CHAPTER IV

RESULTS AND ANALYSIS

This chapter presents the results of cost analysis done for both outreach and health facility based VL case detection programs from providers' and patients' perspectives. Effectiveness at different levels of both the programs are also presented and a cost effectiveness analysis is carried out in the subsequent section in order to answer the primary research question. This chapter opens with results of screening test's performance in detecting VL cases in the study districts and its neighbouring areas.

4.1 Results of k39 dipstick test's performance for VL case detection

The outreach program used a new test called k39 dipstick for diagnosis of VL. A case control study conducted in 1999 by Kala-azar Project (of which the current study is a part) evaluated the effectiveness of k39 dipstick test for rapid case detection of visceral leishmaniasis in Siraha, Dhanusha and Mahottari districts of Nepal. The test was validated against direct agglutination test (DAT), of which both sensitivity and specificity have been found very good in the detection of visceral leishmaniasis in Nepalese field settinngs (Joshi, 1998). Table 4.1 presents the results of evaluation of the dipstick test, followed by calculation of key indicators of the test's performance.

Table 4.1 Performance of k39 dipstick screening test

		DAT		
		+ve	-ve	Total
K39 dipstick	+ve	82	4	86
	-ve	7	107	114
	Total	89	111	200

Note: Calculated on the basis of data provided by Joshi, 1999.

Sensitivity of the test	= 82/89 = 0.92
Specificity of the test	= 107/111 = 0.96
False positive rate	= 1 - specificity = 0.04
False negative rate	= 1 - sensitivity = 0.08
Test positive rate	= 86/200 = 0.43
Predictive value for positive screening test	= 82/86 = 0.95
Predictive value for negative screening test	= 107/114 = 0.94

These statistics well establish k39 dipstick's performance to detect visceral leishmaniasis in the field setting in Nepal, and the results are quite comparable with a study done in India (Sunder, 1998). The test was available at a unit price of USD 1.12. It is important to note that DAT can also be used as a rapid diagnostic test. Using different tests might affect the effectiveness of the program. Here, we discuss the use of k39 dipstick as the diagnostic test in outreach program.

4.2 Providers' costs for VL case detection and treatment

This section examines the costs incurred by health facility based program and outreach program while detecting visceral leishmaniasis cases in Siraha district of Nepal from the providers' viewpoint.

4.2.1 Costs to Health Facility Based Case Detection Program

Providers' costs were assessed in terms of resource use in three primary categories - staffing, materials and capital. Table 4.2 presents staffing costs incurred while delivering VL case detection and treatment services at Siraha district hospital in the year 1998-99 (Nepalese Fiscal Year 2055/56). Data on monthly gross salary of staff involved in VL activities were obtained from the salary sheet, together with the information on field allowances. A division factor of 26 (as there were 4 days off in a month) was used to convert these monthly gross salaries to daily staffing costs incurred by the hospital, which were later apportioned to VL activities. Direct allocation method was used for this purpose with percentage time spent by these personnel in doing case detection and

treatment at the hospital as allocation basis. Attributable days of salary per year was obtained by multiplying daily cost by a conversion factor, which was calculated as: number of hours spent per day times 317 (total working days in a year) divided by 7 (total working hours a day). Time spent by a staff in VL activities was known by interviewing the personnel. The total staffing costs of health facility based detection program was Rs 209,433 at 1999 prices, of which about 18 per cent went to field allowances.

Table 4.2 Staffing Costs of Health Facility Based Case Detection Program (in Rupees, 1999 prices)

Category	Number	Gross Salary/month	Daily cost	Time spent in VL activities	Attribu-table days of salary/yr	Annual Salary attributable to VL activities
	(1)	(2)	(3) =(2)/26	(4)	(5)	(6)= (1)x(3)x(5)
Salary and benefits						
Medical Superintendent	1	6,210	238.85	1 hr/day	45.29	10,817.34
Sr. Medical Officer	1	6,210	238.85	1 hr/day	45.29	10,817.34
Nurses	1	4,701	180.81	1 hr/day	45.29	8,188.78
Lab Technicians	2	4,601	176.96	56 hrs/month	96.00	33,976.62
Auxiliary Nursing Midwives	4	3,380	130.00	1.5 hrs/day	67.93	35,323.60
Lab Assistants	3	4,008	154.15	2 hrs/day	90.57	41,885.14
Vector Control Assistants	1	4,095	157.50	1 hr/day	45.29	7,133.18
Store Keeper	2	3,846	147.92	30 mins/day	22.64	6,697.96
Administrative Assistants	2	3,846	147.92	30 mins/day	22.64	6,697.96
Medical Recordist	1	4,095	157.50	20 mins/day	15.10	2,378.25
Driver	1	3,734	143.62	5 days/month	60.00	8,616.92
Total Salaries						**172,533.08**
Field allowances						
Medical Officer	1		200.00	5 days/month	60.00	12,000.00
Vector Control Assistants	1		150.00	5 days/month	60.00	9,000.00
Lab Assistants	1		150.00	5 days/month	60.00	9,000.00
Driver	1		115.00	5 days/month	60.00	6,900.00
Total Field Allowances						**36,900.00**
TOTAL STAFFING						**209,433.08**

