CHAPTER – VII

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Good health is an important contributor to productivity and economic growth and an end in itself. In a poor country like India, where the only asset most people have, is their physical body, health assumes greater significance. A recent analysis of the World Bank, (May 2001) reveals that a hospitalized Indian spends more than half of his total expenditure on buying health care; more than 40 percent of the hospitalized people, borrow money or sell assets to cover medical expenses and 35 percent fall below the poverty line. It also suggests that out-of-pocket medical cost alone may push 2.2 percent of the population below the poverty line in one year.

The poor are more sensitive to the price of health care and also suffer a greater burden of disease than the non-poor; access to free or low-cost health care produces large increase in their consumption of health care. If this is the outcome of market failure, it requires government intervention in health services all the more. The right choice of interventions and proper level of provision of any public good require careful analysis of the health benefits in relation to the costs (World Bank 1993).

In the world as a whole, almost half the existing disease burden is from communicable diseases, nutritional disorders, and maternal and prenatal causes. It signifies the failure to control the communicable diseases. It is primarily due to inappropriate resource allocation by the States. When
governments pay for health care in addition to regulating it, they have further responsibility to provide value for money by ensuring that public resources go first to cost-effective public health and essential clinical services so as to buy the largest health gain possible (World Bank 1993).

One of the biggest issues in the current health scenario is the failure to control communicable diseases. Infection and parasitic diseases accounted for 34.6 percent of the total 269 million DALYs lost and 33 percent of 9.3 million deaths in 1998 (World Health Report 1999). India's burden of disease on account of communicable diseases is almost three times that of China and accounts for 23.3 percent of global DALYs (Communicable diseases) lost. Lymphatic filariasis is also one of the parasitic infections, mainly seen in southern and southeastern Asia, the Pacific and Eastern Africa (WHO 1992). The population exposed to the risk of filarial infection in India is 464 million. Nearly 50 percent of infected population is contributed by India alone to the Global disease burden. The acute and chronic diseases have a large socio-economic impact in the community (Ramaiah et al 1997, Gyapong et al 1996, Evans et al 1993, Ramu et al 1996, Ramaiah et al 2000, and Dreyer et al 1997). Krishnan (1996) points out that a single episode of hospitalization can account for between 20 and 60 percent of annual per capita income, with the proportion being even higher for poorer groups. This can lead to tremendous financial burden on poor households and indebtedness, sometimes resulting in liquidation of their assets.

Inequitable access to services is a major cause of persistent inequalities in health outcomes. The need to shift to a pro-poor service delivery content and structure place greater
emphasis on preventive rather than curative care was widely recognized after the Almati declaration of Health For All in 1978. The advent of low cost and effective strategy for communicable disease prevention is also considered essential for developing countries.

India has one of the lowest health budgets in the world. The total public expenditure on health is only 4.9 percent (0.9 % Public + 4 % Private) of GDP in 2002. Public expenditure on health has increased over the past decade. But, health is a labour – intensive sector, the bulk of this increase has been due to sharp increases in the wages of public health personnel, following the fifth pay commission recommendations in 1997. Nearly 90 percent of the total cost is shared by health personnel salaries and remaining 10 percent cost is spent on medical supplies (World Bank 2003 and India Health Report 2003). Cost information on health programme/control strategies alone can promote allocative efficiency (World Bank 1993). In the context of meagre allocation for public health sector and the consequent resource constraints faced by the various health care providing systems, economic evaluation, particularly, cost-effectiveness analysis assumes high significance, from both academic and policy perspectives. The lack of comparative field information on the costs and efficacies (benefits) of control strategies poses the constraint. Even to improve the efficiency of the existing programme, economic analysis remains the prerequisite (Ramu 2002). In this context, the CEA for disease control programmes has become very important. Thus, CEA helps the health planners and policy makers ensure the optimum benefits possible from the scarce resources at their disposal. The present study has, therefore, been carried out drawing upon the database created by
VCRC/ICMR from the DEC + IVER drug trial field study for filariasis control conducted in Villupuram district.

