การวิเคราะห์ต้นทุนประสิทธิผลของศูนย์เฝ้ารักษาทางตรงโรควัณโรคของรัฐบาลกลางและของรัฐบาลท้องถิ่นเมืองกาฐมาณฑุ ประเทศเนปาล

นาย สิธาราม กิมิรี

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
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สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

COST-EFFECTIVENESS OF PUBLIC AND METROPOLITAN DOTS CENTRES IN KATHMANDU METROPOLITAN CITY, NEPAL

Mr. Sitaram Ghimire

A Thesis Submitted in Partial Fulfillment of the Requirement
for the Master Degree of Science Program in Health Economics
Faculty of Economics
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สถาบันวิทยบริการ
จุฬาลงกรณ์มหาวิทยาลัย

Thesis Title	COST-EFFECTIVENESS OF PUBLIC AND METROPOLITAN DOTS CENTRES IN KATHMANDU METROPOLITAN CITY, NEPAL
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สิธาราม กิมิรี: การวิเคราะห์ต้นทุนประสิทธิผลของศูนย์เฝ้ารักษาทางตรงโรควัณโรคของรัฐบาลกลางและของรัฐบาลท้องถิ่นเมืองกาฐมาณฑุ ประเทศเนปาล. (COST-EFFECTIVENESS OF PUBLIC AND METROPOLITAN DOTS CENTRES IN KATHMANDU METROPOLITAN CITY, NEPAL) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: รศ. ดร.ไพฑูรย์ ไกรพรศักดิ์ อ.ที่ปรึกษาวิทยานิพนธ์ร่วม : ศ. นพ. ภิรมย์ กมลรัตนกุล, 98 หน้า.

วัณโรคยังคงเป็นสาเหตุการตายที่สำคัญอย่างหนึ่งของโลก โดยเฉพาะอย่างยิ่งวัณโรคเป็นหนึ่งในปัญหาที่สำคัญยิ่งของสาธารณสุขในประเทศเนปาล กว่าโดยร้อยละ 45 ของประชากร เป็นวัณโรคโดยที่ร้อยละ 60 เป็นประชากรในวัยผู้ใหญ่และร้อยละ 70 เป็นประชากรในวัยเจริญพันธุ์ ถึงแม้ว่ากลยุทธ์การรักษาทางตรงจะประสบความสำคัญในการควบคุมการระบาดของวัณโรคแต่ปัญหาวัณโรคยังคงเป็นความท้าทายในเขตเมือง เนื่องจากปัจจัยเสี่ยงของโรควัณโรคนั้นมีอิทธิพลมากยิ่งขึ้นในบริบทเขตเมือง ในการบริหารจัดการเกี่ยวกับผู้ป่วยโรควัณโรคเพื่อที่จะทำลายห่วงโซ่ของการแพร่ระบาดของโรควัณโรคนั้น การจัดการของรัฐบาลเพียงอย่างเดียวไม่สามารถที่จะจัดการได้อย่างมีประสิทธิภาพ ดังนั้นจึงมีความจำเป็นอย่างยิ่งสำหรับการเพิ่มบทบาทของการปกครองส่วนท้องถิ่น

การวิเคราะห์ต้นทุนประสิทธิผลได้รับการประเมินในเมืองกาฐมาณฑุในมุมมองของผู้ดำเนินการ โดยสำหรับขอบเขตการศึกษาด้านสถานที่ได้ทำการเลือกตัวอย่างจำนวนสามตัวอย่างจากสถาบันสาธารณสุขในภาครัฐและสี่ตัวอย่างจากศูนย์เฝ้ารักษาทางตรงโรควัณโรคในเขตเมือง โดยที่ศูนย์เฝ้ารักษาทางตรงโรควัณโรคสาธารณะนั้นมีกล้อ:รุลทรรศน์และเครื่องฉายรังสี x เป็นอุปกรณ์สำหรับการตรวจโรค เมื่อเทียบกับศูนย์เฝ้ารักษาทางตรงโรควัณโรคในเขตเมืองที่ไม่มีเครื่องมือดังกล่าว ขอบเขตการศึกษาด้านระยะเวลาเริ่มตั้งแต่กลางเดือนกรกฎาคม พ.ศ. 2548 ถึง กลางเดือนกรกฎาคม พ.ศ. 2549 โดยต้นทุนเฉลี่ยต่อประสิทธิผลของศูนย์เฝ้ารักษาทางตรงโรควัณโรคสาธารณะคิดเป็นประมาณ 144 ดอลลาร์สหรัฐ ในขณะที่ต้นทุนเฉลี่ยต่อประสิทธิผลของศูนย์เฝ้ารักษาทางตรงโรควัณโรคในเขตเมืองคิดเป็นประมาณ 95 ดอลลาร์สหรัฐ โดยที่ต้นทุนค่าลงทุนในแต่ละศูนย์เฝ้ารักษาทางตรงโรควัณโรคนั้นน้อยกว่าร้อยละ 17 ของต้นทุนทั้งหมด แต่ต้นทุนค่าแรงงานนั้นแตกต่างกันจากร้อยละ 18 ถึง ร้อยละ 38 ของต้นทุนทั้งหมด โดยที่ต้นทุนค่าแรงงานของศูนย์เฝ้ารักษาทางตรงโรควัณโรคสาธารณะนั้นมีค่าระหว่างร้อยละ 29 ถึง ร้อยละ 38.3 จากต้นทุนทั้งหมด ในขณะที่ต้นทุนค่าแรงงานของศูนย์เฝ้ารักษาทางตรงโรควัณโรคในเขตเมืองมีค่าระหว่างร้อยละ 18 จากต้นทุนทั้งหมด สำหรับต้นทุนต่อหนึ่งของการรักษาที่ประสบความสำเร็จของศูนย์เฝ้ารักษาทางตรงโรควัณโรคสาธารณะนั้นสูงกว่า เนื่องจากต้นทุนของโครงสร้างพื้นฐานและต้นทุนในการจ้างบุคลากร เมื่อเปรียบเทียบผลการรักษาแล้วศูนย์เฝ้ารักษาทางตรงสาธารณะมีอัตราความสำเร็จมากกว่าเป้าหมายในระดับชาติ ในขณะที่ศูนย์เฝ้ารักษาทางตรงในเขตเมืองมีอัตราที่ต่ำกว่า ดังนั้นจึงมีความจำเป็นอย่างยิ่งในการพิจารณาการนำไปใช้ของประสิทธิผล โดยสรุปแล้วศูนย์เฝ้ารักษาทางตรงในเขตเมืองมีต้นทุนประสิทธิผลที่ดีกว่าศูนย์เฝ้ารักษาทางตรงสาธารณะและในเขตเมือง

สาขาวิชา เศรษฐศาสตร์สาธารณสุข ลายมือชื่อนิสิต.....

ปีการศึกษา 2550 ลายมือชื่ออาจารย์ที่ปรึกษาวิทยานิพนธ์หลัก.....

ลายมือชื่ออาจารย์ที่ปรึกษาวิทยานิพนธ์ร่วม.....

5085790529 MAJOR HEALTH ECONOMICS
KEY WORD TUBERCULOSIS, PUBLIC AND METROPOLITAN DOTS CENTRES, COST EFFECTIVENESS, KATHMANDU

SITARAM GHIMIRE: COST-EFFECTIVENESS OF PUBLIC AND METROPOLITAN DOTS CENTRES IN KATHMANDU METROPOLITAN CITY, NEPAL. THESIS PRINCIPAL ADVISOR: ASSOCIATE PROFESSOR PAITOON KRAIPORNSAK, Ph.D., CO-ADVISOR: PROFESSOR PIROM KAMOL-RATANAKUL M.D., 98 pp.

Tuberculosis (TB) is still a major cause of death worldwide. It is one of the major public health problems in Nepal. About 45 percent of the total populations are infected with TB, out of which 60 percents are adult and 70 percent of cases in the most economically productive age group. Though DOTS strategy being success in TB control, it is still a big challenges in urban area.

This cost effectiveness analysis was carried out in Kathmandu Metropolitan city from provider prospective. Three from public (government health institution) and four from Metropolitan DOTS centers were selected for the study purpose. The public DOTS centers had microscopy and x-ray facility while Metropolitan DOTS centre had not. The study period was mid July 2005 to mid July 2006.

Cost per effectiveness in public DOTS centers ranges from US$ 87 to US$ 197, while Metropolitan DOTS centers ranges from US$ 83 to US$ 116. The result showed that capital cost of each DOTS centre are less than 17 percent of total providers' cost. But labor cost varied from 18 percent to 38 percent. In public DOTS centers, labor cost was 29 percent to 38.3 percent while in Metropolitan DOTS centre it was around 18 percent. In public DOTS center total providers' cost found high per case treatment success because of its availability of diagnosis facility, infrastructure, staffing. In conclusion, Metropolitan DOTS centers seem more cost effective than public DOTS centre.

Field of Study Health Economics Student's Signature.....

Academic Year 2007 Principal Advisor's Signature.....

Co-advisor's Signature.....

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ABBREVIATION

TB	Tuberculosis
DOTS	Directly observed Treatment Short-course
DOT	Directly observed Treatment
WHO	World Health organization
NTP	National Tuberculosis Control Program
HIV	Human Immunodeficiency Virus
MoH	Ministry of Health
IUATLD	International Union against Tuberculosis and lung Patients
GoN	Government of Nepal
NGO	Non-governmental organization
CBS	Central bureau of Statistics
NTC	national Tuberculosis centre
AFB	Acid-fast bacilli
ARTI	Annual Risk of TB Infection
MDR-TB	Multi drug resistance TB

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CHAPTER I

INTRODUCTION

1.1 Background

Human Tuberculosis (TB) is caused by infection with mycobacterium, principally Mycobacterium tuberculosis. Individuals with pulmonary or laryngeal TB produce airborne droplets while coughing, sneezing, or simply talking. Inhaled infectious droplets lodge in the alveoli, and bacilli are taken up there by macrophages, beginning a series of events that result in either the containment of infection or the progression to active disease. Not all the infected individuals develop tuberculosis; approximately 10% develop the disease (Frieden et al. 2003).The risk of infection in a susceptible individual is high with closed, prolonged, indoor contact with a person with sputum smear positive TB. Infected persons can develop TB anytime. The disease can affected most tissues and organs, but especially the lungs.

1.2 The global TB epidemic

TB is still a major cause of death worldwide, but the global epidemic is on the threshold of decline. There were an estimated 8.8 million new TB cases in 2005, 7.4 million in Asia and sub-Saharan Africa. A total of 1.6 million people died of TB, including 195 000 patients infected with HIV.TB prevalence and death rates have probably been falling globally for several years. In 2005, the TB incidence rate was stable or in decline in all six WHO regions, and had reached a peak worldwide. However, the total number of new TB cases was still rising slowly, because the case-load continued to grow in the African, Eastern Mediterranean and South-East Asia regions (WHO, 2007).

Based on surveillance and survey data (WHO, 2007) estimate that there were 8.8 million new cases of TB in 2005 (136 per 100 000), including 3.9 million (60 per100 000) new smear-positive cases. The 22 high burden countries (HBCs) account for approximately 80% of the estimated number of new TB cases (all forms) arising worldwide each year. The HBCs are not necessarily those with the highest incidence rates per capita; many of the latter are medium-sized African countries with high rates of TB/HIV co-infection.

More than 90% of global TB cases and deaths occur in the developing world, where 75% of cases are in the most economically productive age group (15-54 years). There, an adult with TB loses on average three to four months of work time. This results in the loss of 20-30% of annual household income and, if the patient dies of TB, an average of 15 years of lost income (cited, WHO, 2003). TB deaths often mean the loss of the primary income-earners for entire households (WHO, 2002). In addition to the devastating economic costs, TB imposes indirect negative consequences - children leave school because of their parents' tuberculosis, and women are abandoned by their families as a result of their disease (WHO, 2003).

Table 1. TB incidence rate in SEAR countries in 2005

Country	Incidence/100000population in 2005
Bangladesh	227
Bhutan	103
DPR Korea	178
India	168
Indonesia	239
Maldives	47
Myanmar	171
Nepal	180
Sri Lanka	60
Thailand	142
Timor-Leste	556
SEAR	181

WHO, 2007

1.3 TB situation and control in Nepal

Tuberculosis (TB) is a major Public health problem in Nepal. About 45 percent of the total population is infected with TB, out of which 60 percent are adult. Every year, 40,000 people develop active TB, of whom 20,000 have infectious pulmonary disease. These 20,000 are able to spread the disease to others. Introduction of treatment by Directly Observed Treatment Short course (DOTS) has already reduced the number of deaths; however 5,000-7,000 people still die every year from TB.

Expansion of this cost effective and highly successful treatment strategy i.e. DOTS, which already has proven its efficacy in Nepal, will have a profound impact on mortality and morbidity in Nepal. By achieving the global targets of diagnosing 70 percent of new infectious cases and curing 85 percent of these patients will prevent 50,000 deaths over the next five years. High cure rates will reduce the transmission of TB and lead to a decline in the incidence of this disease, which will ultimately help to achieve the objectives of TB control (MoHP, 2005). The highest risk factor for TB worldwide is HIV infection. HIV infection has not yet affected significant role in Nepal, but it is expected to increase. Both neighboring countries, India and China, already have a large HIV problem. In 1998, estimated HIV prevalence among TB patients was 1.8 %(MOH, 2004).The results indicate that the prevalence of HIV is low but increasing. HIV and TB co-infection stands to be a serious problem in future.

Table 2. Health outcomes of National Tuberculosis Control program, Nepal

Indicator	2002/03	2003/04	2004/05
Case detection (New smear positive)	14614	14647	14077
Case detection rate (%)	71	70	65
Treatment success rate (%) (cure +completed)	88	88	88

Source: NTC Annual report, 2005/2006

1.4 Urban TB control in Kathmandu valley

Kathmandu, the capital city of Nepal, consists of population over 1.38 million as permanent inhabitants. The Annual Risk of TB Infection (ARTI) is estimated 4% in Kathmandu. It contributes 5 % of country's population where as total TB cases in 2005/6 was 3008(9%) and new smear positive cases were 1083(7%). The major problem facing urban TB country is transfer out of cases with out completing of treatment .It is 5 % where as country average is less than 3% (NTP, 2005).

1.5 Public private mix in TB control, Nepal

NTP Nepal has already initiated collaboration with the private sector for diagnosis and treatment of tuberculosis according to DOTS strategy. DOTS orientation to private practitioners, industrial workers and pharmacists is also one of the key activities of NTP. The referral rate of TB cases from the private sectors to the NTP has increased remarkably. Some nursing homes, Polyclinics and industries and pharmacies have established and managed DOTS centers (NTP, 2005).

Involving of different organization broadly categories as follows;

1.5.1 Governmental organization: PPM Nepal, different organization out of ministry of Health and population involve in TB control program. DOTS is implemented in Military hospital, Police Hospital, Prison. This is a good example of Public–Public mix in tuberculosis control in Nepal.

1.5.2 Metropolis DOTS Centre: Local government act Nepal make responsible local governance in Public health. Nepal has one Metropolitan, 3 sub-Metropolitans and 54 municipalities. Local governance act make responsible to Public health, due to lack of different organization Public) health structure only few of them started to manage DOTS centre. In Kathmandu Metropolitan have 34 wards, but DOTS centre only 16 and rest wards has DOTS centre run by other organizations.

1.5.3 Non –profit organization: Different non-profit organization, Factory, Library, Family planning association, Red Cross society, Anti-TB association run DOTS centre in urban setting. Some faith based organizations ,organization involving in rehabilitation and some engage quite different objectives(e.g. red cross, Family planning association, SOS) has been managed DOTS Centre.

1.5.4 Teaching hospitals: Till date, including government and private sector Nepal have 15 medical collages. Each medical collage run DOTS centre as a separate unit to provide better diagnosis and treatment to tuberculosis patients.

1.5.5 Profit organization: It is estimated that 50% of tuberculosis patients getting treatment from private sector. Involvement of for profit organization in tuberculosis control not significance. National tuberculosis program data shows only a few organization private hospitals, Polyclinics and Nursing homes involve in DOTS. NTP annual report (2005) showed out of 3000 DOTS centre for profit organization less than 1% and registered under NTP patients were not more than 1%.this proves that NTP not success to involve for profit organization in DOTS.

Most of above mention model limited urban area. Rural part of country only governmental health institution taking care of tuberculosis patients, has a DOTS centre. Some of them have microscopy facility but almost of these institutions has no X-ray facility. Even NTP not give much emphasis for X-ray, in case of smear positive pulmonary tuberculosis patients.

1.6 DOTS and Public -Public partnership

The NTP regularly conducts orientation and training for concerned health authorities within military, police hospitals, prisons, schools, Public media, Municipalities, Village Development Committees in order to establish collaboration

for appropriate tuberculosis diagnosis and treatment facilities according to DOTS strategy.

1.7 Problems and its significance

The goals of TB control are to reduce mortality .morbidity, and transmission of the diseases, while preventing drug resistance, until it remains no longer poses a threat to public health. It aims to reduce human suffering and the social and economic burden which families and communities have to bear consequence. To achieve this, it is necessary to ensure access to diagnosis, treatment and cure for each TB patient and to protect vulnerable populations from TB and its drug resistance forms (WHO, 2002).

All over the world, tuberculosis (TB) control in large cities is problematic, because the known risk factors for this disease are amplified in the urban context. All large cities have higher levels of TB than the rest of the country because of more frequent occurrence of specific risk factors: poor housing and/or overcrowding, co-infection with HIV, immigrants from countries with a high-TB burden (often illegal immigrants with less access to health care), an elderly population, a homeless and mobile population, and reduced social support. Several factors may impede effective TB control in large cities: lack of political commitment and coordination at national and regional levels; lack of reliable data on the populations to be covered by the programs; the influence of socioeconomic factors not directly controllable by the programs; the fear of stigma among patients; and misleading beliefs about the disease in the general population.

