



CHAPTER IV

RESULTS AND ANALYSIS

This chapter discusses the cost analysis and health outcome of different DOTS Centers that are running in integrated manner with other health care services in Kathmandu Metropolis. This study was concentrated on Cost-effectiveness Analysis from provider's perspective.

4.1 Provider's Cost calculation

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 Cost calculation of Ramghat Primary Health Center

Capital Cost

The table 4.1 presents the capital cost incurred by different units of Ramghat PHC. The present value of all capital items was annualized depending upon the discount rate and useful life. Under some allocation criteria, the annual costs so obtained were allocated to DOTS service for TB.

This Primary Health Center (PHC) is in "Dharmashala", no rent has to pay for it. To include the opportunity cost of that space, government rate (15 NRs/sqft) for renting houses was used (MOF.1999).

The ratio of total TB patients' visits to treatment unit and total OPD patients' visits (TB plus others) was used as allocation proportion ($202/852 = 0.236 = 0.24$ approximately). It was assumed that physician and assistant staffs had spent equal time for each of TB and "other diseases". This proportion helps to distribute leisure time equally between TB and other patients.

Laboratory provides integrated services for TB and Non-TB patients. Due to non-availability of laboratory record except TB, problem was faced to allocate capital cost of different items in the laboratory. In this difficult situation, only interview method was thought to be appropriate. Due to less laboratory caseload, there was more leisure time for laboratory staff. The total number of slide examined during a year was 218 that give less than one slide examined per day. If this number was used to calculate the time spent on TB, it could under estimate the cost incurred by TB patients, ideal time of staff left only for other patients. Here, it was assumed that all OPD patients had had laboratory services. Therefore, the proportion 0.24 (as mentioned above) was used to allocate capital cost related to Laboratory.

Pharmacy unit was particularly arranged only for DOTS. It did not provide any service to non-TB patients. All the items used in pharmacy, therefore, were allocated for TB.

Labor cost Calculation

In labor cost calculation, we should measure the time that they devote to the program (Creese and Parker, 1994). The PHC staffs those who involved for DOTS service for TB were taken into account in this study. Their monthly gross salary was obtained from salary sheet provided by account section of PHC. Gross salary included basic salary, provident fund, grades and others. The gross monthly salary was converted into daily labor cost by dividing factor 22, working days in a month (Saturday and Sunday closed). Direct allocation method was adopted with percentage time spent on TB (allocation basis) by staff.

Time spent on TB at treatment unit and laboratory unit was calculated using TB and other patients' ratio, including ideal time of staff. The pharmacy unit was fully arranged only for TB. So, all the cost incurred by that unit was allocated to TB. Interview method was used to get time spent by administrative staff for different Units of Ramghat PHC (See Appendix D).

Table 4.1 Capital Cost Calculation (In Nepalese Rupees, NRs, 2001 prices, Discount rate 5%), Ramghat PHC

Inputs	Purchase Price	Year of Purchase	Useful life	Present value	Annualization factor	Annual cost (7)= (5)/(6)	8 month cost (8)= (7)x8/12	Allocation Proportion (9)	8 month cost for TB (10)= (8)x(9)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treatment Unit									
Space (10' x 8')				1200		14400.00	9600.00	0.24	2304.00
Furniture Total	9200			10713.81		1858.02	1238.68		297.28
Treatment Unit Total	9200			11913.81		16258.02	10838.68		2601.28
Laboratory Unit									
Space (10' x 8')				1200.00		14400.00	9600.00	0.24	2304.00
Furniture Total	11700			15327.87		2170.60	11047.07		347.30
Microscope (Binocular)	80000	1996	5	102102.53	4.329	19138.24	12758.83	0.24	3773.71
Laboratory Unit Total	91700			118630.39		35708.84	33405.90		6425.01
Radiology Unit (Does not exist)									
									0.00
Pharmacy Unit									
Space (6'x8')				720		8640.00	5760.00	1	5760.00
Furniture Total	9000			10409.94		1689.13	1126.09		1126.09
Pharmacy Unit Total	9000			11129.94		10329.13	6886.09		6886.09
Grand Total	109900			141674.14		62296.00	51130.66		15912.8

Note: See Appendix A1 for detail calculation.

* Present Value of capital Item was calculated using the relation, $P_t = P_o (1+r)^t$,

Where P_t = Present value, P_o = Purchase Price, r = Discount rate, t = number of years since the purchase of goods up to 2001

Attributable days of salary per eight month were calculated as: (Total time spent on TB each day x Total working days in 8 month) divided by total working hours in a day. The working hour in a day was 7 hours. The different service center (unit) provided different nature of services. Therefore, staff working in different units had different allocation proportion. Table 4.2 presents the labor cost incurred by various service centers in providing DOTS services for TB.

Table 4.2 Ramghat PHC: Labor Cost Calculation (In Nepalese Rupees, NRs, 2001 prices),

Category	Number	Gross Salary/Month	Daily Cost	Time Spent in TB (In hr/day)	Attributable day of salary per 8 months	8 month Salary attributable to TB
(1)	(2)	(3)	(4)=(3)/22	(5)	(6)=(5)x (176)/7	(7)=(2)(4)(6)
Treatment Unit						
Medical Officer	1	8812	400.55	1.65	41.49	16616.91
HA	1	8912	405.09	0.20	5.03	2037.03
VHA (Registration)	1	4632	210.55	0.20	5.03	1058.74
Administrative Assist (Store + Account)	1	5000	227.27	0.20	5.03	1142.86
Peon	1	3961	180.05	0.20	5.03	905.37
Treatment Unit Total		31317	1423.50	2.45	61.60	21760.91
Laboratory Unit						
Lab Assistant	1	6112	277.82	1.65	41.49	11525.49
Administrative Assist (Store + Account)	1	5000	227.27	0.20	5.03	1142.86
Peon	1	3961	180.05	0.40	10.06	1810.74
Laboratory Total		15073	685.14	2.25	56.57	14479.09
Radiology Unit (Does not exist)						0.00
Pharmacology Unit						
AHW	1	6330	287.73	7.00	176.00	50640.00
Administrative Assist (Store + Account)	1	5000	227.27	0.20	5.03	1142.86
Peon	1	3961	180.05	0.20	5.03	905.37
Pharmacy Unit Total		15291	695.05	7.40	186.06	52688.23
Total labor Cost		61681	2803.68	12.10	304.23	88928.23

Total working days in 8 month = 176

Total working hours in a day = 7 (9 am- 4 pm)

Attributable days of salary per 8 month per staff = (Time spent on TB each day x working days in 8 months) divided by working hours in a day.

4.1.2 Cost Calculation of Friends of Shanta Bhawan

Capital Cost Calculation

The table 4.3 shows the capital cost incurred by different service units of Friends of Shanta Bhawan (FSB) in delivery of DOTS service for TB. Since FSB did not have its own building, it used rented building (23750 NRs per month) to provide

health services to patients. It occupied two and half story of a building with area 4200sqft.

The building related rent was allocated to other service units on the basis of area used. Cost of donated goods (microscope and shelf) was also taken into account. The useful life of furniture and equipment was estimated from consensus of different staffs by asking how long these types of furniture and equipment were lasted in the past. As earlier, all present value of capital investment was annualized depending upon the discount rate (5%) and useful life. The annualization factor with discount rate (5%) for various useful lives was obtained from Creese, 1994. The annual cost so obtained was allocated to 8 months cost of DOTS service for TB under some allocation proportion.

The proportion of total number of TB patients to total patients visited to treatment unit ($1933/23463 = 0.08$) could reflect the appropriate proportion. It was assumed that physician had spent equal time for TB and other patients. This proportion helps to distribute leisure time equally between TB and other patients.

Laboratory related capital cost was allocated on the basis of TB caseload in the lab (Total TB tests/Total tests provided by Laboratory = $2560/9541 = 0.27$).

Since FSB had separate pharmacy unit for TB, it provided DOTS services only for TB patients. Therefore, all the capital costs of pharmacy unit were allocated for TB.

Table 4.3 Capital costs Calculation (In Nepalese Rupees, NRs, 2001 prices, Discount rate 5%), Friends of Shanta Bhawan.

Inputs	Purchase Price	Year of Purchase	Useful life	Present Value*	Annualization factor	Annual cost	8 month cost	Allocation Proportion	8 month cost for TB
Treatment Unit									
Space (10' x 12' ; 12'x12')				3000		36000	24000	0.08	1920
Furniture Total	30100			36683.98		5933.05	3955.36		316.43
Treatment Unit Total	30100			39683.98		41933.05	27955.36		2236.43
Laboratory Unit									
Space (10' x 15')				1500.00		18000	12000.00	0.27	3240.00
Furniture Total	17200			24045.14	24.97	3695.26	2463.51		665.15
Microscope (Binocular)	80000	1996	5	102102.53	4.329	23585.71	15723.80	0.27	4245.43
Laboratory Unit Total	97200			127647.67		45280.97	30187.31		8150.57
Radiology Unit (Does not exist)									00.00
Pharmacy Unit									
Space (10' x 15')				2000.00		24000	16000.00	1	16000
Furniture Total	27400			33590.52		5348.25	3565.50		3565.50
Pharmacy Unit Total	27400			35590.52		29348.25	19565.50		19565.50
Grand Total	154700			202922.16		116562.26	77708.18		29952.50

Note: See Appendix A2 for detail calculation.