This study has used the secondary database of a project, sponsored by WHO / TDR / UNDP, entitled "Evaluation of impact of mass chemotherapy with DEC, IVER and combination of both (DEC +IVER) on transmission of Lymphatic Filariasis in Villupuram District" conducted by the VCRC / ICMR Pondicherry India. The choice of the district is justified on several counts. It is the 23rd and the fourth agrarian district in the state of Tamil Nadu. Agriculture is the predominant occupation of the population both in terms of income generation and employment. As per the Tamil Nadu Human Development Report, the per capita income of the district is below Rs.10,000. Life expectancy is 61 years and the literate rate of the district is 57 percent. The selected 15 study villages were located on both sides of the Tindivanam and Villupuram sector on the National Highway (NH 47) which links Chennai and Trichy. The study villages were spread over in the three blocks of Vikravandi, Vallam and Mailam. These 15 study villages were served by eight Primary Health Centres (PHC) for their common and minor ailments. The selected villages were classified into three blocks each of them consisting 5 villages, named via - A, B and C group. The enumerated population was 25882 in 5171 households, of which 13098 were males (51 %) and 12784 were females (49 %). The sex ratio was 1.1.02 and the family size was 5. The mf prevalence ranged from 7.1 to 26.6 % in the respective blocks. The average mf rate in each block was 13.2% 14.5% and 14.7% in the respective group. The chronic disease rate in these blocks was 12.96% 13.34% and 13.3% in A, B, and C groups respectively. Based on the morbidity survey by VCRC, hydrocele and
elephantiasis is a major public health problem in these study villages. It implies that the Villupuram district is highly endemic for filariasis (VCRC1994).

The principal tool of this programme is the annual / bi-annual mass chemotherapy with DEC, ivermectin and combination of both of the entire endemic community. This is the first time ivermatin was used at community level in India. Hence, as a safety measure, children under 15 kg body weights were excluded from treatment in the ivermectin arm. For comparison, they were excluded in DEC and combination arms also. And also excluded from treatment were pregnant women, lactating mothers and terminally ill health people. Several decades of research and the availability of new diagnostic and effective control strategies have led to the development of a global strategy to eliminate filariasis. However, most endemic countries are in the poorer regions of the world, often with meagre resources to tackle various health problems (Ramaiah et.al 2004).

Hence, mobilization of financial resources for filariasis control strategies might not be easy and requires a robust advocacy. Study on costs and efficacies (benefits) of filariasis control strategies, therefore, constitute an important component of advocacy. It could facilitate: (i) setting priorities and allocation of funds at district and national levels; (ii) continued support of existing donors; (iii) enlistment of new donors; and (iv) expansion of the programme. The aim of VCRC/ICMR was only to find out the efficacy (drug efficiency) of the three control strategies. They have not undertaken any economic analysis of the strategies. Further, comparative study on cost and efficacy of filariasis elimination programmes is
scarce in academic and policy circles. It is in this context, the present study has been undertaken.

The researcher has attempted an economic evaluation of the data available. The five fold objectives set for the present study went into the questions of assessing and analysing the provider’s cost of various activities of the different filariasis control strategies, to assessing and analysing the provider’s cost of resource inputs of the different filariasis control strategies, besides assessing and analysing the consumer cost (opportunity cost) of the control strategies. Also it attempted to study the various effectiveness indicators to assess the programmes’ effectiveness and, thereby work out the cost-effectiveness ratios of the three control strategies in order to identify the low-cost strategy for public health care system. The in-depth and close scrutiny of data helped the scholar to explore, the costs from both the provider and consumer perspectives. While the former, throws light on the actual financial burden of the state, the later highlights the inevitability of sacrifice (in terms of opportunity cost) on the part of community that benefits from the government activity.

In precise terms, the study has attempted to test five important hypotheses namely (i) there is no significant difference among the study villages in respect of per capita costs in their adoption of treatment strategies. (ii) There is no significant variation among the study villages in respect of the average amount of efficacy in the mf prevalence (E1) and average mf count (E2) achieved in their adoption of the three control strategies. (iii) All the chosen regressors (independent variables) make a significant contribution to the variations in efficacy E1 and E2 over all the study villages together, (iv) there exists
significant correlation between the per capita cost and efficacy E1 and E2 with regard to three different control strategies in the study villages and (v) all the three different control strategies involve the same amount of per capita cost for achieving a particular degree of efficacy. The other objective of the study is to find out whether three rounds of annual / bi-annual of MDA with DEC and ivermectin and two rounds of annual MDA with DEC + IVER could be adequate to achieve cost and effectiveness for lymphatic filariasis elimination. Therefore, an attempt is made to assess the efficacies of the control strategies from the cost perspective.