Unsatisfactory treatment successes and drug resistance are more common in large cities (Codecasa, 2007).Increasing threats of HIV/AIDS and MDR-TB, along with fast movement of the population is the major threats of the current TB control program. It is expected that HIV will increase number of TB cases by at least 10% and

by a considerably higher percentage if HIV becomes much more widespread. And the situation is more severe in areas where the private sector is strong and unregulated, weak pubic health system, and poor resource mobilization (Khatri2002;Day et al.2002;Chen et al.2002).It is important to establish the cooperation between medical facilities and Public health centers within the territory of tuberculosis hospitals in an urban area. The sources of tuberculosis infection in an urban area are quite diverse and complicated (Takatorige, 2006).

Kathmandu being a capital city of Nepal, has weak Public health system facilities, poor responsiveness of the concerned authorities, challenged quality of health services, and strong private sector are worsening the situation of TB control in the valley. In Kathmandu valley, it is expected that around 50% of the TB patients are with entirely private sector, and little information is available about these number of patients. Little is known about the prevalence of delay in seeking care among TB patients in urban areas in Nepal. Considering the low case detection(40%,2006) in Kathmandu valley in comparison with national achievement, and in the rampant availability of diversified health care practices, mobile population, increasing HIV/AIDS epidemic, and changing socio-cultural behavior in living styles, understanding the magnitude of delay existing at different points of health care system under the current National TB Control Programme in Nepal and it contextual factors associated with such delay can provide evidence for making policies and programs aimed at reducing delay by guiding where it really need to focus in designing such programs. Such programs help to enhance early case detection, and that will benefit the society at large (WHO, 2003).

Table 3 Number of DOTS centre in Kathmandu

Institution	In Metropolitan					Out of metro	Total
	Government institution	Metropolitan	Non profit organization	Teaching hospital	Profit orgn.		
DOTS centre	6	14	4	3	2	24	53
Total new TB cases , 2005/06	281 (11%)	866 (33%)	403 (15%)	245 (9%)	40 (2%)	814 (31%)	2645

Source: NTC Annual report, 2005/2006

1.8 Research question

Which DOTS centers is more cost effective, Public (government) or Metropolis, in Kathmandu Metropolitan city?

1.9 Research objective

1.9.1 General objective

To analysis cost effectiveness of metropolis and Public DOTS centre from provider prospective.

1.9.2 Specific objectives

1. To estimate total provider cost for Public and metropolis DOTS centre in Kathmandu.
2. To compare the effectiveness of Public and metropolis DOTS treatment centre in terms of treatment success.
3. To analyze the cost effectiveness of DOTS centre in terms of cost per patient treatment success of Public and metropolis.

1.10 Scope of study

The study will be carried out in Kathmandu metropolis city with estimated 0.83 million population. Annual risk of tuberculosis infection (ARTI) is used 4%.Mertopolion area has different type of DOTS centre. Out of 29 DOTS centre,

government institution are 6, Metropolitan health institution 14, non-profit organization (NGOs) 4, teaching hospital 3 and profit organizations are 2. For this study 4 from government DOTS centre and 3 Metropolitan were taken. The study period was mid July 2005 to mid July 2006.

1.11 Hypothesis

Metropolis DOTS is more cost effective than Public (government) DOTS centre from provider prospective.

1.12 Operational definition

Public (government) DOTS Treatment centre; it refers to those DOTS centre that are fully government health institution, from where service was delivered according to the norms of World Health Organization (WHO) DOTS strategy.

Non-for profit organization (NGOs); it refers to those DOTS centre that are a non-governmental organization (NGO) is a legally constituted organization created by private persons or organizations with no participation or representation of any government. In the cases in which NGOs are funded totally or partially by governments, the NGO maintains its non-governmental status insofar as it excludes government representatives from membership in the organization. A nonprofit organization is formed for the purpose of serving a Public or mutual benefit other than the pursuit or accumulation of profits for owners or investors.

Metropolitan DOTS Centre; DOTS Centre run by Metropolitan authority, from where service is delivered according to the norms of World Health Organization (WHO) DOTS strategy.

Public-private mix (PPM);The term PPM DOTS has thus evolve logically and appropriately to represent a comprehensive approach to link all forms of Public

private, Public-Public or private-private collaboration for the common purpose of controlling TB in community (Malmborg et al.2006)

DOTS; directly observed treatment, short-course; most cost-effective and highly successful strategy for tuberculosis control.

Costs; costs are defined as the value of resources used to produce and deliver tuberculosis treatment services under DOTS strategy.

Provider' cost; cost incurred by DOTS centre in providing tuberculosis treatment services. In this study two types of capital and current cost taken into account.

Capital cost; The cost of any resources input or expenditure whose benefit last more than one year (Philips et al. 1993) including, building, equipment, long-term training and vehicles used for delivering tuberculosis treatment services value greater than US$ 100.

Recurrent cost; the resources that used up in the course of one year were considered as recurrent cost including salary of personnel, material and supply cost ,drugs cost, short-term training cost, social mobilization cost, vehicle/building operation and maintenance cost, utilities, water electricity, telephone).

Case of tuberculosis; a patient in whom tuberculosis has been confirmed by bacteriology or diagnosed by a clinician

Definite case; a patient with positive culture for the Mycobacterium tuberculosis complex. In countries where culture is not routinely available, a patient with two sputum smears positive for acid-fast bacilli (AFB+) is also considered a definite case.

Pulmonary cases; a patient with tuberculosis disease involving the lung parenchyma

Smear positive Pulmonary cases; A patient with at least two initial sputum smear examinations (direct smear microscopy) AFB+; or one sputum examination AFB+ and radiographic abnormalities consistent with active pulmonary tuberculosis as determined by a clinician; or one sputum specimen AFB+ and culture positive for M. tuberculosis.

Smear negative pulmonary cases; a patient with pulmonary tuberculosis not meeting the above criteria for smear-positive disease. Diagnostic criteria should include: at least three sputum smear examinations negative for AFB; and radiographic abnormalities consistent with active pulmonary tuberculosis; and no response to a course of broad-spectrum antibiotics; and a decision by a clinician to treat with a full course of anti-tuberculosis chemotherapy; or positive culture but negative AFB sputum examinations.

Extra-pulmonary; A patient with tuberculosis of organs other than the lungs (e.g. pleura, lymph nodes, abdomen, genitourinary tract, skin, joints and bones, meninges); Diagnosis should be based on one culture-positive specimen, or histological or strong clinical evidence consistent with active extra-pulmonary disease, followed by a decision by a clinician to treat with a full course of anti-tuberculosis chemotherapy. A patient in whom both pulmonary and extra-pulmonary tuberculosis has been diagnosed should be classified as a pulmonary case.

New case; A patient who has never had treatment for tuberculosis or who has taken anti-tuberculosis drugs for less than one month.

Relapse; A patient previously declared cured but with a new episode of bacteriological positive (sputum smear or culture) tuberculosis.

Re-treatment case: A patient previously treated for tuberculosis, undergoing treatment for a new episode, usually of bacteriological-positive tuberculosis.

Definition of treatment success

(Expressed as a percentage of the number registered in the cohort)

Cured; A patient who was initially smear-positive and who was smear-negative in the last month of treatment and on at least one previous occasion.

Completed treatment; a patient who completed treatment but did not meet the criteria for cure or failure. This definition applies to pulmonary smear-positive and smear-negative patients and to patients with extra-pulmonary disease.

Died; A patient who died from any cause during treatment.

Failed; A patient who was initially smear-positive and who remained smear positive at month 5 or later during treatment.

Defaulted; A patient whose treatment was interrupted for 2 consecutive months or more.

Transferred out; A patient who transferred to another reporting unit and for whom the treatment success is not known.

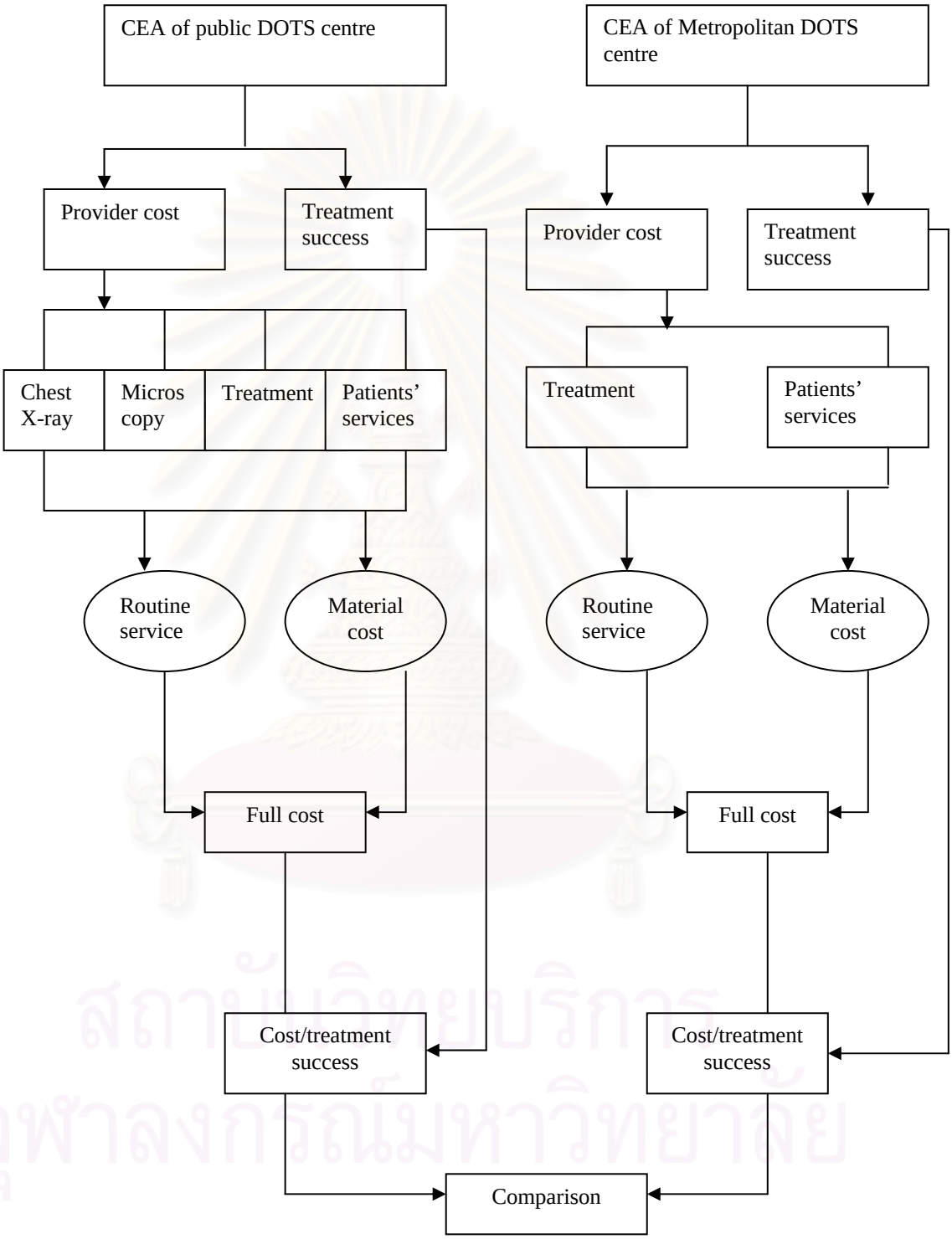
Successfully treated; A patient who was cured and who completed treatment.

Cohort; A group of patients in whom TB has been diagnosed, and who were registered for treatment during a specified time period (e.g. the cohort of new smear-positive cases registered in the calendar year 2004) (WHO, 2003).

1.13 Conceptual framework:

The conceptual framework of this study is shown in figure1. For the treatment of tuberculosis under DOTS strategy, four costs can be found- Treatment unit, laboratory, radiology and pharmacy. Any suspected patients visit to physician. To diagnosis patients has tuberculosis or not send to sputum examination, radiology.

Conceptual framework



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After a laboratory or radiology conformation patient has to register and get tuberculosis treatment. The cost incurred by TB patients at different unit is different, allocate for different unit. The sum of routine service cost and material cost by every unit is full cost for treatment. This study will compare cost incurred in both setting (government and metropolis) to find effectiveness of different DOTS centre.

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CHAPTER II

LITERATURE REVIEW

A comprehensive search in MEDLINE was conducted using the following keywords tuberculosis, cost effectiveness, urban TB control, Metropolitan, Kathmandu, Nepal. In addition, a library search was carried out.

2.1 Theoretical approach of Cost effectiveness analysis (CEA)

Birch and Gafni(1992) defined cost effectiveness analysis " the CEA and CUA techniques have been proposed as methods for assessing or comparing alternative uses of scarce health-care resources in terms of outputs produced. The difference between CEA and CUA lies in the way outputs are measured. In CEA measurement is in natural units, e.g., life years 'saved' or improvements in functional status."

According to Weinstein (1996) "Cost effectiveness analysis (CEA) incorporates information and both costs and health outcomes to describe the value of particular health care program. Analysis evaluates an intervention rough the use of cost –effectiveness ratio. In ratio, all the health outcomes are included in denominator and costs or change in resources included in the numerator."

Dye and Floyd(2006)described the method to calculate cost effectiveness ration of infectious disease as "in monetary terms, the cost-effectiveness (C/E) of a new program of treatment for active infectious disease (here defined as sputum-smear positive), per case prevented, can be calculated from C/E ≈P/_kT, where P is the cost of treatment, _ is the efficacy of treatment, k is a constant determined by the mode of action of the intervention, and T is the duration of the intervention in years." These cost-effectiveness ratios (CERs) are computed from the total costs and total effects of treatment.

Birch and Gafni (1992) clarify the use of cost utility analysis and cost effectiveness analysis mentioned as “CUA and CEA have the common goal of maximizing health benefits produced from a given level of resources. Cost-utility analysis was developed in response to the desire to compare program options producing heterogeneous outcomes and hence extend the application of the CEA technique to a wider set of options”. So, not only for homogeneous health outcome, but also can be used to compare heterogeneous outcome.

CEA needed to support the current decision rules, Programs which produce the same outputs (health improvements) using less resources programs which produce more outputs but from the same allocation of resources. The extra resources required to produce extra outcomes in a particular program area (Birch and Gafni, 1992).

The cost-effectives analysis has been widely used to evaluate health program. Murry(2000) stated the use of cost effectiveness analysis as “ the growing use of cost-effectiveness analysis (CEA) to evaluate the efficiency of specific interventions is dominated by studies of prospective new interventions compared with current practice. The implicit assumption that, to improve overall efficiency, resources would need to be transferred to the more efficient intervention either from another health intervention or from another sector is rarely discussed”.

Cost-effectiveness ratios were calculated by dividing the cost per activity by each different effectiveness measure. The cost per patient cured was calculated by dividing the number of patients cured into the total health system costs. Similarly, the cost per patient successfully treated was calculated by dividing the number of patients successfully treated into the health system costs. The overall total cost per patient

cured was calculated by dividing the total number of patients cured into the sum of the health system and patient costs (Islam, 2002).

2.2. Models of Public (government) Private Mix

The private health sector in India varies considerably in its size, composition, and level of organization, types of services delivered and socio-economic groups served. Public Private Mix (PPM) includes public -Public as well as Public-private collaborations. While involving the private sector and other sectors, it is important to have a well functioning RNTCP in the Public sector first. The involvement of other sectors is important to improve the case detection rates under DOTS and successfully treat additional numbers of TB patients. Other health providers involved in PPM

Government health facilities outside state health departments(All health establishments under ESI, Railways, CGHS, Defense, Petroleum & Natural Gas, Chemical & Fertilizer, Coal, Steel, Mines, Power, Ports and Prisons), Medical Colleges, Private Providers, Non-Government Organizations, Corporate Sector (Chauhan,2007).

The Success Story of ppm mix in India is began collaboration with the government and PPs, Mahavir Trust Hospital, a non-profit specialty hospital, runs a Public -private mix project in Hyderabad City in India. The project area has a population of 500,000. Slum-dwellers comprise about 75% of the population; this population is at a higher risk of TB. At the onset of the Mahavir project, Dr Murthy who is the Medical Advisor for the project initiated contact with local PPs. PPs refers TB suspects to Mahavir Hospital. Diagnosis and initial treatment is done at the hospital. The patient has the option of receiving free drugs under DOT at Mahavir or one of the other 26 DOT centers in the area. No patient has to walk for more than 0.5

km to receive DOT. The DOT centers, located in private nursing homes and clinics, open at 7.30 am and are very convenient for patients who have to work. About two-thirds of the TB patients are referred by participating practitioners. Mahavir has achieved the case detection target of 70% and a cure rate of more than 85% among new infectious patients. Further, almost half of all the new smear positive patients are women compared to a third in other DOTS areas (WHO, 1999).

Public-private partnerships (PPP) could be effective in scaling up services. Two different models of TB provider partnerships are evaluated, relative to sole Public. Cost per case cured was significantly lower in PNP (US $354–446), and comparable between PWP (US $788–979) and Public sites (US $700–1000). PPP models could significantly reduce costs to the patient by 64–100%. Relative to pure Public sector provision and financing, expansion of PPPs could reduce government financing required per TB patient treated from $609–690 to $130–139 in PNP and $36–46 in PWP (Sinanovic and Kumaranayake, 2006).

Newell (2004) highlighted that public-private and public-public mix in tuberculosis control would be more cost effective. In his own words “a combination of the strengths of private practitioners, nongovernmental organizations, and the Public sector in a Public–private partnership can be used to provide a service that is liked by patients and gives high rates of treatment success and increased rates of patient notification.”

The Bangkok Metropolitan Administration (BMA) is in charge of executing TB control in Bangkok. Services are provided to TB patients through a network of Health Centers (HCs) under the Department of Health of the BMA. Prakalapakorn(2000) figure out urgency in DOTS expansion in the Bangkok

metropolis required the collaboration of many different organizations providing TB services in the city .

2.3. Measurement of Effectiveness

A study in Tanzania, Wandwalo(2006) found that Community based DOT was more cost effective with USD 128 per patient successfully treated, compared to USD 203 for patient successfully treated with health facility DOT. The implementation of community based DOT has improved cost-effectiveness by 37%. For smear positive patients, Community based DOT was cost effective with USD 145 per patient cured while health facility was USD 258 per patient cured. Community based DOT improved cost effectiveness by 44% among smear positive patients.