* Present Value of capital Item was calculated using the relation, $P_t = P_o (1+r)^t$, Where P_t = Present value, P_o = Purchase Price, r = Discount rate, t = number of years since the purchase of goods up to 2001

Labor Cost Calculation

The staffs of Friends of Shanta Bhawan (FSB) who were involved directly or indirectly to deliver DOTS service to TB patients were taken into account. As earlier, their monthly gross salary was collected from salary sheet provided by account section of FSB. The gross monthly salary was converted in to daily labor cost by dividing a factor 22, working days in a month (Saturday and Sunday

closed). Direct allocation method was adopted with percentage time spent on Tuberculosis. Interview method was used to assess time spent on TB.

Medical officers' Time spent on TB at treatment unit: Under the assumption of physician spent equal time on all patients, it was calculated by multiplying average time spent on per visit of all kind of patients and average visits of TB patients at treatment unit ($0.063 \text{ hr per day per visit} \times 7.186 \text{ visits per day} = 0.453 \text{ hrs per day}$) (See Appendix E1).

Time spent on TB at laboratory unit: Under the assumption of lab technician spent equal time on all patients, it was calculated by multiplying average time spent on per test of all kind of patients and number of test of TB patients at laboratory unit ($0.155 \text{ hr per day per test} \times 9.51 \text{ test per day} = 1.47 \text{ hrs per day}$) (See Appendix E2).

In pharmacy section, two staffs were fully involved on DOTS. Time spent by administration related staff was assessed by interview method. Then, the attributable days of salary per 8 month were calculated as: (Total time spent on TB each day \times Total working days in 8 month) divided by total working hours in a day. In FSB, total working days in month were 22 and working hour per day was five and half.

Total labor cost of Friends of Shanta Bhawan (FSB) was found 131360.84 NRS at 2001 prices. Total labor cost of Pharmacy unit was 91446.98 NRs (69.61% of total 8 month cost attributable to TB) and followed by treatment unit NRs 24212.04 (18.36%). Table 4.4 presents Total Labor cost of different service units of FSB at 2001 prices.

**Table 4.4 Labor Cost Calculation of Friends of Shanta Bhawan
(In Nepalese Rupees, NRs, 2001 Prices),**

Category	Number	Gross Salary per Month	Daily Cost	Time Spent on TB (In hr/day)	Attributable days of salary Per 8 month	8 month Salary attributable to TB
(1)	(2)	(3)	(4)=(3)/22	(5)	(6)=(5)(176)/5.5	(7)=(2)(4)(6)
Treatment Unit						
Medical Director	1	18683	849.2273	0.2	6.40	5435.05
Medical Officer	1	13282	603.73	0.453	14.50	8751.63
Medical Officer	1	12507	568.50	0.453	14.50	8240.98
Administrative Assist (Store + Account)	1	12552	570.55	0.2	6.40	3651.49
Assistant Staff (Registration)	1	5148	234.00	0.2	6.40	1497.60
Assistant Staff (Registration)	1	2612	118.73	0.2	6.40	759.85
Peon	1	3692	167.82	0.2	6.40	1074.04
Sweeper	1	500	22.73	0.2	6.40	145.45
Treatment Unit Total		68976	3135.27	2.106	67.39	24121.04
Laboratory Unit						
Lab Assistant Administrative Assist (Store + Account)	1	5108	232.18	1.47	47.04	10921.83
Peon	1	3692	167.82	0.2	6.40	1074.04
Sweeper	1	500	22.73	0.2	6.40	145.45
Laboratory Total		21852	993.27		66.24	15792.81
Radiology Unit						
Pharmacy Unit						
DOTS Clinic In charge (Recording + Reporting)	1	8622	391.91	5.5	176.00	68976.00
CHW (DOTS Worker)	1	2200	100.00	5.5	176.00	17600.00
Administrative Assist (Store + Account)	1	12552	570.55	0.2	6.40	3651.49
Peon	1	3692	167.82	0.2	6.40	1074.04
Sweeper	1	500	22.73	0.2	6.40	145.45
Pharmacy Unit Total		27566	1253.00		371.20	91446.98
Total Labor Cost		118394	5381.55		504.83	131360.84

Total working days in 8 month = 176

Total working hours in a day = 5.5 (10 am – 3.30 pm)

Attributable days of salary per 8 month per staff = (Time spent in TB each day x working hours in 8 month) divided by working hours in a day.

4.1.3 Cost Calculation of Helping Hands Clinic

Capital Cost Calculation

The table 4.5 presents the capital cost incurred by different service units of Helping Hands Clinic, Nepal (HHCN) in delivery of DOTS service for TB. Since HHCN did not have its own building, it rented a building to provide health services to patients. It occupied three and half story of a building with area 3648 sq.ft. The building related rent was allocated to other service units on the basis of area used. The useful life of furniture and equipment was estimated from consensus of different staffs by asking how long these types of furniture and equipment were lasted in the past. As earlier, all present value of capital investment was annualized depending upon the discount rate (5%) and useful life. The annual cost so obtained was allocated to DOTS service for TB under some allocation proportion.

Treatment unit related capital cost was allocated on the basis of TB caseload at treatment unit ($\text{Total TB related visits} / \text{Total visits} = 1110 / 12957 = 0.085$). It was assumed that physician had spent equal time for TB and other patients. This proportion 0.085 helps distribute leisure time equally between TB and other patients (See Appendix F1).

Laboratory related capital cost was allocated on the basis of TB caseload in the lab ($\text{Total TB tests} / \text{Total tests provided by Laboratory} = 1325 / 8038 = 0.165$) (See Appendix F2). HHCN has its own radiology unit. The allocation basis adopted for capital cost in radiology unit was the proportion of TB related X-ray and total X-ray performed in the unit ($465 / 1727 = 0.27$).

Since HHCN has separate pharmacy unit for TB, it provides DOTS service only for TB. Therefore, all the capital cost of pharmacy unit was allocated for TB.

**Table 4.5 Capital Cost Calculation of Helping Hands Clinic
(In Nepalese Rupees, 2001 prices, discount rate 5%),**

Inputs	Purchase Price	Year of Purchase	Useful life	Present Value*	Annuali- -zation factor	Annual cost	8 month Cost	Allocation Proportion	8 month cost for TB
Treatment Unit									
Space (12, x 10', 12'x16')				3500.00		42000	28000	0.085	2380.00
Furniture Total				13600.00		2683.96	1789.31		152.09
Treatment Unit Total				17100.00		44683.96	29789.31		2532.09
Laboratory Unit									
Space (12' x 10')				1500.00		18000	12000.00	0.165	1980.00
Furniture Total	900			8606.03		1915.26	1276.84		2190.68
Microscope (Binoculars)	98337	1997	5	119529.24	4.329	27611.28	18407.52	0.055	1012.41
Laboratory Unit Total	98337			128135.27		47526.54	31684.36		5183.09
Radiology Unit									
Space used (7'x12')				1500.00		18000.00	12000	0.27	3240.00
Furniture Total	4600			4830.00		1115.73	743.82		200.83
X-ray Machine	325000	2000	10	341250.00	7.722	44191.92	29461.28	0.27	7954.55
X-ray Grid Plate	11500	2000	10	12075.00	7.722	1563.71	1042.48	0.27	281.47
Equipment Total	336500			353325.00		45755.63	30503.76		8236.01
Radiology Unit Total	345700			716310.00		93742.73	62495.15		16873.69
Pharmacy Unit									
Space Used (8' x 10')				1400.00		16800	11200.00	1	16800.00
Furniture Total	9600			11668.86		2004.47	1336.31		2004.47
Pharmacy Unit Total	9600			13068.86		18804.47	12536.31		18804.47
Total capital cost	453637			874614.13		204757.70	136505.13		43393.35

Note: See Appendix A3 for detail calculation.

* Present Value of capital Item was calculated using the relation, $P_t = P_o (1+r)^t$,

Where P_t = Present value, P_o = Purchase Price, r = Discount rate, t = number of years since the purchase of goods up to 2001.

Labor Cost Calculation

The staffs of Helping Hands Clinic, Nepal (HHCN) who were involved directly or indirectly to deliver DOTS service to TB patients were taken into account. Medical coordinator of HHCN provided their monthly gross salary. The gross

monthly salary was converted into daily labor cost by dividing a factor 26, working days in a month (Saturday closed). Medical coordinator has been working as a volunteer for a long time. His opportunity cost was estimated on the basis of market rate that prevails other similar types of health institutions. Direct allocation method was adopted with percentage time spent on Tuberculosis. Interview method was used to assess other staff time spent on TB.