In order to identify the low cost option, the total programme implementation cost and per capita cost of each intervention were calculated. To find out the most expensive activity and predominant resource input of the programmes, the cost was estimated by both input and activity. Cost per mf case cured, percentage mf reduction after chemotherapy, cost per 1 percent mf prevalence reduction in the community, percentage of reduction in mean mf burden per person have been calculated for identifying the low cost and high effective control strategy. Descriptive statistical methods such as percentages and simple correlation analysis have been used, to get an idea of data structure and behaviour of certain variables such as the growth of cost, variations of cost in different villages, and multiple regression analysis has been used to identify those variables, which influence the efficacy achieved through treatment. The correlation co-efficient between the per capita cost and efficacy achieved in both the cases namely E1 and E2 have been computed and tested for their significance. The ANOVA has been applied to examine the significance of the difference between the
means of per capita cost between the villages and the average amount of efficacy achieved (E1 and E2). The sensitivity analysis has been carried out for cost minimization and cost projection was made to cover the total risk of population in India (4640 lakhs). Finally, the inferences have been drawn.

The total population of the study villages ranged from 739 - 3321. The predominant occupation of the villagers is agriculture and weaving. Most of the (70%) study population is residing in thatched houses and the type of house is one of the indicators for economic status. The average family size is 5, which is higher than the all India average family size 3.5. The mf rate ranged from 6.8% to 26.6% and the chronic disease (morbidity) rate from 7.12% to 20.59% in the study villages. This indicates that, the study villages are highly endemic prone for filariasis. The reported coverage of drug distribution ranged from 60–67 percentages in the respective three control strategies. The three rounds of treatment (Bi-annual and Annual) with DEC (SI) and IVER (SII) covered the total cohort population of 5181 and 4657 respectively. The annual combination therapy with DEC + IVER (SIII) covered the total cohort population of 3841. Perceived side reaction was reported by 10, 27 and 14 percentages of the study community in the respective strategies. This implied that the side reaction was high in SII followed by SIII and SI. The rate of side reaction is also an indication to assess the community acceptance and co-operation as higher rate of side reaction would reduce the coverage.

In order to assess the total cost of the control programmes, a prospective costing exercise was undertaken from the provider’s perspective. The cost of the programme was estimated by input and activity. It was found that, the labour
(health personnel) is the principal cost component accounting for the largest single portion of 55% of the TIC in the three strategies. Transport which accounts around 20 percent of the TIC, this was the second most important cost input. Labour and transport shared nearly 75 percent of the TIC, the remaining cost shared by other inputs such as drugs, supportive medicines, facilities, other supplies and capital cost. Drug distribution was the most expensive and predominant activity of the programme, which has accounted for 73 – 82 percentage of the TIC. In general, this cost is related to the frequency and the type of health personnel involved in the MDA (Michael et al 1996). The present analysis has shown that, SIII has emerged as a low cost option; the most expensive intervention has been SI, followed by SII. This implies that, the information of cost on input and activity of the programme can bring about better allocation of resources.

The per capita financial cost (absolute) of each programme was RS. 34 (0.9$), Rs.36 (0.93$) and Rs.24 (0.6$) in the respective control strategies. When compared with the PFC with all three strategies, the most costly approach was found to be S-II followed by SI and SIII. From this it may be concluded that, the intervention S-III has been the low-cost option assessing from a comparative angle. The ANOVA for the per capita cost of the three strategies has shown that the 'F' ratio is 1.837 with a corresponding 'P' value is greater than 0.05. It is thus found that there is no significant difference in the per capita costs of the three strategies. It assumes that all the study villages are equally treated with regard to the spending of money to provide the same degree or intensity of treatment to the endemic communities. Thus, the results validate the hypothesis that
there is no significant difference among the average per capita costs in the adoption of various strategies.

