				**30625**	
Net Present Value (NPV) of 2012 with 7%****				**28621 (TB)**	

*Subtotal operating cost (Takhar) = (100% time used for TB)

**Subtotal capital cost (Takhar) = (100% time used for TB)

***Total Province cost for TB = (Total operating cost + Total capital cost)

****NPV of 2012 = cost of 2012/ (1+0.07)

After the total cost calculation as presented in the tables 21&22 in above, we computed the unit cost per TB patient as spent by their management in the province level, for both years 2011 & 2012 before and after the piloting of 4RH, the values for each treatment is summarized in table 23 as follows:

Table 23: Unit Cost Calculation of TB patient in Takhar Province

Year	(6EH) 2011	(4RH) 2012
Total Cost of TB in USD	**42906**	**28621**
Total number of TB patients	**1045**	**938**
Average Cost/1 Patient	**41**	**30.5**

6.4. National Level

6.4.1. TOTAL AND UNIT COST CALCULATION OF TB PATIENT AT CENTRAL LEVEL

At the national level, the TB service provision is done under the stewardship of the National TB control program (NTP) in the whole country (in 34 Provinces). The team is based in Kabul overseeing the TB service provision and is responsible for planning, organizing, and controlling the TB program. Cost data at the national level consist again operating costs and the capital asset costs. The operating cost includes the administration, salary and benefits, training, advocacy, awareness, transportation, M&E, drug and logistic supply. Capital assets cost encompass all medical and nonmedical equipment used in the office at the central level of the national TB

control Program. Further, the time of the staff at national level is 100 % dedicated to the TB control program. The calculation was done first for 2011 and repeated for 2012, with an additional step of calculating the Net Present Value (NPV) of the 2012 cost, using the 7% discount rate (WB, 2012). The depreciation cost of the capital asset is calculated using the straight line depreciation method, just like the other levels. The details of the calculation are provided in tables below.

Table 24: TB Control Program Expenditure at Central Level

Currency: USD					
Operating Cost			**Qty**	**Year**	
				(6EH)2011	**(4RH) 2012**
Salary			147	647386	436231
Benefits			147	51791	34898
Drug			National	1165847	1496681
Travelling and Transportation			National	667593	207088
Stationary			National	28678	43573
Maintenance			National	26664	19813
Training			National	858305	341831
Publicity and awareness			National	97941	39902
Administration& Program Supply			National	1264420	1585467
Monitoring & Evaluation (M&E)			National	7567	11351
Sub Total of Operating Cost*				**4791194**	**4199609**
Capital Cost	**Qty**	**Unit Price**	**Total Price**	**Useful life**	**Capital Expenditure**
Computers and Accessories	59	730	43092	3	14855
Car	15	19063	285942	4	85090

Meeting Table	6	424	2541	10	254
Office Desk	6	284	1702	10	170
Chair	80	40	3199	4	800
Heater	4	46	184	2	92
Camera	3	233	700	3	233
TV	1	137	137	3	46
Microscope	47	522	24549	10	2455
X-ray Machine	1	168551	168551	10	16855
Freezer	4	447	1788	2	894
Cupboard	48	91	4363	4	1091
Other	9	165	1485	2	743
Sub Total of Capital Cost**			**538232**		**123577**
Grant Total Cost for Year 2011***			**4,914,771 (Total Central NTP******)**		
Grant Total Cost for Year 2012****			**4,323,186**		
Net Present Value (NPV) of 2012 with 7% Discount Rate*****			**4,040,361 (Total Central NTP)**		

******National TB Control Program

*Subtotal operating cost (central NTP) = (100 % time used for TB)

**Subtotal capital cost (central NTP) = (100 % time used for TB)

***Total central NTP cost for TB = (Total operating cost + Total capital cost) for 2011 (6EH)

*****Total central NTP cost for TB = (Total operating cost + Total capital cost) for 2012 (4RH)

******NPV of 2012 = cost of 2012/ (1+0.07)

Unit cost per one TB patient at central TB control program level is computed from the above table 23 the total cost values are divided by the total TB patients reported to the program. Brief is presented in table 25 as follows:

Table 25: The Unit Cost Calculation of TB Patient at Central TB Program level

Year	(6EH) 2011	(4RH) 2011
Total Cost of Central NTP in USD	4914771	4040361
Total TB Patients	28167	29578
Average Cost/1 TB Patient in USD*	174	137

*Total cost/ Total # of patients

The table 24 in above shows values for unit cost calculation for both treatments the 6EH and 4RH which is USD 174 and USD 137 at central TB control program level.

Summary of the Cost Calculation in three Levels

Total cost and unit cost of each level e.g., the health facility level, provincial level and national level as presented in the tables in above are further compiled, and their total cost, unit cost and outcome data are illustrated in the tables 26 and 27 as follows:

Table 26: Summary of the 3 levels cost comparison for both treatment regimens in Takhar Province

Year	2011 (6EH)		2012 (4RH)	
1. Level of Analysis	Total Cost (USD)	Unit Cost (USD)	Total Cost (USD)	Unit Cost (USD)
Facility Level				
BHC (23)	8654	170	6104	115
CHC (13)	26834	59	18134	43
DH (3)	9254	77	6855	48
2. Province Level	42906	-	28021	-
Total Province (Takhar)	**79319**	**76**	**59114**	**63**
3. National Level				
National TB Program (Central level only)*	**4,914,771**	**174**	**4,040,361**	**137**

*Total cost/Total # of patients

The table 25 in above shows summary of the unit and the average total cost calculation for each level, in Takhar province and as well as the central level cost of the National TB Control Program only.

Furthermore, if we look at the cost per one TB patient at the province level (Takhar) compared to the resources used is higher this is because of the administrative expenditure which account for almost 40% ($42906) of the total cost $109209 in the province.

The comparison shows the difference in the cost values at each level under the two treatment regimens, in 2011 and 2012. The formula below is used for calculating the total costs in the provincial level for Takhar:

$$\text{Total Cost of Takhar (admin)} + \text{Total Cost of BHCs} + \text{Total Cost of CHCs} + \text{Total Cost of DHs?? Total number of TB Patients in Province}$$

So, in the result the cost values USD 104 for 6EH and USD 93 for 4RH, we see the difference of USD 11 which is less spent when 4RH used as treatment protocols.