In Bangladesh, The government program was 50% more expensive for similar outcomes. The involvement of CHWs was found to be more cost-effective in rural Bangladesh. With the same budget, the BRAC program could cure three TB patients for every two in the government program (Islam, 2002).

In India, Chauhan (2007) economic evaluations of DOTS in Hyderabad, New Delhi and Bangalore found that PPM-DOTS is affordable and cost-effective. Another evaluation in Bangalore shows that the intensified PPM initiative has predominantly reached people from lower socio-economic groups. PPM DOTS is essential in the long-term interests of patients, providers and programs

To assess the cost and cost-effectiveness of the Public–Private Mix DOTS (PPM-DOTS) strategy for tuberculosis (TB) control in India. Effectiveness was measured as the number of cases successfully treated. Findings the average cost per patient treated was US$ 111–123 for PPM-DOTS and Public sector DOTS, and US$ 111–172 for non-DOTS treatment in the private sector. From the Public sector’s perspective, the cost per patient treated was lower in PPM-DOTS projects than in

Public sector DOTS programs (US$ 24–33 versus US$ 63) (Floyd, et al. 2006). According to Floyd, et al. (2006) “incremental cost-effectiveness analysis showed that PPM-DOTS can improve effectiveness while also lowering costs and can substantially lower the economic burden of TB for patients.”

Several studies demonstrate that the DOTS strategy is more cost-effective than other approaches to TB control. Public -private partnerships in TB control nowadays are proving to be increasingly cost-effective, as demonstrated by studies in South Africa and India, which suggest that PPPs to deliver DOTS can remove a significant burden from the Public health sector

To carry cost effectiveness analysis good indicators of change in health status are needed. The simplest indicators such as lives saved, life-years gained are commonly used, but recently attempts have been made to incorporated the quality of life, and to construct composite indicators such as the physical quality of life Index(PQLI) or Quality adjusted Life Years(QALYs)(Green,2002).Graber (1997)emphasized that QULYs has become the common currency for sophisticated CE analysis. CEA usually looks at the intermediate outcome, such as number of cases detected in a screening program, and calls the outcomes or consequences as the program’s “effectiveness” (Drummond, 1997).Some example of cost effectiveness analysis:

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Table 4 Cost-effectiveness studies of TB treatment programmes taking a provider's perspective

No.	Year	Setting	Alternatives being compared[a,b]	Marginal analysis	Viewpoint		Scope of study			Sensitivity analysis?
					Provider[c]	Household	Costs	Outcome	Accrued over time?	
1	1965	Korea	Different programme options in rural and urban settings (all using long course regimens)	yes	national provider	yes	yes	yes	yes, future benefits discounted at 5%	yes
2	1982	South Africa	Two regimens: one five month [3(SHRZ)5/2(HZ)5] and one seven month [2(HSZ)5/5(HZ)5]	no	district provider	yes	yes	no	no	no
3	1984	Botswana	7 regimens (6 short, one long) with and without hospitalisation	no	national provider	no	yes	yes	no	yes
4	1989	Indonesia	3 regimens: short course (R, H & E); long course (S, H & Z); and a mixture	no	national provider	no	yes	yes	yes, future costs discounted at 10%	yes
5	1992	Thailand	4 regimens: 3 short [2HRZ/4HR, 2SHRZ/6HT, 2HRZ/4H2R2] and one long [2SHT/16HT]	no	national provider	yes	yes	yes	no	yes
6	1990	Zambia	2 regimens: short course (as out-patient) and long course (in-patient & out-patient)	no	hospital provider	no	yes	no	no	no
7	1992	Uganda	2 programmes: 2 months in-patient then out-patient care, and all out-patient care	no	national provider	yes	yes	yes	no	yes
8	1988–1992	USA	2 programmes: directly supervised and self-administered regimens	no	district provider	no	yes	no	no	no
9	1990	Malawi, Mozambique & Tanzania	4 programmes: Short and long course treatment, and in- and out-patient care	yes	national provider	no	yes	yes	yes; costs & benefits discounted at 3%	no

Sources: Study 1[7] Study 2[8] Study 3[9] Study 4[10] Study 5[11,12] Study 6[13] Study 7[14] Study 8[15,16] Study 9[17]

[a] Short regimens usually refer to courses of tretament of 6–9 months' duration containing rifampicin (R) and pyrazinamide (Z); 'long' regimens usually refer to regimens at least 12 months long, with no rifampicin.

[b] Regimen shorthand: eg '2SHT/10HT' represents 2 months streptomycin (S), isoniazid (H) and thiacetazone (T), followed by 10 months of isoniazid and thiacetazone

[c] National provider refers to a national TB programme or a government health department

(Adopted from Fryatt, 1997)

2.4. Cost Classification

Creese and Parker (1994) Classified cost by inputs .According to them input cost of health intervention can be classified as below;

2.4.1 Capital cost

Vehicle: bicycle, motorcycle, four-wheel-drive vehicle, trucks

Equipment: x-ray machine, microscope, other equipment with a unit cost (price) of US$ 100 or more,

Building, space: hospital, health centre, administrative office, storage facilities,

Training: training activities for health personnel that occur only once or rarely

Social mobilization, non recurrent: social mobilization activities e.g. promotion, Publicity campaigns that occurs only once or rarely

2.4.2. Recurrent costs

Personnel (all type): supervisors, health workers, administrators, technicians, consultants, casual labors

Supplies: drugs, syringes, slides, small equipment (unit cost less than US$100)

Vehicles, operation and maintenance: petrol, diesel, lubricants, tyres, spare parts, registration, insurance

Building, operation and maintenance: electricity, water, heating, fuel, telephone, telex, insurance, cleaning, painting, plumbing, roofing, electricity supply/appliances

Training, recurrent (e.g. short in-service course)

Social; mobilization: operating costs

Other operating costs not included above

2.5 Cost allocation of shared inputs

Some inputs such as building, staff, vehicles, supplies, equipments may be shared for particular intervention. In this case, it is necessary to find a reasonably accurate way of dividing the costs of shared resources among various activities or programs. The process of dividing cost is called cost allocation. In this case, we must know about the particular components of various inputs that determine costs (Ceers and parker, 1994).The components that determine the cost of inputs are listed below:

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Table: 5 Cost determining components

Inputs	***Components that determine the cost***
Vehicles	Distance traveled/time used
Equipment	Time used
Building space	Time used/space used
Personnel	Time used
Supplies	Volume
Vehicles: operation and maintenance	Distance traveled/time used
Building; operation and maintenance	Time used/space used
Other inputs	Miscellaneous

In many cases, it is not easy to measure staff time. There are some highly accurate, but not necessarily practicable, ways of measuring time. It is risky to rely on staff members' memories of how they distribute their time. We can arrange for staff to fill out time sheet routinely or over a certain period of time. This procedure requires supervision to be reliable. We can also directly observe staff on a random sample of days; recording what they do in every half-hour .But this is impracticable. So, Creese and Parker (1994) suggested that "to use proxy-that we can expect to be closely related to the direct determinant of cost. But we should be aware of the assumption that underlines choice of proxy. If these assumptions are not true, the proxy may not be accurate. If there is no reasonable proxy and none of the more accurate methods is feasible, we might have made some kind of direct measurement with some margin of error."

2.6 Health Outcomes:

Disease burden is an indicator of health outcome. Disease burden can be expressed in many ways, such as the number of cases (e.g. incidence or prevalence), deaths or disability-adjusted life years lost (DALYs) associated with a given condition. Health outcomes, in the denominator of cost-effectiveness ratio, can be reported as intermediate outcomes or longer-term outcomes such as life saved, life years gained, or quality adjusted life year gained. QALYs can capture both quality and quantity of life. This outcome is becoming popular in cost effectiveness analysis as well as cost-utility analysis. This study took into account the cured/complete cases as its health outcomes.

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CHAPTER III

RESEARCH METHODOLOGY

This chapter presents the methodology applied in investigates the cost effectiveness of public and Metropolitan DOTS centre under DOTS program. This chapter addresses the study site, study subjects, size of sample, sampling procedure, study instruments, measurement of variables and method of data collection, management and analysis.

3.1 Research design

This is a descriptive study. Cost effective analysis (CEA) model for economic evaluation of two different management systems working for same health outcome will be carried out. The result will be expressed in term of cost per treatment success patient. The effectiveness will be measured in natural units i.e. treatment success (cured and completed). The period of evaluation will be first 8 months of 2005/06.

3.2 Study population

Kathmandu Metropolitan city has 29 DOTS centres. Among these 6 are running by government health institution, 14 are running by Metropolitan , 2 running by profit organization,4 are running by non-profit organization and 3 are running by teaching hospitals.

3.3 Sampling procedure

Kathmandu Metropolitan city is purposively selected for this study. It has 29 DOTS centre. Among these 6 are running by government health institution, called public DOTS center, 14 are running by Metropolitan 2 running by for-profit organization,4 are running by nor-profit organization and 3 are running by teaching hospitals. Out of 6 governments 3 DOTS centre were purposively selected similarly, 4 DOTS centre run by Metropolitan were selected. The Public DOTS centers are at

government hospital, though these centre runs as separate entity. Where as, Metropolis DOTS centre run at Metropolitan Ward Health Center, where there was no microscopy and x-ray facility.

3.4 Assumptions

1. Prevalence of TB cases is same for all DOTS centre in Metropolitan city.
2. There is no location variation among DOTS centre to get TB service.
3. Economic of scale and economic of scope does not affects both cost and health outcome (treatment success) under DOTS strategy.

3.5 Inclusion criterion

- All new tuberculosis cases, who registered in 2005 July to 2006 July, are included.
- DOTS centre run by government health institution and Metropolitan are included in study.

3.6 Exclusion criterion

- DOTS centre run by non governmental organization, for profit organization and teaching hospitals.
- Patients cost and societal cost not covered,
- DOTS centre out of Metropolitan city area

3.7 Data collection instruments

Date collection sheet was developed considering the cost and treatment outcome. Capital cost and recurrent cost and treatment out come were collected by sampled DOTS centre.

3.8 Data analysis

3.8.1 Capital cost

There are two component of capital cost opportunity cost of fund tie up in capital assets and depreciation over time of asset itself. Despite the availability of various economic tools, calculation of “equivalent annual costs” will be used in this study as a ‘this would give both types of costs” (Drummond et at. 1997).The method of capital cost calculation adopted in this study will reflect the opportunity costs of capital assets.

To calculate the annualize factors 5% discount rate will be used. The logics of setting discount rate are;

- During FY 2005/06, the discount rate of Treasury bill was 3.87%-4.31%.
- Commercial Banks’ interest rate on saving and lending was 2-5 to 8-13.5% respectively
- General inflation rate was 6-6.5%

3.8.2 Economic cost and financial cost:

Financial cost includes money or expenses in exchange for goods and services. Economic cost describes not only money or expenses; it also includes resources sacrifice in order to obtain goods and services or inputs. In other words economic cost include both money and opportunity cost.

3.8.3 Opportunity cost:

The concept of opportunity cost is fundamental to the economist's view of costs. The opportunity cost of investing in a healthcare intervention is best measured by the health benefits (life years saved, quality adjusted life years (QALYs) gained) that could have been achieved had the money been spent on the next best alternative intervention or healthcare programme.

Opportunity cost can be accessed directly with cost effectiveness or cost utility studies. When two or more interventions are compared cost utility effectiveness analysis makes the opportunity cost of the alternative uses of resources explicit. Although the concept of opportunity cost is fundamental, incorrect conclusions can result from difficulties in applying the concept.

The study perspective (societal, patient, etc) is critical since it determines which costs and effects to include in the evaluation. A societal perspective incorporates all the costs and benefits regardless of who incurs or obtains them.

The choice of comparisons can play a crucial part in cost effectiveness analysis, affecting the measurement of opportunity cost. Ideally an intervention should be compared with all relevant interventions, including doing nothing. Sometimes, however, the do nothing option may be unethical, such as when a new treatment is being compared with one that has been shown to be beneficial. Partly for this reason, many studies compare particular interventions with existing practice which may or may not be well defined. Failure to select an appropriate comparator may make the intervention appear more cost effective than it should, lead to wrong estimates of the opportunity cost.

The incremental rather than average cost effectiveness ratio should be estimated.

Resources used in economic evaluations should be valued at opportunity cost, but doing this is difficult (especially in health care, where there is no perfect market), so unit costs tend to be used instead, based on the costs of the various inputs.

Accounting practices do not aim to measure opportunity costs. Opportunity costing generally requires comprehensive, disaggregated data at the individual patient level. Even then, the allocation of overhead and fixed costs is difficult since the cause and

effect relation between resources and different users is difficult to determine. Since many economic evaluations use accountancy cost data, the results should be treated with some caution. The prices of pharmaceutical products may be poor estimates of their opportunity cost because the retail price reflects the patent, the regulation of profits by governments, and the sunk research and development of both successful and unsuccessful products. In practice, very few studies attempt to estimate the opportunity costs of drugs, relying instead on prices.

3.8.4 Allocation criterion

It is assumed that time spends for caring TB patients and other service has same value. In this study the following relation will be adopted to calculate allocation proportion:

$(W_{TB}+W_{OTS}) = W$

Where,

W_{TB} =Total number of tuberculosis related visits/tests in a year

W_{OTS} =Total number of other service (non-tuberculosis) related visits/tests in a year

W= Total number of visit in a year

3.8.5 Cost of donated drugs

No things free in the world. This is economic analysis, drug cost, whether it is donated or not, because if not donated government has to spend money on drugs, so taking into account to calculate cost effectiveness.

3.8.6 Economic cost of capital items

To calculate the cost of equipment an annualizes basis, the following approaches (Creese and Parker, 1994) will be used:

Present value of item, $p_t=p_0 (1+r)^t$

Where, p_t=present value, p_0=purchase price, r=discount rate t= year since purchase

3.8.7 External factor affecting provider cost

This study will be carried at same geographical setting to avoid the affect of external factors.

3.8.8 Division of cost centers

DOTS centre are divided into 4 cost centre; treatment unit, laboratory unit, radiology and pharmacy unit to identify provider's total cost.

Total provider cost will be calculated from labor costs, capital costs and material costs at DOTS centres (Public and Metropolitan) during the period of 8 months of FY2005/06.

The total provider costs of each DOTS centre will be calculated using following relation:

Total provider cost =Total labor cost + Total capital cost + Total material cost

Total provider cost =Total routine cost + Material cost (direct)

Where,

Routine service costs= Total overhead costs — Material costs (direct)

Total overhead cost= Labor cost + Capital costs + Material costs (indirect)

Total material (direct cost) =Total sputum examination cost + Total chest x-ray Cost + Total drug cost

Sputum examination cost=CSE x N

Where, CSE=cost per slide exam

N= Number of slide exam

CSE=cost of (sputum cup +slide+ staining)

Chest X-ray cost =CCX x N

Where, CCX=cost of per chest X-ray

N= number of X-ray

CCX=cost of (film +solution)

Total Drug cost = $\sum DC_1+DC_2+DC_3$

Where, DC_1=Drug cost per patients of category I

DC_2=Drug cost per patients of category II

DC_3=Drug cost per patients of category III

3.9 Data collection and Analysis

Data on providers' costs in both Public (government) and Metropolitan DOTS centers were collected from their account records and interviewing and observation using structured formats. Health outcomes were assessed using TB registered and quarterly progress report maintained at the DOTS centre.

Total provider costs were assessed in term of resource used mainly in three categories;

3.9.1 Capital cost

Cost of resource inputs/expenditure whose benefits lasts more than one year such as building, vehicles, equipments (x-ray , microscope), furniture, land etc were calculated in this heading. Purchase price of capital goods was obtained from office record (stock ledger). In case of unavailability of records, Information was obtained by interviewing with senior staff. The present value of all capital goods was annualized on the basis of discount rate and useful time. Ratio of space used for building and space, life time, and ratio of time used for equipment, vehicles were used to obtained annual cost.

3.9.2 Labor cost

Cost incurred by staff of different cost centre to provide tuberculosis service at both setting (Public and metropolis) was calculated. Data on monthly gross salary of

staff were obtained from salary sheet. Later, it was converted into 8 months salary attributable to TB.

3.9.3 Material cost

Material cost of revenue producing centre (Radiology, laboratory and pharmacy) varied among patients who received different drug regimens (Kamolratanakul et.al, 1992).So drug cost was calculated separately .Indirect cost covered all recurrent costs. Direct material cost covered the cost of sputum examination, chest x-ray and TB related stationary.

Table 6 Materials cost (indirect)

Resource used	measurement	Valuation
1. Building related(maintenance, water & electricity)	Space used	Market price conversion
2. Vehicles(operation & maintenance)	Time used/distance	Market price conversion
3. Administration related (telephone, stationary, miscellaneous)	Unit /amount consumed	Market price conversion

3.9.3.1 Drug cost

In tuberculosis treatment, drug may differ according to treatment category. This will make variation of drug costs in treating different type of tuberculosis patients. Study in Thailand showed the drug cost of smear negative and smear positive cases were bht 696.48 and 2482.72 respectively(Kamolratanakul et.al, 1997).total drug costs of different types of TB patients will be in the following;

- Total drug cost for new smear positive cases
- Total drug costs for new smear negative /EP cases
- Total drug cost for re-treated cases

3.10 Effectiveness measurement

In this study, two kind of effectiveness will be assessed.

- Patients cured (new smear positive cases)
- Treatment completed (smear negative and extra pulmonary cases)

3.11 Cost effectiveness analysis

Cost effectiveness ratio (C/E) of each setting (Public (government) and Metropolitan DOTS centre) will be calculated and comparison will be made in between to find which setting is more cost effective. This will give the answer of proposed study.

3.12 Sensitivity analysis

Since the model for the CEA was based on a number of assumptions, we performed a sensitivity analysis to determine whether plausible variations in these assumptions would alter the findings. If the CE ratio changes significantly by altering one of these variables we can conclude that particular assumption requires further investigation.

What impact will be different valuation of costs on the result? Choosing discount rate to annualize the capital costs could affect on total provider cost. To avoid this uncertainty, sensitivity analysis will be done for different discount rate. (3%, 5%, 8%).