Calculation of capital costs posed some difficulty, as no records documenting its actual purchasing price were available in some cases. This difficulty was overcome by interviewing the senior hospital staff, who had been working there for a long time and could tell both year of purchase of the capital and its price then, but in round figure (Table 4.3). In case of land, the current value was used to estimate its opportunity cost. Records of furniture were not available, so a hospital staff was asked to do an estimate if all currently used furniture were to be replaced. The inpatient department had most of the furniture, which worth estimated Rs 200,000 and Rs 117,000 was added for others. Land valuation was done at the rate of Rs. 400,000 per 'kattha' (1 kattha = 3645 square feet). Building was estimated to have 30 years of useful life, vehicle of 10 years and other equipment's useful life was estimated between 2-10 years. The vehicle was donated by an international agency in 1994. The data obtained from the donor (UNFPA) showed that the price of vehicle at purchase was USD 5600 plus USD 71.5 as clearance charge. This was converted to local currency by using the then exchange rate of 1 USD = Rs 49.398.

A discount rate of 10 per cent was used to find the present value of the capital investment. The choice of 10 per cent was dictated by several reasons. First, the country's treasury bills discount rate in 1999 was 4-5 per cent. Second, the prevailing law also demanded any capital goods to be used in industries be discounted at 5-25 percent, depending on the items. Third, the commercial banks interest rate on savings was less than 10 per cent but lending interest rate nearly 20 percent in 1998-99 and general inflation rate between 7 to 8 percent. Thus, a discount rate of 10 percent was thought to reflect true depreciation and it would also allow for comparison with several other studies.

The present value of all capital goods was annualised depending upon the discount rate and useful life. The annual costs so obtained were apportioned to VL activities by using three allocation bases. For building, land and furniture, ratio of space used by VL program (243 square feet, equivalent to 3 beds in inpatient department based on occupancy of VL cases round the year on an average) to total IPD space (1,215 square

feet) was used. Vehicle's cost was allocated to VL program according to days of use (60/365). For equipment, usage time (about 30 percent) was considered for the allocation. Generator's cost was allocated as estimated 20 percent use by VL cases round the year (3 out of 15 inpatient beds).

Table 4.3 shows all calculation in details. The total capital costs to health facility based case detection program was Rs 1308378.00 at 1999 prices, of which building alone accounted for 92 percent.

Table 4.3 Capital Costs of Hospital Based Case Detection Program (in Rupees, 1999 prices, Discount rate of 10 per cent)

Inputs	Purchase Price	Year of purchase	Useful life years*	Current Price ***	Annuali -zation factor	Annual cost	Alloc a- tion %	Annual program Cost
Building	8,500,000	1979	30	57,183,749.57	9.427	6,065,954.13	0.20	1,213,190.83
Land**				2,400,000.00		240,000.00	0.20	48,000.00
Vehicle	280,160.76	1994	10	451,200.48	6.145	73,425.63	0.16	12,070.00
Furniture**			5	317,000.00	3.791	83,619.10	0.20	16,723.82
Equipments	196,450	Different years	2-10 years	268,637.84	Different values	71,387.49		18,393.68
TOTAL CAPITAL	**8,976,610**			**60,620,589.11**		**6,534,386.54**		**1,308,378.33**

* Obtained from interview with Medical Superintendent, Administrator, Accountant and Lab Technicians, where applicable.

** Replacement value as estimated by the hospital staff.

*** Calculated using $C_t = C_0(1+r)^t$ where, C_t=Current price, C_0=Purchase price, r=Discount rate t=Number of years since purchase upto 1999

Note: Appendix E shows the detailed calculation.

Material costs were calculated based on two headings- direct to activity and indirect to activity (Table 4.4). Direct to activity costs included costs of investigations, drugs and meals. As no data could be obtained as to how much supplies were received by the laboratory, an indirect approach was used to estimate unit costs of the investigations (the details are shown in Appendix G, where market prices were used to calculate each unit of input required to have one investigation). Similar approach was adopted to estimate drug

costs as well (Appendix H). A market survey revealed that it would cost Rs 30 per day (2 meals) for the foods that were being served to inpatient by the hospital, and this estimate was used to calculate costs on food. The average length of stay used in the estimate was 12 days, as obtained by interviewing the medical recorder.

There were 170 VL cases admitted to the hospital in 1998-99, the evaluation period. All were given the first line drug (SAG), 12 were given second line drug (Amphotericin B), and all 170 underwent investigations listed in Appendix F. The costs indirect to the activity were divided into building related, administration, vehicles, laundry and cleaning. Annual costs were obtained from the accounts and where applicable estimates were used. Building related costs were apportioned according to space use, while administration, laundry and cleaning costs were allocated based on percentage of VL cases (all inpatient) as total inpatient cases. Usage days were the allocation basis for vehicles recurrent costs.