Table 27: Summary of 3 Level Cost Analysis for the National TB control Program level with the average cost of 4 provinces

Year	2011 (6EH)		2012 (4RH)	
1. Level of Analysis	Total Cost (USD)	Unit Cost (USD)	Total Cost (USD)	Unit Cost (USD)
Facility Level				
BHC (23)	8654	254	6104	231
CHC (13)	26834	88	18134	80

DH (3)	9254	115	6855	95
2. Province Level	32625	-	24073	-
Total 4 Province	77367	84	55166	53
3. National Level				
Total Cost of TB Program at National Level*	7,327,648	260	5,786,582	195

*Total cost/Total # of patients

Data in table 27 show the comparison summary of the total cost and the unit cost for both treatment regimens in two years (2011&2012).

Unit cost per one TB patient at central level is increased compared to the province and health facility levels, it indicates that the operating cost of the central level is accounted for almost 60% of the total expenditure taken place. While the treatment cost itself is not as much higher to alter the result, by decreasing some of the operating cost e.g. training and transportation cost we can decrease the unit cost to almost reasonable level.

Calculation of the total and unit costs of each level is presented under each section with detailed in the table 27 in above.

To compute total costs of the both programs the 6EH and 4RH at the national level in 2011 and 2012 the below formula is used:

$$\text{Total Cost of National} + \text{Total Cost of 4 Provincs} * 34(\text{admin}) + \text{Total BHCs Cost} + \text{Total CHCs Cost} + \text{Total DHs Cost (in country)} \; ?? \text{Total number of TB Patients in country}$$

Considering the formula in the above total costs of the both programs are computed based on the assumption made that the unit cost in Takhar province represent the national level unit cost.

The cost values are presented in table 26 in the above and 27 in below for the total health facilities in the country, so the total cost is measured as follows.

$$Natinal\ Level\ TB\ cost\ for\ 2011\ (6EH)$$
$$= 4914771 + AC\ 4Province\ (32625)x\ 34(province)$$
$$+ 1303627\ (TC\ of\ HFs)$$

$$= \boldsymbol{USD\ 7,327,648\ National\ Level\ Program\ Cost}$$

$$Natinal\ Level\ TB\ cost\ for\ 2012\ (4RH)$$
$$= 4914771 + AC\ 4Province\ (24073)x\ 34(province)$$
$$+ 927739(TC\ of\ HFs)$$

$$= \boldsymbol{USD\ 5,786582\ National\ Level\ Program\ Cost}$$

In the equations in above the AC= Average Cost, TC= Total Cost and HF= Health Facilities.

Note: the average cost of total BHCs', CHCs' and DHs' for the entire country for the both treatments are summarized in the table 28 in below.

Table 28: Summary of the average cost per health facility (BHC, CHC and DH) for TB program in 2011-12

Year	**2011 (6EH)**		
	Total HFs	AC/BHC	Total Cost
BHC	813	376	305688
CHC	379	2064	782256
DH	47	4589	215683
Total in USD		**$ 1303627**	
Year	**2012 (4RH)**		
	Total HFs	AC/BHC	Total Cost
BHC	813	284	230892
CHC	384	1394	535296
DH	47	4819	226493
Total in USD		**$ 992681**	
After Discounting*		**$ 927739**	

*NPV 2012= Cost of 2012/(1+0.07)

Table 28 in above provides the details on the average cost per each type of the health facilities for both treatment regimens, this cost was used for the computation of the national level TB Program cost.

The unit cost computation for the National Level of the TB Control Program is calculated and the below formula is used:

$$The\ UC\ fo\ TB\ in\ 2011\ (6EH) = TC\ (\boldsymbol{USD\ 7,327,648})??\mathbf{28167} = \$\mathbf{260}$$

$$The\ UC\ fo\ TB\ in\ 2012\ (4RH) = TC\ (\boldsymbol{USD\ 6,466,221})??\mathbf{29578} = \$\mathbf{195}$$

Where UC = unit cost, TC= Total Cost, EH= Eithambitol plus Isoniazid, RH= Rifampicin plus Isoniazid

The total cost values of the central level TB control Program in the equation in above are from the table 26, for the both treatment regimens. The unit cost for one TB patient at the national level is equal to $ 260 for 6EH, and $195 for (4RH), where the cost difference is equal to USD 65 that is less spent in the year 2012 for 4RH, and considered as the cheapest treatment compared to 6EH.

6.5. Cost Effectiveness Analysis

The cost effectiveness analysis of the two TB treatment regimens the 4RH and 6EH is conducted from the provider perspective at all three levels: the health facility level, provincial level and at the national level. To measure the CER at BHC level the total average cost of the 23 BHCs occurred in 2011 for (6EH) divided by the effectiveness (treatment success) patients in at the BHCs levels. For e.g. the total cost of **$8657** is divided over the number of the treatment success patients which are (45). This gives the ratio of $192 per one successfully treated TB patients with 6EH in 2011, and the below formula was used to find the cost per one successfully treated patient.

$$\boldsymbol{CER = (Total\ Cost\ 6EH/ (Effectivenes\ (Treatement\ \ Sucees)6EH}$$

$$\boldsymbol{CER = (Total\ Cost\ 4RH/ (Effectiveness\ (Treatmetn\ Sucesss)4RH}$$

The same process is repeated for 2012, so CER per one successfully treated patient is $142, which is lower than that of 6EH. The difference is about **$50** per one successfully treated TB patient.

- For measuring the CER at the CHC level the above mentioned formula was used again and the cost per one successfully treated TB patient for 4RH in year 2012 is equal to $USD 64, and 45 for 6EH and 4RH accordingly, there is $19 difference that is less spent by using the 4RH in 2012, so the 4RH is more cost effective at CHC level as well compared to 6EH.

- The CER calculation was measured in a District Hospital (DH) level, the cost per one treatment success patient at DH level is equal to $90 for 6EH and $56 for 4RH. The difference in cost is $34, which less spent by using the 4RH.

- **The CER** at the province level for the two treatment regimens in Takhar province is equal to $121 and $103 for 6EH and 4RH.

- At the national level CER for the both treatment regimens were calculated the result indicates that the 4RH treatment strategy implemented in 2012 is more cost effective compared to the 6EH that was implemented in 2011 and before that. The cost per one treatment success patient is $582 and $484 for 6EH and 4RH apparently.

The total difference in cost is $98 per one successfully treated patient the number of patient is equal to 12601 for 6EH and 11957 for 4RH.

Table 29 in below provides summary of the CER calculation in 3 levels for the 4RH and 6EH in 2012 and 2011 respectively.