3.13 Benefit of the study

The study will be beneficial to policy makers and planners of ministry of health and population and central focal point of tuberculosis control in Nepal National tuberculosis centre for cost effective expansion DOTS treatment centre in future at Kathmandu Metropolitan city as well as other municipal area of Nepal.

CHAPTER IV

RESULTS AND ANALYSIS

This chapter discusses the cost analysis and health outcome of different DOTS Centre that running by government health institution; public DOTS center and Metropolitan ward health service centre; metropolis DOTS centre with in kathmandu Metropolitan city. This study was concerned on cost effectiveness analysis from provider's prospective.

4.1 Provider's cost calculation

The main objective of this study was to find out cost and cost effectiveness of both types of DOT S from providers' prospective. Before final analysis of result the nature of each DOTS centre should be taken into consideration. The following table gives the basic information regarding each types of DOTS center.

Table 7 Characteristics of different DOTS centre

Characteristics activities	Public DOTS centre (DOTS centre on Government Health institution)	Metropolitan DOTS Centre
1. Drug regime	2HRZE/6HE, 2SHRZE/1HRZE/5 HR 2HRZ/6HE	2HRZE/6HE, 2SHRZE/1HRZE/5 HR 2HRZ/6HE
2. Packing	Combined drug(HR/HE)	Combined drug(HR/HE)
3. Type of supervisor	Health personnel (Nurses/paramedics)	Health personnel (Nurses/paramedics)
4. Infrastructure		
X-ray facility	Available most at hospital level	Not available
Microscopy	Available at primary health centre	Not available
Building	Most centre have own building	No own building, rented
5. organizational structure	Large hospital with OPD,IPD service, consultant service available	Only 3 or 4 staff, senior nurses, paramedics
6. DOT available	At 10am to 2 pm	Open 10 am to 5 pm

7. volunteers for follow-up of defaulted patients	Not available	Available, not active in all DOTS centre.
8. DOTS committee	Not formed	Formed, active DOTS centre at only a few

In this study providers' cost were assessed in terms of resource used in the three primary categories namely; capital cost, labor cost, and material cost.

4.1.1 Capital cost

4.1.1.1 Bir Hospital DOTS centre

Bir hospital is a large centrally located tertiary care hospital. Valuation of all capital goods was not possible in the short period. DOTS centre at here operated as a separated entity though all resources provided by government. Table 4.2 presents the capital cost incurred by different units of Bir Hospital in for the purpose of TB treatment. The present value of capital items was annualized at 5% discount rate and useful life. Under some allocation criteria obtained the annual cost so were allocated to DOTS service for TB.

To conclude the cost of space used for DOTS centre plinth area cost of concerning year was used. (22000/sq meter for government houses)(MoFP, 1990).The ratio of total TB patients' visit to treatment unit and OPD patients' visits (TB plus others) was used as allocation proportion (9044/454501=0.02).Hospital has a separate OPD room and pharmacy. Separate staffs were assigned to conduct DOTS Centre. However X-ray and laboratory were operated in integration. Most of TB cases diagnosed by sputum smear microscopy. That service was provided at microbiology unit. The total slide examine by micro biology section in the study year were

12560.Most of time microbiology section spent on sputum microscope. So cost of microscope and furniture fully charged to TB treatment.

A separate Pharmacy unit was established to provide DOT. It did not provide any service for non-TB patients. All items used in pharmacy, therefore, were allocated for TB.

Table 8 Capital cost calculation, Bir Hospital (In Nepalese rupees, NRS, 2005 prices, discount rate 5%)

Inputs	Purchase price	Year of purchase	Useful life	Present value	Annualization	Annual cost	8 mth cost	allocation pro	8 mth cost for TB
Treatment Unit									
Space	146477	1990	30	304515	15.372	19810	13206	1	13206
furniture total	12750	7982		20027	42.42	1942	1295		1295
Treatment Unit Total	**159227**			**324542**		**21752**	**14501**	**1**	**14501**
Laboratory Unit									
Space(8'*10")	177419	1990	30	367258	15.372	23891	15928	1	15928
furniture total	**22300**			**37363**		**3211**	**2141**		**2140**
Microscope (binocular)	80000	1996	10	124106	7.722	16072	10714	1	10714
Laboratory unit Total	**279719**			**528727**		**43174**	**28783**		**28782**
X-ray Unit									
furniture total	29100			36959		3257	2171		1086
X-ray Machine	450000	2000	8	571500	6.463	88426	58951	0.5	29475
X-ray Unit Total	**2182325**			**4133536**		**321002**	**214001**		**107001**
Pharmacy unit									
Space used(7'*12)	146477	1990	30	304515	15.372	19809	13206	1	13206
furniture total	11550			13365		1300	866		867
pharmacy unit Total	**158027**			**317880**		**21110**	**14073**		**14073**
Total capital cost	***2779298***			***5304685***		***407037***	***271358***		***171221***

4.1.1.2 Teku Hospital DOTS centre

Teku hospital is a specially established for prevention and control of tropical diseases. However it provides other health care services as well. The present value of capital items was annualized depending upon the discount rate and useful life. Under some allocation criteria obtained the annual cost so were allocated to DOTS service for TB.

In Teku hospital DOTS services was provided as integrated with other services. There was no separate treatment unit, microscopy centre, x-rays and pharmacy for DOTS center. So capital cost was allocated on the proportion to total OPD visit and visit of TB patients. The ratio of total TB patients' visit to treatment unit and OPD patients' visits (TB plus others) was used as allocation proportion (3572/336=769=0.11). Capital cost of X-ray and laboratory were allocated on the basis of service provided by these units. Table: 10 present the capital cost incurred by different units of Teku Hospital in relation to DOTS Centre.

4.1.1.3 Ramghat PHC DOTS centre

Ramghat DOTS centre is in primary health care centre (PHC). PHC has no its own building .Monthly rent was treated as a capital cost. The PHC provides DOTS services integrated with other primary health services. No separate sputum microscopy, treatment unit and pharmacy were found. So capital cost calculation was made on the proportion of total OPD visit and TB patients visit. Table: 11 present the capital cost incurred by different units of Ramghat PHC in relation to DOTS Centre.

4.1.1.4 Metropolitan DOTS centre

Among 14 DOTS centre running by Metropolitan ward health service centre only one had its own building, which was also very old. The rest DOTS centers are either rented or on club building or Metropolitan ward office. Capital cost of furniture,

equipments was calculated on the basis of proportion of total OPD visit and TB patients visit. Most of Metropolitan ware health centre were operated at one or two rooms. These centers were provided all primary health service like reproductive service, immunization and other primary health service including DOT to TB patients. The data showed that more than 50% daily time spent for TB patients. All services were provided on integrated way, same equipment and furniture were used for TB and non TB patients. So capital cost was allocated on the proportion of services provided for TB and non TB patients. The table 12 showed the detail of capital cost calculation.

Table 9 Capital cost calculation, Teku Hospital (In NRS, 2005)

Inputs	Purchase price	Year of purchase	Useful life	Nominal value	Annulization factor	Annual cost	8 mont cost	allocation prop	8 mth cost for TB
Treatment Unit									
Space	360000	1997	30	531804	15.372	34596	23064	0.11	2537
furniture total	13800			15723		1543	1029		304
Treatment Unit Total	**373800**			**547527**		**36139**	**24093**		**2841**
Laboratory Unit									
Space(8'*10'')	360000	1997	30	531804	15.372	34596	23064	0.13	2883
furniture total	***9200***			***12810***		***1152***	***768***		***96***
Microscope (binocular)	80000	2000	10	124106	7.722	16072	10714	0.13	1339
Laboratory unit Total	**449200**			**668720**		**51820**	**34546**		**4318**
X-ray Unit									
Space used(9'*11)	445500	1990	30	926102	15.372	60246	40164	0.1	4016
furniture total	12800			16256		1462	975		97
X-ray Machine	200000	2002	8	231525	6.463	35823	23882	0.5	11941
X-ray Unit Total	**658300**			**1173883**		**97531**	**65020**		**16055**
Pharmacy unit									
Space used(7'*12)	378000	1990	30	782460	15.372	50902	33934	0.11	3733
furniture total	12400			13981		1249	832		92
pharmacy unit Total	**390400**			**796441**		**52150**	**34767**		**3824**
Total capital cost	**1871700**			**3186571**		**237640**	**158427**		**27038**

Table 10 Capital cost calculation, Ramghat PHC (In Nepalese rupees, NRS, 2005 prices, discount rate 5%)

Treatment Unit	Purchase price	year of purchase	Useful life	Nominal value	Annualization	Annual cost	8 mont cost	allocation prop	8 mth cost for TB
Space				5000			3333	0.25	833
furniture total	3420			3742		391	261		65
Treatment Unit Total	**3420**			**8742**		**391**	**3594**		**899**
Laboratory Unit									
Space(8'*10'')				5000			3333	0.25	833
Microscope (binocular)	135000	2003	10	148000	7.722	19166	12777	0.25	3194
Laboratory unit Total	**143500**			**162363**		**20134**	**16756**		**4189**
Pharmacy unit									
Space used(8'*10)				5000			3333	0.23	767
furniture total	12900			14560		1433	955		220
pharmacy unit Total	**12900**			**19560**		**1433**	**4289**		**986**
Total capital cost	**159820**			**185665**		**21959**	**21306**		**5241**

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Table 11 Capital cost calculation; Metropolitan DOTS centre (In Nepalese Rupees, NRS, 2005 prices, discount rate 5%)

Inputs	Purchase price	Year of purchase	Useful life	Nominal value	Annualization	Annual cost	8 mont cost	allocation prop	8 mth cost for TB
1.Balaju									
Treatment Unit									
Space				60000			40000	0.6	24000
furniture total									
Treatment Unit Total	**11950**			**76896**		**1536**	**41024**		**24615**
Pharmacy unit									
Space used(7'*12)				60000			40000	0.6	24000
pharmacy unit Total	**11650**			**72843**		**1304**	**40870**		**24522**
Total capital cost	**23600**			**149739**		**2841**	**81894**		**49137**
2.Sayambhu									
Treatment Unit									
Space(10'*8')	50000	1980	30	169317	15.372	11014	7343	0.75	5507
Treatment Unit Total	**65550**			**190792**		**13609**	**9073**		**7085**
Pharmacy unit									
Space used(10'*8')	50000	1980	30	169317	15.372	11014	7343	0.75	5507
pharmacy unit Total	**63650**			**186495**		**12664**	**8443**		**6332**
Total capital cost	**129200**			**377287**		**26273**	**17515**		**13418**
3.Jayabageshwori									
Treatment Unit									
Space				60000			40000	0.6	24000
Treatment Unit Total	**12150**			**73187**		**1192**	**40795**		**24477**
Pharmacy unit									
Space used(10'*12)									
pharmacy unit Total	**10950**			**12308**		**1226**	**817**		**490**
Total capital cost	**23100**			**85495**		**2418**	**41612**		**24967**
4.Koteshwor									
Treatment Unit									
Space				36000			24000	0.6	14400
Treatment Unit Total	**10350**			**51718**		**1420**	**24947**		**14968**
Pharmacy unit									
Space used(10'*12)				36000			24000	0.6	14400
pharmacy unit Total	**11450**			**50409**		**1333**	**24888**		**14933**
Total capital cost	**21800**			**102127**		**2753**	**49835**		**29901**

4.1.2 Labor cost calculation

In labor cost calculation, we should measure the time they devoted to the program.(Creese and Parker, 1994).The hospital staff/Metropolitan ward health service centre those who involved for DOTS services for TB were taken into account in this study. Their gross monthly salary was obtained from account section. Gross salary included basic salary, provided fund, grades and others. The gross monthly salary was calculated for 8 months and multiplied by allocation factor. The allocation factor was calculate on the basis of time spend to perform the Tb related activities.

As mention above, Bir hospital provides a separate clinic for TB patients. Full time staffs were engaged to at clinic. Time spend on TB at laboratory unit was calculated using TB and non TB patients proportion. The pharmacy unit was fully arranged only for TB. So, all cost incurred by that unit was allocated to TB.

At the rest two government DOTS centre all service were integrated. So, for allocation of labor cost of treatment centre staff, pharmacy staff, laboratory, and x-ray unit staff ration of time spend was used.

For all government DOTS centre administrative staffs Interview method was used to find out time spent by administrative staff. Here administrative staff includes administrative assistant, accountant, cleaner, sweepers, and peon etc for different units of hospital/primary health care centre, and Metropolitan ward health services centre.

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Table 12 Labor cost calculation of different public DOTS centre. (In Nepalese rupees, NRs, 2005/06)

Bir Hospital					
Category	Number	Gross salary per month	time spent on TB(hours/day)	Attributable days of salary for 8 months	8 month salary attributable for TB
Treatment Unit					
Doctor(specialist)	1	15000	1	120000	120000
clinic assistant	1	6500	1	52000	52000
administrative assistant	1	5000	0.1	40000	4000
sweeper	1	3500	0.25	28000	7000
Treatment Unit Total		**30000**		**240000**	**183000**
laboratory Unit					
Pathologist	1	13500	0.1	108000	10800
Medical technologist	1	12000	0.1	96000	9600
Lab technicians	1	8500	0.5	68000	34000
Lab assistant	1	6500	0.5	52000	26000
lab boy	1	5000	0.5	40000	20000
sweeper	1	4000	0.25	32000	8000
laboratory Unit		**49500**		**396000**	**108400**
radiology unit					
radiologist	1	13500	0.1	108000	10800
radiographer	1	8750	0.1	70000	7000
Dark room assistant	1	5250	0.1	42000	4200
administrative assistant	1	5000	0.1	40000	4000
sweeper	1	4000	0.25	32000	8000
radiology unit total		**36500**		**292000**	**34000**
Pharmacy Unit					
paramedics(AHW)	1	6500	1	52000	52000
sweeper	1	4000	0.25	32000	8000
Pharmacy Unit total		**10500**		**84000**	**60000**
total labor cost		**126500**	**0**	**1012000**	**385400**
TEKU Hospital					
Treatment Unit					
Doctor	1	13250	0.25	106000	26500
clinic assistant	1	6500	0.25	52000	13000
administrative assistant	1	5000	0.1	40000	4000
sweeper	1	3500	0.25	28000	7000

Treatment Unit Total		**28250**		**226000**	**50500**
laboratory Unit					
Medical technologist					
Lab technicians	1	8500	0.15	68000	10200
Lab assistant	2	6500	0.15	52000	7800
lab boy	1	5000	0.15	40000	6000
sweeper	1	4000	0.25	32000	8000
laboratory Unit		**24000**		**192000**	**32000**
radiology unit					
radiologist	1	13500	0.15	108000	16200
radiographer	1	8750	0.25	70000	17500
Dark room assistant	1	5250	0.25	42000	10500
administrative assistant	1	5000	0.1	40000	4000
sweeper	1	4000	0.25	32000	8000
radiology unit total		**36500**		**292000**	**56200**
Pharmacy Unit					
paramedics(AHW)	1	6500	0.5	52000	26000
sweeper	1	4000	0.25	32000	8000
Pharmacy Unit total		**10500**		**84000**	**34000**
Total labor cost		**99250**	**0**	**794000**	**172700**
Ramghat PHC					
Treatment Unit					
Doctor	1	9000	0.1	72000	7200
clinic assistant	1	6500	0.23	52000	11960
administrative assistant	1	5000	0.1	40000	4000
sweeper	1	3500	0.25	28000	7000
Treatment Unit Total		**24000**		**192000**	**30160**
laboratory Unit					
Lab assistant	1	6500	0.15	52000	7800
sweeper	1	4000	0.25	32000	8000
laboratory Unit		**10500**		**84000**	**15800**
radiology unit					
Pharmacy Unit					
paramedics(AHW)	1	6500	0.23	52000	11960
sweeper	1	4000	0.25	32000	8000
Pharmacy Unit total		**10500**		**84000**	**19960**
Total labor cost		**45000**	**0**	**360000**	**65920**

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For all 14 Metropolitan DOTS all health service was provided .Time spent for TB patients and non TB patients was taken as labor cost allocation criteria.

Table 13 Labor cost calculation of Metropolitan DOTS centre (in Nepalese rupees, NRs, 2005/06)

Balaju					**Sayambhu**			
Category	monthly salary	salary for 8 month	allocation for TB	8month labor cost for TB	monthly salary	salary for 8 month	allocation for TB	8month labor cost for TB
Treatment Unit								
clinic assistant	7800	62400	0.52	32448	8750	70000	0.8	56000
administrative assistant	5400	43200	0.52	22464	0	0		0
sweeper	3500	28000	0.52	14560	3500	28000	0.8	22400
Treatment Unit Total	**16700**	**133600**		**69472**	**12250**	**98000**		**78400**
Pharmacy Unit								
paramedics(AHW)	6700	53600	0.52	27872	6500	52000	0.8	41600
Pharmacy Unit total	**6700**	**53600**		**27872**	**6500**	**52000**		**41600**
Total labor cost	**23400**	**187200**		**97344**	**18750**	**150000**		**120000**
	Jayabageshwori				**Koteshwor**			
Treatment Unit								
clinic assistant	0	0	0.36	0	8500	68000	0.59	40120
administrative assistant	0	0		0	0	0		0
sweeper	3500	28000	0.36	10080	0	0		0
Treatment Unit Total	**3500**	**28000**		**10080**	**8500**	**68000**		**40120**
Pharmacy Unit								
paramedics(AHW)	6250	50000	0.36	18000	5700	45600	0.59	26904
Pharmacy Unit total	**6250**	**50000**		**18000**	**5700**	**45600**		**26904**
Total labor cost	**9750**	**78000**		**28080**	**14200**	**113600**		**67024**

4.1.3 Material cost calculation

Material cost was allocated into two parts; direct cost and indirect cost to TB treatment. Diagnostic reagents, drugs and TB related stationeries that were specially provided only for tuberculosis, were categories under direct cost headings. Since different types of regimens were used for tuberculosis patients, the drugs cost was calculated in separate heading. As laboratories, Ziehi-Neelsen method was used to sputum smear microscopy. On an average 3ml of each reagent (carbon fuchsine solution, 20% sulphuric acid and 0.1%methylene blue) was used to stain one slide. Direct material cost i.e. Sputum containers, slides were calculated on the basis of each for one sputum test. National Tuberculosis TB centre staff provided unit cost of laboratory materials. Table 14 presents the material cost of DOTS centre.