The risk of side-reaction is known to be important for the mass drug administration (Ottesen 1987). Most of the disease control studies have overlooked cost on the consumer time lost in different empirical settings. In this context, the indirect cost (consumer wage forgone due to side reaction) was estimated. The mean age of affected population due to side reaction was 30–32 years in the three interventions. It is found that, the wage lost (opportunity cost) was high in S-II, bearing a cost of Rs. 1, 02, 240 (2622$), followed by other two strategies. This implies that, the higher rate of side reactions would be reduced by the community co-operation. The incremental cost (Marginal) analysis of the control strategies indicated that, the coverage was not an influencing factor of TIC of programme. The assumption that coverage only influences the costs because more drugs are needed might not be realistic: as treating more people takes more time (Stolk 1998). The programme design and re-course of treatment in the control programmes are the deciding factors of the cost (Michael et al 1996).

The relationship between the cost and health outcome is an important variable of interest. There are many factors, which would influence the amount of efficacy achieved. For this, the multiple regression analysis has been carried out separately for the types of efficacies achieved (E1 and E2) with cost of different inputs. It implies that 56% (R² 0.560) of the variation in the (E1) is due to the influence of the inputs (regressors) and 45% (R² 0.451) changes in E2. Hence the hypotheses that all the chosen regressions make a significant
contribution to the variations in E1 and E2 over all the study
villages taken together is accepted.

It is important to examine the efficacies E1 and E2
which are same individually under three control regimens
adopted in the study villages. For this purpose, the “ANOVA” was
adopted to test the null hypotheses. It has shown that, the E1 ‘F’
ratio is 0.392 and it is less than unit (one) that is, it is not
significant. In the case of E2, the ‘F’ ratio is found to be 2.889
with corresponding ‘P’ value which is greater than 0.05, the ‘F’
statistic is not significant. It implies that there is no significant
difference between the average amounts E1 and E2 achieved
under the control strategies. Hence, the null hypothesis is
accepted.

The cost-effectiveness analysis has been carried-out
to find out the most effective low-cost option for filariasis
control. It has been found that the SIII was the most effective and
low-cost option in terms of cost and efficacy. The least effective
was SII and the next best alternative was SI in the context of
efficacies. In the case of SI and SII, the per capita cost remains
almost equal whereas for SIII, it is almost half. At the same time,
the number of mf cases cured is the highest for SIII and it is
almost 150 percent of the number of mf cases cured under SI
and SII individually. Similarly, if we look at the per capita cost of
mf cases cured, it is more or less equal under SI and SII but it is
only 40 percent under SIII. The reduction of mf prevalence is very
high (65.3%) under SIII compared with SI and SII. Therefore, it
may be concluded that the SIII is far better than SI and SII in all
aspects. The hypotheses that all the three strategies involve the
same amount of per capita cost to achieve a particular degree of
efficacy could not be accepted and the fact emerges that SIII
proves superior to SI and SII with regard to cost and effectiveness.

Correlation between the cost and efficacy of the control strategies is another important variable of interest. It shows that there is no correlation between cost and efficacy in the SI and SII. In the case of SIII, there is a high positive correlation between cost and efficacy. Hence, the hypotheses which state that there exists significant correlation between the per capita cost and efficacies E1 and E2 individually with regard to three control interventions is only partially accepted. That is, this hypothesis holds good only with regard to SIII, but it does not hold well under the other two strategies SI and SII.

Finally, the incremental cost effectiveness ratios were calculated. From this analysis, it has been found that, it is less expensive per unit gain in effectiveness to move from strategy II to strategy I than to choose strategy III instead of SI. It may therefore, be concluded that the combination therapy option (DEC + IVER), would be more cost-effective in an endemic area.

Many uncertainties play a role in the estimation of programme cost. In view of that, sensitivity analysis has been carried out for cost minimization. It focuses mainly on the programme design of the control interventions. The design and structure of programme have the greatest impact on the cost of control programmes. A simple drug delivery mechanism is essential for operational feasibility at macro level. Estimation of programme cost at the PHC level with the existing infrastructure showed that the additional financial cost required for each round of mass drug administration (MDA) was Rs.47277, Rs.55347, and Rs.72138 to cover a eligible population of 23766 (76%) in the
respective three control strategies. The estimated PHC level per capita financial cost (PFC) of three control programmes was Rs.1.99, Rs.2.3 and Rs.3.00 respectively.