Table 29: Summary of the Cost Effectiveness Ratio Calculation and its comparison in in 3 Levels for Takhar Province

Level of Analysis	Formulas	Cost Effectiveness Ratio in 3 Level in 2011 for (6EH)			Cost Effectiveness Ratio in 3 Level in 2012 for (4RH)		
		Value(USD)	Effectiveness	CER	Value(USD)	Effectiveness	CER

BHC (23)	TC* of BHC/ Effectiveness	8654	45	192	6104	43	142
CHC (13)	TC of CHC/ Effectiveness	26834	422	64	18134	407	45
DH (3)	TC of DH/ Effectiveness	9254	103	90	6855	123	56
Province (Takhar)	TC of Province(admin) + TC of BHC+TC of CHC+TC of DH/ Effectiveness	**79319**	653	121	**59114**	**576**	103
National (NTP)	TC of National +TC of 4 Province (Admin)*34 +TC (DH)* + TC(CHC)* +TC (BHC)* / Effectiveness	**7,327,648**	**12601**	**582**	**5,786,582**	**11957**	**484**

*Total Cost of BHC/Total treatment success patients

**TC=Total Cost

Table 29 in above describes the cost effectiveness ratios measurement for all 3 levels. Thus, to be clear that for the CER calculation in Takhar province the below formula was used:

$$\text{Total Cost of Provinc (admin)} + \text{Total Cost of BHC} + \text{Total Cost of CHC} + \text{Total Cost of DH?? Effectiveness (Treatment success Patients)}$$

While measuring the CER at the national level we used the following specific formula:

$$\text{Total Cost of National} + \text{Total Cost of 4 Provincs} * 34(\text{admin}) + \text{Total Cost of BHCs} + \text{Total Cost of CHCs} + \text{Total Cost of DHs}?? \text{Effectiveness (Treatment success Patients)}$$

In the formula in above the average CER of the four provinces were used to find the national level CER. Table 30 in below provides the summary of the result, together with the national level CER calculation.

Table 30: Comparison of the CER in all 3 Levels for 6EH and 4RH Using average cost of four Provinces

Year		2011 (6EH)			2012 (4RH)		
Level of Analysis	Formulas	Value	Effectiveness (Treatment Success)	Average (CER)	Value	Effectiveness (Treatment Success)	Average (CER)
BHC (Takhar)	TC* of BHC/ Effectiveness	8654	45	192	6104	43	142
CHC (Takhar)	TC of CHC/ Effectiveness	26834	422	64	18134	407	45
DH (Takhar)	TC of DH/ Effectiveness	9254	103	90	6855	123	56
Province (4)	TC of 4 Province (admin) + TC of BHC+TAC of CHC+TC of DH/ Effectiveness	**77367**	**554**	**140**	**55166**	**572**	**96**
National TB Control Program	(TC** of National +TC of 4 Province (Admin)*34 +TC (DH)* + TAC(CHC)* +TC (BHC)* / Effectiveness)	**7,327,648**	**12601**	**582**	**5,786,582**	**11957**	**484**

*Total Cost of BHC/Total treatment success patients

**TC=Total Cost

- As an additional efforts **t**he CER and the average costs per 1 TB patient for all 4 provinces (Baghlan, Badakhshan, Kunduz and Takhar) were calculated, the result of the analysis is summarized in the table 31 in below:

Table 31: Summary of the Unit Cost and CER Calculation for 4RH and 6EH in four Provinces in 2011 and 2012

2011 (6EH)	Total Cost (USD)	Treatment Success (TB)	CER (USD)	Ave. Cost (USD)
Takhar	42906	653	66	41
Badakhshan	34704	454	76	53
Baghlan	11274	515	21	12
Kunduz	41657	591	70	41
Average (4Provinces)	32635	553	58	**34**
2012 (4RH)	**Total Cost (USD)**	**Treatment Success (TB)**	**CER (USD)**	**Ave. Cost (USD)**
Takhar	28621	576	50	27
Badakhshan	30375	563	54	42
Baghlan	11420	520	22	13
Kunduz	25876	563	46	25
Average (4Provinces)	24073	556	43	28

6.6. Sensitivity Analysis

The sensitivity analysis can be either one way or two ways depend on the nature of the study. The two-way sensitivity analysis examines the effect of changes of two variables on consequences. While one way sensitivity analysis examines the effect of variables on consequences by considering one variable at a time. However, we focus on way sensitivity analysis to see how changes in some of key input variables for e.g. cost of TB drug, or time affect the result, every input variable is held at its base value except the one we are looking for, and then the variable is going to be analyzed

vary from a base number by certain percentage, while holding other variables constant in one time (ceteris paribus) to see how it affect the result. Because many uncertainties involve in the costs and outcomes data, for decision making purposes, we need to be confident in the results obtain from such analysis (Drummond, 2005).

Based on the available data for the two treatments (4RH and 6EH) under two different scenarios we assume that, the difference in the total cost of the 4RH which is less spent compared to 6EH that could be a result of the drug cost particularly in the continuation phase. The TB drug cost could affect the cost effectiveness ratio, because, the 4RH is advised for 4 months in the continuation phase and the total duration is for 6 months so the cost is less spent. While EH is advised for 6 months in the continuation phase and for the total period of 8 months, the sensitivity analysis will be done in two different scenarios at the health facilities levels; the BHC level, the CHC level and the DH level.

After increasing the drug cost by 10% and 20% from base value (see appendix-4 sensitivity Appedix-4 **Sensitivity Analysis** p 111) for each type of the health facility separately. And then increased the drug cost of 4RH up to 100 % the CER is recalculated with changed value and compared with the normal ratios. Therefore, the CER of 4RH remained low than the 6EH.

The result of study remains robust even the drug cost increased by 100%, thus the 6EH cost remained high, it indicates that the 4RH is remained low cost with good outcome, the drug cost has no effects on the CER ratio. For more detailed the below table 32 provides the compiled CER calculation for all types of the health facilities with the sensitivity analysis.