Medical officers' Time spent on TB at treatment unit: Under the assumption of physician spent equal time on all patients, it was calculated by multiplying average time spent on per visit of all kind of patients and average visits of TB patients at treatment unit ($0.147 \text{ hr per day per visit} \times 3.5 \text{ visits per day} = 0.514 \text{ hrs per day}$) (See Appendix F1).

Time spent on TB at laboratory unit: Under the assumption of lab technician spent equal time on all patients, it was calculated by multiplying average time spent on per test of all kind of patients and number of test of TB patients at laboratory unit ($0.237 \text{ hr per day per test} \times 4.18 \text{ test per day} = 0.99 \text{ hrs per day}$) (See Appendix F2)

Time spent on TB at radiology unit: Under the assumption of radiographer spent equal time on all patients, it was calculated by multiplying average time spent on per X-ray exam of all kind of patients and number of X-ray exam of TB patients at radiology unit ($1.103 \text{ hrs per day per test} \times 1.467 \text{ test per day} = 1.62 \text{ hrs per day}$) (See Appendix F3).

In pharmacy section, two staffs were involved on DOTS for 5 hours. Then, the attributable days of salary per 8 month were calculated as: (Total time spent on TB x Total working days in 8 month) divided by total working hours in a day. In HHCN, total working days in a month was 26 and working hour per day was different for different staff (6-8 hrs/day).

Total 8 months attributable to TB labor cost of Helping Hands Clinic, Nepal (HHCN) was NRs 80113.52 at 2001 prices. Total labor cost of Pharmacy unit was NRs 41942.86 (52.35% of total TB related labor cost) and followed by radiology unit 14274.29 NRs (17.82%). Table 4.6 presents total labor cost of different service units of HHCN at 2001 prices.

4.1.4 Cost Calculation of Anam Nagar Poly Clinic and Research Center

Capital cost calculation

The table 4.7 presents the capital cost incurred by different service units of Anam Nagar Poly Clinic and Research Center (APCRC) in delivery of DOTS service for TB. Since APCRC does not have its own building, it uses rented building to provide health services to patients. It occupies two story of a building with area 896 sq.ft. The building related rent was allocated to other service units on the basis of area used. As earlier, all present value of capital investment was annualized depending upon the discount rate (5%) and useful life. The annual cost so obtained was converted into 8-month cost to DOTS service for TB under some allocation proportion.

The proportion of total number of visits of TB patients (Suspected, follow up and new cases) to total patients visited to treatment unit ($267/1434 = 0.19$) was used as allocation proportion. Laboratory Unit related capital cost was allocated on the basis of TB caseload in the laboratory ($\text{Total TB visits/Total service provided by Laboratory} = 267/3437 = 0.07$).

Table 4.6 Labor Cost Calculation of Helping Hands Clinic (In Nepalese Rupees, NRs, 2001 prices)

Category	Number	Gross Salary/Month	Daily Cost	Time Spent on TB	Attributable days of salary per 8 month	8 month Salary attributable to TB
(1)	(2)	(3)	(4)=(3)/26	(5)	(6)=(5)x(208)/y	(7)=(2)(4)(6)
Treatment Unit						
Coordinator	1	18000.00	692.31	0.30	8.91	6171.43
Medical Officer	1	14000.00	538.46	0.21	8.74	4704.00
Administrative Assist (Store + Account +Registration)	2	3500.00	134.62	0.20	5.94	1600.00
Peon	1	2500.00	96.15	0.20	5.94	571.43
Sweeper	1	2500.00	96.15	0.20	5.94	571.43
Treatment Unit Total		40500.00	1557.69	1.11	35.48	13618.29
Laboratory Unit						
Lab Technician	1	4000.00	153.85	0.25	17.33	2666.67
Lab Assistant	1	4000.00	153.85	0.74	21.99	3382.86
Admin Assistant (Store + Account)	1	3500.00	134.62	0.20	5.94	800.00
Peon	1	2500.00	96.15	1.00	29.71	2857.14
Sweeper	1	2500.00	96.15	0.20	5.94	571.43
Laboratory Unit Total		16500.00	634.62	2.39	80.92	10278.10
Radiology Unit						
Radiologist	1	6000.00	230.77	0.25	17.33	4000.00
X-ray Technician	1	4500.00	173.08	1.62	48.14	8331.43
Admin Assist (Store + Account)	1	3500.00	134.62	0.20	5.94	800.00
Peon	1	2500.00	96.15	0.20	5.94	571.43
Sweeper	1	2500.00	96.15	0.20	5.94	571.43
Radiology Unit Total		19000.00	730.77	2.47	83.30	14274.29
Pharmacology Unit						
DOTS In charge	1	3500.00	134.62	5.00	148.57	20000.00
CMA	1	3500.00	134.62	5.00	148.57	20000.00
Admin Assistant (Store + Account)	1	3500.00	134.62	0.20	5.94	800.00
Peon	1	2500.00	96.15	0.20	5.94	571.43
Sweeper	1	2500.00	96.15	0.20	5.94	571.43
Pharmacy Unit Total		15500.00	596.15	10.60	314.97	41942.86
Total Labor Cost		91500.00	3519.23	16.57	514.67	80113.52

Total working days in 8 month = 208

Total working hours in a day (y) = 6-8 days

Attributable days of salary per 8 month per staff = (Time spent on TB each day x working days in 8 months) divided by working hours in a day

APCRC has its own radiology unit. The allocation basis adopted (caseload) for capital cost in radiology unit was the proportion of TB related X-ray and total X-ray performed in the unit ($112/1585 = 0.07$).

APCRC did not have separate pharmacy unit for Tuberculosis. DOTS service was provided through reception unit. i.e., capital cost and labor cost was shared by different services. The time spent by DOTS worker with TB patient for counseling and dispensary of drug was assessed by interview and the proportion of time spent on TB and non-TB patients was used as allocation proportion to separate capital cost incurred by DOTS service. The estimated number of visits made by TB patients of different categories during full course of treatment was 2128. The average estimated time spent on each case was 5 minutes that gives 0.6 hr per day. Thereafter, the allocation proportion was obtained by dividing working hour in a day i.e., $0.6/6 = 0.1$.

The total 8 month capital cost for TB was NRs 9993.51 at 2001 price. The radiology units shared NRs 3403.4(34.05%) of total TB related capital cost and followed by laboratory (29.07%).

Table 4.7 Capital Cost Calculation of Anam Nagar Poly Clinic and Research Center (In Nepalese Rupees, 2001 prices, discount rate 5%)

Inputs	Purchase Price	Year of Purchase	Useful life	Present Value	Annualization factor	Annual cost	8 month Cost	Allocation Proportion	8 month cost for TB
Treatment Unit									
Space(8'x10')				1164.00		13968.00	9312	0.19	1769.28
Furniture Total	5000			5250.00	4.329	1212.75	808.50	0.19	153.62
Treatment Unit Total	5000			6414.00		15180.75	10929.00		1922.90
Laboratory Unit									
Space (8'x10')				1164.00		13968.00	9312.00	0.09	838.08
Furniture Total	13600			14994.00		2848.15	1898.76		170.89
Microscope (Binocular)	118209	1998	5	136841.69	4.329	31610.46	21073.64	0.09	1896.63
Laboratory Unit Total	131809			14994.00	4.329	31610.46	21073.64		2905.60
Radiology Unit									
Space (6'x10')				860.00		10320.00	6880.00	0.07	481.60
Furniture Total	3500			3858.75		891.37	7474.25		523.20
X-ray Machine	360000	1999	10	396900.00	7.722	51398.60	34265.73	0.07	2398.60
Radiology Unit Total	363500			400758.75		63501.35	49214.23		3403.40
Pharmacy Unit									
Space (8' x 8')				2000.00		24000.00	16000.00	0.1	1600.00
Furniture Total	12200			13450.50					161.62
Pharmacy Unit Total	12200			15450.50		26424.32	17616.22		1761.62
Total Capital cost	512509			437617.25		136716.88	98833.09		9993.51

Note: See Appendix A4 for detail calculation.

* Present Value of capital Item was calculated using the relation, $P_t = P_o (1+r)^t$, where P_t = Present value, P_o = Purchase Price, r = Discount rate, t = number of years since the purchase of goods up to 2001.

Labor Cost Calculation

The monthly gross salary of staff was assessed from managing director of Anam Nagar Poly Clinic and Research Center (APCRC). Since managing director did not have his salary scale, his opportunity cost of time was thought to be 12000 NRs per month and used as his monthly salary. The gross monthly salary was converted in to daily labor cost by dividing a factor 26, working days in a month. This clinic remained open from 7.30 am to 7.30 pm (12 hours). But working hour

of that clinic was set as 6 hours depending on availability of physician and other staff. Medical officer and Radiologist did not work on salary. They got fee for service from patients i.e., APCRC did have any extra cost for them. Their opportunity cost was estimated as 4000 per hour per month and average working hour in APCRC was 3 hours per day. Direct allocation method was adopted with percentage time spent on Tuberculosis. Interview method was used to assess time spent on TB.