Based on the above findings cost projection with PHC level per capita financial cost for the three control strategies for the total risk population in India was attempted for 4640 Lakhs for the five years was RS.5139 (million), Rs.5910 (million) and Rs.7709 (million) for SI, SII, and SIII respectively. Estimation of present value of future cost of the programme for subsequent rounds of MDA for five years showed that each PHC would require an additional financial allocation of Rs.2.63 lakhs for S-I, Rs.3.02 lakhs for S-II and Rs.3.94 lakhs for S-III. With the estimated PFC of three strategies at PHC level, the revised strategies are demanding the mean cost of Rs.1028 (million), Rs.1182 (million) and Rs.1542 (million) respectively per annum to cover the entire population at risk in India. **This is only less than 2% of the annual economic loss due to filariasis in India.** By adopting any one of the control programme at an average cost of Rs 1252 million per annum, we can save the annual economic loss due lymphatic filariasis over a period of time.

The Economic burden of filarial disease in terms of disability adjusted life years (DALYs) lost in India has been estimated to be 2.8 and 1.6 lakhs for men and women respectively (World Bank 1993). The annual economic loss due to lymphatic filariasis in India was estimated to be Rs.6750 crores (1.5 billion$). Annually, about Rs.12 crores are spent to protect 460 lakh population under the NFCP through anti-larval measures and detection-cum-treatment of micro-filaria carrier in urban areas (WHO 1994, Sharma et al 1995). The per capita
recurring cost of this programme is Rs.2.60 per year (estimated cost of Rs.14.37 for five years). Analysis of revised cost-effective annual combination strategy (DEC +IVER) showed that the per capita financial cost for five annual rounds would be only Rs.16.50. This covers the entire population of 4640 lakhs at risk of filarial infection in India. This analysis thus provides insight for state’s active measures for the control of filariasis in India in future.

To analyse the per capita cost of different intervention – strategies, a pilot study (Rao et al 1980), carried out between 1966 – 1975 to control brugain filariasis showed that one round of selective DEC treatment was low cost option (Rs.11.70) when compared to one round of weekly doses of mass DEC treatment for 12 weeks (Rs.13.34), 36 rounds of HCH residual spray (Rs.83.34), its supplementation with selective treatment (Rs.86.47), and its supplementation with mass chemotherapy (Rs.89.03). Another study showed that the per capita cost of DEC medicated salt programme to control bancroftian filariasis in Lakshadweep was Rs.7.43 (present value) (Rao et al 1981). The cost to screen an individual for selective DEC treatment was reported to be Rs 3.00 (present value) (Sharma et al 1986). The available cost effectiveness data shows that the DEC medicated salt programme is more cost effective as the cost (present value) per 1 percent reduction in mf prevalence is the lowest (Rs.0.09) when compared to the rest. The application of 36 rounds of HCH spray is the least cost – effective intervention (Rs.1.10).

A recent study has showed that the per capita cost of mass annual single dose DEC programme in Tamil Nadu was Rs.7.29 (present value) for five years but it did not analyse the
issue of effectiveness of the programme (Krishnamoorthy et al 2000). A study from Tanzania has shown the cost – effectiveness of four different mass DEC chemotherapy regimes – (i) standard dose, (ii) semi-annual single dose, (iii) low monthly dose and (iv) DEC – medicated salt in reducing mf prevalence at the community level. The per capita costs of these strategies were Rs.85.5, Rs.31.5 Rs.36.0, and Rs.130.5 (Present value) respectively. The study concludes that the most expensive and most effective strategy in reducing community mf prevalence over two years was DEC salt programme, followed in order of cost by the standard, low monthly and semi-annual DEC strategies. The most cost-effective strategy was the low monthly DEC treatment (Michael et al 1996). However, these studies suffer from certain inherent methodological limitations arising from lack of uniformity in costing, efficacies, and implementation at different points of time.

In view of the above-mentioned constraints, the present cost–effectiveness analysis of current programmes SI, SII, and SIII has been carried out systematically. The cost minimization analysis of cost effective combination therapy SIII (DEC +IVER) showed that the PFC for five annual rounds would be only Rs.16.50 to cover entire population (4640 lakhs) at the risk of filariasis in India. The two rounds of annual treatment with DEC + IVER, even with less coverage (60%) and higher amount of community acceptance, substantially and significantly reduce mf prevalence (65%) and mf intensity (98%) in communities. The present study has brought out that, more than two rounds of annual therapy (probably 3 –5 years) with DEC + IVER can produce optimum results. However, higher coverage
and compliance are essential to achieve optimum reduction from the filarial infection.

