Original article

Cost analysis of insecticide spraying for malaria control in a terai district of eastern Nepal

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Abstract

Background: Malaria is one of the public health problems in Nepal. It is estimated that 25% of population of Nepal are infected by malaria at any time. Malaria control program was first initiated in 1954 with support of USAID through the Insect Born Disease Control Program. This program was changed into Malaria Eradication Program in 1958. The program was reverted to control program in 1978. **Objective:** The objective of this study was to estimate the cost of insecticide spraying from the provider's perspective in a Terai district of eastern Nepal. **Methods:** Morang District of eastern Terai was purposively selected. A pre-tested interview was used to collect data from program managers and government officers in the Malaria Control Program. The main categories of variables were manpower, insecticide, pump and others. **Results:** The cost for indoor residual spraying per person protected was calculated as Rs.24.70 (US$0.31). This cost was for one cycle and there were two cycles in a year. So the cost per year was Rs.49.40 (US$0.62). The cost per household was calculated as Rs. 129.56 (US$1.65) per cycle and Rs.259.12 and US$3.30 per year for residual spraying. **Conclusion:** In this cost analysis of indoor residual spraying, the cost per household per year was found Rs. 259.12 and US$3.30. The cost calculated per person protected per year was Rs. 49.40 and US$0.62. This analysis would be more complete if a comparative study of both costs and effectiveness of various vector control measures are undertaken in Nepal.

Keywords: malaria, cost, insecticide, spraying

Introduction

In 1950s Malaria known as "Aulo" in Nepali language was endemic in Nepal. It is estimated that 25% of population are infected by malaria at any given time[1]. It is highly prevalent in low land (Terai) of Nepal. Malaria control program was first initiated in 1954. It was supported by USAID through the Insect Born Disease Control Program. In 1958 this program was converted to Malaria Eradication Program. It was the first public health program of the country. The objective of the program was to eradicate malaria from the country within a limited time period. The objective of malaria eradication was not achieved due to many reasons and consequently eradication program was reverted to control program in 1978. The strategy to tackle to malaria was revised according to the WHO Global Malaria Control Strategy (GMCS) in 1993. The Role Back Malaria (RBM) initiative was launched in 1998. The strategic RBM program was carried out in 12 most malaria endemic districts of Nepal. Malaria Control program activities are going on in 65 districts of Nepal.

The objectives of malaria control program are to decrease malaria morbidity and mortality, control *P falciparum*, and involve community participation in malaria control[2]. The strategies

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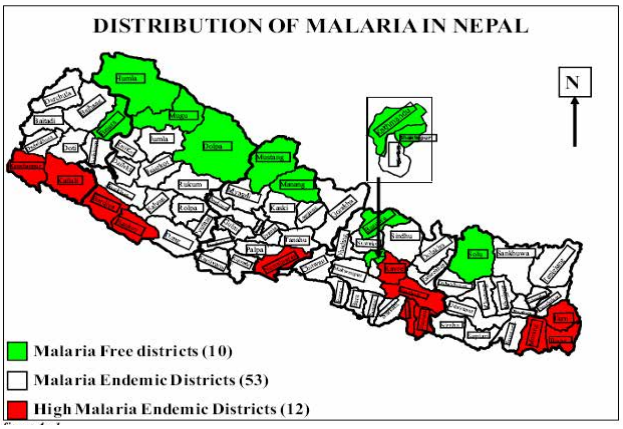
are; early diagnosis and prompt treatment, integrated vector management, outbreak management and epidemic control, accessibility for the treatment and strengthening referral system, and strengthening laboratory capacity in priority malaria endemic districts. Under the strategy of integrated vector management, there will be selective application of indoor residual spraying[2]. Global Fund is supporting for malaria control in 12 most malaria endemic districts[2]. Nevertheless, The World Health Organization states that there are 17 districts at high risk of Malaria[3]. According to WHO, 22.8 million people in Nepal live in malaria prone area. There are 4,219 reported malaria cases and out of that 1,391 (33%) are *P falciparum*. However, no confirmed deaths are reported due to malaria[3].