Medical officers' Time spent on TB at treatment unit: Under the assumption of physician spent equal time on all patients, it was calculated by multiplying average time spent on per visit of all kind of patients and average visits of TB patients at treatment unit ($1.326 \text{ hr per day per visit} \times 0.842 \text{ visits per day} = 1.12 \text{ hrs per day}$) (See Appendix G1).

Time spent on TB at laboratory unit: Under the assumption of lab technician spent equal time on all patients, it was calculated by multiplying average time spent on per test of all kind of patients and number of test of TB patients at laboratory unit ($0.54 \text{ hr per day per test} \times 0.1016 \text{ test per day} = 0.55 \text{ hrs per day}$) (See Appendix G2).

Time spent on TB at radiology unit: Under the assumption of radiographer spent equal time on all patients, it was calculated by multiplying average time spent on per X-ray exam of all kind of patients and number of X-ray exam of TB patients at radiology unit ($1.2 \text{ hrs per day per test} \times 0.353 \text{ test per day} = 0.423 \text{ hrs per day}$) (See Appendix G3).

APCRC did not have separate pharmacy unit for Tuberculosis. DOTS service was provided through reception unit. i.e., capital cost and labor cost was shared by different services. The time spent by DOTS worker with TB patient for counseling

and dispensary of drug was assessed by interview and the proportion of time spent on TB and non-TB patients was used as allocation proportion to separate capital cost incurred by DOTS service. The estimated number of visits made by TB patients of different categories during full course of treatment was 2128 and the other was 1167. The proportion ($2128/3295 = 0.65$) of TB patients' visits and other patients' visits was used to allocate labor cost in pharmacy unit. The time spent on TB was 65% of working hour in a day ($0.65 \times 6 = 3.9$ hours) was approximately 4 hours.

Then, the attributable days of salary per 8 month were calculated as: (Total time spent on TB x Total working days in 8 month) divided by total working hours in a day.

Total labor cost attributable to TB for 8 month was NRs 94133.33 at 2001 prices. Total labor cost of treatment unit was NRs 43440 (46.1) and followed by pharmacy unit NRs 37813.33(40.17%) of total labor cost. Table 4.8 presents total labor cost incurred by different service units of APCRC at 2001 prices.

Table 4.8 Labor Cost Calculation of Anam Nagar Poly Clinic and Research Center (In Nepalese Rupees, NRs, 2001 prices)

Category	Number	Gross Salary per Month	Daily Cost	Time Spent on TB (Hr/day)	Attributable days of salary per 8 month	8 month Salary attributable to TB
(1)	(2)	(3)	(4)=(3)/26	(5)	(6)= (5)x(208)/y	(7)=(2)(4)(6)
Managing Director	1	12000	461.54	0.5	13.00	6000.00
Medical Officer	1	12000	461.54	1.12	77.65	35840.00
Administrative Assist (Store + Account + DOTS)	1	3500	134.62	0.2	6.93	933.33
Sweeper + Peon	1	2500	96.15	0.2	6.93	666.67
Treatment Unit Total		30000	1153.85		104.52	43440.00
Laboratory Unit						
Lab Technician	1	6000	230.77	0.55	19.07	4400.00
Store Keeper + Medical Record	1	3500	134.62	0.2	6.93	933.33
Sweeper + Peon	1	2500	96.15	0.2	6.93	666.67
Laboratory Unit Total		12000	461.54		24.27	6000.00
Radiology Unit						
Radiologist	1	12000	461.54	0.06	4.16	1920.00
Darkroom assistant	1	6000	230.77	0.42	14.56	3360.00
Store Keeper + Medical Record	1	3500	134.62	0.2	6.93	933.33
Sweeper + Peon	1	2500	96.15	0.2	6.93	666.67
Radiology Unit Total		24000	923.08		32.59	6880.00
Pharmacy Unit						
CMA (DOTS)	1	5500	211.54	4	138.67	36213.33
Administrative Assist (Store + Account + DOTS)	1	3500	134.62	0.2	6.93	933.33
Sweeper + Peon	1	2500	96.15	0.2	6.93	666.67
Pharmacy Unit Total		11500	442.31	4.4	152.53	37813.33
Total labor cost		77500	2980.77	4.4	313.91	94133.33

Total working days in 8 month = 208

Total working hours in a day (y) = 6-8 days (7 am-9 am, and 2 pm-7 pm)

Attributable days of salary per 8 month per staff = (Time spent on TB each day x working days in 8 month) divided by working hours in a day.

4.1.5 Cost Calculation of Birendra Police Hospital

Capital Cost Calculation

The table 4.9 presents the capital cost incurred by TB related different service units of Birendra Police Hospital (BPH) in delivery of DOTS service for TB. BPH has its own building with chest ward established in 1990. It occupies 3200 sq ft area. This hospital has separate building for Radiology and Laboratory (Established in 1984). Only space used for TB was taken into account. Due to non-availability of data, an estimate was made to assess cost for building construction (750 NRs/sq ft in 1990, and 500 NRs/sq ft in 1984). The estimated replacement value (market price) was used for equipment and furniture that had no useful life (already over). The useful life of furniture and equipment was estimated from consensus of different staffs by asking how long these types of furniture and equipment were lasted in the past. As earlier, all present value of capital investment was annualized depending upon the discount rate (5%) and useful life. The annual cost so obtained was converted into 8 month cost for DOTS service of Tuberculosis under some allocation criteria.

Since this study mainly concerned with the cost incurred by DOTS service for OPD TB patients. It did not spend more efforts to find cost incurred by IPD TB patients. Most of police TB patients were admitted due to far distance of workplace from the hospital, severity of illness was not main cause of admission. To make it comparable to other four DOTS centers, it was assumed that IPD TB patients also made visits to the physician. There were only 894 (estimated) visits to the physicians at treatment unit. A physician had spent 8 minutes with each patient that produced 0.44 hour per day. This time usage proportion (Time spent on TB each day/working hour in a day = $0.44/8 = 0.055$) was used for allocation of cost of capital investment.

Laboratory Unit related capital cost was allocated on the basis of TB caseload in the laboratory (Total TB tests/Total service provided by Laboratory = $1205/21862 = 0.055$).

BPH has its own radiology unit. The allocation basis adopted for capital cost in radiology unit was the proportion of TB related X-ray and total X-ray performed in the unit ($260/7637 = 0.03$).

Since the pharmacy unit for DOTS also shares services to IPD TB cases, cost associated to DOTS service was obtained by using time usage in pharmacy unit. During FY 2000/2001, total TB case finding was 107 (cat I: 53, cat II : 8, cat III: 46) . It was assumed that all of them had had full course of treatment making 7634 visits to pharmacy unit. But transfer out rate after two month was 27.7% that reduced 754 visits i.e., only 6880 visits were made to pharmacy section. By interviewing with DOTS worker, it came to know that the average time spent per visit was five minutes including dispensary, counseling and recording, that could produce 2.13 hours per day. The proportion (Time spent on TB/ working hour per day = $2.13/8 = 0.27$) thus obtained could reflect capital cost of DOTS service, the remaining part was left for IPD TB patients.

Labor Cost Calculation

The staffs of Birendra Police Hospital (BPH) who were involved directly or indirectly to deliver DOTS service to TB patients were taken into account. As earlier, their monthly gross salary was collected from salary sheet provided by account section of BPH. The gross monthly salary was converted into daily labor cost by dividing a factor 22, working days in a month. Direct allocation method was adopted with percentage time spent on Tuberculosis. Interview method was also used to assess time spent on TB.

In treatment Unit, Medical officers' time spent on TB was 0.44 hour per day. (As mentioned in capital cost calculation section). Lab technicians' time was 0.44 hour per day approximately half an hour. In radiology unit, 15 minutes was spent for Tuberculosis.

In pharmacy section, one staff was specially trained for DOTS and had spent 8 hours and a sister contributed 2 hours per day. Time spent by administration related staff was assessed by interview method. Then, the attributable days of salary per 8 month were calculated as: (Total time spent on TB x Total working days in 8 month) divided by total working hours in a day. In BPH, total working days in a month was 22 and working hours per day was eight.

Total 8 months labor cost for Tuberculosis was NRs 95686.73 at 2001 prices. Total labor cost of Pharmacy unit was NRs 44959.2 (46.98% of total attributable to TB labor cost) and followed by treatment unit NRs 20761.28 (21.7%). Table 4.10 presents total labor cost of different service units at 2001 price.