Indirect cost for DOTS centre includes cost of telephone, electricity, water, stationery, and postage and miscellaneous. Administrative costs were allocated on the basis of TB and non-TB cases visited to each health institutions that could reflect the volume used by TB patients. Higher number of other non-TB cases may reduce the share of TB related administrative costs. Table presents the direct and indirect cost related to DOTS for tuberculosis.

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Table 14 Material cost of Public and Metropolitan DOTS centers (In NRS, 2005 prices)

Category	Eight months material cost for tuberculosis						
	Bir Hosp.	Teku Hosp.	Ramghat PHC	Balaju DOTS Centre	Sayambhu DOTS centre	Koteshwor DOTS centre	J.Bageshwori
Treatment Unit							
Direct cost to TB							
Laboratory Unit							
Direct to TB	4,580	1,847	1,761				
Radiology Unit							
Direct to TB	7,355	4,115	-				
Pharmacy Unit							
Direct to TB	3,445	1,225	1,395	2,445	3235	1465	1050
Total direct cost	15,380	7,187	3,156	2,445	3,235	1,465	1,050
Total indirect cost	76,667	61,600	2014	6,564	11,556	7,026	1,520
Total material cost	92,047	68,787	5,170	9,009	14,791	8,491	2,570

4.1.4 Drug cost calculation

Drug costs were calculated on the basis of TB patients who registered under different treatment categories in 2005 July 2006 July. Drug costs varied from the category to category. Combined drugs were used to make treatment more effective. New smear-positive cases and sever TB cases were treated under treatment category I (regimen used 2HRZE/6HE). New TB cases other than smear positive pulmonary cases; smear negative and extra pulmonary cases were treated under category III (regimen used 2HRZ/6HE).Re-treated cases (failure, relapse, defaulted) cases were treated as category II (regimen used 2SHRZE/1HRZE/5HRE). Table 15 presents' drugs costs incurred by treatment success cases.

Table 15 Drug cost calculation of public and Metropolis DOTS centre (In Nepalese rupees, NRS, 2005 prices)

DOTS Centre	patients registered			Drug cost			Total cost
	CAT I	CAT II	CAT III	CAT I	CAT II	CAT III	
Public DOTS centers							
Bir_Hospital	42	10	67	156920	77673	218407	435123
Ramghat_PHC	10	3	26	37362	23302	84755	145419
Teku_Hospital	10	6	31	37362	46604	101054	185020
Metropolis DOTS Center							
Balaju-UHC	41	9	61	153184	69906	198848	421937
Jayabageswori_UHC	7	3	14	26153	23302	45637	95092
Koteswor_UHC	26	3	32	97140	23302	104314	224756
Swayambhu_UHC	59	12	69	220436	93208	224926	538569

4.4 Total Provider cost of various DOTS centers

Cost analysis of public DOTS center found that more than one third cost incurred in labor cost, it was only about 15% in metropolis DOTS centre, because of availability microscopy and x-ray facility. Similarly material cost showed high percentage of full costs in public DOTS centre (9.5%) in comparison to metropolis DOTS centre (1.7%). Capital cost was found around 10% of full cost in both settings. The highest percentage of cost was incurred in drug. It was more than 40% in public DOTS centre and more than 70% in metropolis DOTS centre. Though drug cost was same in both setting, differences in proportion of full cost was found due volume of full cost. Table 16 presents providers' full cost for treatment of tuberculosis under DOTS strategy.

Table 16 Total Providers' cost for treatment of tuberculosis at DOTS centre (in Nepalese currency, 2005/06)

DOTS Centre	Capital cost (%)	Labor cost (%)	Material cost (%)	Drug cost (%)	Total provider cost
Bir Hospital	171221 (17)	385400 (38.3)	14854 (1.5)	435123 (43.2)	1006598
Teku Hospital	27038 (6.0)	172700 (38.4)	64756 (14.4)	185020 (41.2)	449514
Ramghat PHC	5347 (2.4)	65920 (29.7)	5170 (2.3)	145419 (65.5)	221856
Public DOTS Centre	**203605 (12.1)**	**624,020 (37.2)**	**84780 (5.1)**	**783438 (45.6)**	**1677,986 (100.0)**
Balaju DOTS Centre	49315 (8.5)	97344 (16.9)	9009 (1.6)	421937 (73.0)	577605
Jayabageswori	24967 (16.6)	28080 (18.7)	2300 (1.5)	95092 (63.1)	150439
Koteswor	49835 (14.2	67024 (19.1)	8493 (2.4)	224756 (64.8)	347111
Swayambhu	13418 (2.0)	120,000 (17.5)	14791 (2.1)	538569 (78.4)	686778
Metropolitan DOTS Centre	**496,051 (9.9)**	**832,491 (16.7)**	**85830 (1.7)**	**3590791 (71.9)**	4994456

4.5 Effectiveness of public and Metropolitan DOTS

4.5.1 Bir Hospital DOTS centre

Bir hospital provides DOTS services for tuberculosis control covering about 80,000 populations. Using annual rate of tuberculosis infection (ARTI) 4%, the estimated number was about 160.During the first FY 2005/2006, 42 new sputum smear positive cases were registered under DOTS services for tuberculosis.

Case detection rate: the number of new pulmonary smear cases detected ,expressed as percentage of estimated new smear positive cases .the cases detection rate was found 26%(42/160).

Cure rate: the number of new pulmonary smear positive cases cured divided by all registered new smear positive cases for a given period. Cure rate for new smear positive cases and re-treatment cases are the most important outcome indicator. Bir hospital had 90 %(38/42) for new smear positive and 60 %(6/10) for re-treatment cases. Both cure rate and treatment success rate were higher than national target (85%) for new smear positive cases. However, treatment success rate of re-treatment cases was found below national target. Table 17 presents the total number of TB patients registered and its outcome.

Table 17 TB cases registered and treatment outcome at Bir hospital DOTS centre in the FY 2005/2006

Type of cases	Number regd.	Treatment success (cured+com)	failure	died	defaulter	T.out	No result
New smear positive	42	38	1	2	0	0	1
New smear negative	8	7	0	0	0	0	1
New extra pulmonary	59	53	0	2	0	3	1
Re-treatment	10	6	1	2	0	0	2

Source: NTC Annual report, 2005/2006

4.5.2 Teku Hospital DOTS centre

Its catchments population was about 40,000.Since the annual rate of tuberculosis infection (ARTI) was 4% for kathmandu, the estimated new smear positive cases were 80 for FY 2005/2006.During study period 10 smear new smear positive pulmonary TB cases were registered under DOTS.

Case detection rate: the number of new pulmonary smear cases detected ,expressed as percentage of estimated new smear positive cases .The cases detection rate was found 12.5%(10/80).

Re-treatment ratio: the ratio of number of all smear positive re-treatment cases (relapse, failure and returned after defaulter) out of all smear positive cases registered.

Inadequate treatment, miss-management of TB cases may increase the re-treatment ratio, because it adds the number of failure, relapses and defaulters. Also, the increase in this ratio may increase the number of multi drug resistance .the ratio seems to be quite high 38 %(6/16).

Cure rate: the number of new pulmonary smear positive cases cured divided by all registered new smear positive cases for a given trimester. Cure rate for new smear positive cases and re-treatment cases are the most important outcome indicator. Teku hospital had 70 %(7/10) for new smear positive and 50 %(3/6) for re-treatment cases. Treatment success rate were lower than national target (80%) for both new smear positive cases and re-treatment cases. Table 18 presents the total number of TB patients registered and its outcome.

Table 18 TB cases registered and treatment outcome at Teku hospital DOTS centre in the FY 2005/2006

Type of cases	Number regd.	Treatment success (cured+com)	failure	died	defaulter	Transfer out	No result
New smear positive	10	7	0	0	2	1	0
New smear negative	18	12	0	1	1	4	0
New extra pulmonary	13	10	0	1	1	1	0
Re-treatment	6	3	0	0	2	1	0

Source: NTC Annual report, 2005/2006

4.5.3 Ramghat PHC DOTS centre

Estimated population of Ramghat PHC covered about 60,000 population (ward 8and 9).Since the annual rate of tuberculosis infection (ARTI) was 4% for kathmandu, the estimated new smear positive cases were 120 for FY 2005/2006.During study period 10 smear new smear positive pulmonary TB cases were registered under DOTS.

Case detection rate: the number of new pulmonary smear cases detected ,expressed as percentage of estimated new smear positive cases .The cases detection rate was found 12.5%(10/120).

Re-treatment ratio: the ratio of number of all smear positive re-treatment cases (relapse, failure and returned after defaulter) out of all smear positive cases registered. Inadequate treatment, mismanagement of TB cases may increase the re-treatment ratio, because it adds the number of failure, relapses and defaulters. Also, the increase in this ratio may increase the number of multi drug resistance. There-treatment ratio was 25 %(3/13).

Cure rate: the number of new pulmonary smear positive cases cured divided by all registered new smear positive cases for a given period. Cure rate for new smear positive cases and re-treatment cases are the most important outcome indicator. Ramghat PHC had 100 %(10/10) for new smear positive and 100 %(3/3) for re-treatment cases. Treatment success rate was higher than national target (85%) for both new smear positive cases and re-treatment cases. In small number of cases high success rate did not indicate most effective treatment, because if one or two cases had not cured then result may entirely different. Table 19 presents the total number of TB patients registered and its outcome.

Table 19 TB cases registered and treatment outcome at Ramghat PHC in the FY 2005/2006

Type of cases	Number regd.	Treatment success (cured+com)	failure	died	defaulter	Transfer out	No result
New smear positive	10	10	0	0	0	0	0
New smear negative	7	5	0	1	0	1	0
New extra pulmonary	19	18	0	0	0	0	0
Re-treatment	3	3	0	0	0	0	0

Source: NTC Annual report, 2005/2006

4.5.4 Metropolitan DOTS center:

With in Kathmandu metropolis area 14 DOTS center running by Kathmandu Metropolitan. DOTS Centre was integrated with other primary health services – immunization, family panning, and primary health care. Most of center had found similar cost nature. Most of Metro DOTS center had no their own building. Either those centre were running at ward office or different community club building. Physical facility found very poor. Health outcome of selected centre was described below.

4.5.4.1 Sayambhu DOTS center

Sayambhu ward Health center provides DOTS service for tuberculosis control covered about 50,000 population (ward 15).Since the annual rate of tuberculosis infection (ARTI) was 4% for kathmandu metropolis and its surrounding area, the estimated new smear positive cases were 100 for FY 2005/2006.During study period 59 smear new smear positive pulmonary TB cases were registered under DOTS. This area has many monasteries where many monk lived together, as a result transmission of tuberculosis become high compare to other area.

Case detection rate: the number of new pulmonary smear cases detected ,expressed as percentage of estimated new smear positive cases .The cases detection rate was 59%(59/100).

Re-treatment ratio: the ratio of number of all smear positive re-treatment cases (relapse, failure and returned after defaulter) out of all smear positive cases registered. Inadequate treatment, mismanagement of TB cases may increase the re-treatment ratio, because it adds the number of failure, relapses and defaulters, and, may increase multi drug resistance .The ratio was 16 %(12/71).

Cure rate: the number of new pulmonary smear positive cases cured divided by all registered new smear positive cases for a given period. Cure rate for new smear positive cases and re-treatment cases are the most important outcome indicator. Sayambhu DOTS centre had 78 %(46/59) treatment success rate for new smear positive and 75 %(9/12) treatment success rate for re-treatment cases. Treatment success rate was lower than national target (85%) for both new smear positive cases and re-treatment cases. This DOTS centre had high rate of transfer out 19 %(11/59).If those cases were not follow up and monitor properly it may increase the chances of multi drug resistant TB.

Table 20 TB cases registered and treatment outcome at Sayambhu DOTS centre in the FY 2005/2006.

Type of cases	Number regd.	Treatment success (cured+com)	failure	died	defaulter	Transfer out	No result
New smear positive	59	46	0	2	0	11	0
New smear negative	20	14	0	0	0	6	0
New extra pulmonary	49	27	0	0	0	14	8
Re-treatment	12	9	0	0	0	0	0

Source: NTC Annual report, 2005/2006

4.5.2.2 Balaju DOTS center

Balaju ward Health center provides DOTS service for tuberculosis control covered about 35,000 population (ward 16).Since the annual rate of tuberculosis infection (ARTI) was 4% for Kathmandu, the estimated new smear positive cases were 70 for FY 2005/2006.During study period 41 new smears positive pulmonary TB cases were registered under DOTS. This centre located as a gateway of Nuwakot district. So, people not only from Kathmandu Metropolitan but also neighboring village were got treatment from this centre.

Case detection rate: the number of new pulmonary smear cases detected ,expressed as percentage of estimated new smear positive cases .The cases detection rate was found 58.5%(41/70).

Re-treatment ratio: the ratio of number of all smear positive re-treatment cases (relapse, failure and returned after defaulter) out of all smear positive cases registered. Inadequate treatment, mismanagement of TB cases may increase the re-treatment ratio, because it adds the number of failure, relapses and defaulters. Also, the increase in this ratio may increase the number of multi drug resistance .The ratio was 18 %(9/50).

Cure rate: the number of new pulmonary smear positive cases cured divided by all registered new smear positive cases for a given trimester. Cure rate for new smear positive cases and re-treatment cases are the most important outcome indicator. Balaju DOTS clinic had 90 %(37/41) for new smear positive and 100 %(9/9) for re-treatment cases. Treatment success rate were higher than national target (85%) for both new smear positive cases and re-treatment cases.

Table 21 TB cases registered and treatment outcome at Balaju DOTS centre in the FY 2005/2006.

Type of cases	Number regd.	Treatment success (cured+com)	failure	died	defaulter	Transfer out	No result
New smear positive	41	37	0	1	0	3	0
New smear negative	20	18	0	0	1	1	0
New extra pulmonary	41	33	0	0	2	6	0
Re-treatment	9	9	0	0	0	0	0

Source: NTC Annual report, 2005/2006

4.5.2.3 Koteshwor DOTS center

Koteshwor ward Health center provides DOTS service for tuberculosis control covered about 50,000 populations (ward 35). Since the annual rate of tuberculosis

infection (ARTI) was 4% for Kathmandu, the estimated new smear positive cases were 100 for FY 2005/2006.During study period 26 smear new smear positive pulmonary TB cases were registered under DOTS. Case finding rate was very low comparing to national achievement70% of estimated cases.

Case detection rate: the number of new pulmonary smear cases detected ,expressed as percentage of estimated new smear positive cases .The cases detection rate was found 26%(26/100).

Re-treatment ratio: the ratio of number of all smear positive re-treatment cases (relapse, failure and returned after defaulter) out of all smear positive cases registered. Inadequate treatment, mismanagement of TB cases may increase the re-treatment ratio, because it adds the number of failure, relapses and defaulters. Also, the increase in this ratio may increase the number of multi drug resistance .The ratio was found less than 10 %(3/29).

Cure rate: the number of new pulmonary smear positive cases cured divided by all registered new smear positive cases for a given trimester. Cure rate for new smear positive cases and re-treatment cases are the most important outcome indicator.

The treatment success rate of Koteshwor DOTS center was 73 %(19/26) for new smear positive and 67 %(2/3) for re-treatment cases. Treatment success rate were lower than national target (85%) for both new smear positive cases and re-treatment cases. This DOTS centre had high rate of transfer out 15 %(4/26) and 8 %(2/26) were defaulted. If those cases were not follow up and monitor properly it may increase the chances of multi drug resistant TB.

Table 22 TB cases registered and treatment outcome at Koteshwor DOTS centre in the FY 2005/2006.

Type of cases	Number regd.	Treatment success (cured+com)	failure	died	defaulter	Transfer out	No result
New smear positive	26	19	0	1	2	4	0
New smear negative	8	6	0	0	1	1	0
New extra pulmonary	24	18	0	1	2	3	0
Re-treatment	3	2	1	0	0	0	0

Source: NTC Annual report, 2005/2006

4.5.2.4 Jayabageshwori DOTS centre

Jayabageshwori ward Health center provides DOTS service for tuberculosis control covered about 20,000 populations (ward 8). Since the annual rate of tuberculosis infection (ARTI) was 4% for Kathmandu, the estimated new smear positive cases were 40 for FY 2005/2006.During study period 7 smear new smear positive pulmonary TB cases were registered under DOTS. Case finding rate was very low comparing to national achievement70% of estimated cases.

Case detection rate: the number of new pulmonary smear cases detected ,expressed as percentage of estimated new smear positive cases .The cases detection rate was found 18%(7/40).

Re-treatment ratio: the ratio of number of all smear positive re-treatment cases (relapse, failure and returned after defaulter) out of all smear positive cases registered. Inadequate treatment, mismanagement of TB cases may increase the re-treatment ratio, because it adds the number of failure, relapses and defaulters. Also, the increase in this ratio may increase the number of multi drug resistance .The ratio was found very high 30 %(3/10). Since the number of cases was small we could not decide about the risk associated with high re-treatment ratio.

Cure rate: the number of new pulmonary smear positive cases cured divided by all registered new smear positive cases for a given trimester. Cure rate for new smear positive cases and re-treatment cases are the most important outcome indicator. The treatment success rate of Jayabageshwori DOTS centre was 57 %(4/7) for new smear positive and 67 %(2/3) for re-treatment cases. Treatment success rate was lower than national target (85%) for both new smear positive cases and re-treatment cases. This DOTS centre had high rate of failure 29 %(2/7) .While number was small, inference may wrong, however result not showed good management of TB patient.