The total material cost to health facility based detection program was Rs 691,010.60, of which costs direct to activity accounted for 55 percent. Drug costs alone accounted for 39 percent of the total material costs (Table 4.4).

Table 4.4 Material Costs to Health Facility Based Case Detection Program (in Rupees, 1999 prices)

Category	Annual cost to program
Direct to activity	
Investigation	50,141.50
Drugs	267,000.00
Food	61,200.00
Total Direct	**378,341.50**
Indirect to activity	
Building related	188,688.00
Administration	4,782.82
Vehicle oil and maintenance	107,720.00
Laundry	1,409.67
Cleaning	10,069.10
Total Indirect	**312,669.10**
TOTAL MATERIAL	**691,010.60**

Note: Appendix F shows the detailed calculation.

Thus, total costs to health facility based detection program were as follows:

Category of costs	Rupees, 1999 price	As % of total
Staffing	209,433	9.5
Material	691,010	31.3
Capital	1,308,378	59.2
Total	**2,208,821**	**100.0**

The capital costs accounted for more than half of the total costs while staffing costs seemed much lower. This might be due to the lower government salary for the staff.

4.2.2 Costs to Outreach Case Detection Program

Data for costing of outreach case detection was made available by the co-ordinator of the Kala-azar Project. Since international donors funded this project, all costs data were available in USD terms. An exchange rate of 1 USD = Rs 68.15 was used for conversion of these figures to Rupees.

Table 4.5 describes all cost items for the outreach project and actual amount spent. As the program was run for two months, which also had components other than case detection, the total costs incurred to the project was apportioned to outreach case detection program with appropriate allocation basis. There was no capital investment. Staffing costs were allocated according to days spent in new case detection in Siraha district (9) divided by total number of days spent by the program (60). The project bought k39 dipstick test for screening from InBios International, USA at the rate of USD 1.12 per test. The project used 3 vehicles for 60 days at USD 90 per vehicle per day, of which the vehicles were used for 9 days in new case detection in Siraha district (allocation proportion 9/60). Office rent was apportioned according to days of work (10/30) and costs of other supplies by number of cases (16/92).

Since it was considered, mainly on ethical grounds and also as policy, that detected case must be treated by the program, an estimate of treatment costs that would be incurred for

each detected case was made. The underlying assumption of this estimate was that all cases thus detected would respond to the first line drug (SAG), would undergo bone marrow test for confirmation, and would be hospitalised for 30 days, in which time patients would manage their meals and travelling costs to and from hospital by themselves. As shown in Table 4.5, the actual costs of outreach case detection was Rs 643,786.86 in 1999 prices and if cost of treatment is added, if becomes Rs 680,506.86.

Table 4.5 Calculation of Total Costs to Outreach Case Detection Program (In Rupees, 1999 prices; 1USD = 68.15 Rupees)

1. Staffing	**Number**	**Daily cost, USD**	**No. of working days**	**Total Costs to VL Project, USD**	**Allocation proportion**	**Cost to outreach program, USD**	**Costs to Outreach Program, Rs**
	A	B	C	D=AxBxC	E	F=DxE	G=Fx68.15
Project Director	1	200	60	12,000	0.15	1,800.00	122,670.00
Project Co-ordinator	1	50	60	3,000	0.15	450.00	30,667.50
Field worker	4	30	60	7,200	0.15	1,080.00	73,602.00
Parasitologist	1	40	60	2,400	0.15	360.00	24,534.00
Technician	1	30	60	1,800	0.15	270.00	18,400.50
Total salaries				***26,400***		***3,960.00***	***269,874.00***
2. Material	**Quantity**	**Unit Price**		**Total Costs to Project, USD**	**Allocation Proportion**	**Cost to outreach program, USD**	**Costs to Outreach Program, Rs**
Screening test (k39 dipstick)	100	1.12		112	0.16	17.92	1,221.25
Office rent	30	40		1,200	0.33	400.00	27,260.00
Vehicle	180	90		16,200	0.30	4,860.00	331,209.00
Other supplies				1,200	0.17	208.70	14,222.61
Total material costs							***373,912.86***
Total costs for case detection							**643,786.86**
3. Treatment costs (estimated, Rupees)	**Number**	**Unit Price**					**Costs to Outreach,Rs**
Confirmative diagnosis (BM)	16	225					3,600.00
Drug (SAG)	16	1,320					21,120.00
Hospitalization	480	25					12,000.00
Total treatment cost							***36,720.00***
TOTAL COSTS TO PROGRAM							**680,506.86**

However, a market survey revealed that the unit prices of the inputs the Kala-azar Project paid were much higher than the existing market rates. There were some foreigners (specialists) in the project, who could be replaced by the local people if the outreach program is to be implemented again. This prompted the investigator to adjust the costs of outreach case detection program. There were three rates available- market rates, government rates and research rates. The market rates were the ones that most of non-governmental agencies paid for similar intervention usually in long term and were very common. This was the rate the health care providers were willing to pay for the staff and the staff were willing to accept in order to serve the providers. Thus, it was assumed to be the rate where competitive labor market were functioning. The government rates were the one that it paid for its staff as per government rules and regulation, which might not reflect the true opportunity cost of resources employed. Research rate was for activities relating to research, usually funded by the foreign agencies and would be of short term.