Economic evaluation is very much important to understand the benefits, sustainability and scalability of any intervention programs. A systematic analysis using different perspectives may be important to identify and understand best alternatives for any programs. A program



Methods

Morang District of Eastern Terai was purposively selected because it is a high malaria endemic area and there is a malaria control program running with the support of Global Fund.

A pre-tested interview was scheduled to collect the data from program managers and government officers in the Malaria control program. Total 6 interviews were done from different personnel of District Health Office, Morang.

The main categories of variables were manpower, insecticide, pump and others. All costs were estimated in Nepalese rupees and presented in USD too. An exchange rate of NR 78.35 per USD of Nepal Rastra Bank (central bank) on 20th August 2009 was used to calculate USD to NR and vice versa. .

There were 10 foremen hired to maintain the pumps, 2 distributors to distribute the insecticide and 40 spray-men to spray insecticide for 30 days. Supervision and monitoring was done by Monitoring and Evaluation Officer, District Public Health Administrator, Vector Control Officer, and two Malaria Inspectors. Total 18 villages were covered from 9 Village Development Committees for this indoor residual spraying. The total households covered were 6,870 and total population covered was 36,030. The cost per household spraying is calculated by dividing by the total households covered to the total cost and the cost per person protected is calculated dividing by the total population covered to the total cost. In many studies the cost is calculated per person protected and there are also studies in which the cost is calculated per household.

The quantity of insecticide is estimated per person 15 grams for malaria and 7.5 grams for Kala-azar. But the actual quantity may not be exactly 15 grams per person for malaria and 7.5 grams per household for Kalz-azar. In this study total population was 36,030 and if it is multiplied by 15 it will be 540.45 kg. but actual quantity spent on this program was 500 kg.

All the calculations in this study are done for one cycle. Only per household cost and per person protected cost is calculated for one year.

The respondents of this study were District Health Officer, Vector Control officer, Monitoring and Evaluation Officer of Malaria Control Program, Malaria Inspector, Account Officer and Store Keeper of Morang District Health Office.

Ethical clearance was obtained from Institutional Ethical Review Board of B.P. Koirala Institute of Health Sciences, Dharan, Nepal. Informed consent was obtained from the respondents.

Results

The cost for indoor residual spraying per person protected was calculated as Rs.24.70 and US$0.31. This cost was for one cycle and there were two cycles in a year. So the cost per year was Rs.49.40 and US$0.62. The cost per household was calculated as Rs.129.56 and US$1.65 per cycle and Rs.259.12 and US$3.30 per year for residual spraying.

Among the manpower, District Public Health Administrator, Vector Control Officer and Malaria Inspectors are regular staffs of District Public Health Office, Morang. Monitoring and Evaluation Officer is hired by Global Fund to look after the malaria control program in the district. The Foreman, Insecticide Distributor and Spray-man were hired for spraying purpose. A Spray-man sprayed five to six houses in a day. The total cost for manpower for one cycle spraying was Rs.425, 112.00 and US$5,425.81. Almost half (47.8 percent) of the budget was spent on manpower. The second highest expenditure category for indoor insecticide spraying was on insecticide. The total cost for insecticide was Rs. 285, 980.00 and US$3,650.00. The share of cost of insecticide was almost one third (32.1 percent). The expenditure for pump is also high. Its share for total cost is more than 11 percent. The functional life time of pump is assumed for 5 years. Less than 10 percent was spent on others category under which come transportation, stationery, training, repairing etc.

