CHAPTER – III

Review of Literature and Methodology
CHAPTER - III

REVIEW OF LITERATURE AND METHODOLOGY

III.1 THEORY OF HEALTH ECONOMICS: THE ROLE OF STATE AND MARKET IN HEALTH SERVICES

Health economics is now a central tool for those who plan, provide, receive, or pay for health services (Paul Miller 2001). The application of the conventional tools of economics in health sector has raised many issues giving rise to a host of controversies. One such controversy relates to the relative efficiency of the state and the market in the production and distribution of health care services (Kethineni 1991).

The neo – classical school is divided over the merits of market and state in achieving the objectives of efficiency in the allocation of health care resources as well as equity in their distribution. The production and distribution of goods and services in an ideal competitive market economy is governed by the rational actions of individuals in their capacity as consumers and producers. The market functions as a giant auction system wherein the consumers bid for various goods and services and the producers, in turn, sell them to the highest bidder. Market exchange is based on the two fundamental principles of exclusion and revealed preferences (Allan 1971). Exchange between consumers and producers can occur only when there is exclusive title to the property to be exchanged and property rights can exist only if it is possible to exclude an individual from the consumption of a good or service for which he does not pay. And given the possibility of exclusion, the consumers have no escape
from bidding for various goods and services, thereby revealing their preferences to the producers. Under the pressure of competition, the producers are compelled to produce the goods preferred by the consumers. Utility maximising consumers and profit maximising producers interact through the price mechanism for a given distribution of income. An allocation is defined as efficient or Pareto – optimal when reallocation can improve the welfare of any individual without adversely affecting the welfare of any other (Davis and Kamien 1977). The Pareto – optimal allocation of resources can be achieved only when certain pre – requisites of perfect competition are satisfied. Three of them which are relevant for the present discussion are (i) absence of public goods and externalities, (ii) consumer sovereignty and (iii) information asymmetry.

III.1.1. Public Goods and Externalities

Health care is a heterogeneous product consisting of a variety of services provided by health personnel, hospitals, public health programmes, etc, each of them having its own distinctive economic characteristics. Broadly they can be classified into two categories: public health services which include service like clean water supply, safe disposal of sewage and solid waste, preventing new infections, clearing of central sources of infection, etc, and confer their benefits generally without any discrimination to all the inhabitants of a relevant area; and personal health services which comprise services provided by health institutions, health personnel, etc, directly to the specified individuals (Kethineni 1991).
Paternalists' contend that the joint consumption of public health services deviate from the precepts of the ideal market economy making it inefficient in the allocation of resources. For instance, public health services like the draining of malaria breeding swamps, spraying campaign and other vector control programmes provide the most convincing example of public goods, which are not individually packageable. Once a necessary investment is made on them, they become a part of the environment yielding benefits to all inhabitants irrespective of their payment or non-payment. For instance, as a result of a spraying campaign against flies and mosquitoes, all residents of a concerned area derive benefits equally from the reduced number of insects and the consequent reduction in the probability of contracting diseases carried by them (Weisbrod 1961). In such cases, the individual's consumption is a function of total supply, not of the quantity he/she buys. Hence, there is no incentive for any single individual to make a voluntary contribution.

On the contrary, an individual has an economic incentive to hide his/her real preferences with the hope that other individuals would reveal their preferences and pay for the services from which he, in any case, cannot be excluded. With all consumers acting with the same economic rationale, there is

---

* The terms 'Paternalists' and 'Liberals' were used to denote the supporters of the state and the market respectively by Charles M Allan, The Theory of Taxation Penguin, Harmondsworth, 1971),pp 124-25. Kenneth J Arrow, Charles M Allan, Charles W Baird, R A Musgrave, H E Klarman, Burtan A, Weisbrod, et al, advocate the Paternalist position while the two main proponents of the Liberal stand are J M Buchan and S Lee who belong to the radical liberalism (Liberatarianism) of Milton Friedman’s variety.
no effective demand. The auction system is frustrated by the 'free riders' as they refuse to send signals to the producers about what goods are to be produced and there is no one to whom the producer can sell his goods. Hence, provision of services through the market is considered unlikely, i.e., the breakdown of the market system. Even if all the beneficiaries of collective consumption goods reveal their true preferences, the market mechanism cannot operate efficiently in the provision of public goods.

The consumers, reflecting their subjective utility, will have to pay different prices for the same goods and it is incompatible with the uniform price rule of competitive market model. The application of exclusion to joint consumption goods, even if possible, is inefficient because it costs no additional resources to the society in enabling a potential consumer to utilize a public good. Hence, from the angle of promoting the welfare of the potential users, the joint consumption goods should be provided at zero prices, which is possible, only under state intervention (Musgrave 1971).