Table 32: Cost Effectiveness Ratios calculation with Sensitivity Analysis at Health Facility Level

Sensitivity Analysis	4RH (2012) CER	6EH (2011) CER	4RH (2012) CER	6EH (2011) CER	4RH (2012) CER	6EH (2011) CER
	BHC	BHC	CHC	CHC	DH	DH
Original Value of (CER)*	142	192	45	64	56	90
10% increase in the drug cost under 4RH	142	192	45	64	57	90
20% increase in the drug cost under 4RH	142	192	45	64	57	90
30% increase in the drug cost under 4RH	142	192	45	64	58	90
40% increase in the drug cost under 4RH	142	192	45	64	59	90
50% increase in the drug cost under 4RH	143	192	46	64	60	90
60% increase in the drug cost under 4RH	143	192	46	64	61	90
70% increase in the drug cost under 4RH	143	192	46	64	62	90
80% increase in the drug cost under 4RH	143	192	46	64	62	90
90% increase in the drug cost under 4RH	143	192	46	64	63	90
100% increase in the drug cost under 4RH	143	192	47	64	64	90

Table 32 in above provides summary of the CER calculation after changing the drug cost from 10% to 100% for the 3 types of the health facilities (BHC, CHC and DH) for the 4RH treatment regimen only under the two scenarios. The changing in the new

CER particularly for Basic Health Center (BHC) was less than one USD, so it is not considered and the absolute values were put in the table the same role is applied for other health facilities as well.

The *original values in the table described the CER before changing the drug cost (normal values) and then with the increasing percentage up to 100% as stated in the table accordingly.

6.7. Discussion

The findings confirmed that that the 4RH treatment regimen for treating TB at level is more cost effective compared to the 6EH treatment regimen.

Moreover, the 4 RH has further benefits in term of the period of treatment which is two months shorter compared to 6EH. It is typically important for TB patients to remain adherent to the treatment, and they are more likely to stop the treatment at any stage if the treatment period is too lengthy.

Furthermore, by scaling-up of the 4RH treatment regimen to the whole country, it is possible to reduce the supply and some of the administrative costs as well, such as stationary, printing and transportation represent big portions the suggestion is made in light of the fact that the 4RH treatment was piloted in four out of 34 provinces in 2012, which was a relatively small area compared to the whole country.

Currently the 4RH are used in 30 provinces, while four provinces still continue with the old 6EH treatment regimen. It is understood that every new program needs more resource for the implementation in terms of set-up and providing training to the staff on that specific subject or area.

Nevertheless, from the patients' perspective the 6EH treatment strategy could be less costly in the context of Afghanistan, considering the geographical structure of the country and traveling costs. The 4RH treatment needs six months (DOTS) in both intensive and continuation phases. This means that TB patient must come to health facility every day (except the holidays). To take medicine in front of a health personnel as part of the requirement of the 4RH treatment, when initiating anti TB treatment combining the Rifampicin. Furthermore, the procedure recommended by

the World Health Organization (WHO). In contrast, the 6EH treatment needs the observation (DOTS) during the intensive period and by Bi weekly DOTS in the continuation phase for the sputum smear positive patients. Further studies should combine cost from the patient's perspective with the provider's perspective to have a more comprehensive understanding of the comparison between 4RH and 6EH.

CHAPTER VII
CONCLUSION & RECOMMENDATIONS

7.1. Conclusion

This is a cost effectiveness analysis of the two TB treatment regimens the 6EH and the 4RH. The 6EH was continued to be as treatment strategy for treating all new TB patients in the country. However, in 2012 the National TB Program launched a new treatment protocol of six months as pilot in four out of 34 provinces and then in 2013 it expanded to 26 more provinces.

As, Afghanistan was the only country in EMRO region used the 6EH treatment regimen in the continuation phase of TB treatment, while the World Health Organization (WHO) recommended treatment protocol was the 4RH in the continuation phase.

In this study, we compared the cost and effectiveness of both the treatment regimens before and after the piloting in the 3 levels i) at the health facility level ii) province level and iii) at the national level.

The total cost of the 4RH TB treatment regimen in 2012 at the national level was USD 5,786,582 with a total number of 11957 SS+ve TB patients successfully treated. The cost effectiveness ratio was USD 484/ 1 outcome (one treatment success patient). The total cost of the 6EH treatment regimen in 2011 at the national level was USD 7,327,648 with a total number of 12601 SS+ve TB patients successfully treated. The cost effectiveness ratio was USD 582/ 1 outcome (one treatment success patient), and the cost difference is about USD 1,541,066.

With the 4RH treatment regimen the National TB Control Program may likely save (21%) of the current cost so the 4RH treatment is more cost effective compared to 6EH in 2011. The difference of cost between the 4RH and 6EH is seen in all the 3 levels of analysis (the facility level, the province level and the national level). The cost effectiveness ratios at the provincial level in 2011 was USD 140 and for 4RH was USD 96 as an average of 4 provinces while the ratio in one province e.g. Takhar is USD **121** and USD 103 for 6EH and 4RH respectively. The cost effectiveness ratio at the health facility levels are USD 192 and USD 142, USD 64 and USD 45, USD 90 and USD 56 respectively, for BHC, CHC and DH in 2011 (6EH) and 2012 (4RH). The difference in cost is USD 50, USD 19, and USD 34 for BHC, CHC and DH respectively in 2011 and 2012.

Furthermore, the unit cost (average) per one TB patient (she/he may diagnose as TB case regardless of the types of the TB) for both treatment regimens were also calculated at all three levels; the national level, provincial level and at the health facility level. The result shows that cost per one TB patient at national level **is USD 260** for 6EH and USD **195** for 4RH respectively. Unit cost at the health facility level for each type is USD 170, USD 115 for BHC, USD 59 and USD 43 for CHC and USD 77 and USD 48 for DH in 2011 and 2012 accordingly.

In conclusion the 4RH treatment regimen as piloted in 2012 remained dominantly cost effective compared to 6EH in 2011, the decision of shifting treatment regimen to the new (4RH) is rational and sound economics.

7.2. Policy Recommendations

Considering the study result in all 3 levels of analysis, at health facility level, province level and at the national level the 4RH has a low unit cost per treating one TB patient and low cost effectiveness ratio. Compared to the 6EH which has high unit cost per treating one TB patient, and high cost effectiveness ratio per one successfully treated patient.

By the implementation of the 4RH treatment strategy the program may likely to save the additional USD 1,541,066 per year (21%) of the current expenditure even if the price of drug increase even up to 100% in the future.

Besides, the economic benefits that the 4RH has, it has a shorter treatment period, which increases the adherent to anti TB treatment, and it may likely decrease the default rate in the country in the upcoming years.

The study finds the unit cost per one TB patient who may get treatment at health facility level; for e.g. at Basic Health Center level (BHC), comprehensive Health Center level (CHC) and District Hospital level (DH), this can be used for the future financial planning.