Thus, the market rate seemed appropriate to estimate the costs of outreach case detection program. The total costs of outreach case detection program thus was Rs. 135,200, of which detection alone accounted for 72 per cent and the rest cost was for the treatment, i.e. Rs. 98,480 and Rs. 36,720 respectively (Table 4.6).

The gaps, as shown in Table 4.6, between total costs of the program when different unit prices are used seems very interesting (i.e. Rs. 135,200 vs. Rs. 122,150). While the program's total costs of Rupees 122,150 is the outlay (expenditure) that the government has to spend if it wants to implement the outreach program separately, and in that sense, is the financial costs of the program. The estimates given by using market rates is the adjusted costs. While adjusting the costs, it was assumed that the unit prices paid by the government for its staff might underestimate the total costs of outreach program, as the government salary was subsidized. Secondly, as this was the rate lower than the common market price, running the outreach program at the same rate might not attract the staff to work efficiently and thus the program might not sustain. However, the difference in total costs of the program using the government rate and the market rate is not so big. As long

as the government is able to pull up these additional resources and run the program, the results show that it will not be less efficient than the present outreach program and also be sustainable.

Table 4.6 Calculation of Total Costs to Outreach Case Detection Program with three different unit costs of ingredients (In Rupees, 1999 prices; 1USD = Rs. 68.15)

Category			Market rate		Government rate		Research rate	
1. Staffing	**Number**	**No. of working days**	**Daily cost**	**Cost to Outreach Program**	**Daily cost**	**Cost to Outreach Program**	**Daily cost**	**Cost to Outreach Program**
Project Director	1	9	600	5,400	200	1,800	1000	9,000
Project Coordinator	1	9	400	3,600	200	1,800	800	7,200
Field worker	4	9	300	10,800	150	5,400	600	21,600
Parasitologist	1	9	400	3,600	200	1,800	800	7,200
Technician	1	9	200	1,800	150	1,350	600	5,400
Total salaries				***25,200***		***12,150***		***50,400***
2. Material	**Quantity**		**Unit Price**	**Costs to outreach program**	**Unit Price**	**Costs to outreach program**	**Unit Price**	**Costs to outreach program**
Screening test (k39 dipstick)	16		80	1,280	80	1,280	80	1,280
Office rent				4,000		4,000		4,000
Vehicle	27		2,000	54,000	2,000	54,000	3,500	94,500
Other supplies				14,000		14,000		14,000
Total material costs				***73,280***		***73,280***		***113,780***
Total costs for detection				**98,480**		**85,430**		**164,180**
3. Treatment costs (estimated, Rupees)	**Number**		**Unit Price**	**Costs to outreach program**	**Unit Price**	**Costs to outreach program**	**Unit Price**	**Costs to outreach program**
Confirmative diagnosis (BM)	16		225	3,600	225	3,600	225	3,600
Drug (SAG)	16		1,320	21,120	1,320	21,120	1,320	21,120
Hospitalization	480		25	12,000	25	12,000	25	12,000
Total treatment costs				***36,720***		***36,720***		***36,720***
TOTAL COSTS TO PROGRAM				**135,200**		**122,150**		**200,900**

4.3 Patients' costs for VL case detection and treatment

In order to estimate the costs incurred by the patients in both alternatives, a survey of 22 VL cases detected by health facility based program and 28 cases detected by outreach programs in Siraha district were interviewed. The patients were asked to recall the expenditures they made out of pocket while treating their illness. Information on the magnitude of informal support of the relatives while treating the case and days of absence from work for the patient were also collected to estimate indirect costs. In some cases, estimates were made for the expenditure based on several assumptions.

4.3.1 Summary statistics of VL cases interviewed

Table 4.7 presents the summary statistics of VL cases interviewed. There were a total of 50 cases, of which 28 were from the outreach detection program. The number of males was equal to that of females in health facility based detection program while it was half in the case of outreach program. Median age of cases in outreach program was 25.5 (5.0-65.0) and 25.0 (8.0-50.0) in health facility based detection program.

Table 4.7 Summary Statistics of VL Cases Interviewed

	Outreach program	Health facility based program
Number of cases interviewed	28	22
Male:Female	1.2	1.1
Age	25.5	25.0
Earnings per day (Rs)	35.0	40.0
Days of absence from work	30.0	90.0
Duration of morbidity (days	120.0	127.5
Time between infection and seeking care (days)	52.5	30.0
Distance to hospital (kms)	35.0	16.5
Time of travelling to hospital (hrs)	2.0	15.5
Days spent in hospital for treatment	1.0	5.5

Note: Appendix I presents the details of these figures. Median values are taken because of higher variation between the observations.