In addition, there are substantial externalities in all public health programmes like water purification, sewage treatment and eradication of communicable diseases from which outsiders benefit from the diminished chance of getting infected by the group undertaking such campaigns. The divergence between social and private benefits results in under-provision of the goods in the private market. In the case of goods with externality, the individual counting his own benefits would undervalue the product thereby leading to a level of consumption that is less than what is socially optimum. The only feasible
solution to the problem of harmonizing social and private interests is state intervention (Klarman 1963).

Liberals did not oppose state intervention in the provision of public health services. The sharp division of opinion between Liberals and Paternalists arises mainly over organization of personal health care services. It is argued that the prevention or cure of communicable diseases gives rise to the problem of externalities even in the case of personal health care services. For instance, vaccination against communicable diseases is a personal health service in the sense that it is directly administrated to a specific person. Here, consumption is rival but benefits are not completely internalized. Since a vaccinated person is no longer a source of infection to others, the latter would also benefit from the vaccination. In such cases, the private marginal benefits are less than the social marginal benefits resulting in less than social optimum consumption level. Hence, Paternalists argue that it would be advantageous for society to encourage vaccination, the cost being borne by the State (Klarman 1963). They also assert that a person not immunized against an infectious disease risks not only his or her health but also that of others. In an ideal market, there should be a price he or she should pay to others for risking his or her health or alternatively a price that others should pay to induce him or her to undergo immunization process. As no such price mechanism exists in practice, it is considered a case of market failure in facilitating demand for and supply of goods (Arrow 1973).

III.1.2. Consumer sovereignty

The concept of consumer sovereignty is based on two assumptions; the individual’s interpretation of his/her own
welfare is one that counts and the choices reveal the individual's preferences. The paternalist case for public provision of personal health care services rests mainly on the limitations of this concept with reference to health care. They believe that uncertainty in the incidence of illness and recovery from it and the ignorance of the consumer in the health care market render this concept invalid (Kethineni 1991).

Since demand for health care, except in preventive aspects, is irregular and unpredictable and yields utility only in the event of illness, an individual's consumption in such cases is considered involuntary. When the market entry is involuntary, consumer's preferences are not revealed in the usual way because he or she is not free to choose a combination of goods and services that give him or her maximum utility out of his or her income. In a normal market situation, the consumer gives his or her utility function and budget constraint will choose between different goods in such a way that marginal utility per unit of money is equal in all expenditure directions. But curative services yield utility only in the event of illness and, when that happens; the medical expenditure is made on the advice of the physician reducing his budget constraint.

In other words, instead of balancing the marginal utility of unit of money spent on health services against that of all other expenditure uses, the consumer buys whatever medical care is warranted by his condition and sets about his usual task of maximizing the utility from whatever income is left after medical expenditure (Baird 1969). In addition, contrary to the assumption of relative independence of demand from the influence of suppliers, doctors have considerable influence over the quantity demanded in the medical care market. A patient is
often ignorant of his or her need and the type and quantity of service required. Consequently, the quantity demanded reflects not the consumer's utility function but the doctor's preference for a reasonable income, which depends upon the nature and quantity of services supplied, and the price he charges.

In a fee-based service system, the income maximizing doctor tends to expand the volume of services provided, particularly those which yield high income (Mills 1983). Product uncertainty or uncertainty in the outcome of treatment further weakens the position of the consumer in the medical care market. Recovery from disease is as uncertain as its incidence. The lack of consumer experience at least in the case of severe illness adds to unpredictability in the medical care market. Moreover, the degree of uncertainty is not the same on the two sides of the transaction (patient and physician) and it renders the consumer vulnerable in the medical care market (Arrow 1973). Since it is impossible to apply equi-marginal rule in determining the optimum consumption pattern, and the consumer is ignorant about both the quantity and the quality of care he is in need of, the concept of consumer sovereignty makes little sense in the medical care market. To cope with the problems of ignorance and vulnerability of consumers, Paternalists demand state intervention in the form of free medical care financed from public revenues.

III.1.3. Information asymmetry

Liberals contend that rational solution to the problem is not abolition of the market system in favour of state provision but removing ignorance itself by encouraging informational services. They believe that private informational
services would arise in the market economy to cope with the problem of decision-making in the health care market (Allan 1971). But paternalists point out that since commodity information is itself a public good, which can be used over and again without being consumed, its provision is always sub-optimal in the market system. Moreover, if a consumer knows how to evaluate a given piece of information, he knows the information itself and the question of buying it do not arise. The problem of information in the health care market is compounded by the fact that the commodity purchased is basically information in the form of skilled medical care (Arrow 1973).