Table 1: Cost of insecticide spraying in Morang District

Cost category	**Units**	**Rate (Rs.)**	**Total (Rs.)**
(I) Manpower			
Foreman	300 man days	225.00	67,500.00
Insecticide Distributor	60 man days	200.00	12,000.00
Spray-man	1200 man days	225.00	270,000.00
Monitoring and Evaluation Officer	8 man days	1043.00	8,344.00
District Public Health Administrator	8 man days	1043.00	8,344.00
Vector Control officer	8 man days	1043.00	8,344.00
Malaria Inspector	60 man days	843.00	50,580.00
Manpower total			**425,112.00**
(II) Insecticide (Alpha-cypermethrin)	500 kg.	571.96(US$7.3)/kg	285,980.00
(III) Pump (Hudson X-pert)	40	24,750.00	*99,000.00
(IV) Others			
Snacks for training			8,000.00
Fuel			5,000.00
Pump repair			14,000.00
Transportation			15,000.00
Office goods			5,000.00
Other goods (stationery, globe, boot, soap, mask, apron etc.)			33,000.00
Others total			80,000.00
Grand Total			**890,092.00**
Per unit household and person cost			
Total Household covered	6,870	Per household cost	129.56
Total population covered	36,030	Per person cost	24.70

*The life of a pump is estimated about 5 years. There will be 2 cycles in a year. Thus there will be 10 cycles in 5 years. So the total cost is divided by 10 to calculate the real total cost of pump for one cycle spraying.

Discussion

A study done in highland of Kenya was found that the cost for indoor residual spraying per person protected was much less (US$0.86) than that of insecticide treated bed net (US$4.21). However, the economic cost for per person protected for residual spraying was a little higher (US$0.88) than the financial cost. It was almost 50 percent less (US$2.34) than that of financial cost for insecticide treated bed net. Nevertheless, the cost for insecticide treated bed net is still higher in comparison to indoor residual spraying[5].

It is reported in a study in southern Mozambique that economic cost per person protected per year using indoor residual spraying in rural area was higher (US$3.48) compared to the peri-urban area (US$2.16) excluding the cost of project management, monitoring and surveillance. The financial cost seems to be slightly higher compared to economic cost in both rural (US$3.86) and peri-urban areas (US$2.41)[6].

Similarly a study from northern Vietnam shows that the cost per person per year for household spraying was less (US$0.47) compared to the distribution of cost of impregnated bed net (US$0.90)[7].

Studies done in Nepal, India and Bangladesh do not show clear trend of cost of different intervention programs. A study done by B.P. Koirala Institute of Health Sciences, Dharan demonstrates that the cost per household was less (US$3.1) for indoor residual spraying compared to insecticide treated bed net (US$4.9) and ecological vector management (US$5.5)[8]. Whereas a study done by Institute of Medicine, Kathmandu is reported that the cost per house hold for insecticide treated bed net was cheaper (US$3.8) compared to ecological vector management (US$5.0) and indoor residual spraying (US$5.7)[8]. Thus this study does not give clear idea about which is least costly intervention. The study in Bangladesh also shows insecticide treated bed net as more economical (US$3.5/ household) compare to ecological vector management (US$9.3/ household) and indoor residual spraying (US$11.7/ household)[8]. The result of India was similar to the result of BPKIHS, Dharan. The cost per household was cheaper (US$2.4) compare to insecticide treated bed net (US$5.1) and ecological vector management (US$14.0)[8]. Most studies show that the costs for indoor residual spraying were cheaper for vector control than other intervention programs.

Conclusion

In this cost analysis of indoor residual spraying, the cost per household per year was found Rs.259.12 and US$3.30. The cost calculated per person protected per year was Rs.49.40 and US$0.62. The major cost for spraying was spent on manpower followed by insecticide and Pump. This study compares well with other studies in the region reporting US$3.1 to US$11.7 towards per household cost of IRS. Most of the study shows the cost of indoor residual spraying as cheaper for vector control compare to the distribution of insecticide treated bed net.

This analysis would be more complete if a comparative study of both costs and effectiveness of various vector control measures are undertaken in Nepal.

Acknowledgements

We are thankful to Dr. Beena Varghese, Dr. Harish Nair and Mr. Maulik Chokshi, Public Health Foundation of India for their assistance and guidance to conduct this study. We also thank the staffs of District Public Health Office, Morang for their support by giving valuable information.

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