The study result can be used for allocating resources to all levels based on their actual utilization, by which the program may save unnecessary expenditure. The study also revealed that the CHCs are the most cost effective Health facilities among others, in term of treating one TB patient, as well as one treatment success TB patient.

The attention should be paid to improve TB performance at the Basic Health Centers level, which appeared to be less cost effective for treating TB patient, though

the 4RH program is cost effective at BHC level compared to 6EH that implemented in 2011.

In general, it is important for the program people to improve the utilization of the resources in its most efficient way to get more TB patients under the 4RH program. As it appeared from the study result that at the national level outcome (treatment success rate) was less than that of 6EH in 2011.

In addition, the study further recommends that there should be other concurrent, programs to increase the community and patient awareness for the new treatment as it is two months shorter than the previous treatment of 8 months, this will definitely increase the treatment adherence, increase the treatment success rate and decrease the default rate at the national level in the long run.

7.3. The Study Limitations

Like the other economic studies which, faced with shortage of enough financial/cost data. In this study I was not able to access to the financial data of some of the partners of TB program in the country such as the Japan International Cooperation Agency (JICA), TB/CARE and Italian Cooperation (IC). They have been supporting the TB program, while their cost data is not reflected here.

Using the intermediate outcome the (treatment success patients) as an effectiveness is another limitation of this study. Further, the health facility level data are presented from one province out of four under study provinces, this could be another limitation of this study.

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APPENDIX

Appendix-1 Cost calculation of the three provinces

Table 33: Total Cost Calculation OF TB patient in Badakhshan Province for 2011 (6EH)

Province Name: Badakhshan

Year: 2011 (6EH)

Currency: USD

Operating Cost					
1. Salary& Benefits			Qty	Unit/Month	Yearly
Provincial TB Coordinator (PTC)			1	516	516
Provincial Lab Supervisor (PLS)			1	344	344
Other Staff			5	771	3854
2. Training			180	156	28125
3. Other cost			12	10	125
Sub Total Operating Cost			32964		
Capital Cost	Qty	Unit price	Total Price	Useful Life	Total Capital Expenditure
1. Microscope	1	3667	3667	10	367
4. Office Disk	6	57	344	10	34
5. Shelf/Cupboard	7	26	182	10	18
6. Chair	20	30	596	4	149
7. Computer (Laptop)	1	1375	1375	3	458
8. Printer	1	917	917	2	458
9. Computer (Desktop)	1	458	458	3	153

10.Scal adult	1	34	34	2	17
11.Stethscope	1	23	23	2	11
12. Stand/hunger	1	115	115	2	57
13. Other	1	34	34	2	17
Sub Total Capital Cost			**1741**		
Grant Total Cost			**34704**		

Table 34: Total Cost Calculation of TB patient in Badakhshan Province in 2012 (4RH)

Province Name: Badakhshan

Year: 2012

Currency: USD

Operating Cost				
1. Salary& Benefits		Qty	Unit/Month	Yearly
Provincial TB Coordinator (PTC)		1	377	377
Provincial Lab Supervisor (PLS)		1	270	270
Other Staff		5	725	3627
2. Training		180	147	26471
3. Other cost		12	10	118
Sub Total Operating Cost			30863	
Capital Cost	Qty	Unit price	Total Price	Useful Life	Total Capital Expenditure
1. Microscope	1	3451	3451	10	345
4. Office Disk	6	54	324	10	32
5. Shelf/Cupboard	7	25	172	10	17
6. Chair	20	28	561	4	140
7. Computer (Laptop)	1	1294	1294	3	431
8. Printer	1	863	863	2	431
9. Computer (Desktop)	1	431	431	3	144
10.Scal adult	1	32	32	2	16
11.Stethscope	1	22	22	2	11
12. Stand/hunger	1	108	108	2	54
13. Other	1	32	32	2	16
Sub Total Capital Cost				1638	
Grant Total Cost				32501	

Net Present Value (NPV) of 2012 to 2011 with 7%	30375

Table 35: Total Cost Calculation of TB patient in Baghlan Province in 2011 (6EH)

Province Name: Baghlan

Year: 2011 (6EH)

Currency: USD

Operating Cost					
1. Salary& Benefits			Qty	Unit/Month	Yearly
Provincial TB Coordinator (PTC)			1	516	516
Provincial Lab Supervisor (PLS)			1	344	344
2. Training			61	156	9531
3. Other cost			12	15	177
Sub Total Operating Cost				10568	
Capital Cost	Qty	Unit price	Total Price	Useful Life	Capital Expenditure
1. Microscope	1	1563	1563	10	156
4. Office Disk	4	63	250	10	25
5. Shelf/Cupboard	3	61	182	10	18
6. Chair	15	23	344	4	86
7. Computer (Laptop)	1	498	498	3	166
8. Printer	1	152	152	2	76
9. Computer (Desktop)	1	492	492	3	164
13. Other	1	31	31	2	16
Sub Total Capital Cost				707	
Grant Total Cost				11274	

Table 36: Total Cost Calculation of TB patient in Baghlan Province in 2012 (4RH)

Province Name: Baghlan

Year: 2012

Currency: USD

Operating Cost					
1. Salary& Benefits			**Qty**	**Unit/Month**	**Yearly**
Provincial TB Coordinator (PTC)			1	377	377
Provincial Lab Supervisor (PLS)			1	270	270
2. Training			73	147	10735
3. Other cost			12	14	167
Sub Total Operating Cost				**11549**	
Capital Cost	**Qty**	**Unit price**	**Total Price**	**Useful Life**	**Total of Capital Expenditure**
1. Microscope	1	1471	1471	10	147
4. Office Disk	4	59	235	10	24
5. Shelf/Cupboard	3	57	172	10	17
6. Chair	15	22	324	4	81
7. Computer (Laptop)	1	469	469	3	156
8. Printer	1	143	143	2	71
9. Computer (Desktop)	1	463	463	3	154
13. Other	1	39	39	2	20
Sub Total Capital Cost				**670**	
Grant Total Cost				**12219**	
Net Present Value (NPV) of 2012 to 2011 with 7%				**11420**	

Table 37: Total Cost Calculation of TB patient in Kunduz Province in 2011 (6EH)

Province Name: Kunduz

Year: 2011 (6EH)