III.1.4. Equity

Apart from market inefficiency in the allocation of resources, equity considerations in the distribution of health care also form the main basis of the Paternalist support for free provision of health care services (Grand 1982). State intervention is considered necessary to reduce inequalities in the access to health care and income distribution in the long run. Poverty represents a specific social situation, which affects all aspects of life including health, illness and related behaviour. It is a major causative factor in disease in underdeveloped countries. Disease, in turn, imposes an economic burden on individuals by way of medical cost and loss of productive time (income), which further worsens the conditions of poor. Poverty and disease are thus said to form a vicious circle, “Men and women were sick because they were poor; they became poorer because they were sick, and sicker because they were poor” (Winslow 1951). Under these conditions, Paternalists argue, that health care, if left to market forces, would aggravate the problem of poverty and its
social costs. Since an individual's earnings are basically a function of his productive capacity which is acquired through investment in education, training, health, etc, they argue that the free provision of health care and other social services to the poor would contribute not only to immediate enhancement of their well-being but also to the redistribution of income in their favour. Thus, the Paternalist's demand for the free provision of health care by the state is based on the market failure in achieving the objectives of both efficiency and equity in the organization of health care services.

World Development Report 1993 has therefore emphasized three rationales for government action for health sector. First, the poor cannot always afford health care that would improve their productivity and well-being. Publicly financed investment in the health of the poor can reduce poverty or alleviate its consequences. Second, some actions that promote health are pure public goods or create large positive externalities. Private markets would not produce them at all or would produce too little and third, market failures in health care and health insurance mean that government intervention can raise welfare by improving how those markets function. The flow chart 2 summarises the issues discussed above.
Chart 2

ROLE OF STATE AND MARKET IN HEALTH SERVICES:
FLOW CHART

Health Services Provision By

STATE

- Equity in Health Services
- Free Provision (Subsidized)
- Public Goods
- Positive Externalities
- Social Marginal Benefits
- Higher Consumption and Better Health Status
- Higher Investment in Health Sector

MARTKET

- In equity in Health Service
- (Fee Based and Quality Oriented System)
- Absence of Public Goods
- Negative Externalities
- Private Marginal Benefits
- Low Consumption and Low Health Status
- Market Failure

Cost-Effective Intervention Strategies

Universalized Provision of Health Services to Society
III.1.5. Need for cost analysis

State has a responsibility to spend well; to get “Value for money” whenever it devotes public resources to health. This means allocating resources so as to obtain the most improvement in health per rupees spent. Investing in the health of poor is an economically efficient and politically acceptable strategy for reducing poverty and alleviating its socio economic consequences, as World Development Report 1990 emphasized. The poor are more sensitive to the price of medical care and also suffer a greater burden of disease than the non-poor, access to free or low-cost care can produce large increase in their consumption of health care.

The inclusion of health care as part of a strategy for combating poverty justifies public financing of “essential” clinical or individual services. These are highly cost-effective service that would greatly improve the health of poor. Since poor people typically cannot buy such care for themselves, there is a straightforward case for public finance. Public health measures and essential care together constitute a package of health care that might justifiably be financed by general revenues. To provide equitable access for the poor, to address problems of adverse selection, and to contain cost is an important task of the state. As such the proper level of provision of any public good requires careful analysis of the health benefits in relation to the costs (World Bank 1993).

III.1.6 Cost Analysis (CA) of Disease Control Programmes

Collection and analysis of data on programme costs is a powerful decision making tool for the health programme managers when it comes to resource allocation and planning
for any disease control programme (WHO 1994). Cost, in an economist's view, refers to the sacrifice (of benefits) made when a given resource is consumed in implementing an intervention. Therefore, it is important not to restrain one's attention to expenditures (financial) alone, but also to consider their resources, the consumption of which is not adequately reflected in market prices (Opportunity cost). Diverted staff time, volunteer's time and donated equipments are of this category (Krishnamoorthy 1994).

The application of economic evaluation methods to parasitic control programmes is increasing and becoming a central tool for assessing the programmes (Prescott and Warford 1983; Prost and Prescott 1984; Korte et al 1986; Guyatt and Evans 1992; Prescott 1993; Hammer 1993; Guyatt et al; 1993 and 1995). Cost information is required to calculate the cost effectiveness of the different options, but little comparative information on the costs of control strategies under field conditions is available (Evans et al 1993). Ideally the evaluation of economic efficiency requires information on both external and internal efficiencies of a programme (Rosenfield et al 1984 and Prescott 1993). Even to improve the efficiency of the existing programmes, economic analysis remains to be a prerequisite (Kaewsonthi and Harding 1989).