Table 23 TB cases registered and treatment outcome at Jayabageshwori DOTS Centre in the FY 2005/2006

Type of cases	Number regd.	Treatment success (cured+com)	failure	died	defaulter	Transfer out	No result
New smear positive	7	4	2	0	0	1	0
New smear negative	2	2	0	0	0	0	0
New extra pulmonary	12	10	0	0	0	2	0
Re-treatment	3	2	1	0	0	0	0

Source: NTC Annual report, 2005/2006

4.5.3 Over all health outcome of Kathmandu Metropolitan DOTS Center

Estimated population in Kathmandu metropolis in fiscal year 2005/2006 were about 0.83 million. Since the annual rate of tuberculosis infection (ARTI) was 4% for Kathmandu metropolis and its surrounding area, the estimated new smear positive cases were 1660 for FY 2005/2006.During study period 1009 smear new smear positive pulmonary TB cases were registered under DOTS with in 29 DOTS centre of Kathmandu Metropolitan city. Case detection rate was very low 44 %(729/1660) comparing to national achievement (70%) of estimated cases. Re-treatment ratio was less than 23 %(221/950).

Cure rate: the number of new pulmonary smear positive cases cured divided by all registered new smear positive cases for a given period. Cure rate for new smear positive cases and re-treatment cases are the most important outcome indicator. Treatment success rate (cure plus completed) was 80 %(259/323) for new smear positive and 74 %(69/93) for re-treatment cases Metropolis DOTS center. Treatment success rate were lower than national target (85%) for both new smear positive cases and re-treatment cases and was more than 10% transfers out (10% in new smear positive and 14 % in re-treatment cases.

Table 24 TB cases registered and treatment outcome at Metropolitan DOTS centers in the FY 2005/2006.

Type of cases	Number regd.	Treatment success (cured+com)	failure	died	defaulter	T. out	No result
New smear positive	323	259(80)	6(2)	8(2)	14(4)	33(10)	3(1)
New smear negative	157	131(83)	1(1)	5(3)	3(2)	17(11)	0
New extra pulmonary	386	302(78)	0	4(1)	14(4)	46(12)	20(5)
Re-treatment	93	69(74)	5(5)	4(4)	2(2)	13(14)	0

Source: NTC Annual report, 2005/2006

4.6 Cost-effectiveness analysis

This cost effective analysis was carried out to answer the research question" Which DOTS centers is more cost effective, Public (government) or Metropolis, in kathmandu Metropolitan city?" and it was based on the cost effectiveness of DOTS center for tuberculosis. The cost per effectiveness was calculated as total cost incurred by the DOTS centre divided by total effectiveness i.e. treatment success (cured and completed patients) of DOTS centre.

4.6.1 Bir hospital DOTS centre

Bir hospital is a centrally located tracery care hospital. It has separate treatment unit for tuberculosis patients .One chest physician assigned for diagnosis and follow

up of TB patients. Separate room and staff are assigned to provide DOT. Even there is a micro biology section in laboratory for sputum examination. This all elements contributed for high cost to treat TB patients. In FY 2005/2006 all together 119 patients registered for treatment and 104 successfully completed treatment. Total provider cost was NRS 1,006,589.So,per case successfully treated was NRS 10,593 (US$147).Major proportion of provider cost at Bir hospital was incurred in drug cost (43.2%) following by labor cost (38.3). The major cause of higher cost and less cost effectiveness due to size of hospital, separate clinic, staff and availability of diagnosis facility, with consultant.

4.6.2 Teku hospital DOTS centre

Teku hospital is established for tropical disease and communicable disease. DOTS centre is integrated with other services. Separate staffs are not assigned at clinic though diagnosis facility available. The number of OPD visit is comparatively low and a little bit higher proportion of indirect material cost is high. As a result proportion of material cost was higher (14.4%) in comparison to other public DOTS. In FY 2005/2006 all together 47 patients registered for treatment and 32 successfully completed treatment. Total provider cost was NRS 449514.So, per case successfully treated was NRS 14,173(US$197). As other public DOTS centre major proportion of provider cost at Teku hospital was incurred in drug cost (41.2%) following by labor cost (38.4%). The major cause of higher cost and less cost effectiveness due to high indirect cost, small number of patient. Teku hospital was found more costly DOTS centre among public and Metropolitan DOTS centre and approximately 55% less cost effective than Ramghat PHC and 25% less cost effective than Bir hospital DOTS centre.

4.6.3 Ramghat PHC DOTS centre

Ramghat DOTS centre is running at primary health care centre. This centre has microscopy facility but no chest x-ray. All services including tuberculosis treatment were integrated. Since it operates at rented house indirect costs were low. As a result proportion of material cost was lower (2.3%) in comparison to other public DOTS. In FY 2005/2006 all together 39 patients registered for treatment and 36 successfully completed treatment. Total provider cost was NRS 221,856.So, per case successfully treated was NRS 6,275(US$87). As other public DOTS centre major proportion of provider cost at Ramghat DOTS centre was incurred in drug cost (65.5%) following by labor cost (29.7%). Among public DOTS centre Ramghat DOTS centre was found less costly and more cost effective (69% than Bir hospital DOTS centre and 126% than Teku hospital DOTS centre). The major cause of higher cost effectiveness was higher percentage of treatment success (92%) and comparatively large number of patients.

4.6.4 Sayambhu DOTS centre

Sayambhu DOTS centre is running at Metropolitan ward health centre. Metropolitan DOTS centre has no microscopy and chest x-ray facility. All services including tuberculosis treatment were integrated. This centre has its own building but very old one. Its present value was found nominal. So, capital cost among other metropolis DOTS centre was very low (2%). In FY 2005/2006 all together 140 patients registered for treatment and 96 successfully completed treatment. Total provider cost was NRS 686,778.So, per case successfully treated was NRS 7154(US$99). As other public and Metropolitan DOTS centers major proportion of provider cost was incured in drug cost (78.4%) following by labor cost (17.5%). Metropolitan DOTS centre had low labor cost. Only three or four staffs were there. In

comparison to public DOTS centre drug cost found very high because of large number of patients. In comparison to Ramghat PHC, Sayambhu DOTS centre found more costly and less cost-effective.

4.6.5 Balaju DOTS centre

Balaju DOTS centre is running at Metropolitan ward health centre. Metropolitan DOTS centre has no microscopy and chest x-ray facility. All services including tuberculosis treatment were integrated. This centre has operated at rented house. In FY 2005/2006 all together 111 patients registered for treatment and 97 successfully completed treatment. Total provider cost was NRS 577605.So, per case successfully treated was NRS 5955 (US$83). As other public and Metropolitan DOTS centers major proportion of provider cost was incurred in drug cost (73%) following by labor cost (16.9%). Metropolitan DOTS centre had low labor cost. Only three or four staffs were there. In comparison to public DOTS centre drug cost found very high because of large number of patients. In comparison to other Metropolitan and public DOTS centre Balaju DOTS centre was found less costly and more cost effective. It was 136% cost effective than Teku hospital DOTS centre and 2% more cost effective than Ramghat PHC.

4.6.6 Koteshwor DOTS centre

Koteshwor DOTS centre is running at Metropolitan ward health centre. Metropolitan DOTS centre has no microscopy and chest x-ray facility. All services including tuberculosis treatment were integrated. This centre has operated at rented house. In FY 2005/2006 all together 61 patients registered for treatment and 45 successfully completed treatment. Total provider cost was NRS 347111.So, per case successfully treated was NRS 7714(US$107). As other public and Metropolitan DOTS centers major proportion of provider cost was incurred in drug cost (64.2%) following

by labor cost (19.1%). Metropolitan DOTS centre had low labor cost. Only three or four staffs were there. In comparison to public DOTS centre drug cost found very high because of number of patients. In comparison to other Metropolitan and public DOTS centre Koteshwor DOTS centre was found relatively costly and less cost effective. It was 28% more costly and less cost effective than Balaju DOTS centre.

4.6.7 Jayabageshwori DOTS centre

Jayabageshwori DOTS centre is running at Metropolitan ward health centre. Metropolitan DOTS centre has no microscopy and chest x-ray facility. All services including tuberculosis treatment were integrated. This centre has operated at rented house. Only one staff run the DOTS centre .Patients load was very low. In FY 2005/2006 all together 24 patients registered for treatment and 18 successfully completed treatment. Total provider cost was NRS 150439.So, per case successfully treated was NRS 8358 (US$116). As other public and Metropolitan DOTS centers major proportion of provider cost was incurred in drug cost (63.2%) following by labor cost (18.7%). This DOTS centre had low labor cost because only one staff was there. In comparison to other Metropolitan and public DOTS centre Jayabageshwori DOTS centre was found more costly and less cost effective among the Metropolitan DOTS centre. It was 40% more costly and less cost effective than Balaju DOTS centre.

Table 25 presents cost, effectiveness and its ratio of individual DOTS centre and average of government and Metropolitan DOTS center in Kathmandu metropolis.

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Table 25 Cost effectiveness ratio of government and Metropolitan DOTS center in Kathmandu metropolis ,FY 2005/2006

DOTS center	Total provider cost (NRs,2005 price)	Effectiveness (treatment success {cure + complete})	Cost/effectiveness	
			NRs	US$
Bir Hospital	1101,668	104	10593	147
Teku Hospital	453545	32	14173	197
Ramghat PHC	225901	36	6275	87
Public DOTS Centre	**1677968**	**172**	**9756**	**135.5**
Sayambhu DOTS center	686,778	96	7154	99
Balaju DOTS center	577,605	97	5955	83
Kotweshor DOTS center	347,111	45	7714	107
Jayabageshwori DOTS center	150,439	18	8358	116
Metropolis DOTS center	**5,186,313**	**761**	**6815**	**95**

Data showed that cost per effectiveness i.e. treatment success was US$ 144 in public and US$ 95 in metropolis DOTS centre. It means public(governmental health institution)were found more costly and less cost effective and metropolis DOTS centre were found more less costly and more cost effective.

4.7. Sensitivity Analysis

There are a number of sources of uncertainty in economics evaluation. First, no data available and informed guess are necessary to complete evaluation. Second estimation may be available but they may know to be imprecise. Third, there are methodological controversies, or value judgment may be incorporated in the study. The sensitivity analysis was carried out for different discount rate. Drummond has explained, in his book, to undertake sensitivity using 0%, 3%, and 5%discount rate. World Bank prefers to use 10% discount rate. In Nepalese context 5% discount rate was thought to be appropriate; based on economic indicator were explained on section

3.8.therefore sensitivity analysis was carried out for three different discount rates:3%,5%,8%. The sensitivity analysis revealed that changes in key input variable did not change the cost effectiveness ratio of Metropolitan DOTS in favor of public (government health institution) based DOTS centre. Metropolitan DOTS centre remained less costly and more cost effective. The observed differences (at 3%and 8%discout rate)of cost of per effectiveness was about US$ 2-3 in government DOTS center and about same in metropolis DOTS center.

This analysis support that DOTS for tuberculosis is not capital intensive strategy. The following table present capital cost annualized at 3% and 8%and its impact on cost per effectiveness. Nepalese currency was converted into US$ value using official exchange (US$=NRs 72) (NRB.2005)

Table 26 Cost –effectiveness ratio of public and Metropolitan DOTS center with capital annualized at 3% discount rate for FY 2005/2006.

DOTS center	capital cost	Total Provider cost (NRs,2005 price)	Cost/effectiveness	
			NRs	US$
Bir Hospital	152,239	1,082,686	10,410	145
Teku Hospital	23,056	449,563	14,049	195
Ramghat PHC	4,985	225,540	6,292	87
Public DOTS Centre				
Sayambhu DOTS center				
Balaju DOTS center	10,811	684,171	7,127	99
Kotweshor DOTS center	49,172	577,462	5,953	83
Jayabageshwori DOTS	29,754	327,030	7,267	101
center	24,845	150,326	8,351	116
Metropolis DOTS center	49,2390	5,956,153	6,776	94

Note: 1USD=72 NRs (NRB, 2005)

Table 27 Cost –effectiveness ratio of public and Metropolitan DOTS center with capital annualized at 8% discount rate for FY 2005/2006.

DOTS center	Total capital cost	Total provider cost (NRs,2005 price)	Cost/effectiveness	
			NRs	US$
Bir Hospital	214,443	1,144,890	11,009	153
Teku Hospital	33,683	460,190	14,381	200
Ramghat PHC	5,945	226,500	6,292	87
Public DOTS Centre				
Sayambhu DOTS center	17,896	691,256	7,209	100
Balaju DOTS center	49,612	577,902	5,958	83
Kotweshor DOTS center	30,161	327,437	7,276	101
Jayabageshwori DOTS center	25,195	150,667	8,370	116
Metropolis DOTS center	504,045	5,167,848	6,791	94

Note: 1USD=72 NRs (NRB, 2005)

Table 28 Cost –effectiveness ratio of public and Metropolitan DOTS center with capital annualized at 3%, 5% and, 8% discount rate for FY 2005/2006.

DOTS center	3%		5%		8%	
	NRs	US$	NRs	US$	NRs	US$
Bir Hospital	10,410	145	10,593	147	11,009	153
Teku Hospital	14,049	195	14,173	197	14,381	200
Ramghat PHC	6,265	87	6,275	87	6,292	87
Public DOTS Centre						
Sayambhu DOTS center	7,127	99	7,154	99	7,209	100
Balaju DOTS center	5,953	83	5,955	83	5,958	83
Kotweshor DOTS center	7,267	101	7714	107	7,276	101
Jayabageshwori DOTS center	8,351	116	8,358	116	8,370	116
Metropolis DOTS center	6,776	94	6,815	95	6,791	94

Note: 1USD=72 NRs (NRB, 2005)

CHAPTER V

DISCUSSION AND CONCLUSION

5.1 Discussion

Cost per effectiveness varied with different setting. Total provider cost largely depends upon infrastructure, staffing, opening hour, availability of diagnosis facility, number of patients etc. Most of public DOTS centre were found more costly and less cost effective in comparison to Metropolitan DOTS centre cost effectiveness per case successfully treat ranged US$ 197 to US$ 85 in public DOTS centre. Public DOTS centre running at big hospital had high operation cost, staffing cost consequently cost per effectiveness was found high (Bir hospital US$ 147, Teku hospital US$ 197) while public DOTS centre at primary health centre was found more cost effectively, i.e. less costly, sometimes even than Metropolitan DOTS centers.

Cost per effectiveness at Metropolitan DOTS centre was found from US$ 83 to US$ 116. Balaju DOTS centre were found more cost effective (US$ 83per effectiveness) while Jayabageshowari DOTS centre was found less cost effective (USD116 per effectiveness). Though organizational structure and facility was found same in all Metropolitan DOTS centre, number of patients registered and treatment success were affect the cost effectiveness largely.

5.1.1 Cost

Capital cost represents an investment in assets which is used over time. Most assets, such as buildings, equipment and Vehicles etc wear or depreciate with the time but land is not depreciable, but appreciable, its value increase day by day. There are two components of capital costs; one is opportunity cost of the funds tie up in the assets itself. There are several methods of measuring and valuing capital cost in economic evaluation. The best method is to annualize the initial capital outlay over the

useful life of the assets. This method automatically incorporates both depreciation aspect and opportunity cost aspect of the capital cost (Drummond, 1997).This method was adopted in this study and all the calculated capital cost reflects economic cost of capital inputs.

While calculating annual cost, the useful life of furniture was based on American hospital association 1978 edition. Because in Nepal estimated useful life of depreciable hospital assets not found. Depreciation rate mentioned in Nepal income tax was not applicable to this case. Rest assets useful life was estimated from consensus of staffs. For those equipments and furniture that had already expired its lifetime, replacement value (market price, that could reflect the opportunity costs of capital assets, were used.

Economic costs of donated goods (especially drugs and equipment), were taken into account. Since shadow exchange rate and official exchange rate were almost similar, the value of foreign currency was converted into local currency (Nepalese rupee) using exchange rate.

The allocation proportion set to distribute annual capital costs to DOTS services for tuberculosis might not free from question. In this study, allocation proportion for capital cost was based on time used by TB patients and other patients in the clinic. The assumption made for this calculation was physician spend equal amount of time for all types of patients. Similar approach was adopted calculate the proportion to allocate annual cost to TB.

Most of DOTS centre that did not have own building and used rent free or rent pay building, to reflect the economic cost of that space, some estimates had been adopted to of the Nepal gazette,1999 and consensus of local people and staff to find

market price. This could be more realistic in calculating economic cost rather than putting zero value for rent free building.

Though, tax is a major cause for variation in, when we would like to compare the total provider cost of government health institution DOTS center and metropolis DOTS center. Both of settings are not for profit institution, tax factor not applicable in cost calculation.

To minimize the providers' future cost, it was important to assess the necessary conditions of treatment success. Basically, quality of care, monitoring and supervision, good counseling to patients, proper follow up patients were important factor for successful treatment .National tuberculosis center has very clear guidelines to monitor and supervise the DOTS centre.

Among sample 3 DOTS centre, Bir hospital worked as referral hospital. It deals with OPD and IPD as well for all type of patients. Teku hospital has no separate clinic and diagnosis facility and pharmacy.

The result shows that capital cost of each DOTS center was with in the range of 2 to 19%.In government health institution it ranged from 2.4 to 17% and in metropolis DOTS centre from 2 to 16.6%. Capital cost at large hospital with microscopy and X-ray facility, and with its own building found high. Since DOTS for TB is being provided in integrated manner with other service, capital investment is not a big concern.

Labor costs among government DOTS centre varied from 29-38.3%. DOTS centre with diagnosis facility and separate clinic was found high labor cost. DOTS centre at large hospital (Bir, Teku) had more that one fourth (29-38%) cost incurred for labor cost. Metropolis DOTS centre had no microscopy and x-ray facility and no separate DOTS clinic and pharmacy, as a result labor cost was not more than 20of

total cost. Case load was another cause of labor cost .DOTS center with high case load had low proportion of labor cost and vice versa.

Material cost accounts the lowest percentage (1.2-14.4%) of total provider costs. Public DOTS center having radiology and microscopy facility had comparatively high (1.5-14.4%) material cost. while Metropolitan DOTS center had no microscopy and x-ray facility as result material cost found lower (1.5-2.4%). This percentage was not included drug cost.

Drug is major component in tuberculosis control. Anti-TB drugs (ATT) were procured through Global drug facility and no taxed. National tuberculosis centre supplied drug for each treatment centre, cost depends upon case load. Drug cost was approximately 50% of full cost. In government DOTS centre it ranges from 41.2-65.5% while Metropolitan DOTS centre ranges from 63-78%.This proportion directly relater to capital cost, material, and labor cost.