The median earnings per day of the interviewed cases detected by outreach program and health facility based program were Rs 35 (USD 0.50) and Rs 40 respectively. There was a large difference between days of absence from work between the cases detected by these programs (median 30 in outreach versus 90 days in health facility). The larger number of days of absence from work in health facility based program might be attributed to the poor diagnosis at the initial stage, which might have resulted in complications later on. Most of the cases in health facility group reported that they stayed at the hospital for about 5-6 days, which were probably not adequate for the treatment of VL and they might have admitted to hospital for other reasons. Data on this was not available, and it is not easy to conclude what was actually the reason for longer days of absence from work. The duration of morbidity was found to be similar between the two programs while time lag between infection and seeking health care was higher in outreach program (median 52 versus 30 days). Most of the cases detected by the outreach program either did not know that they had the disease (they simply considered it as fever) or could not afford going to health facility to seek care. This fact show that these two programs can be complimentary. The time and travel costs to these patients, most of whom were poor people (laborers) and worked on daily wage basis, might have caused this delay, although the district hospital was accessible for almost all cases (median distance = 35 kms, mean time to travel to hospital = 1.8 hours) and treatment was almost free of charge.

4.3.2 Costs to patients

Median costs are used to explain the differences in costs of two programs, as there were substantial variation in the observation, and the mean was affected largely by the extreme values. Table 4.8 presents costs to patients due to VL by different headings. These costs estimates were based on several important assumptions. For cases who were newly detected and had no data available for variables like out of pocket drug costs, travelling costs, cost of hospitalization, etc., some estimates were used based on how much would it cost at the minimum for a detected case if treatment is started now. Indirect cost

estimates assumed 30 days of treatment time and hence absence from work for the treatment for all newly detected cases. There were 18 newly detected cases out of 28 in outreach program for which such estimates were made.

As Table 4.8 shows, the median total cost to cases detected by health facility based program was about 6 times higher than that in case of outreach program. This is largely attributed by the total indirect costs to patients, which included opportunity costs of relatives accompanying the patient to hospitals and taking care at home plus costs due to his/her own absence from work. Indirect costs accounted for about 85 per cent of the total costs to patients.

Opportunity costs of patients due to absence from work in case of health facility based program was more than three fold higher than that in case of outreach program. This is remarkable result, as the median duration of morbidity due to VL in both cases were similar (120 in outreach and 127 in health facility). This was probably because of the assumptions made to calculate indirect cost due to absence from work in cases detected by outreach program (one month treatment time was added from date of detection, while this was not always true in the actual data of cases detected by health facility based program).

Importantly, median opportunity costs to relatives due to patient's care at home was zero for cases detected by outreach program. Most cases newly detected could take care of themselves and did not require any support from their relatives, and in case of those who required, the hours per day of the support was less than that for cases detected by health facility based program. This was probably the reason why this cost was higher in health facility based program.

The travelling costs in outreach program was higher that that in health facility based program. This was largely attributed to the travelling costs arisen from accompanying persons (almost all cases at least one in outreach versus none in health facility based

program). Moreover, the cases detected by outreach programs lived farther from hospital and would incur more travelling costs while seeking care. It is important to note that estimates based on real data were entered on the cost function for those newly detected cases in outreach program while calculating travelling costs.

Table 4.8 Median Costs to patients due to VL by different headings (also expressed in terms of days of earnings)

	Outreach Detection Program (n=28)		Health Facility Based Detection Program (n=22)	
	Median costs	Costs in terms of days of earnings (Rs 35/day)	Median costs	Costs in terms of days of earning (Rs 40/day)
Opportunity costs to relatives in accompanying patients to hospital	40	1.1	937	23.4
Opportunity costs to relatives for taking care of patients at home	0	0.0	1175	29.4
Indirect costs to patient due to absence from work	1200	34.3	4500	112.5
Out of pocket drug costs	0	0.0	500	12.5
Out of pocket cost of hospitalization	0	0.0	322	8.1
Travelling costs	80	2.3	44	1.1
Total indirect costs	1525	43.6	8540	213.5
Total direct costs	192	5.5	2154	53.9
Total costs	1670	47.7	9954	248.9

The difference in time lag between infection and seeking care in these two programs (52 days in outreach and 30 days in health facility based detection) might suggest that the indirect costs in terms of days of absence from work in outreach should be higher. However, the results say the different story- the total costs in outreach is much lower than the health facility based detection. A close look at the components of patients costs describe this difference to be due to the higher opportunity costs (as cases detected by health facility based program tend to have more absence from work while most of the cases detected by outreach were still working and did not know that they had the

disease). Importantly, while estimating direct costs, it was assumed that the costs of drugs and hospitalization for these patients would be borne by outreach program. This has also attributed to lower patient's direct costs in outreach detection.