Attempts to identify and value the costs of health services should at least recognize that there are costs incurred by both providers and consumers, in terms of the resources they expend in delivering or consuming health care (Mills and Lee 1984). The costs incurred by the consumers and providers are referred to as social costs. It is also possible that some externalities associated with its production or consumption
imposes costs to third parties not directly involved in either the production or the purchase of the product. Policy makers and planners contribution can be considered as such externalities, which are difficult to quantify.

A number of costing models such as ingredients and adaptation approaches are available including the ones for disease specific programmes (Creese and Parker 1994; Drummond and Stoddard 1985; Mills 1993; Kaewsonthi 1989; Shaw 1991; WHO 1989 and Haddix and Shapper 1996). Also a number of notable problems have been reported at cost analysis of alternative disease control options (Bunndy and Guyatt 1992). The principal problems of current practices in health sector have been grouped under different headings. They are, Omissions and under estimation, mishandling of the capital/recurrent issues, absence of shadow pricing, inadequate treatment of joint cost allocation, lack of cost models and failure to derive and effectively examine unit costs.

Omissions (Guyatt and Tanner 1994) and underestimations are frequent in costing of health care programme. In particular, many cost estimates do not include development and training costs, expatriates salaries, wastage costs of items etc., (Bundy and Guyatt 1992). While the true cost of an activity is considered, which is the value of the attention endeavor that might have been undertaken with the same resources (Warrner and Luce 1982), and it is also necessary to identify the important and typical items that do not have a monetary cost attached.

Cost analysis of schistosomiasis has shown that developing realistic cost analysis of schistosomiasis involves
multifactorial approach, which recognizes that health is only partially a clinical problem. This, in turn, requires expertise beyond that of traditional health workers. Involvement of economists and epidemiologist is obvious, though rarely fulfilled, but the central importance of reliable socio economic data have been consistently overlooked (Bunndy and Guyatt 1992). Another study in schistosomiasis has shown, that the itemized cost data for each strategy is given in the cost menu is designed to be simple enough for field use by programme managers, while flexible enough to incorporate some of the more complex issues of costing. Each item is categorized under the headings: personnel, vehicle, consumable and capital items. The units for each item are identified and the unit cost is further classified under the activity classes of supervision, training, screening and treatment (Guyatt et al 1994).

However, they are often cost - description studies, rarely making a comparison of alternative strategies or directly linking cost with effectiveness measure (Mills 1985). Studies on costing for bancroftian filariasis control programme are currently not available. However, Some studies, in India, have attempted to assess the per capita cost of mass drug administration, but the details of costing methodology has not been given (Rao et al 1980, Sharma et al 1986, and Rao et al 1981).

Recently, costing of mass drug distribution programme has been carried out at district level for the control of filariasis by the department of public health and preventive medicine of Tamil Nadu in Cuddalore district. Different inputs for different activities were estimated and the per capita economic cost was found to be Rs. 1. 99. However, with the
existing health care system (through which the programme was implemented) per capita financial cost is estimated at Rs.1.06 (excluding opportunity cost) (Krishnamoorthy et al 2000). Though the cost of drug distribution is low, this report is silent on the percentage of actual consumption of drug by the community, as it has not done evaluation of the programme. Inadequacy of data on programme cost is a major set back to the policy makers for the construction of appropriate control strategies for any disease. Therefore, it is necessary to take adequate care on the entire aforesaid problem while working out scientifically the costing methodology in an endemic country like India.

Today, many governments spend much on sophisticated hospital services of low cost- effectiveness and little on essential public health and clinical services, particularly for communicable diseases. It is primarily due to inappropriate resource allocation. When government pay for health care in addition to regulating it, they have a 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).

A study in India shows that, low priority and under-funding for disease control programmes persist in spite of an increase in morbidity and mortality due to malaria, filaria, tuberculosis, blindness, diarrohea, immunisable diseases, AIDS etc. The declining trend and under-funding by most of States has been a major reason for the non-functioning of public hospitals. Consequently, there has been mushrooming of private hospitals and nursing homes, which are largely un-regulated (Duggal et al 1995). 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. The impact of ill health on well-being and financial outcomes depends not only on whether people are sick, but also on whether they obtain appropriate preventive, or curative care. Timely preventive care can ameliorate adverse health outcomes and financial consequences in the future. Effective treatment for sick/infected persons can reduce the length of time they are ill and the income losses associated with morbidity and premature mortality (Sundar and Sharma 2002).

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 and 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 effective strategy for communicable disease prevention is also essential for developing countries. The role of government is vital in health policy making in bringing about the significant social change and the strategy for state provision of health programmes in view of the emerging new challenges (Mahmud 2004).