5.1.2 Effectiveness

As mentioned on effectiveness, Bir Hospital and Ramghat PHC had achieved remarkable success for treatment of tuberculosis .The treatment success rate was found 90-100% for new smear positive cases, and 60-100% for re-treatment cases. While Teku hospital had lower than national target (70%).

In Metropolis DOTS centre, Balaju DOTS centre had same success rate (90%) and rest other Sayambhu (78%), Koteshwor (73%), and Jayabageshwori (57%).The average success of 14 metropolis DOTS centre was 80%, still below national target (85%).

5.1.3 Cost effectiveness

The cost per effectiveness was quite high in government health institution's DOTS centre. Main cause behind it was high capital and labor cost. So, the cost per effectiveness of government health institution's DOTS centre ranged from NRS 6275

to 14,173 (USD 87-197),while the cost per effectiveness of metropolis DOTS center ranges from NRs 5,955 to 8358 (USD 83-116).Simply, this results showed that the metropolis DOTS centre were more cost effective.

The main source of variation in total provider cost was labor cost. In the government health institution's DOTS centre, it is almost one and half to two times more than that of metropolis DOTS centre. In government health institution DOTS centre labor cost accounts up to 38% and metropolis DOTS centre up to 18% .High proportion of labor cost in public DOTS centre was due to availability of diagnosis facility, separate treatment unit, and pharmacy.

Even if the cost of microscopy and x-ray omitted for comparison of metropolis DOTS centre the cost per effectiveness of public DOTS still found more costly than metropolis DOTS centers. In this condition cost per effectiveness in public DOTS centre was ranged from NRs 5,703 to 8894 (USD 79 to124). It means about one third of provider cost incurred for diagnosis of tuberculosis at large hospital Public DOTS centers.

Table 30 Total providers' cost at public and Metropolitan DOTS centre (without X-ray and Microscopy cost) in FY 2005/2006

DOTS Centre	capital cost	labor cost	material cost	Drug cost	Total provider cost
Bir Hospital	28,574	243,000	18,824	435,123	725,521
Teku Hospital	6,665	84,500	8,412	185,020	284,597
Ramghat PHC	1,157	50,120	8,597	145,419	205,293
Public DOTS Centre	***36,396***	***377,620***	***35,833***	**765,562**	***1215,411***
Sayambhu DOTS center	13,418	97344	14791	538569	153223
Balaju DOTS center	49,315	120,000	9009	421973	144974
Kotweshor DOTS center	49,835	67024	8493	224756	54567
Jayabageshwori DOTS center	24,967	28080	2300	95092	120890
Metropolis DOTS center	**137,574**	**312,503**	**34539**	**1280550**	**1765230**

5.2 Conclusion

The result showed that the metropolis DOTS centers more cost effective. The cost per effectiveness of Public (DOTS centre at government health institution i.e. hospital and primary health care centre in kathmandu Metropolitan area) DOTS centres ranged from NRS 6275 to 14,173 (USD 87-197), while the cost per effectiveness of metropolis DOTS center ranges from NRs 5,955 to 8358 (USD 83-116).This showed that metropolis DOTS centre were 35% more cost effective than public DOTS centre.

So, in urban area, basically in metropolis and sub–metropolis, involvement of metropolis ward health centre to treatment of tuberculosis will be more cost effective. The large hospital could be used as a referral centre for diagnosis of tuberculosis and follow up examination.

DOT should be provided at nearest point as a result individual patient could be monitored and effectiveness could be increased. As a result, transmission chain of tuberculosis could be cut as result morbidity and mortality will be reduced. At the same time involvement of other private sector should be increased to make easy excess of each TB patients. So, national tuberculosis centre should established better coordination with Metropolitan authority to expand DOTS centre in every ward health centre.

5.3 policy implication

Result showed that cost per effectiveness (treatment success i.e. cured and completed) was almost 35% lower in Metropolitan DOTS centers than public DOTS centers. DOTS should be expanded up to each and every Metropolitan ward health centers. More effective coordination should be developed with Kathmandu Metropolitan authority. At data collection procedure researcher found that though 14

Metropolitan DOTS centre were committed to tuberculosis control, the basic infrastructure of those centre were found poor. Some motivational activities and incentives should be provided for the staff. Certainly most of metropolis DOTS centre spend about 50% of time for TB patients, poor physical facility needs to improve .For that national tuberculosis centre and Kathmandu Metropolitan should go ahead in more coordinated way.

5.4 Limitation of the study

This study was carried out from provider prospective. It did not include the patients direct and indirect cost to have DOTS service. It did not include the part of externalities to the society of treatment success, not treating and delaying for treatment of TB patients. The cost incurred by national tuberculosis centre to provide training , monitoring and supervision was not calculated in this study. Also, incremental analysis was not carried out in this study because it needed more additional data that could not be collected in this study.

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APPENDICES

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Appendix A1

List of DOTS Centre in Kathmandu district in FY 2005/2006

1 **Public (government Institution) DOTS Centre**
- Bir_Hospital
- BirendraP_Hospital
- Central Jail
- Kanti_Hospital
- Ramghat_PHC
- Teku_Hospital

2 **Metropoils DOTS Centre**
- Balaju-UHC
- Baneswor_UHC
- Bhimsengola-4
- Dillibazar_UHC
- Humattole_UHC
- Inabahal_UHC
- Jayabageswori_UHC
- Koteswor_UHC
- Lainchaur_UHC
- Mitrapark_UHC
- Naradevi_UHC
- Naxal_UHC
- Nyokha_UHC
- Swayambhu_UHC

3 **DOTS at non for profit(in metro city)**
- Care&Fare_Clinic
- GENETUP_Clinic
- Helping_Hands
- Kingkong

4 **DOTS at non for profit (out of metro city)**
- FoShanta_Bhawan
- Himalyan_HCentre
- Shenchen_Clinic
- NRedcross_Society

5 **DOTS at for profit (private clinic)**
- Anamnagar poly clinic
- Baba Community Health Centre

6 **DOTS centre out of metropolis city at Kathmandu district**
- Alapot HP
- Bishnudevi_PHC
- Budhanilkantha_SHP
- Chankhel
- Dharmasthali HP
- Gangabu_HP
- Gokarna HP
- Indriyani HP
- Mulpani_PHC
- Manamaiju SHP
- Ramkot
- Sangla_PHC
- Shankhu HP
- Satungal HP
- Thankot_SHP
- Tokha_PHC

7 **DOTS at Teaching Hospital**
- KMC_MC
- NMC_MC
- Stupa_PHCollege
- TUTH_MC

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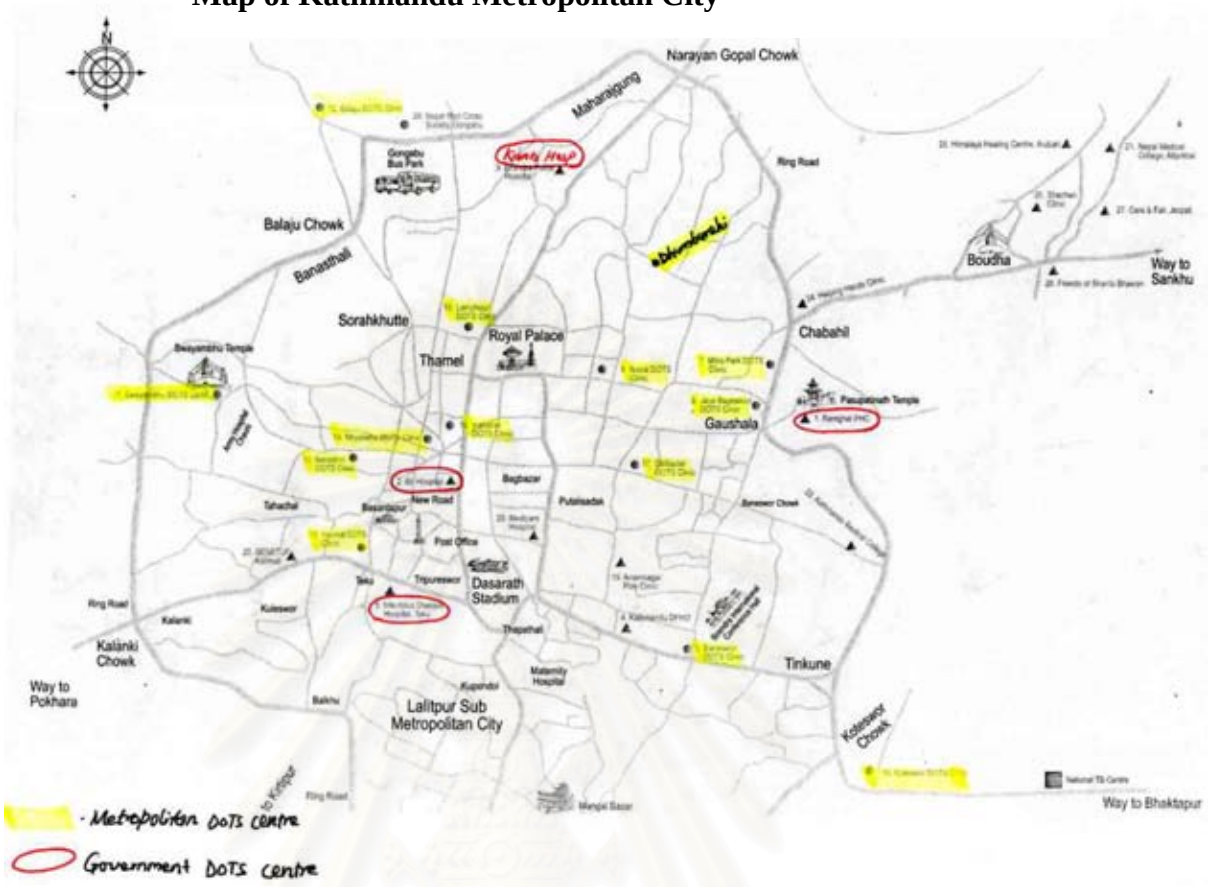
Map of Kathmandu Metropolitan City



Source: National Tuberculosis centre, Urban DOTS program, Nepal

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Appendix C1 Capital Cost

Calculation of capital cost of Bir Hospital DOTS Centre (in Neplease Rupees,2005 prices, at 5%discount rate)

Bir Hospital DOTS Centre

Inputs	Purchase price	Year of purchase	Useful life	present value*	Annualization	Annual cost	8 mont cost	allocation prop	8 mth cost for TB
Treatment Unit									
Space	146477	1990	30	304515	15.372	19810	13206	1	13206
furniture total	12750	7982	60	20027	42.42	1942	1295		1295
Treatment Unit Total	**159227**			**324542**		**21752**	**14501.07**	**1**	**14501**
Laboratory Unit									
Space(8'*10")	177419	1990	30	367258	15.372	23891	15928	1	15928
furniture total	**22300**			**37363**		**3211**	**2141**		**2140**
Micriscope(binacular)	80000	1996	10	124106	7.722	16072	10714	1	10714
Laboratory unit Total	**279719**			**528727**		**43174**	**28783**		**28782**
X-ray Unit									
furniture total	29100		67	36959	44.905	3257.34	2171.5597		1086
X-ray Machine	450000	2000	8	571500	6.463	88426	58951	0.5	29475
X-ray Unit Total	**2182325**			**4133536**		**321002**	**214001**		**107001**
Pharmacy unit									
Space used(7'*12)	146477	1990	30	304515	15.372	19809.7	13206.5	1	13206
furniture total	11550			13365		1300.3	866.9		867
pharmacy unit Total	**158027**			**317880**		**21110.1**	**14073.4**		**14073**
Total capital cost	***2779298***			***5304685***		***407037***	***271358***		***171221***

*present value of capital item was calculated using the relation ,Pt=P0(1+r)t

Where pt=present value,p0=purchase price, r=discount=number of year since purchase of goods up to 2005

Appendix C2 Capital Cost

Calculation of capital cost of Teku Hospital DOTS Centre (in Neplease Rupees,2005 prices, at 5%discount rate)

Teku Hospital DOTS Centre

Inputs	Purchase price	Year of purchase	Useful life	prtsent value	Annualization	Annual cost	8 mont cost	allocation prop	8 mth cost for TB
Treatment Unit									
Space	360000	1997	30	531804	15.372	34596	23064	0.11	2537
furniture total	13800			15723		1543	1029		304
Treatment Unit Total	**373800**			**547527**		**36139**	**24093**		**2841**
Laboratory Unit									
Space(8'*10'')	360000	1997	30	531804	15.372	34596	23064	0.13	2883
furniture total	***9200***			***12810***		***1152***	***768***		***96***
Micriscope(binacular)	80000	2000	10	124106	7.722	16072	10714	0.13	1339
Laboratory unit Total	**449200**			**668720**		**51820**	**34546**		**4318**
X-ray Unit									
Space used(9'*11)	445500	1990	30	926102	15.372	60246	40164	0.1	4016
furniture total	12800			16256		1462	975		97
X-ray Machine	200000	2002	8	231525	6.463	35823	23882	0.5	11941
X-ray Unit Total	**658300**			**1173883**		**97531**	**65021**		**16055**
Pharmacy unit									
Space used(7'*12)	378000	1990	30	782460	15.372	50902	33934	0.11	3733
furniture total	12400			13981		1249	832		92
pharmacy unit Total	**390400**			**796441**		**52150**	**34767**		**3824**
Total capital cost	**1871700**			**3186571**		**237640**	**158427**		**27038**

*present value of capital item was calculated using the relation ,Pt=P0(1+r)t

Where pt=present value,p0=purchase price,r=discount,t=number of yearsince purchase of goods up to 2005

Appendix C3 Capital Cost

Calculation of capital cost of Ramghat PHC DOTS Centre (in Neplease Rupees,2005 prices, at 5%discount rate)

Ramghat PHC DOTS Centre

Inputs	Purchase price	year of purchase	Useful life	prtsent value	Annualization	Annual cost	8 mont cost	allocation prop	8 mth cost for TB
Space				5000			3333	0.25	833
furniture total	3420	6010		3742		391	261		65
Treatment Unit Total	**3420**			**8742**		**391**	**3594**		**899**
Laboratory Unit									
Space(8'*10'')				5000			3333	0.25	833
Micriscope(binacular)	135000	2003	10	148000	7.722	19166	12777	0.25	3194
Laboratory unit Total	**143500**			**162363**		**20134**	**16756**		**4189**
X-ray Unit									
X-ray Unit Total									
Pharmacy unit									
Space used(8'*10)				5000			3333	0.23	767
furniture total	12900			14560		1433	955		220
pharmacy unit Total	**12900**			**19560**		**1433**	**4289**		**986**
Total capital cost	**159820**			**185665**		**21959**	**21306**		**5241**

*present value of capital item was calculated using the relation ,Pt=P0(1+r)t

Where pt=present value,p0=purchase price,r=discount,t=number of yearsince purchase of goods up to 2005

Appendix C4 Capital Cost

Capital cost analysis of Mertopolis DOTS centre at 5% discounting rate for 2005/2006

Balaju

Inputs	Purchase price	Year of purchase	Useful life	replacement value	Annualization	Annual cost	8 mont cost	allocation prop	8 mth cost for TB
Treatment Unit									
Space				60000			40000	0.6	24000
Land									0
Wooden Table	4500	1996	15	7330	11.118	659	440	0.6	264
Wooden chair	500	1996	15	800	11.118	72	48	0.6	29
Woddwn Bench									
Steel cupboard	5250	2000	20	6700	12.462	538	358	0.6	215
weighimg Machine	1700	2001	10	2066	7.722	268	178	1.6	285
ceilling Fan									
Treatment Unit Total	**11950**			**76896**		**1536**	**41024**		**24793**
Laboratory unit Total									
X-ray Unit Total									
Pharmacy unit									
Space used(7'*12)				60000			40000	0.6	24000
Wooden Table(1)	5500	2002	12	6306	8.863	711	474	0.6	285
Chair(1)	450	2002	15	520	11.118	47	31	0.6	19
Bench(1)	700	2002	15	810	11.118	73	49	0.6	29
Water Filter(steel)	1500	2000	10	1157	7.772	149	99	0.6	60
Steel Cabinet,Big(1)	3500	1998	20	4050	12.462	325	217	0.6	130
furniture total	11650			12843		1305	870		522
pharmacy unit Total	**11650**			**72843**		**1305**	**40870**		**24522**
Total capital cost	**23600**			**149739**		**2841**	**81894**		**49315**

*present value of capital item was calculated using the relation ,Pt=P0(1+r)t

Where pt=present value,p0=purchase price,r=discount,t=number of year since purchase of goods up to 2005

Appendix C5 Capital Cost

Capital cost analysis of Mertopolis DOTS centre at 5% discounting rate for 2005/2006

Sayambhu

Inputs	Purchase price	Year of purchase	Useful life	Nominal value	Annualization	Annual cost	8 month cost	allocation prop	8 mth cost for TB
Treatment Unit									
Space(10'*8')	50000	1980	30	169317	15.372	11015	7343	0.75	5507
Land									
Wooden Table	4250	1996	15	7330	11.118	659	440	0.75	330
Wooden chair	350	1996	15	800	11.118	72	48	0.75	36
Table Fan	1500	2003	5	1823	4.329	421	281	1.75	491
Steel cupboard	5250	2000	20	6700	12.462	538	358	0.75	269
weighimg Machine	1700	2001	10	2066	7.722	268	178	0.75	134
Heater	2500	2003	5	2756	4.329	637	424	0.75	318
Treatment Unit Total	**65550**			**190792**		**13609**	**9073**		**7085**
Laboratory unit Tota	0								
X-ray Unit Total	**0**								
Pharmacy unit									
Space used(10'*8')	50000	1980	30	169317	15.372	11015	7343	0.75	5507
Wooden Table(1)	5500	2002	12	6306	8.863	711	474	0.75	356
Chair(1)	450	2002	15	520	11.118	47	31	0.75	23
Bench(1)	700	2002	15	810	11.118	73	49	0.75	36
Water Filter(steel)	1000	2000	10	1100	7.772	142	94	0.75	71
Rack(1)									
Steel Cabinet,Big(1	6000	1998	20	8442	12.462	677	452	0.75	339
Steel Cabinet,small	4500	2003	20	4961	12.462	398	265	1.75	464
furniture total	13650			17178		1650	1100	0.75	825
pharmacy unit Total	**63650**			**186495**		**12665**	**8443**		**6332**
Total capital cost	129200			**377287**		**26274**	**17516**		**13418**