Table 4.9 Capital Cost of Birendra Police Hospital (In Nepalese Rupees, 2001 prices, discount rate 5%)

Inputs	Purchase Price	Year of Purchase	Useful life	Present Value	Annualization factor	Annual cost	8 month Cost	Allocation Proportion	8 month cost for TB
Treatment Unit									
Building (10'x10')	150000	1989	30	269378.45	15.372	17523.97	11682.65	0.055	642.55
Land (10' x 10')				29,200		29200.00	29200.00	0.055	1606.00
Furniture Total	3800			3990		921.69	614.46		33.80
Treatment Unit Total	153800			302,568		47645.66	41497.11		2282.34
Laboratory Unit									
Building	252000	1984	30	577588.62	15.372	37574.07	25049.38	0.055	1377.72
Land (12' x 14')				49056		49056.00	49056.00	0.055	2698.08
Furniture Total				14500		2562.43	1708.29	0.055	93.96
Microscope (Binocular)	98377	1999	5	108460.64	4.329	25054.43	16702.96	0.055	918.66
Laboratory Unit Total	350377			749605.26		114246.94	76164.62		5088.41
Radiology Unit									
Building	330000	1984	30	756366.04	15.372	49204.14	32802.76	0.03	984.08
Land (20' x 11')				64240		64240	64240	0.03	1927.20
Furniture Total				27600	18.514	4395.46	2930.31		87.91
X-Ray Machine	360000	2000	10	378000	7.722	48951.05	32634.03	0.03	979.02
Radiology Total	690000			1226206		166790.65	132607.10		3978.21
Pharmacology Unit									
Building (10'x10')	150000	1989	30	269378.45	15.372	17523.97	11682.65	0.27	3154.31
Land (10' x 10')				29200		29200.00	29200.00	0.27	7884.00
Furniture Total	16300			17115		3367.41	2244.94		606.13
Pharmacy Unit Total	166300			315693.45		50091.37	43127.58		11644.45
Total Capital Cost	1360477			2,594,073		3,78,774.63	293,396.42		22,993.42

Note: See Appendix A5 for detail calculation.

* Present Value of capital Item was calculated using the relation, $P_t = P_o (1+r)^t$,
Where P_t = Present value, P_o = Purchase Price, r = Discount rate, t = number of years since the purchase of goods up to 2001.

Table 4.10 Labor Cost Calculation of Birendra Police Hospital (In Nepalese Rupees, NRs, 2001 prices)

Category	Number	Gross Salary/Month	Daily Cost	Time Spent in TB (Hr/day)	Attributable day of salary/8 month	8 month Salary attributable to TB
(1)	(2)	(3)	(4)=(3)/22	(5)	(6)=(5)x(176)/8	(7)=(2)(4)(6)
Treatment Unit						
Medical Officer (SP)	3	12769	580.41	0.44	9.68	16855.08
Sister (ASI)	1	5275	239.77	0.44	9.68	2321
Administrative Assist (H/C)	1	4103	186.50	0.2	4.4	820.6
Sweeper	1	3823	173.77	0.2	4.4	764.6
Treatment Unit Total	6	25970	1180.45	1.28	28.16	20761.28
Laboratory Unit						
Lab Technologist (DSP)	1	10865	493.86	0.5	11	5432.5
Lab Assistant (ASI)	2	5275	239.77	0.5	11	5275
Administrative Assist (H/C)	1	4103	186.50	0.2	4.4	820.6
Sweeper	1	3823	173.77	0.2	4.4	764.6
Laboratory Unit Total	5	24066	1093.91	1.4	30.8	12292.7
Radiology Unit						
Radiologist (SP)	1	12759	579.95	0.2	4.4	2551.8
MRT (Insp)	1	9284	422.00	0.2	4.4	1856.8
Radiographer (SI)	3	6195	281.59	0.25	5.5	4646.25
Assist Radiographer (ASI)	3	5275	239.77	0.25	5.5	3956.25
Darkroom Assist (H/C)	3	4103	186.50	0.25	5.5	3077.25
Administrative Assist (H/C)	1	4103	186.50	0.2	4.4	820.6
Sweeper	1	3823	173.77	0.2	4.4	764.6
Radiology Total	13	45542	2070.09	1.55	34.1	17673.55
Pharmacy Unit						
Sister (ASI)	1	5275	239.77	2	44	10550
CMA(H/C) (DOTS)	1	4103	186.50	8	176	32824
Administrative Assist (H/C)	1	4103	186.50	0.2	4.4	820.6
Sweeper	1	3823	173.77	0.2	4.4	764.6
Pharmacy Unit Total	3	12029	546.77	8.4	184.8	44959.2
Total labor cost		107607	4891.23	12.63	277.86	95686.73

Total working days in 8 month = 176

Total working hours in a day = 8 days (9 am-5 pm)

Attributable days of salary per 8 month per staff = (Time spent on TB each day x working days in 8 month) divided by working hours in a day.

4.3 Material Cost Calculation

Material costs were allocated into two parts namely direct cost to TB and indirect cost to TB. The following heading provides the details.

4.3.1 Allocation of Direct Cost

Diagnostic reagents, drugs and TB related stationeries that were specially provided only for tuberculosis, were categorized under direct cost heading. Since different types of strength and regimens were used for tuberculosis patients, the drug costs were calculated in separate heading. As laboratory training was provided by National Tuberculosis Center to all DOTS centers, the same methodology (Ziehl-Neelsen Microscopy) of diagnosis process was observed in all laboratories. On an average, 3 ml of each reagent (Carbol Fuchsin Solution, 20% Sulphuric acid and 0.1% Methylene Blue) was used to stain one slide. This basis was adopted to calculate the consumption of laboratory reagent. The quantity of sputum containers consumed and slides examined were calculated on the basis of one of each for per one sputum test. NTC staff provided unit cost of laboratory materials. Table 4.11 presents the material (direct and indirect) cost of five DOTS centers.

4.3.2 Allocation of Indirect Cost

Indirect cost to tuberculosis was calculated into two headings. Cost of maintenance/repair and water & electricity was calculated under building related cost. Cost of telephone, stationary and miscellaneous was calculated under administrative cost. Building related costs were allocated according to space/area used while administration related cost was allocated on the basis of TB and non-TB cases visited to 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 cost. Annual costs were obtained from account section. In case of non-availability data, indirect cost estimation that could reflect the closest value was adopted. Annual costs thus obtained were converted into 8-month cost for

tuberculosis. Table 4.11 presents the direct and indirect cost related to DOTS for tuberculosis.

Table 4.11 Material Costs to Various DOTS Centers (in Nepalese Rupees, 2001 prices)

Category	Eight Month Material Cost for Tuberculosis				
	Ramghat PHC	Friends of Shanta Bhawan	Helping Hands Clinic	Birendra Police Hospital	Anam Nagar Poly Clinic
Treatment Unit					
<i>Direct Cost to TB</i>					
Direct Total	0	0	0	0	0
<i>Indirect Cost to TB</i>					
Building Related	99.97	301.31	336.45	494.16	104.16
Administration	480	356.39	480	1004.4	1299.6
Indirect Total	579.97	657.7	816.45	1498.56	1403.76
Laboratory Unit					
<i>Direct to TB</i>					
Lab reagents	349.86	2030.22	877.68	1074.9	371.52
Sputum cont. + slides	826.95	6493.5	3396.6	4356.75	932.4
TB related Stationary	510.65	2852.84	1506.6	1818	551.4
Direct Total	1687.46	11376.56	5780.88	7249.65	1855.32
<i>Indirect to TB</i>					
Building Related	99.97	577.8	251.2	830.18	34.72
Administration	480	356.39	480	1004.4	1299.6
Indirect Total	284.23	934.19	731.2	1834.58	1334.32
Radiology Unit					
<i>Direct to TB</i>					
X-ray Film	0	0	27075	9880	1760
Chemical	0	0	4703.11	1728	375.6
Direct Total	0	0	31778.11	11608	2135.6
<i>Indirect to TB</i>					
Building related	0	0	630.04	592.99	26.01
Administration	0	0	240	334.8	577.6
Indirect Total	0	0	870.04	927.79	603.61
Pharmacy Unit					
<i>Drug cost*</i>					
<i>Pharmacy Related</i>					
Stationary Total	497.56	1626.12	1475.64	731.6	280.16
Direct Total	497.56	1626.12	1475.64	731.6	280.16
<i>Indirect to TB</i>					
Building related	249.92	2140	224.6	2425.86	234.48
Administration	4373.33	2257.12	4800	8816.4	4043.2
Indirect Total	2738.32	4397.12	5024.6	11242.26	4277.68
Total Indirect Cost	3602.52	5989.01	7442.29	15503.19	7619.37
Total Direct cost	2185.02	13002.68	39034.63	19589.25	4271.08
Total Material cost	5787.54	18991.69	46476.92	35092.44	11890.45

* Drug cost was different for different treatment categories. Therefore, it was calculated separately. Appendices B1, B2, B3, B4, B5, B6, B7 and B8 show the details of direct and indirect material cost calculation.