Amartya Sen points out despite the lack of unanimity over the state's role in health care, there seems to be agreement that universal access and equity in a poor country are dependent on the state's provision, or financial support, of basic health care for the poor. Protecting the vulnerable is considered a core function of the state; and publicly financed health care is an important tool in poverty alleviation (Dreze and Sen 2005).
A recent study by Monica Das Gupta in (2005) has stated that, in India, policies have focused largely on Medical services. Public health services and the implementation of basic public health regulations and vector control have been neglected. When public health system falters, people pay a high price in terms of illness, debility and if full-fledged outbreaks occur the economic cost can be very large. It has also been stated that communicable diseases remain the major source of ill health in India.

The foregoing theoretical discussion has brought to focus that, there is a need for a significant role of the state in the health sector. It advocates a more focused government engagement in securing equity, efficiency, and quality objectives through more effective policy making (steering), regulating, contracting and ensuring through adequate financing arrangements and cost effectiveness evaluation so that the scheme could cover the whole population. The rationale of cost effectiveness analysis is to accomplish optimum results from government intervention programmes in view of resource constraints. The focal theme of the thesis is therefore set to assess the economic cost of control strategies in assessing the problems of health programmes with particular reference to lymphatic filariasis.

III.2 EMPIRICAL STUDIES

Drawing guidelines from the theoretical context, a few major directions of empirical research by prominent authors and institutions may now be reviewed. Broadly, studies in health economics fall under five groups: studies on, (1) socio-economic research on diseases, (2) cost analysis (CA)
of different control programmes, (3) cost - benefit analysis (CBA) of different control interventions, (4) cost-effectiveness analysis (CEA) of different control options and (5) health care financing. This section confines itself to a critical review of works most relevant to the present study.

III.2.1 STUDIES ON SOCIO - ECONOMIC RESEARCH ON FILARIASIS:

III.2.1.A Social Impact

Six diseases-via Malaria, Schistosomiasis, Filariasis, Trypanosomiasis, Leishmaniasis and Leprosy were identified by WHO in collaboration with UNDP and World Bank as eradicable disease. The available literature on the impact of filariasis brings to focus a revealing fact that the full spectrum of social and economic effects of lymphatic filariasis has not yet been systematically assessed or quantified. However it is clear that, the filariasis is almost entirely a disease of poor communities (WHO 1992). This necessitates assessing the policy efforts from the medical, social and economic analysis. One should also assess whether they are in tune with the required action, in terms of coverage and intensity. The various empirical studies, which obtain are mostly partial in approach rather than holistic.

Whether the priority accorded to filariasis in various places around the World is appropriate to its impact is unclear, because the full spectrum of its effects - medical, social and economic - have not been assessed systematically (Evans et al., 1993). Regarding the social impact, that literature that is available deals solely with chronic disease where reports suggest that local perceptions of filariasis vary not only from place to place, but also with the same
communities. In general, the degree of stigma seems to be associated with severity and visibility of the disease (Evans et al. 1993).

Studies in endemic communities in French Polynesia, Malaysia, Philippines and the United Republic of Tanzania have shown that people are aware of the chronic manifestations but the cause for disease is very poorly understood (WHO, 1992). A study from Philippines (Lu et al., 1988), observed that people with hydrocele were the subject of considerable teasing though otherwise they could lead normal lives. On the other hand, women with labial enlargement and lowered uterus were presumed to be promiscuous. In fact, the shame associated with chronic disease led to poor reporting to the local clinics. Similarly, Kessel (1957) also reported earlier that women with elephantiasis in Polynesia were considered undesirable as wives. It was also observed in Polynesia that people suffering from filariasis retired to the background because they were the laughing stock of the community (Keasel 1957). A similar situation prevailed in an area in Tanzania, where people afflicted with hydrocele led restricted social life due to the fact that they were considered socially unacceptable and very shameful (Muhondowa 1983).

The impact of filariasis on sexual activity and fertility does not seem to be of great social significance among affected populations. Lu et al. (1988) reported that filariasis was not seen as affecting sexual intercourse, except by younger respondents, while inconclusive results were obtained in Kenya (Wijers and Kaleli 1984). Recent study in Brazil has shown, that men with urogenital filariasis report a wide spectrum of disease - related problems including marriages devoid of
physical and sexual intimacy, a "conspiracy of silence" that includes both patient and his partner, profound shame and suicidal thoughts among men with lymph scrotum, a condition that causes leaking of lymph fluid through the scrotal skin that soils the clothing, painful intercourse for the partners of men with lymphoedema of the penis and recourse to homosexual relations both by heterosexual male patients and their female partners (Dreyer et al., 1997).