*present value of capital item was calculated using the relation ,Pt=P0(1+r)t

Where pt=present value,p0=purchase price,r=discount,t=number of yearsince purchase of goods up to 2005

Appendix C6 Capital Cost

Capital cost analysis of Mertopolis DOTS centre at 5% discounting rate for 2005/2006

Koteswor

Inputs	Purchase price	Year of purchase	Useful life	Nominal value	Annualization	Annual cost	8 mont cost	allocation prop	8 mth cost for TB
Treatment Unit									
Space				60000			40000	0.6	24000
Land									
Wooden Table	4250	2003	15	4086	11.118	368	245	0.6	147
Wooden chair(2)	800	2003	15	882	11.118	79	53	0.6	32
Woddwn Bench									
Steel cupboard	5600	2002	20	6483	12.462	520	347	0.6	208
weighimg Machine	1500	2002	10	1736	7.722	225	150	0.6	90
ceilling Fan									
Treatment Unit Total	**12150**			**73187**		**1192**	**40795**		**24477**
Laboratory unit Total									
X-ray Unit Total									
Pharmacy unit									
Space used(10'*12)									
Wooden Table(1)	4250	2001	12	5165	8.863	583	389	0.6	233
Chair(1)	400	2001	15	406	11.118	37	24	0.6	15
Bench(1)	700	2002	15	810	11.118	73	49	0.6	29
Water Filter(steel)	1100	2002	10	1202	7.772	155	103	0.6	62
Steel Cabinet,small(1)	4500	2003	20	4725	12.462	379	253	0.6	152
furniture total	10950			12308		1226	817		490
pharmacy unit Total	**10950**			**12308**		**1226**	**817**		**490**
Total capital cost	**23100**			**85495**		**2418**	**41612**		**24967**

*present value of capital item was calculated using the relation ,Pt=P0(1+r)t

Where pt=present value,p0=purchase price,r=discount,t=number of yearsince purchase of goods up to 2005

Appendix C7 Capital Cost

Capital cost analysis of Mertopolis DOTS centre at 5% discounting rate for 2005/2006

Koteshwor

Inputs	Purchase price	Year of purchase	Usefull life	Nominal value	Annualization	Annual cost	8 month cost	allocation prop	8 mth cost for TB
Treatment Unit									
Space				36000			24000	0.6	14400
Land									
Wooden Table	3500	2000	12	4690	8.863	529	353	0.6	212
Wooden chair(1)	450	2000	15	603	11.118	54	36	0.6	22
Woddwn Bench									
Steel cupboard(big 1)	6400	1996	20	10425	12.462	837	558	0.6	335
weighimg Machine									
ceilling Fan									
Treatment Unit Total	**10350**			**51718**		**1420**	**24947**		**14968**
Laboratory unit Total									
X-ray Unit Total									
Pharmacy unit									
Space used(10'*12)				36000			24000	0.6	14400
Wooden Table(1)	3500	2000	12	4690	8.863	529	353	0.6	212
Chair(1)	450	2000	15	603	11.118	54	36	0.6	22
Bench(1)	1500	2002	15	1823	11.118	164	109	0.6	66
Water Filter(steel)									
Rack(1)									
Steel Cabinet,Big(1)									
Steel Cabinet,small(1	6000	2002	20	7293	12.462	585	390	0.6	234
furniture total	11450			14409		1333	888		533
pharmacy unit Tota	**11450**			**50409**		**1333**	**24888**		**14933**
Total capital cost	**21800**			**102127**		**2753**	**49835**		**29901**

*present value of capital item was calculated using the relation ,Pt=P0(1+r)t

Where pt=present value,p0=purchase price,r=discount,t=number of yearsince purchase of goods up to 2005

Appendix D1

Labor cost calculation (in neplease rupees,NRs,2005/06)

Bir Hospital

Category	Number	Gross salary per month	Time spent on TB(hours/day)	Attributable days of salary for 8 months	8 Months salary attributable for TB
Treatment Unit					
Doctor(specialist)	1	15000	1	120000	120000
Clinic assiatant	1	6500	1	52000	52000
Administrative assistant	1	5000	0.1	40000	4000
sweepper	1	3500	0.25	28000	7000
Treatment Unit Total		**30000**		**240000**	**183000**
laboratory Unit					
Pathologist	1	13500	0.1	108000	10800
Medical technologist	1	12000	0.1	96000	9600
Lab technicians	1	8500	0.5	68000	34000
Lab assistant	1	6500	0.5	52000	26000
Lab boy	1	5000	0.5	40000	20000
Sweeper	1	4000	0.25	32000	8000
Laboratory Unit		**49500**		**396000**	**108400**
Radiology unit					
Radiologist	1	13500	0.1	108000	10800
Radiographer	1	8750	0.1	70000	7000
Dark room assistant	1	5250	0.1	42000	4200
Administrative assistant	1	5000	0.1	40000	4000
Sweeper	1	4000	0.25	32000	8000
Radiology unit total		**36500**		**292000**	**34000**
Pharmacy Unit					
paramedics(AHW)	1	6500	1	52000	52000
sweeper	1	4000	0.25	32000	8000
Pharmacy Unit total		**10500**		**84000**	**60000**
Total labor cost		**126500**	**0**	**1012000**	**385400**

Appendix D2

Labor cost calculation (in neplease rupees,NRs,2005/06)

TEKU Hospital

Category	Number	Gross salary per month	Time spent on TB(hours/day)	Attributable days of salary for 8 months	8 Months salary attributable for TB
Treatment Unit					
Doctor	1	13250	0.25	106000	26500
clinic assistant	1	6500	0.25	52000	13000
administrative assistant	1	5000	0.1	40000	4000
sweeper	1	3500	0.25	28000	7000
Treatment Unit Total		**28250**		**226000**	**50500**
laboratory Unit					
Lab technicians	1	8500	0.15	68000	10200
Lab assistant	2	6500	0.15	52000	7800
lab boy	1	5000	0.15	40000	6000
sweeper	1	4000	0.25	32000	8000
laboratory Unit		**24000**		**192000**	**32000**
radiology unit					
radiologist	1	13500	0.15	108000	16200
radiographer	1	8750	0.25	70000	17500
Dark room assistant	1	5250	0.25	42000	10500
administrative assistant	1	5000	0.1	40000	4000
sweeper	1	4000	0.25	32000	8000
radiology unit total		**36500**		**292000**	**56200**
Pharmacy Unit					
paramedics(AHW)	1	6500	0.5	52000	26000
sweeper	1	4000	0.25	32000	8000
Pharmacy Unit total		**10500**		**84000**	**34000**
Total labor cost		**99250**	**0**	**794000**	**172700**

Appendix D3

Labor cost calculation (in neplease rupees,NRs,2005/06)

Ramghat PHC

Category	Number	Gross salary per month	Time spent on TB(hours/day)	Attributable days of salary for 8 months	8 Month salary attributable for TB
Treatment Unit					
Doctor	1	9000	0.1	72000	7200
clinic assistant	1	6500	0.23	52000	11960
administrative assistant	1	5000	0.1	40000	4000
sweeper	1	3500	0.25	28000	7000
Treatment Unit Total		**24000**		**192000**	**30160**
laboratory Unit					
Lab assistant	1	6500	0.15	52000	7800
sweeper	1	4000	0.25	32000	8000
laboratory Unit		**10500**		**84000**	**15800**
radiology unit					
Pharmacy Unit					
paramedics(AHW)	1	6500	0.23	52000	11960
sweeper	1	4000	0.25	32000	8000
Pharmacy Unit total		**10500**		**84000**	**19960**
Total labor cost		**45000**	**0**	**360000**	**65920**

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Appendix D4

Labor cost calculation (in neplease rupees,NRs,2005/06)

	Balaju				**Sayambhu**			
Category	Monthly salary	Salary for 8 month	Allocation for TB	8months labor cost for TB	Monthly salary	Salary for 8 month	Allocation for TB	8month labor cost for TB
Treatment Unit								
Clinic assiatant	7800	62400	0.52	32448	8750	70000	0.8	56000
Administrative assistant	5400	43200	0.52	22464	0	0		0
sweepper	3500	28000	0.52	14560	3500	28000	0.8	22400
Treatment Unit Total	**16700**	**133600**		**69472**	**12250**	**98000**		**78400**
Pharmacy Unit								
Paramedics(AHW)	6700	53600	0.52	27872	6500	52000	0.8	41600
Pharmacy Unit total	**6700**	**53600**		**27872**	**6500**	**52000**		**41600**
Total labor cost	**23400**	**187200**		**97344**	**18750**	**150000**		**120000**

Category	**Koteshwor**				**Jayabageshwori**			
Treatment Unit								
Clinic assiatant	8500	68000	0.59	40120	0	0	0.36	0
Administrative assistant	0	0	0	0	0	0		0
sweepper	0	0		0	3500	28000	0.36	10080
Treatment Unit Total	**8500**	**68000**		**40120**	**3500**	**28000**		**10080**
Pharmacy Unit								
Paramedics(AHW)	5700	45600	0.59	26904	6250	50000	0.36	18000
Pharmacy Unit total	**5700**	**45600**		**26904**	**6250**	**50000**		**18000**
Total labor cost	**14200**	**113600**		**67024**	**9750**	**78000**		**28080**

Appendix E1

Calculation of direct Material cost of Bir Hospital(amount in Nepalese rupees,2006)

Category	Unit	Qty used	Unit cost	total cost
Treatment unit				
Laboratory Unit				
carbon Fusin solution	ml	1539	0.21	323.19
20% sulpheric Acid	ml	1539	0.18	277.02
0.1%methylele blue	ml	1539	0.12	184.68
Immersion oil	ml	150	2.1	315
lab reagent total				**1099.89**
sputum container	num	513	3	1539
slides	num	513	1.25	641.25
Diamond pencil	num	1	100	100
sputum examination request form	pad	11	50	550
Lab registered	num	1	150	150
pen ballpen black/red ink	time	1	500	500
lab related stationary total				**3480**
laoratory total				**4580**
X-ray Unit				
X-ray film	num	119	45	5355
developer	lit	22	45.45	1000
fixture	lit	22	45.45	1000
chemical total				
x-ray unit total				**7355**
TB registered	num	1	150	150
TB treatment card	num	119	5	595
TB patient card	num	119	5	595
4 monthly reporting form	pad	3	35	105
Pen ballpen ,file ,paper etc	time	1	2000	2000
stationary total				**3445**
Pharmacy unit total				
Total direct material cost				**15380**

Appendix E2

Calculation of direct Material cost of Teku Hospital(amount in Neplease rupees,2006)

Category	Unit	Qty used	Unit cost	total cost
Treatment unit				
Laboratory Unit				
carbon Fusin solution	ml	567	0.21	119.07
20% sulpheric Acid	ml	567	0.18	102.06
0.1%methylele blue	ml	567	0.12	68.04
immersion oil	ml	50	2.1	105
lab reagent total	ml			**394.17**
sputum container	num	189	3	567
slides	num	189	1.25	236.25
dimond pencil	num	1	100	100
sputum examination request form	pad	4	50	200
Lab registered	num	1	150	150
pen ballpen black/red ink	num	1	200	200
lab related stationary total				**1453**
laoratory total				**1847**
X-ray Unit				
X-ray film	num	47	45	2115
developer	lit	22	45.45	1000
fixture	lit	22	45.45	1000
chemical total				
x-ray unit total				**4115**
TB registered	num	1	150	150
TB treatment card	num	47	5	235
TB patient card	num	47	5	235
4 monthly reporting form	pad	3	35	105
Pen ballpen ,file ,paper etc	num	1	500	500
stationary total				**1225**
Pharmacy unit total				
Total direct material cost				**7187**

Appendix E3

Calculation of direct Material cost of Ramghat PHC(amount in Nepalese rupees,2006)

Category	Unit	Qty used	Unit cost	total cost
Treatment unit				
Laboratory Unit				
carbon Fusin solution	ml	594	0.21	124.74
20% sulpheric Acid	ml	594	0.18	106.92
0.1%methylele blue	ml	594	0.12	71.28
immersion oil	ml	50	2.1	105
lab reagent total				**407.94**
sputum container	num	189	3	567
slides	num	189	1.25	236.25
diamond pencil	num	1	100	100
sputum examination request form	pad	2	50	100
Lab registered	num	1	150	150
pen ball pen black/red ink/marker/cotton etc	times	1	200	200
lab related stationary total				**1353.25**
laboratory total				**1761.19**
X-ray Unit				
X-ray film	num			
developer	lit			
fixture	lit			
chemical total				
x-ray unit total				
TB registered	num	1	150	150
TB treatment card	num	39	5	195
TB patient card	num	39	5	195
4 monthly reporting form	pad	3	35	105
Pen ball pen ,file ,paper etc	num	1	750	750
stationary total				
Pharmacy unit total				**1395**
Total direct material cost				**3156**

Appendix E4

Direct Material cost (Metropolitan DOTS center ,in NRs,2005/2006)

			Balaju		**Sayambhu**	
Items	Unit	cost	used qty.	amount	used qty.	amount
TB registered	num	150	1	150	1	150
TB treatment card	num	5	111	555	140	700
TB patient card	num	5	111	555	140	700
4 monthly reporting form	pad	45	3	135	3	135
Sputum examination request form	pad	25	2	50	2	50
Pen ballpen ,file ,paper etc	num	1	1000	**1000**	1500	1500
Pharmacy unit total				**2445**		**3235**
			Koteshwor		**Jayabageshwori**	
TB registered	num	150	1	150	1	150
TB treatment card	num	5	53	265	24	120
TB patient card	num	5	53	265	24	120
4 monthly reporting form	pad	45	3	135	3	135
Sputum examination request form	pad	25	2	50	1	25
Pen ballpen ,file ,paper etc	num	1	600	600	500	500
Pharmacy unit total				**1465**		**1050**

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Appendix F1

Indirect cost calculation(in Neplease Rupees,2005)

S.N.	Institution	Annual cost	8mth cost	allocation propor	8mth cost TB	8 mth cost to TB
1	**Ranghat PHC**					
	Telephone	6000	4000	0.23	920	613
	water/electricity	7200	4800	0.23	1104	736
	stationery and others	5000	3333	0.23	767	511
	miscellaneous	1500	1000	0.23	230	153
	Total	**19700**	**13133**		**3021**	**2014**
2	**Bir Hospital**					
	Telephone	425000	283333	0	5667	3778
	water/electricity	5000000	3333333	0	66667	44444
	stationery and others	1200000	800000	0	16000	10667
	miscellaneous	2000000	1333333	0	26667	17778
	Total	**8625000**	**5750000**		**115000**	**76667**
3	**Teku Hospital**					
	Telephone	50000	33333	0	3667	2444
	water/electricity	800000	533333	0	58667	39111
	stationery and others	210000	140000	0	15400	10267
	miscellaneous	200000	133333	0	14667	9778
	Total	**1260000**	**840000**		**92400**	**61600**

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Appendix F2

Indirect cost calculation(in Neplease Rupees,2005)

Metropolis DOTS centre

1	**Balaju**					
	Telephone	18000	12000	0.52	6240	4160
	water/electricity	8400	5600	0.52	2912	1941
	stationery and others	2000	1333	0.52	693	462
	miscellaneous	0	0		0	0
	Total	**28400**	**18933**		**9845**	**6564**
2	**Sayambhu**					
	Telephone	12000	8000	0.8	6400	4267
	water/electricity	18000	12000	0.8	9600	6400
	stationery and others	2500	1667	0.8	1333	889
	miscellaneous	0	0		0	0
	Total	**32500**	**21667**		**17333**	**11556**
5	**Jayabageshwori**					
	Telephone	3000	2000	0.36	720	480
	water/electricity	6000	4000	0.36	1440	960
	stationery and others	500	333	0.36	120	80
	miscellaneous	0	0		0	0
	Total	**9500**	**6333**		**2280**	**1520**
10	**Koteswor**					
	Telephone	4800	3200	0.59	1888	1259
	water/electricity	21000	14000	0.59	8260	5507
	stationery and others	1000	667	0.59	393	262
	miscellaneous					
	Total	**26800**	**17867**		**10541**	**7028**

Appendix -G
Cost effectiveness of Public and Metropolitan DOTS centers in kathmandu Metropolitan city , Nepal
Information collection sheet
(2005 July to 2006 July)

Institution: **Type: G/M** **Total OPD Visit:**
Location: **No. of TB Patients visits:**

Human resource (DOTS centre)

	Doctor	Nurses	X-ray Tech	Lab staff	Paramedics	Administration	Other
Number							
Monthly salary							

Capital cost

Items	Unit	Num.	Cost(NRS)	Purchased yr.	remarks
Building					
Vehicles					
……					
Microscope					
……..					
X-ray Machine					
Other(specify)					
……					
…….					
…….					

Material costs

Items	Unit	Num.	Cost(NRS)	remarks
Lab reagents				
…….....				
…….....				
X-ray				
…….....				
…….....				
Pharmacy				
…….....				
…….....				
…….....				

Drug cost

Items	**Unit**	**Num.**	**Cost(NRS)**	**remarks**
Rifampicin + Isoniazid (HR)	Tab.			
Isoniazid + Ethambotal(HE)	Tab.			
Ethambotal(E)	Tab.			
Pyrazainamide(Z)	Tab			
Streptomycin(inj.)	ml.			

Overhead cost

Items	Unit	Unit cost	Amount(NRS)	remarks
Telephone				
Water/Electricity				
…….....				
…….....				
.....				

Health Outcome:

Type	Case registered	Cure	Completed	Failure	Died	Defaulter	Transfer out	No result
New sputum positive								
New sputum Negative								
Extra pulmonary								
Re-treatment								

CURRICULUM VITAE

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