It may, therefore, be concluded that the present CEA for control strategies can be used as a guideline for planning and programme implementation. This emphasises need for continued significant role of the state in the health sector. It advocates in securing equity, efficiency, quality, regulating and adequate finance available for the population.

POLICY DIRECTIONS

The study of “Cost - effectiveness analysis of control strategies for lymphatic filariasis in Villupuram district of Tamil Nadu”, leads to certain policy directions. It is hoped that these would help policy makers and disease control managers for constructing control interventions for vector borne diseases, in the following ways.

The research brings to focus an important fact, that resource allocation for disease control programmes should be based on the economic burden of the diseases (EBD). Further, the study reiterates the importance of economic evaluation like CA, CEA and CBA for health care programs in the modern economic world. The results assert the view that state intervention is essential for controlling communicable diseases, particularly vector borne diseases. The researcher is inclined to suggest achieving still higher coverage and greater compliance rate (Drug consumption rate) at the time of MDA (Mass Drug Administration for Filariasis). Further, it is hoped that the present research would prompt policy makers to realise the importance of Rapid Assessment Procedure (RAP) for mapping of filariasis in both rural and urban areas. Besides,
this research intends to invite the attention of policy makers towards the imperative need to undertake the following tasks: (i) periodic mass blood examination for rural and urban for eliminating the mf prevalence from the community, (ii) rigorous annual Mass Drug Administration (MDA) for filariasis at least for five consequent years, (iii) establishment of Filariasis Control Unit (FCU) in rural areas and (iv) pre and post evaluation of MDA for further level modification of filariasis control programmes.

Next, the researcher suggests that a visionary approach with a long-term perspective is needed on the part of the government. This would mean certain additional tasks to be assumed by them such as, periodic training programme with the current clinical epidemiology of diseases and IT for supportive health care personnel. They should also be exposed to proper environmental management programmes for the control of mosquitoes (VECTOR) breeding places. Further, it would be helpful if training programmes are organized for community volunteers on aetiology of the vector bone acute, chronic disease and community directed treatment (ComDT) for filariasis.

Next, with a view to strengthening the administrative structure of the present health service delivery, the study suggests establishment of Village Health Regulatory Authority (VHRA) for the control of communicable diseases. The researcher is of the view that such an organization would go a long way in enhancement of community participation and co-operation. This would mean the creation of new local institution, say a Community Health Awareness Cell (CHAC),
which would inculcate a sense of responsibility on the part of people to benefit most from the health services.

ISSUES FOR FUTURE RESEARCH

From the angle of providing academic support to policy issues covering health sector, the researcher is of the view that in future, the following research issues might be explored. First, it is necessary to assess the economic national burden of communicable and non-communicable diseases (EBD) in the rural and urban areas. Second, the CBA may be undertaken for the alternative health systems in vogue, such as Allopathy and Homeopathy, from a comparative perspective.

Further, there is a prevailing general view that the quality of public health system is diminishing rapidly and resource allocation for the health sector is also very meagre. In this context, the researcher suggests that probing into issues such as, economic and health consequences of user fees, telemedicine, out sourcing, willingness to pay (WTP) for primary / secondary health care and WTP for rural health insurance in the public health care system, which would provide guidelines for the policy makers, to help redesign the health delivery programmes, from multiple angles.

Besides, the researcher wishes to record his view that a periodic economic evaluation of national level (vertical) disease control programmes (like, malaria, leprosy, cancer, TB, AIDS etc) is of heightened importance for policy makers. As income is one of the factors determining health consumption, the researcher suggests that empirical studies on treatment - seeking behaviour of different income communities in rural and urban areas would help in a large measure, the health sector
reforms in future. Further, studies on economic viability of public-private mix in the health sector would be timely and appropriate to decide the pace and complexion of reforms in future. There is a widely prevalent opinion that the cost of private health care is increasing and there is no regulatory mechanism for private health sector. This view deserves further exploration through research. Finally, the researcher recommends that studies are required on the assessment of consumer and provider's cost for different diseases, in public and private health systems.