In India, the social impact of the disease is least understood. It is known that many filarial patients remain unmarried because of social rejection (VCRC 1993). There is inadequate understanding of the social stigma and psychological effects resulting from chronic disease, but more severely affected people are socially restricted as well as physically burdened (WHO, 1992). Studies from rural Tamil Nadu highlighted people's awareness of the cause and transmission of filariasis poor, but their ideas on prevention have no basis, which is evident from descriptive as well as qualitative data (Ramaiah et al. 1996). In an another paper, Ramaiah has shown that, the opinion of most patients and others about filariasis hamper their domestic and economic activities and stated that those who were affected are less productive. For example, the disease impairs occupational work, movement, domestic and economic activities of about 70% of the affected individuals (Ramaiah et al. 1997).

**III.2.1.B. Economic Impact**

**III.2.1.B.1. Indirect Economic Loss**

The belief that both chronic and acute diseases affect labour productivity and income, has been expressed in
the literature that are currently available. The literature that is available fails to quantify the reduction in income and the mechanisms by which any reductions occur (Evans et al., 1993). Many of them believe that late stage chronic disease reduces people's productive capacity which is based on the observation that people with large hydrocele and with advanced elephantiasis are often confined to their homes (Kessel 1957, Wijers 1977, Wegesa et al. 1979 and Muhondowa 1983). However, documentary evidence of the extent and nature of any loss of income and production is difficult to find (Andreano and Helminiak 1988). A complicating factor is that the prevalence of filarial symptoms increases with age, peaking in the most productive part of life (Evans et al., 1993). It has also been observed by another study in Tanzania that people afflicted with hydrocele change from more productive to less productive work for example from fishing to farming (Muhondowa, 1983).

The evidence on the economic impact of acute disease is similarly scanty. The records of 600 rubber tappers who worked in the year in 1950 in Malaysia rubber plantations were studied by Kessel in 1957. He reported a total of 150 acute attacks, leading to a total of 450 lost workdays. This would certainly have resulted in loss of income to the tappers, but may not have reduced the plantation's output. The results of a recent study from Tamil Nadu, has identified that chronic disease stage of lymphatic filariasis had adverse impact on the labour productivity of the weavers in organized sector. It was found to be 27% less than that of the normal individuals (Ramu et al. 1996). In another study in Ghana, an estimation of the indirect economic loss due to disability related to chronic filarial disease has revealed that among 4.1% and 20% of
potential female and male forces 10% and 60% disablement were reported respectively on a daily basis (Gyapong et al 1996).

Surgical cost and hospitalization for reduction of hydrocele may be another mechanism by which chronic disease could reduce income and thereby production losses (Wijers, 1977). Attempts to crudely quantify the economic impact of acute filarial attacks have been made from India and Indonesia recently (WHO 1992). The following was reported from India. During 1990, in Pondicherry (Dicroftian filariasis endemic areas), with a population 372000 and disease rate of 11.5% (in working age class only 5, the total number of working days lost was estimated to be 323205 in a year and considering the minimum wages, the annual economic loss was estimated to be Rs.77,56,913 (US$ 387845). Similar study estimated the annual economic loss in Kerala (Brugian filariasis endemic area, population: 435000 disease rate (9.6%) was Rs. 38,54,466 (US$ 19,27,23) in a year (WHO, 1992, Sabesan et al., 1992). In a recent study in Tamil Nadu during the acute episode both male and female patients spent significantly less time than the normal individuals (Ramaiah et al., 1998). Murray in 1994 has estimated the Disability Adjusted Life Years (DALY) lost due to lymphatic filariasis in Global situation was 845000 years.

The available empirical studies on indirect economic loss due to filariasis, indicates that, the indirect economic loss (wage foregone and productivity loss) is higher than the direct economic loss. The later stage of clinical manifestation of filariasis will lead the constant disability to
human population and it is also additional burden on the public health system.

**III.2.1.B.2. Direct Economic Loss**

Evans emphasized the need for quantity of the economic cost (direct + indirect cost) of filariasis to set priorities within the health system and attract resources to control the disease (Evans et al., 1993). Costs estimates, though disturbing, failed to attract the funds or attention of the planners for the control of the disease (Ramaiah et al. 1998). Evidence of serious economic loss due to onchocerciasis in parts of West Africa (Remme and Zongo 1989) attracted the World attention, leading to planning and successful implementation of effective control programmes. Similar evidence is lacking for lymphatic filariasis (Andreano and Helminiak 1988) which may be one reason for neglecting the control of the disease.

Recent study in India has shown that, the cost on acute attacks and the patients who consulted a doctor and paid for treatment incurred an expenditure of Rs. 32.11 (US$ 0.91) (Range 5.00 - 1000) per episode (Ramaiah et al. 1998). Similar study on treatment cost to individuals with chronic filariasis patients, the mean expenditure of Rs. 72 (US$ 2.1; range Rs 0 - 1360 (US$ 39.0)) per annum (Ramaiah et al 1998). The annual economic loss caused by lymphatic filariasis in India has been conservatively estimated at US$ 1.5 billion (WHO 1997). The disease is estimated to be responsible for the loss of about 0.63% of per capita GNP in India (Ramaiah et al 2000). The literature and empirical evidences clearly indicates that filariasis is a serious socio-economic problem in India. It
implies that an appropriate cost effective control strategy for lymphatic filariasis is essential.