4.3.3 Drug Cost Calculation

Development partners donated drugs. The border price of drugs was provided by National Tuberculosis Center. Since shadow exchange rate and official exchange rate did not differ much more (maximum 2 rupees for one Dollar), the official exchange rate was used to convert Dollar into Nepalese currency. To calculate full cost of drugs, transportation and storage cost were adjusted to the point of delivery (DOTS Centers). Table 4.12 shows unit cost of drugs with transportation and storage cost.

Table 4.12 Unit cost of Drug with transportation and storage cost

Description	Quantity Of Drug	Total Cost (US\$)	Exchange Rate*	Total Cost (NRs)	Unit Cost**	Unit cost ***	Total Unit Purchase cost	Purchase year
Rifampicine 150 mg	5300000	170660	69.05	11784073	2.22	0.017	2.24	Jan,2000
Pyrazinamide 500 mg	1475000	59980.5	68.25	4093669	2.78	0.017	2.79	Jul-98
Ethambutol 400mg	8480000	279840	69.05	19322952	2.28	0.017	2.30	Jan, 2000
Isoniazid 300 mg	5200000	23542	68.8	1619690	0.31	0.017	0.33	Feb,99
Streptomycine 1 g	325000	27910.75	69.05	1927237	5.93	0.017	5.95	Jan, 2000
Total	20780000	561933.3		38747621				

Note: Appendix C1 shows the detailed calculation

* NRB. 2001

** Unit cost including transportation and storage cost

*** Unit Cost at border price (in Nepalese rupees)

Drug costs were calculated for those who were registered under different treatment categories as TB patients at pharmacy unit during eight-month period (first two quarters of FY 2000/2001). Drug cost varied from the category to category (different regimens). New smear-positive cases and other severe TB cases were treated under treatment category I (Regimen: 2HRZE/6HE). New smear-negative and extra-pulmonary cases were treated under category III (Regimen: 2HRZ/6HE) and re-treatment cases (failure, relapse, return after default) were treated under treatment category II (Regimen: 2SHRZE/1HRZE/5HRE). Drug costs incurred by cured/completed cases and failure, died, defaulter and transfer out cases were

estimated separately to get total drug costs. On an average 33-50 kg age group patients and standard factors were used to estimate drug cost. Table 4.13 presents drugs cost incurred by cured and completed cases. Table 4.14 presents drug cost incurred by failures, died, defaulters and transfer out cases. For detail drug cost calculation of all five DOTS centers, see Appendices C2, C3, C4, C5, and C6.

Table 4.13 Drug cost for Cured and completed cases that were treated under different treatment categories, price in Nepalese rupees.

	Drug cost for Cured and completed cases who were treated under different treatment categories			
	Category I	Category II	Category III	Total
Ramghat PHC	31329	0	19938.6	51267.6
Birendra Police Hospital	33417.6	15615.6	79754.4	128787.6
Friends of Shanta Bhawan	131582	74219.7	132319.8	338121.5
Helping Hands Clinic	121138.8	27344.1	108756	257238.9
Anam Nagar Poly Clinic	10443	3906.3	9063	23412.3

Table 4.14 Drug cost for failure, died, defaulted and transfer out cases who were treated under different treatment categories

	Drug cost for failure, died, defaulted and transfer out cases who were treated under different treatment categories			
	Category I	Category II	Category III	Total
Ramghat PHC	11554.44	7130.5	1111.04	19795.98
Birendra Police Hospital	30654.16	3350.4	2343.6	36348.16
Friends of Shanta Bhawan	7654.84	5359.48	9732.8	22747.12
Helping Hands Clinic	16019	14442.4	7707.84	38169.24
Anam Nagar Poly Clinic	0	0	0	0

Table 4.15 Total Drug cost incurred by cured/completed, failure, defaulter, died and transfer out cases

Total Drug cost	Category I	Category II	Category III	Total
Ramghat PHC	42883.44	7130.5	21049.64	71063.58
Birendra Police Hospital	64071.76	18966	82098	165135.76
Friends of Shanta Bhawan	139236.84	79579.18	142052.6	360868.62
Helping Hands Clinic	137157.8	41786.5	116463.84	295408.14
Anam Nagar Poly Clinic	10443	3906.3	9063	23412.3

4.4 Full Providers' Cost for Various DOTS Centers

Full providers' costs of individual DOTS center were obtained by using various economic tools. Total capital cost, total labor cost, total material cost and total drug cost all together gave full costs of provider. This full cost could be used to compare cost effectiveness ratio of different DOTS centers. Table 4.16 presents provider's full cost for the treatment of Tuberculosis under DOTS strategy. Table 4.17 shows full cost without opportunity cost of space used by Ramghat PHC and labor cost of coordinator of Helping Hands Clinic.

Table 4.16 Full Providers' Cost of Various DOTS Centers, Nepalese Rupees, in 2001 price

DOTS Center	Total Capital Cost (%)	Total Labor Cost(%)	Total material cost (%)	Total drug Cost(%)	Full Cost
Public					
Ramghat PHC	15912.38(8.76)	88928.23(48.94)	5787.54(3.19)	71063.58(39.11)	181691.73
Birendra Police Hospital	22993.41(7.21)	95686.73(30.0)	35092.44(11.0)	165135.76(51.78)	318908.34
Public-Private Mix					
Friends of Shanta Bhawan	29952.5(5.46)	131360.86(24.27)	18991.69(3.51)	360868.42(66.68)	541173.47
Helping Hands Clinic	45418.17(9.72)	80113.54(17.14)	46476.92(9.94)	295408.52(63.2)	467417.15

Note: The figures in parenthesis indicate percentage of full cost.

4.17 Full Providers' Cost of Various DOTS Centers, without opportunity cost

DOTS Center	Total Capital Cost	Total Labour Cost	Total material cost	Total drug Cost	Full Cost
Public					
Ramghat PHC	5560.73	88928.23	5787.54	71063.58	171340.08
Birendra Police Hospital	22993.41	95686.73	35092.44	165135.76	318908.34
Public-Private Mix					
Friends Of Shanta Bhawan	29952.5	131360.86	18991.69	360868.42	541173.47
Helping Hands Clinic	45418.17	73942.1	46476.92	295408.52	461245.71

Note: This table provides full cost omitting opportunity cost of area used by Ramghat PHC, and labor cost of Coordinator of Helping Hands Clinic

4.5 Effectiveness of Public and Public-Private mix DOTS Centers

4.5.1 Ramghat Primary Health Center (PHC)

Ramghat PHC provides DOTS service for tuberculosis control covering about 40,000 (ward no 8 and 9) population. Using annual rate of tuberculosis infection (ARTI) 4%, the estimated number of new smear-positive cases was found to be about 80. During the first eight-month of FY 2000/2001, 37 TB patients were registered under DOTS service for tuberculosis.

Case Detection Rate: The number of new pulmonary smear positive cases detected, expressed as percentage of estimated new smear positive cases. The case detection rate was found 22.5%(18/80) for first eight month and 41.25%(33/80) by the end of FY 2000/2001.

Cure rate: The number of new pulmonary smear-positive cases cured divided by all registered new smear-positive cases for a given trimester. Cure rates for new smear-positive cases and relapses are the most important treatment outcome indicators. Ramghat had cure rate 44.4% for new smear-positive and 0%(0/1) for relapse cases. Defaulter cure rate was also 0% - that might increase the potential candidate for multi-drug resistant. The treatment success rate was 66.6% (12/18). Both cure rate and treatment success rate were lower than the national target (85%). Table 4.18 presents the total number of TB patients registered and its outcome.

The smear conversion rate is an early indicator of treatment outcome. It is the number of smear-positive cases that convert from smear-positive to smear negative after 2(3) months of treatment, out of all smear-positive cases registered during a trimester. The conversion rate of new smear-positive cases and relapses should be at least 80% at two months. It should be at least 75% for other re-treatment cases. The conversion rate of smear-positive cases was 85%, greater than National target (80%). It meant that TB patients became defaulter after 2(3) month treatment. Table 4.19 presents conversion rate of smear-positive cases.

Table 4.18 Case finding and Treatment Outcome of First Eight Month of FY 2000/2001

Types of Cases	Number						Transferred out	No Result
	Registered	Cured	Completed	Failure	Died	Defaulted		
New Smear Positive	18	8(44.4)	4(22.2)	0	0	5(27.85)	1(5.6)	
New Smear Negative	13	-	12(92.3)	0	0	1	0	
New Extra-pulmonary	4	-	3(75)	0	0	1	0	
Relapse	1	0(0.0)	0(0)	1(100)	0	0	0	
Failure	0	0	0	0	0	0	0	
Return After Default	1	0(0.0)	0(0)	0	0	1(100)	0	
Total	37	8	19	1	0	8	1	

Note: The figures in parenthesis indicate percentage of corresponding registered cases

Table 4.19 Smear Conversion of smear-positive cases during a period of first eight months of FY 2000/2001, Ramghat PHC

Types of Cases	Number			Died	Defaulted	Transferred out	No Result
	Registered	Negative	Positive				
New Smear Positive	18	15(83.3)	2	0	-	0	1
Relapse	1	1(100.0)	0	0	0	0	0
Failure	0	0	0	0	0	0	0
Return After Default	1	1(100.0)	0	0	0	0	0
Total	20	17(85)	2	0	0	0	1

Note: The figures in parenthesis indicate percentage of corresponding registered cases

4.5.2 Friends of Shanta Bhawan(FSB)

Its catchment population was about 100,000. That area was thought as reservoir of tuberculosis patients. Since the annual rate of tuberculosis infection (ARTI) was 4% for Kathmandu metropolis and its surrounding area, the estimated new smear positive cases were 200 for year 2001. During the first eight month of FY 2000/2001, 596 TB suspected cases attended FSB to have treatment. After diagnosis process, only 172 TB patients were registered under DOTS service for tuberculosis.