Currency: USD

Operating Cost					
1. Salary& Benefits		**Qty**	**Unit/Month**		**Yearly**
Provincial TB Coordinator (PTC)		1	516		516
Provincial Lab Supervisor (PLS)		1	344		344
Other staff		4	513		2050
2. Training		240	156		37500
3. Other cost		12	52		625
Subtotal Operating Cost			**41034**		
Capital Cost	**Qty**	**Unit price**	**Total Price**	**Useful Life**	**Total of Capital Expenditure**
1. Microscope	1	1563	1563	10	156
2. Examination table	1	104	104	10	10
3. Office Disk	4	63	250	10	25
4. Shelf/Cupboard	3	61	182	4	46
5. Chair	15	23	344	3	115
6. Printer	1	152	152	2	76
7. Computer (Desktop)	1	492	492	3	164
8. Other	2	31	63	2	31
Subtotal Capital Cost			**623**		
Grant Total Cost			**41657**		

Table 38: Total Cost Calculation of TB patient in Kunduz Province in 2012 (4RH

Province Name: Kunduz

Year: 2012

Currency: USD

Operating Cost					
1. Salary& Benefits			**Qty**	**Unit/Month**	**Yearly**
Provincial TB Coordinator (PTC)			1	377	377
Provincial Lab Supervisor (PLS)			1	270	270
Other staff			4	482	1929
2. Training			160	147	23529
3. Other cost			12	49	588
Subtotal Operating Cost				**26694**	
Capital Cost	**Qty**	**Unit price**	**Total Price**	**Useful Life**	**Total of Capital Expenditure**
1. Microscope	1	1471	1471	10	147
2. Examination table	1	98	98	10	10
3. Office Disk	6	59	353	10	35
4. Shelf/Cupboard	3	57	172	4	43
5. Chair	20	22	431	3	144
6. Printer	1	863	863	2	431
7. Computer (Desktop)	1	431	431	3	144
9. Other	2	39	78	2	39
Subtotal Capital Cost				**993**	
Grant Total Cost				**27687**	
Net Present Value (NPV) of 2012 to 2011 with 7%				**25876**	

Appenix-2 The Four Provinces

The four under study pilot provinces, namely; Baghlan, Kunduz, Takhar and Badakhshan and their health, TB case, notification by age and gender base, socioeconomic and demographic profiles are briefly described as follows:

1. **Baghlan Province:** Baghlan is located in the northeastern region, surrounded by Panjshir, Parwan, Bamyan, Samangan, and Kunduz provinces, a total of 8,255 Sqkm, the area covered by, representing 2.8% of total country land. It has 15 districts with a total population of 879000 representing 3.2% of the total country population; it is the 13th most populated province in Afghanistan. The economic activities are the same like Kabul as mentioned in above with slight variations (CSO, 2004). Total health facilities with its types are: 3 SHCs, 21 MHTs, 28 BHCs, 12 CHCs, 2 DH, 1 PH and 3Others. Below table provides a brief summary of the TB case, notification at the province level

Table. 5 Summary of TB cases notified in 2012

Province	Pulmonary sputum smear microscopy positive										New pulmonary sputum smear microscopy negative						New Pulmonary sputum smear microscopy not						Other						TOTAL
	New Cases		Total	Previously treated							0-4 yrs		5-14 yrs		≥ 15 yrs		0-4 yrs		5-14 yrs		≥ 15 yrs		New extra-pulmonary		previously treated [3]		TOTAL All cases		
				Relapses		After failure		After default																					
	M	F		M	F	M	F	M	F		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
BAGHLAN	178	382	560	15	24	5	11	0	2		1	1	8	17	56	96	12	5	8	9	34	47	129	162	1	1	447	757	1204

Source: (NTP, 2012)

2. **Kunduz Province:** This is also located in the same region (northeastern), has bordered with the Takhar, Baghlan, Samangan, and Balkh provinces, a total area of 8,081 Sqkm covered by Kunduz, representing 1.24 % of the total country land. It has 7 districts, with a total population of 972000, represent 3.3% of the total country population the 12th most populated province in Afghanistan the economic activities

are the same as mentioned for Baghlan and Kabul provinces (CSO, 2004). Total health facilities with its types are: 15 SHCs, 2 MHTs, 31 BHCs, 14 CHCs, 1 DH, 1PH and 6 others. Below table provides a brief summary of the TB case, notification at the province level:

Table.6 Summary of TB cases notified in 2012

Province	Pulmonary sputum smear microscopy positive										New pulmonary sputum smear microscopy negative						New Pulmonary sputum smear microscopy not						New extra-pulmonary		Other previously treated[3]		TOTAL All cases		TOTAL
	New Cases		Total	Previously treated							0-4 yrs		5-14 yrs		≥ 15 yrs		0-4 yrs		5-14 yrs		≥ 15 yrs								
				Relapses		After failure		After default																					
	M	F		M	F	M	F	M	F		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
KUNDUZ	232	433	665	21	24	10	11	4	3		0	0	15	21	73	109	5	5	5	4	11	13	107	160	2	5	485	788	1273

Source: (NTP, 2012)

3. Takhar Province: This province is one of the northeastern region provinces, has bordered with Badakhshan, Panjshir, Baghlan and Kunduz provinces, total 12,458 Sqkm, area are covered by this province, representing 1.91% of the country area. It has 17distreicts with a total population of 950000, represents 3.6% of the total country population, the 9th most populated province in the country, the economic activities and products are the same with Kunduz (CSO, 2004). Health facilities with its types are: 14 SHCs, 2 MHTs, 37 BHCs, 13 CHCs, 1 DH, 1 PH and 3 others. Below table provides a brief summary of the TB case, notification at the province level:

Table. 7 Summary of TB case, notification in 2012

Province	Pulmonary sputum smear microscopy positive										New pulmonary sputum smear microscopy negative						New Pulmonary sputum smear microscopy not						New extra-pulmonary		Other previously treated [3]		TOTAL All cases		TOTAL
	New Cases		Total	Previously treated							0-4 yrs		5-14 yrs		≥ 15 yrs		0-4 yrs		5-14 yrs		≥ 15 yrs								
				Relapses		After failure		After default																					
	M	F		M	F	M	F	M	F		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
TAKHAR	218	387	605	22	31	7	8	1	1		0	1	14	33	125	144	4	4	1	1	4	7	151	179	1	4	548	800	1348

Source: (NTP, 2012)