III.2.2. STUDIES ON COST - BENEFIT ANALYSIS (CBA)

Cost - benefit analysis (CBA) is potentially a broad form of economic evaluation, although, in practice, the range of costs and benefits investigated is often restricted by measurement difficulties. For example CBAs often restrict themselves to the narrowly defined economic changes brought about by treatments and programmes, such as changes in health care costs and the productive output of patients (or those carrying for them) (Drummond et al., 1987). Cost - benefit analysis is difficult to apply in health sector because of the problems of placing a value of benefits (Mills 1994).

Cost - benefit analysis and cost - effectiveness analysis are not to be confused; under CBA, benefits are assessed in monetary value, while in CEA effectiveness are assessed in physical units. Moreover, there have been recent developments in the technique of cost - effectiveness analysis that bring it rather closer to cost - benefit analysis. Thus, it is important to be clear on the distinctions within the family of techniques. The components CBA and CEA, include (Mills and Drummond1987), direct costs referring to the direct resource costs of implementing an activity (C1), indirect costs denoting loss of production associated with being involved in the activity e.g. as a patient (C2), intangible costs signifying (e.g. pain and anxiety caused by treatment) (C3). Regarding outputs, the model comprises health effects such as reduction in morbidity and mortality (E), utility weighted health effects like those measured by (QALY) quality adjusted life years (U), besides
including associated economic benefits (B), direct benefits, savings in treatment or prevention costs (B1), indirect benefits (gain in production because of improved health, or directly because of project-related income-generating activities) (B2) and intangible benefits (the value of health per se) (B3).

Cost analysis includes C1 and some times C2 as well. Cost-effectiveness analysis in its simplest form (the most frequently found developing country studies) divides C1 (sometimes plus C2) by E. However, studies in Europe and United States now routinely subtract B1 and B2 from C1 and C2, producing net costs before dividing by E. Cost-utility analysis is another method which is calculated in the same way as cost-effectiveness analysis, except that E is replaced by U. Cost-benefit analysis ideally subtracts all the C components from all the B components; or divides the Bs by Cs. However, no completely satisfactory means exists for putting a monetary value on B3. Thus, most studies consider only C1 and C2, and B1 and B2. It can clearly be seen that in this form, cost-benefit analysis adds nothing to the more complex version of cost-effectiveness analysis (Mills 1994).

No cost-benefit ratio for filariasis control as on date has been obtained. The only study dealing directly with economic aspects of filariasis (Basu 1971a, and Ramaiah et al 2004) makes estimates of the annual output lost in India due to the disease, but the calculations were based on a large number of assumptions about the extent of disability and marginal product of labor. This implies that, the CBA study in health sector is a debatable issue.
III.2.3. STUDIES ON COST - EFFECTIVENESS ANALYSIS

One observes that in assessing the health care delivery systems, cost-effectiveness analysis (CEA), has grown in the past few years (Ramu 2002). CEA can be a powerful tool for choosing between different disease controls interventions. Resources for health sector in the economy are scarce. Resources are finite whereas the potential demand for health care is infinite.

While, CBA has certain inherent issues, still being debated in methodology, the attention of any policy-oriented research is turning towards CEA. The World Bank (1993) and World Health Organization propose using CEA as a tool of select health care programmes for public Financing, constrained by limited resources.

Cost-effectiveness analysis is the most powerful tool available to assess the effectiveness of health programmes, to monitor and improve the efficiency of ongoing programmes and help in designing better programmes based on the outcomes of using this tool in other programmes (WHO 1994). The five steps calculation of cost-effectiveness analysis for a programme, involves, defining the programme's objectives, identifying the possible ways of achieving these objectives, identifying and measuring the costs of each option, identifying and measuring the effectiveness of each option and calculating the cost-effectiveness of each option and interpreting the results.

There are two relevant concepts of efficiency to be borne in mind. The first is "technical efficiency" - how does a given health care programme work? Is the service effective in
75% of cases or 95%? - The second concept is that of "allocative efficiency". Are we choosing the best allocation of resources among possible health delivery system? Should we spend more on preventing new infections or on treating cases? (Foster 1997). Under the CEA approach, effectiveness measures are stated in terms of health outcomes, such as years of life gained, days of morbidity saved or percentage reduction in premature mortality rate or disease incidence and percentage of reduction in the infection (Ramu 2002). In another study, Foster (1997) has shown that, the health outcomes are, cases prevented, deaths averted, year of healthy life lost or more recently 'Disability Adjusted Life Years (DALYs)'. The per capita cost of different interventions for malaria control in Nepal is one the measures used for cost effectiveness analysis (Mills 1992).