Case Detection Rate: The number of new pulmonary smear positive cases detected, expressed as percentage of estimated new smear positive cases. The case

detection rate was found 29.5%(59/200) for first eight month and 54.5%(109/200) by the end of FY 2000/2001.

Re-treatment ratio: The ratio of number of all smear positive re-treatment cases (relapse, failure and return after default) out of all smear positive cases registered. Inadequate treatment may increase the re-treatment ratio, because it adds the number of failures, relapses, and defaulters. Also, the increase in this ratio may increase the future cost of treatment that could be freed for other new cases. The ratio seems to be quite high ($22/81 = 0.27$). High cure rate (93.2%) shows that the re-treatment cases were not produced by FSB. Those cases might come from other treatment centers.

Cure rate: The number of new pulmonary smear-positive cases cured divided by all registered new smear-positive cases for a given trimester. Cure rates for new smear-positive cases and relapses are the most important treatment outcome indicators. FSB had cure rate 93.2% for new smear-positive and 80% for relapse cases. The treatment success rate was 89.5% (154/172). Both cure rate and treatment success rate were higher than the national target (85%). Table 4.20 presents the total number of TB patients registered and its outcome.

The conversion rate of smear-positive cases was 85%, greater than National target (80%). Table 4.21 shows smear conversion rate of smear-positive cases.

Table 4.20 Case finding and Treatment Outcome of First Eight Month of FY 2000/2001, Friends of Shanta Bhawan

Types of Cases	Number Registered	Cured	Completed	Failure	Defaulted	Died	Transferred out	No Result
New Smear-Positive	59	55(93.2)	0(0.0)	1(1.7)	0(0.0)	2	1	
New Smear - Negative	49	-	42(85.7)	0(0.0)	2(4.1)	0	5	
New Extra-pulmonary	42	-	39(92.9)	0(0.0)	0(0.0)	0	3	
Relapse	15	12(80.0)	1(6.7)	1(6.7)	0(0.0)	1	0	
Failure	1	1(100.0)	0(0.0)	0(0.0)	0(0.0)	0	0	
Return After Default	6	4(66.7)	0(0.0)	0(0.0)	0(0.0)	2	0	
Total	172	72	82	2	2	5	9	

Note: The figures in parenthesis indicate percentage of corresponding registered cases

Table 4.21 Smear Conversion of smear-positive cases during a period of first eight months of FY 2000/2001, Friends of Shanta Bhawan

Types of Cases	Number Registered	Negative	Positive	Died	Defaulted	Transferred out	No Result
New Smear Positive	59	50(84.7)	6	2	-	1	
Relapse	14	12(85.7)	1	1	0	0	
Failure	1	1(100)	0	0	0	0	
Return After Default	6	5(83.3)	1	0	0	0	
Total	80	68(85)	8	3	0	1	

Note: The figures in parenthesis indicate percentage of corresponding registered cases

4.5.3 Helping Hands Clinic, Nepal (HHCN)

The catchment population of HHCN was about 100,000. That area was also thought as reservoir of tuberculosis patients. Since the annual rate of tuberculosis infection (ARTI) was 4% for Kathmandu metropolis and its surrounding area, the estimated new smear positive cases were 200 for year 2001. During the first eight-month of FY 2000/2001, 154 TB patients were registered under DOTS service for tuberculosis.

Case Detection Rate: The case detection rate was found 30%(60/200) for firsteight month and 53 %(106/200) by the end of FY 2000/2001)

Re-treatment ratio: The registered re-treatment ratio was about 16.7%(12/72) for smear-positive cases. When we see the outcome, the default rate of new smear-positive cases was 5%(3/60). This rate always should be less than 10% (WHO/NTC). The failure rate was 0%.

Cure rate: HHCN had 75% cure rate and 83.3% treatment success rate for new smear-positive cases and 36.4% cure rate and 54.6% treatment success rate for relapse cases. Treatment success rate was very close to WHO/NTC standard target (85%). Table 4.22 presents the total number of TB patients registered (case finding) and its outcome.

Smear Conversion Rate: The conversion rate of new smear-positive cases and relapses should be at least 80% at two months. It should be at least 75% for other re-treatment cases. The reported conversion rate of smear-positive cases was 77.8%, close to National target (80%). Table 4.23 shows smear conversion of all registered smear-positive cases. All of these indicators showed that DOTS service for TB at HHCN was running effectively.

Table 4.22 Case finding and Treatment Outcome of First Eight Month of FY 2000/2001

Types of Cases	Number				Died	Defaulted		No Result
	Registered	Cured	Completed	Failure		Transferred out		
New Smear Positive	60	45(75)	5(8.3)	0	1(1.67)	3(5.00)	6	
New Smear Negative	48	-	44(91.6)	0	0	2(4.16)	2	
New Extra-pulmonary	34	-	27(79.4)	0	0	6(17.65)	1	
Relapse	11	4(36.4)	2(18.2)	2		1(9.01)	2	
Failure	0	0	0	0	0	0	0	
Return After Default	1	1(100)	0	0	0	0	0	
Total	154	50	78	2	1	12	11	

Note: The figures in parenthesis indicate percentage of corresponding registered cases

Table 4.23 Smear Conversion of smear-positive cases during a period of first eight months of FY 2000/2001, Helping Hands Clinic, Nepal.

Types of Cases	Number			Died	Defaulted	Transferred	
	Registered	Negative	Positive			out	No Result
New Smear Positive	60	47(78.3)	4	0	-	6	3
Relapse	11	8(72.7)	0	0	2	1	0
Failure	0	0(0.0)	0	0	0	0	0
Return After Default	1	1(100)	0	0	0	0	0
Total	72	56(77.8)	4	0	2	7	3

Note: The figures in parenthesis indicate percentage of corresponding registered cases

4.5.4 Anam Nagar Poly Clinic and Research Center (APCRC)

The catchment's area of Anam Nagar Poly Clinic was ward number 10,11 and 32 with population 69421(based on Population census 2001, preliminary report). Annual rate of tuberculosis infection (ARTI) was used 4% to estimate new smear-

positive cases, 139. During the first eight-month of FY 2000/2001, 54 suspected TB patients visited APCRC and 11 TB patients were registered under DOTS service for tuberculosis.

Case Detection Rate: The case detection rate was found 3.6%(5/139) for first eight month and 7.9%(11/139) by the end of FY 2000/2001. This rate was quite low with compared to target set by NTC (70%).

Re-treatment ratio: The registered re-treatment ratio was about 9.1%(1/11) for smear-positive cases. When we see the outcome, the default rate of new smear-positive cases was 0%.

Cure rate: APCRC had 60%(3/5) cure rate and 80% treatment success rate for new smear-positive cases. Relapse cases were not registered. Table 4.24 presents the total number of TB patients registered (case finding) and its treatment outcome.

Smear Conversion Rate: The reported conversion rate of smear-positive cases was 100%. Table 4.25 shows smear conversion of all registered smear-positive cases at Anam Nagar Poly clinic

Table 4.24 Case finding and Treatment Outcome of First Eight Month of FY 2000/2001

Types of Cases	Number Registered	Cured	Completed	Failure	Died	Defaulted	Transferred out	No Result
New Smear Positive	5	3(60.0)	1(20.0)	0	0	0	1	0
New Smear Negative	2		2(100.0)	0	0	0	0	0
New Extra-pulmonary	3		3(100.0)	0	0	0	0	0
Relapse	0	0(0.0)	0(0.0)	0	0	0	0	0
Failure	0	0(0.0)	0(0.0)	0	0	0	0	0
Return After Default	1	1(100)	0(0.0)	0	0	0	0	0
Total	11	4	6	0	0	0	1	0

Note: The figures in parenthesis indicate percentage of corresponding registered cases

Table 4.25 Smear Conversion of smear-positive cases during a period of first eight months of FY 2000/2001, Anam Nagar Poly Clinic

Types of Cases	Number						
	Registered	Negative	Positive	Died	Defaulted	Transferred out	No Result
New Smear Positive	5	5	0	0		0	0
Relapse	0	0	0	0	0	0	0
Failure	0	0	0	0	0	0	0
Return After Default	0	0	0	0	0	0	0
Total	5	5(100.0)	0	0	0	0	0

Note: The figures in parenthesis indicate percentage of corresponding registered cases

4.5.5 Birendra Police Hospital (BPH)

The catchment population of BPH was about 50,000. 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 year 2001. During the first eight-month of FY 2000/2001, 265 suspected TB patients visited BPH and 65 TB patients were registered under DOTS service for tuberculosis.