4. Badakhshan Province: Located in the northeastern region, it bordered with Takhar and Nooristan provinces, additionally this province shares international border with Tajikistan in the north, China in the west and with Pakistan in the south. Total land covered by this province is 44,836 Sqkm, represents 6.87% of total country land, has 28 districts, with a total population of 919000, represents 3.5% of the total country population, the 10 most populated province in the country, the economic activities are more or less same with the above mentioned provinces in the region (CSO, 2004). Health facilities are: 35 SHCs, 19 MHTs, 34 BHCs, 14 CHCs, 2 DHs, 1 PH and 4 others (HMIS, 2013). Below table provides a brief summary of the TB case, notification at the province level:

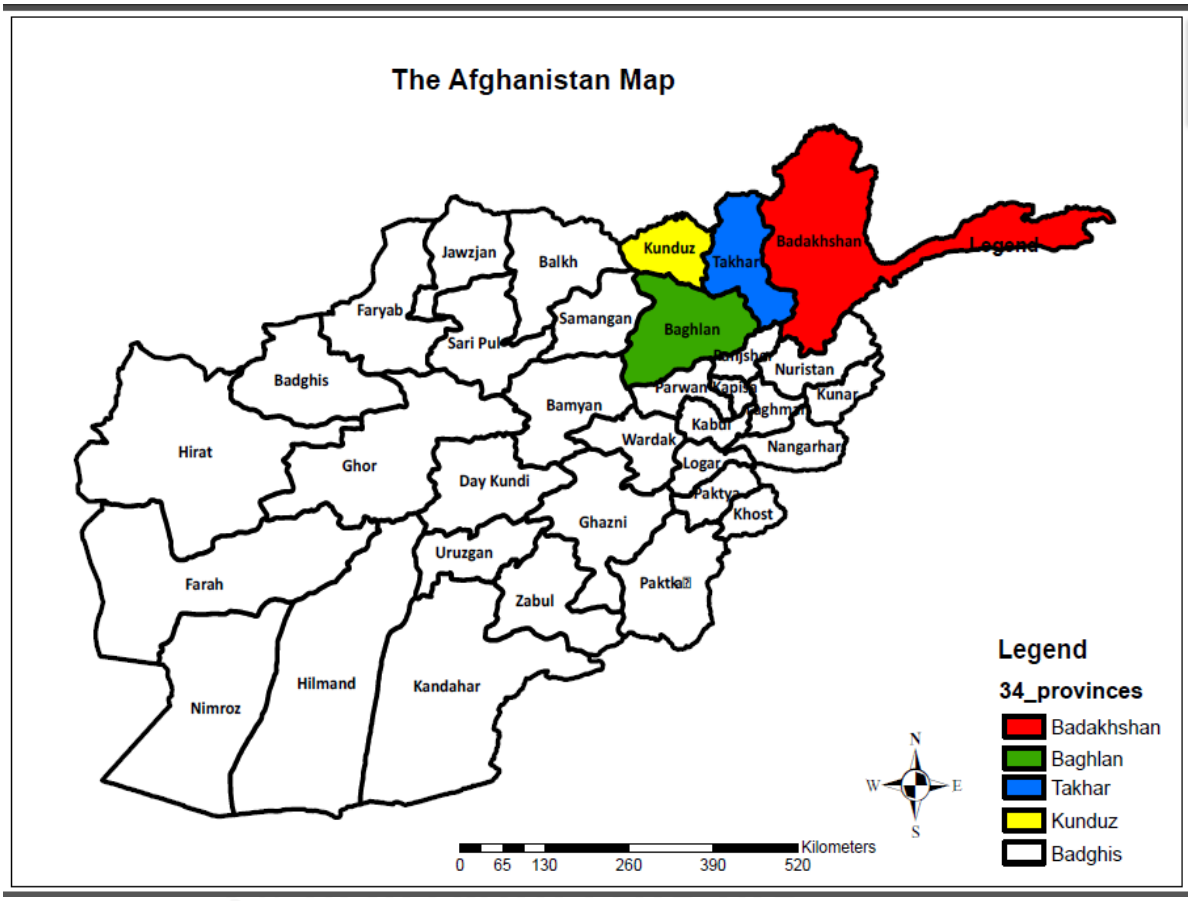
Table.8 Summary of TB cases notified in 2012

Province	Pulmonary sputum smear microscopy positive										New pulmonary sputum smear microscopy negative						New Pulmonary sputum smear microscopy not						New extra-pulmonary		Other previously treated [3]		TOTAL All cases		TOTAL
	New Cases		Total	Previously treated							0-4 yrs		5-14 yrs		≥ 15 yrs		0-4 yrs		5-14 yrs		≥ 15 yrs								
				Relapses		After failure		After default																					
	M	F		M	F	M	F	M	F		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
BADAKHSHAN	132	263	395	10	14	1	0	0	0		1	0	7	7	58	115	4	4	5	0	6	9	114	141	4	6	342	559	901

Source: (NTP, 2012)

The highlighted areas in the below figure (map of Afghanistan) provides information on the location of the four provinces where the new treatment regime (4RH) was piloted in 2012.

Figure 3: The four under study provinces in highlighted arrears



Source: (MoPH, 2013

Appendix-3 The Questionnaires and formats used for data collection

The questionnaire used during data collection for TB Program costing in Takhar Province

Afghanistan Tuberculosis Intervention Health Service Cost Analysis Instrument	
Date of Interview: _____ / _____ / _____	Province: -_____
Start Time of Interview: _____:_____ ☐AM ☐PM	Implementing Organization: _____
End Time of Interview: _____:_____ ☐AM ☐PM	Health Facility Name: _____
Name of interviewer: _____	Health Facility Code: _____
	Health Facility Type: ☐ BHC ☐ CHC ☐ DH