Table 4.8 also presents these cost figures expressed in days of earnings for these cases and this might be helpful to estimate the burden of disease. The average earning per day used to calculate these estimates were Rs 35.0 and Rs. 40 respectively for outreach and health facility based programs. These figures were based on the analysis of the actual data available for these groups (Appendix I presents the data). For cases detected by health facility based program, a VL case was found to give up his equivalent 8 months' earnings, when all direct and indirect costs were considered. In outreach program, it was equivalent to about one and half months' earnings.

In order to see the distribution of total costs, stratification was done and each group was classified according to three main variables considered to be important – income, gender and time lag between infection and the health care seeking. These results are presented respectively in Tables 4.9, 4.10 and 4.11. In order to see the distribution of total costs by income, the daily income was converted to yearly income by multiplying it with 365, and grouped into two categories. The first one was individuals with yearly income less than Rs. 25,000 a day (equivalent to USD 1.0 per day, classified as absolute poverty by World Bank), and the second one was those with more than that sum. Twenty three out of 27 (85.2 per cent) cases detected by outreach program whose annual income was less than Rs 25000 were found to spend less than 5 thousand rupees for their treatment. Among the same group of cases detected by health facility based program, 84 per cent spent more than 5 thousand rupees (Table 4.9). This difference in patients' costs suggest that there is a serious problem of equity, and outreach program might serve as a better alternative to solve this problem.

Table 4.9 Distribution of patients' total costs by income level

Patients total costs	Income level (Rupees)					
	Less than 25,000 per annum (Less than 1 USD a day)		More than 25,000 per annum		Total	
	Number	%	Number	%	Number	%
Outreach Detection Program						
0-5 thousand	23	85.2	1	100.0	24	85.7
5-10 thousand	2	7.4	0	0.0	2	7.1
10-15 thousand	2	7.4	0	0.0	2	7.1
15 thousand plus	0	0.0	0	0.0	0	0.0
Total	27	100.0	1	100.0	28	100.0
Health Facility Based Detection Program						
0-5 thousand	3	15.8	0	0.0	3	13.6
5-10 thousand	7	36.8	1	33.3	8	36.4
10-15 thousand	5	36.3	0	0.0	5	22.7
15 thousand plus	4	31.1	2	66.6	6	27.3
Total	19	100.0	3	100.0	22	100.0

The distribution of total costs by gender revealed that both males and females spent more than 5 thousand rupees for their treatment among cases detected by health facility based program (Table 4.10). Similar observation was true for cases detected by outreach program, indicating that gender made no big difference.

Table 4.10 Distribution of patients' total costs by sex

Program and Sex	Patients' total costs (Thousand Rupees)				
	0-5	5-10	10-15	15+	Total
Outreach Detection					
Male	7 (77.8)	0	2 (22.2)	0	9 (100.0)
Female	17 (89.5)	2 (10.5)	0	0	19 (100.0)
Total	24 (85.7)	2 (7.1)	2 (7.1)	0	28 (100.0)
Health Facility Detection					
Male	2 (18.2)	3 (27.3)	3 (27.3)	3 (27.3)	11 (100.0)
Female	1 (9.1)	5 (45.5)	2 (18.2)	3 (27.3)	11 (100.0)
Total	3 (13.6)	8 (36.3)	5 (22.7)	6 (27.2)	22 (100.0)

Note: The figures in parenthesis indicate percentage.

Distribution of total costs by time lag between infection and seeking care showed higher costs incurred by cases detected by health facility based program than the outreach, irrespective of the time lag (Table 4.11.). Of total 12 (54.5 percent) cases who reported to the health facility within one month, only 16.7 percent incurred costs less than 5 thousand rupees, the rest higher than that. In outreach program, all cases detected within one month of infection were found to incur costs less than 5 thousand rupees. However, this estimate is highly sensitive to the assumptions made while calculating costs (all costs of treatment after case detection would be borne by the provider and that there would be only 30 days time for recovery). The results suggests that although the case reported in earlier stage to the health facility, the diagnostic inaccuracy of the system might have contributed to their longer days of absence from work. Hence the larger average patients costs even for smaller time lag between infection and seeking care.

Table 4.11 Distribution of patients' total costs by time lag between infection and seeking health care

Time lag between infection and health care seeking	Patients' total costs (Thousand Rupees)					
	0-5	5-10	10-15	15-20	20+	Total
Outreach Detection Program						
Within 1 month	10 (100.0)	0	0	0	0	10 (100.0)
1-3 months	7 (77.8)	1 (11.1)	1 (11.1)	0	0	9 (100.0)
3-6 months	5 (83.3)	1 (16.7)	0	0	0	6 (100.0)
6 months plus	2 (66.7)	0	1 (33.3)	0	0	3 (100.0)
Total	24 (85.7)	2 (7.1)	2 (7.1)	0	0	28 (100.0)
Health Facility Based Detection Program						
Within 1 month	2 (16.7)	5 (41.7)	2 (16.7)	1 (8.3)	2 (16.7)	12 (100.0)
1-3 months	0	2 (40.0)	0	3 (60.0)	0	5 (100.0)
3-6 months	1 (25.0)	1 (25.0)	2 (50.0)	0	0	4 (100.0)
6 months plus	0	0	1 (100.0)	0	0	1 (100.0)
Total	3 (13.6)	8 (36.4)	5 (22.7)	4 (18.2)	2 (9.1)	22 (100.0)

Note: The figures in parenthesis indicate percentage.