Case Detection Rate: The case detection rate was found 16%(16/100) for first eight month and 29 %(29/100) by the end of FY 2000/2001.

Re-treatment ratio: The registered re-treatment ratio was about 7.7%(5/65) for smear-positive cases. When we see the outcome, the default rate of new smear-positive cases was 12.5%(2/16). This rate always should be less than 10% (WHO/NTC). The failure rate was 0%.

Cure rate: BPH had 31.2%(5/16) cure rate and 37.4% treatment success rate for new smear-positive cases and 50%(2/4) cure rate and 75%(3/4) treatment success rate for relapse cases. Treatment success rate for new smear positive cases was found very low compared to WHO/NTC standard target (85%). Table 4.26

presents the total number of TB patients registered (case finding) and its treatment outcome.

Smear conversion rate: The reported conversion rate of smear-positive cases was 66.7%(14/21), lower than National target (80%). Table 4.27 shows smear conversion of all registered smear-positive cases.

Table 4.26 Case finding and Treatment Outcome of First Eight Month of FY 2000/2001, Birendra Police Hospital

Types of Cases	Number Registered	Cured	Completed	Failure	Died	Defaulted	Transferred out	No Result
New Smear Positive	16	5(31.2)	1(6.2)	0	0	2(12.5)	8(50.0)	0
New Smear Negative	20	-	10(50.0)	0	1	1(5)	8(40.0)	0
New Extra-pulmonary	24	-	13(54.2)	0	1	4(16.7)	2(8.30)	4
Relapse	4	2(50.0)	1(25)	0	1	0	0	0
Failure	1	1(100.0)	0(0.0)	0	0	0	0	0
Return After Default	0	0	0	0	0	0	0	0
Total	65	8	25	0	3	7	18	4

Note: The figures in parenthesis indicate percentage of corresponding registered cases

Table 4.27 Smear Conversion of smear-positive cases during a period of first eight months of FY 2000/2001, Birendra Police Hospital.

Types of Cases	Number Registered	Negative	Positive	Died	Defaulted	Transferred out	No Result
New Smear Positive	16	10(62.5)	2	0	-	2	2
Relapse	4	3(75.0)	0	1	0	0	0
Failure	1	1(100)	0	0	0	0	0
Return After Default	0	0	0	0	0	0	0
Total	21	14(66.7)	2	1	0	2	2

Note: The figures in parenthesis indicate percentage of corresponding registered cases

4.6 Cost-Effectiveness Analysis

This cost-effectiveness analysis was carried out to answer the research question “Is public-private mix DOTS treatment center or public DOTS treatment center running more cost-effective?” and it was based on the cost and effectiveness of DOTS treatment centers for tuberculosis. The cost per effectiveness was calculated as total cost incurred by the DOTS centers divided by total effectiveness (treatment outcome) of DOTS centers. Table 4.28 presents cost, effectiveness and its ratio of individual DOTS center and average of Public and Public-Private Mix DOTS centers.

Table 4.28 Cost-effectiveness Ratio of Public and Public-Private Mix DOTS centers

DOTS Centers	Full Cost (NRs,2001 price)	Effectiveness (Treatment Outcome)	Cost/Effectiveness	
			NRs	US\$
Ramghat PHC	181708.08	27	6729.93	89.26
Birendra Police Hospital	318908.34	33	9663.89	128.17
Public DOTS Center	500600.07	60	8343.61	110.66
Friends of Shanta Bhawan	541173.47	154	3514.11	46.61
Helping Hands Clinic	467417.15	128	3651.70	48.43
Public-Private Mix	1008590.62	282	3576.56	47.43

This shows that Public mix with private DOTS centers are more cost-effective than public DOTS centers. Only on this basis, it may not be appropriate to conclude which of these is more cost-effective. There are other important indicators in tuberculosis treatment that may add valuable remarks on decision. Inadequate treatment may increase the re-treatment ratio, because it adds the number of failures, relapses, and defaulters and may increase the future cost of treatment that could be freed for other new cases. Details are on Discussion and conclusion section.

Ramghat PHC pays no rent for building, even though its rent was included in calculation. In Helping Hands Clinic, coordinator (a physician) provides service as volunteer. His salary (opportunity cost) was determined using prevailing market value of similar cadre physician. Table 4.29 presents full costs without these opportunity costs. The cost per effectiveness of Ramghat PHC reduced by 5 US\$ and that of Helping Hands Clinic lowered by about US\$ 0.29 after omitting opportunity cost.

Table 4.29 Cost-effectiveness Ratio of Public and Public-Private Mix DOTS centers, omitting opportunity cost

DOTS Centers	Full Cost (NRs, 2001 price)	Effectiveness (Treatment Outcome)	Cost/Effectiveness	
			NRs	US\$
Ramghat PHC	171340.08	27	6345.93	84.16
Birendra Police Hospital	318908.34	33	9663.89	128.17
<i>Public DOTS Center</i>	<i>490248.42</i>	<i>60</i>	<i>8170.81</i>	<i>108.37</i>
Friends of Shanta Bhawan	541173.47	154	3514.11	46.61
Helping Hands Clinic	461245.71	128	3603.48	47.79
<i>Public-Private Mix</i>	<i>1002419.18</i>	<i>282</i>	<i>3554.68</i>	<i>47.14</i>

4.7 Sensitivity Analysis

There are a number of sources of uncertainty in economic evaluation. First, no data may be available and informed guess are required. Second, estimates may be available but they may be known to be imprecise. Third, there may be methodological controversy, or value judgment may be incorporated in the study. This sensitivity analysis was carried out for different discount rate. Drummond has explained, in his book, to undertake sensitivity analysis 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- supporting economic indicators were explained on section 3.6. Therefore sensitivity analysis was carried out for three different discount rates: 3%, 5%, and 10%. The observed difference (at 3% and 10% discount rate) of cost per effectiveness was about US\$ 3 in public DOTS center and about US\$ 2 in Public-Private Mix DOTS centers. This analysis supports that DOTS service for tuberculosis is not capital-intensive strategy. The following tables present capital cost annualized at 3% and 10% and its impact on cost per effectiveness. Nepalese currency was converted into US\$ value using official exchange (US\$ 1= NRs 75.4) (NRB. 2001).

Table 4.30 Cost-effectiveness Ratio with Capital Cost annualized at 3% discount rate

	3%	Total capital Cost	Full Cost	Effectiveness	Cost/Effectiveness	
					NRs	US\$
Ramghat PHC		15570.3	181349.65	27	6716.65	89.08
Birendra Police Hospital		21467.94	317382.87	33	9617.66	127.56
<i>Public DOTS Center</i>		<i>37038.24</i>	<i>498732.52</i>	<i>60</i>	<i>8312.21</i>	<i>110.24</i>
Friends Of Shanta Bhawan		29366.07	504587.04	154	3276.54	43.46
Helping Hands Clinic		43502.51	465501.9	128	3636.73	48.23
<i>Public-Private Mix</i>		<i>72868.58</i>	<i>970088.94</i>	<i>282</i>	<i>3440.03</i>	<i>45.62</i>

Table 4.31 Cost-effectiveness Ratio with Capital Cost annualized at 10% discount rate

10%	Total capital Cost	Full Cost	Effectiveness	Cost/Effectiveness	
				NRs	US\$
Ramghat PHC	16195	181974.35	27	6739.79	89.39
Birendra Police Hospital	35876.94	331791.87	33	10054.30	133.35
Public DOTS Center	52071.94	513766.22	60	8562.77	113.56
Friends of Shanta Bhawan	34087.37	545308.34	154	3540.96	46.96
Helping Hands Clinic	52782.57	474781.55	128	3709.23	49.19
Public-Private Mix	86869.94	1020089.89	282	3617.34	47.97

Table 4.32 Cost-effectiveness Ratio with Capital Cost annualized at different discount rates

	Cost/Effectiveness					
	3%		5%		10%	
	NRs	US\$	NRs	US\$	NRs	US\$
Ramghat PHC	6716.65	89.08	6729.32	89.25	6739.79	89.39
Birendra Police Hospital	9617.66	127.56	9663.89	128.17	10054.30	133.35
Public DOTS Centers	8312.21	110.24	8343.61	110.66	8562.77	113.56
Friends of Shanta Bhawan	3276.54	43.46	3514.11	46.61	3540.96	46.96
Helping Hand Clinic	3636.73	48.23	3651.70	48.43	3709.23	49.19
Public-Private Mix	3440.03	45.62	3576.56	47.43	3617.34	47.97

Note: Summarized from tables 4.28, 4.30 and 4.31