Section 1: Main Respondent's Identification					
		1	**2**	**3**	**4**
1.1	Can I please ask your Name?				
1.2	Which position do you occupy in this health facility?				
1.3	What is your highest level of education?				
1.4	How many years have you worked in this health facility?				
1.5	Please, can we have your cell phone number?				
Section 2: Staff Time Allocation for TB Programme					
2.1	**In any 3 months, how much did you receive for each of the following:**			*IF Zero, Record 00000 Don't Know (DK) = 99999*	
2.1.1	*Salary*	|__|__|__|__|__|	|__|__|__|__|__|	|__|__|__|__|__|	|__|__|__|__|__|
2.1.2	*Bonus*	/__/__/__/__/__/	|__|__|__|__|__|	|__|__|__|__|__|	|__|__|__|__|__|
2.1.3	*Other*	|__|__|__|__|__|	|__|__|__|__|__|	|__|__|__|__|__|	|__|__|__|__|__|
2.2	**What proportion of time did you spend in a month on the following service?**				*Percent < 100 DK=9*
2.2.1	TB services all	|___|___| %	|___|___| %	|___|___| %	|___|___| %
2.2.1a	Pulmonary Sputum Smear positive	|___|___| %	|___|___| %	|___|___| %	|___|___| %
2.2.1b	Pulmonary Sputum Smear negative	|___|___| %	|___|___| %	|___|___| %	|___|___| %
2.2.1c	Extra Pulmonary TB	|___|___| %	|___|___| %	|___|___| %	|___|___| %
2.2.13	All other services	|___|___| %	|___|___| %	|___|___| %	|___|___| %
2.2.14	Do you spend time on analysis and reporting of TB related activities?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
2.2.15	If YES, # of hours per 3 months	|___|___| hr	|___|___| hr	|___|___| hr	|___|___| hr

2.2.17	If YES, # of hours per 3 months	|___|___| hr	|___|___| hr	|___|___| hr	|___|___| hr

Section 1: Main Respondent's Identification					
		5	**6**	**7**	**8**
1.1	Can I please ask your Name?				
1.2	Which position do you occupy in this health facility?				
1.3	What is your highest level of education?				
1.4	How many years have you worked in this health facility?				
1.5	Please, can we have your cell phone number?				
Section 2: Staff Time Allocation for TB Programme					
2.1	**In any 3 months, how much did you receive for each of the following:**			*IF Zero, Record 00000* *Don't Know (DK) = 99999*	
2.1.1	*Salary*	|__|__|__|__|__|	|__|__|__|__|__|	|__|__|__|__|__|	|__|__|__|__|__|
2.1.2	*Bonus*	|__|__|__|__|__|	|__|__|__|__|__|	|__|__|__|__|__|	|__|__|__|__|__|
2.1.3	*Other*	|__|__|__|__|__|	|__|__|__|__|__|	|__|__|__|__|__|	|__|__|__|__|__|
2.2	**What proportion of time did you spend in a month on the following services?**				*Percent < 100* *DK=9*
2.2.1	TB services all	|___|___| %	|___|___| %	|___|___| %	|___|___| %
2.2.1a	Pulmonary Sputum Smear positive	|___|___| %	|___|___| %	|___|___| %	|___|___| %
2.2.1b	Pulmonary Sputum Smear negative	|___|___| %	|___|___| %	|___|___| %	|___|___| %
2.2.1c	Extra Pulmonary TB	|___|___| %	|___|___| %	|___|___| %	|___|___| %
2.2.13	All other services	|___|___| %	|___|___| %	|___|___| %	|___|___| %
2.2.14	Do you spend time on analysis and reporting of TB related activities?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
2.2.15	If YES, # of hours per 3 months	|___|___| hr	|___|___| hr	|___|___| hr	|___|___| hr

2.2.17	If YES, # of hours per 3 months	|___|___| hr	|___|___| hr	|___|___| hr	|___|___| hr
2.2.14	Do you spend time on analysis and reporting?	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
2.2.15	If YES, # of hours per 3 months	|___|___| hr	|___|___| hr	|___|___| hr	|___|___| hr

Format used for TB data collection in four provinces on the staff costs

Cost data Collection Format for TB Program

Name of Province:

Year: 2011

A. Staff costs

Staff involved in provincial TB Management	Salary/ month	Per-diem /Bonus	Annual cost	Proportion of time spent for TB magt.	Annual cost of time Spent on TB program magt.	Source of fund	Remarks
Year: 2012							

Data collection format on the equipment used for the TB Program

Cost data Collection Format for TB Program

Name of Province:

Year: 2011 and 2012

Name of Province:

Equipment List and cost

Name of equipment	Medical	Non-medical	Estimated price	Remarks

Format used for the TB data collection on TB Related Trainings

Compiled Cost data collection Format for Training (TB)

Name of Province:

Year: 2011

Staff received training	Name of Training	# of participants	Other cost	Total cost	Total # of patients in province	Average cost (total cost/# of patients)	Source of fund
Year: 2012							
Staff received training	**Name of Training**	**# of participants**	**Other cost**	**Total cost**	**Total # of patients in province**	**Average cost (total cost/# of patients)**	**Source of fund**

Logistic and stationary Cost data Collection Format for (TB)

Name of Province:

Other costs

Year: 2011

Supply/stationary cost	**Source of fund**	**Remarks**
Year: 2012		

Appedix-4 Sensitivity Analysis

Table 39: Sensitivity Analysis for the 4RH at BHC level

Normal Values					Change Values			
Treatment	Cost (USD)	Drug Cost	Effectiveness	CER (USD)*	10%	20%	CER (USD) 10%	CER (USD) 20%
4RH (2012)	6104	50	43	142.	6109	6114	142.	142.

*Total cost/Effectiveness

Table 40: Sensitivity Analysis for the 6EH at BHC level

Normal Values				
Treatment	Cost (USD)	Drug Cost	Effectiveness	CER (USD)
6EH (2011)	8657	54	45	192.4

*Total cost/Effectiveness

Table 41: Sensitivity Analysis for the 4RH at CHC level

Normal Values					**Change Values**			
Treatment	Cost (USD)	Drug Cost	Effectiveness	CER (USD)	10%	20%	CER (USD) 10%	CER (USD) 20%
4RH (2012)	18130	800	407	45	18210	18290	45	45

Table 42: Sensitivity Analysis for the 6EH at CHC level

Normal Values				
Treatment	Cost (USD)	Drug Cost	Effectiveness	CER (USD)*
6EH (2011)	26834	880	422	64

*Total cost/Effectiveness

Table 43: Sensitivity Analysis for the 4RH at DH level

Normal Values					Change Values			
Treatment	Cost (USD)	Drug Cost	Effectiveness	CER (USD)*	10%	20%	CER (USD) 10%	CER (USD) 20%
4RH (2012)	6855	1025	123	56	6958	7060	57	57.4

*Total cost/Effectiveness

Table 44: Sensitivity Analysis for the 6EH DH level

Normal Values				
Treatment	Cost (USD)	Drug Cost	Effectiveness	CER (USD)*
6EH (2011)	9254	981	103	90

*Total cost/Effectiveness

VITA

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