4.4 Effectiveness of the programs

The primary effectiveness measure used in this research was number of cases detected by the two different programs, which was found as follows:

Program	Population at risk of VL*	Number of case detected	Detected case per 100,000 population at risk
Outreach detection	39,102	16	40.9
Health facility based detection	497,816	170	34.1

Note: This data was obtained from MOH, 1998. The figures represent the population of the endemic areas covered by the detection programs. These figures are not the number of people screened by the program.

The detection rate per 100,000 population in outreach program was slightly better than the health facility based program. This small difference was perhaps due to the active nature of the outreach program. This primary effectiveness was translated into a higher level of effectiveness by multiplying it with probability of survival of a case if detected and treated properly. The case fatality rate was considered as a good proxy for the probability that a case dies due to VL even after treatment. Looking at the currently available data (Kala-azar Project, 1999) and discussions with experts, this probability was estimated as 5 per cent. The survival rate of case after treatment, was, therefore,

Probability of survival of a case under treatment = $1 - p_0 = 1 - 0.05 = 0.95$,
where, p_0 = probability that a case dies even after treatment = 0.05

Thus, Effectiveness of the program = Number of deaths averted
= (Number of cases detected) x $(1 - p_0)$

Outreach detection program = 16 x 0.95 = 15.2 deaths averted

Health facility based program = 170 x 0.95 = 161.5 deaths averted

It is important to note that these estimates of effectiveness were based on several assumptions and do not take into account all other factors that might have contributed to the aversion of deaths. This has already been discussed in Section 3.2 in Chapter III).

4.5 Cost Effectiveness Analysis

A cost effectiveness analysis was carried out to answer the primary research question, based on the costs and effectiveness estimates obtained above. Cost per effectiveness was calculated as total costs incurred by the program divided by total effectiveness of the program. This is the average cost of the program in terms of cost per case detected. The cost-effectiveness ratio for each program were obtained as follows:

Table 4.12 Cost effectiveness ratio of two alternative programs for VL case detection

Program	Costs (Rs.)	Effectiveness	Cost / Effectiveness	
Providers' Perspective				
		No. of cases detected (E_1)	**Rs.**	**US$**
Outreach detection program	135,200	16	8,450	124
Health facility based detection program	2,208,821	170	12,993	191
		No. of deaths averted (E_2)		
Outreach detection program	135,200	15.2	8,895	131
Health facility based detection program	2,208,821	161.5	13,677	200

Thus, outreach detection program seems more cost effective alternative intervention for the early case detection of visceral leishmaniasis in the study area both in terms of number of cases detected and number of deaths averted. The difference in cost effectiveness ratio (USD 67 per case detected) is substantial in the context of Nepal.

However, these are the average costs of each program and it may not be appropriate to conclude which of these two programs is more cost-effective based on average costs. The

strengths and weakness of this approach is discussed in the next chapter where the marginal concept of analysis is also given.

Since the largest component of total costs in health facility based detection program was the capital items (as discussed in Section 4.2.1), it was thought appropriate to analyze the cost-effectiveness ratio, excluding capital items of both the programs. Table 4.13 shows the analysis, which reveals that health facility based program becomes more cost-effective if capital items are not considered. This is because of the capital-intensive nature of the health facility based detection program.

Table 4.13 Cost effectiveness ratio of two alternative programs for VL case detection, after excluding the capital items

Program	Costs (Rs.)	Effectiveness	Cost / Effectiveness	
Providers' Perspective				
		No. of cases detected (E_1)	**Rs.**	**US$**
Outreach detection program	135,200	16	8,450	124
Health facility based detection program	900,443	170	5,296	78
		No. of deaths averted (E_2)		
Outreach detection program	135,200	15.2	8,895	131
Health facility based detection program	900,443	161.5	5,575	82

Note: There was no capital investment in outreach program. The cost data (Rs. 900,443) was obtained by subtracting the capital costs from the total costs of health facility based program. The total costs and its components are discussed in Section 4.2.1.

4.6 Translation of effectiveness into monetary term

An attempt was made to translate the effectiveness of the programs into monetary term, assuming that the program, by means of averting potential deaths, would result in potential life years saved. A value was attached to these life years by multiplying them with the present income of the cases. Age specific income data was obtained by interviewing the detected cases.

The value of potential life years saved was calculated using the formula and assumptions given on p. 31 in Chapter III. As the income data was of the current year, no discounting was needed to convert the future benefit to the present value. The probability of survival of the case after detection was considered to be 0.95 (for the same reasons described in Section 4.4 above) and potential limit to life was considered to be 58 years for both males and females. The value of potential life years saved are presented in Table 4.14.

Table 4.14 Value of potential life years saved by VL case detection programs

	Outreach detection program (n=27)	**Health facility based detection program (n=22)**
Total value of potential life years saved (in Rupees)	9,357,049	13,868,266
Total value of potential life years saved (in US Dollars)	137,301	203,496
Value of potential life years saved per case detected (in Rupees)	346,557	630,375
Value of potential life years saved per case detected (in US Dollars)	5,085	9,250

The average value of potential life years saved (value per case detected) was found to be USD 9250 in health facility based detection program and USD 5085 in outreach detection program. This result is different from earlier findings, as this places health facility based program in better position. This is largely due to the fact that the formula used to translate effectiveness into money term gives more weight to younger population. The interviewed cases detected by the outreach program were older than those detected by health facility based program. Moreover, as the formula simply gives more value for the group whose average income is higher, the higher value of potential life years saved in health facility based detection is also attributed to more average income in this group.

4.7 Sensitivity Analysis

The costs and effectiveness estimates thus obtained were based on several assumptions and variables the value of which might suffer from uncertainty. In order to incorporate these uncertainties into the estimates and to allow the readers to make their judgements on the results presented here, a sensitivity analysis was carried out. The variables which were considered to have influenced this uncertainty are:

1. Discount rate in cost function of health facility based detection
2. Probability of survival of a detected and subsequently treated case in effectiveness estimates.

Since choice of discount rate (10 per cent) in the analysis was dictated by several assumptions (see p. 36), uncertainty still exist as we do not know exactly if this is the rate that can reflect the individuals' or society's time preference. In view of this, costing of capital costs for health facility based detection program were done taking two more discount rates, 3 percent and 5 percent. The choice of these rates come from looking at past studies and also assuming some scenario. A 3 percent discount is preferred by many economists and health workers these days (Murray, 1996), as they argue that this discount rate gives a social time preference globally. Discounting by 5 percent would allow this study to be compared with several others (Drummond, 1997), which have in general taken 5 percent discount rate in their calculation. The following table shows how costs and cost-effectiveness ratio changed for health facility based detection program if we use different discount rates.

Table 4.15 Sensitivity Analysis with Discount Rate for Health Facility Based Program

Discount rate	Capital Costs (Rupees)	Total Costs (Rupees)	C/E_1 = Costs per case detected in Rs.	C/E_2 = Costs per death averted in Rs.
3 per cent	635,556	1,535,999	9,035 (USD 133)	9,511 (USD 140)
5 per cent	808,364	1,708,807	10,052 (USD 147)	10,581 (USD 155)
10 per cent	1,308,378	2,208,821	12,993 (USD 191)	13,677 (USD 200)

Note: The health facility based program detected 170 cases. The number of deaths averted by the program was 161.5.

Thus, we see that the costs of health facility based program is sensitive to the discount rate used to annualize the capital costs. With the discount rate of 3 per cent or less the health facility based program becomes comparable with the outreach program. This is because capital cost is the largest component of the total costs in health facility based program. In other words, health facility based program is capital intensive and thus different discount rate might affect the results differently.

Likewise, the probability of survival of a detected and subsequently treated case might be uncertain for different time and place. Although the value for the probability to calculate number of deaths averted used in the estimate was from the current epidemiological data, the country's case fatality rate in 1998 was about 1.24 per cent (MOH, 1998). Considering the complement (1-0.0124=0.9876) of this probability as the survival rate of detected and subsequently treated cases, the number of deaths averted would change to 15.8 and 167.9 respectively for outreach and health facility based detection programs from 15.2 and 161.5 (with CFR= 5%). This would change the cost per death averted for outreach program from USD 131 to USD 126 and that of health facility based program from USD 200 to USD 193. With the highest range of case fatality rate found in Nepal (13 percent) the effectiveness becomes USD 143 and USD 219 per death averted respectively for outreach and health facility based detection programs (Table 4.16). Thus, cost-effectiveness was found not so sensitive to probability of survival.

Table 4.16 Sensitivity Analysis with Probability of Survival

Probability of Survival = (1 – CFR)*	Programs	Total Costs (Rupees)	Number of Cases detected	Number of Deaths averted	Cost/death averted (Rs)	Cost/death averted (USD)
1 – 0.13	Outreach	135200	16	13.92	9712	143
	Health facility	2208821	170	147.9	14934	219
1 – 0.05	Outreach	135200	16	15.2	8895	131
	Health facility	2208821	170	161.5	13677	200
1- 0.0124	Outreach	135200	16	15.8	8556	126
	Health facility	2208821	170	167.9	13155	193

Note: CFR= Case fatality rate.

Source: Data used for calculation was obtained from MOH, 1998.