"Cost effectiveness" in drug application is wide ranging (Doubilet, Weinstein, Mcneil 1986). Cost-effectiveness analysis intends to brings out whether a treatment or intervention is cost effective or not. There should be agreement as to the way the term cost effectiveness is operationalised. This would facilitate a meaningful interpretation of claims that an intervention is cost effective.

Doubilet, Weinstein, and Mcneil (1986) suggest that, in medical applications, the term 'cost effectiveness' should be used when an intervention provides a benefit at an acceptable cost. Within this framework, they identify four criteria for calling an intervention cost effective. These criteria are less costly and least effective, more effective and more costly, with the added benefit worth the added cost, less effective and less costly, with
the added benefit of the alternative not worth the added cost and cost saving with an equal or better outcome.

Cost-effectiveness analysis of health sector interventions was first applied in the 1960s based on methods developed to analyse military investments (Klarman et al., 1968). Since 1970, the number of published studies using cost-effectiveness has been steadily rising reflecting a growing concern for the appropriate use of scarce health sector resources (Elixhauser et al 1993). Initially, most cost-effectiveness studies reported results using indicators such as the cost per case diagnosed and treated of a particular disease or the cost per fully immunized child. These studies have used more general measures of health outcome. With more widespread reporting of results in terms of costs per Quality-Adjusted Life Year (QALY) or the other general health measures, comparisons of the cost-effectiveness of interventions targeting different health problems have become possible. League tables of the cost-effectiveness of different interventions are a natural consequence (Torrance et al., 1984, Williams., 1985, Allen et al., 1989, Schulman et al., 1991, Drummond et al., 1993, and Jamison et al, 1993).

The valuation of outcomes from medical intervention and the rankings from cost-effectiveness analysis were then subject to extensive public review through a series of town meetings. The rank list of interventions from this process can then be used for selecting the interventions that Medicaid will finance in the state, which plans to fund (in the order of the rank list) each intervention maximally until the budget runs out. This sectoral application of cost-effectiveness is now being implemented (Kitazber 1993).
The *World Development Report* 1993 proposes that cost-effectiveness analysis be used to determine the package of services covered by insurance schemes and to inform health research priorities. In the issue of the Bulletin, Bobadilla et al (1994) provide details on the method and rationale for selection and of interventions and their quantities in the proposed package. In brief, estimates of the current burden of disease are combined with a cost-effectiveness rank list of interventions, to derive packages of service that will purchase the largest improvement in health as measured by DALYs.


The accepted standard for reporting the results of cost-effectiveness studies is to provide information on the average cost per unit of health output (such as a DALY) at one level of production. Average cost equals the sum of general or infrastructure fixed costs, programme-specific fixed costs, and variable costs divided by total output (Murray et al 1994).
External efficiency relates to the question of whether the control of a particular disease is worthwhile in relation to the economic impact of other health and development concerns. Internal efficiency, on the other hand, addresses the narrower question of the relative cost effectiveness of available options for intervention. Thus cost effectiveness analysis has the potential for facilitating the efficient design of control projects by identifying the most cost-efficient method among available options (Prescott 1993).

Control options for lymphatic filariasis are diverse and range from chemotherapy to vector control by the application of insecticides, polystyrene beads and biocides (WHO 1994, Ottensen and Ramachandran 1995). A study by Rao et al (1980) of seven different control techniques applied to a group of villages in Kerala. Cases prevented and costs were calculated for each technique, and best ranking was achieved by the technique of indoor spraying, which cost$ 11.79 per case year prevented. Three of the seven techniques were found totally ineffective.

A study of a mass chemotherapy experiment in Kenya reported a cost of only $ 5.65 per case-year prevented, though in this instance, the disease was bancroftian rather than brugian filariasis (Wijers and Kaleli 1984).

The majority of the filariasis studies did not yield cost-effectiveness estimates for control programmes. The information that they contained about the effects of the disease on health related mostly to prevalence rates and disability
rates. Widely varying impressions about the importance of the disease are conveyed, ranging from dramatic (Brengues 1973) to trivial (Wijers 1977). In another study, it has been suggested that DEC applied, as an additive to common table/cooking salt is equally effective as a control agent and may have the advantage of easy delivery and reduced costs (WHO 1994, Ottesen and Ramachandran 1995).

Despite these advances, the problem of optimal programme design continues to present a major constraint to the wide application of chemotherapy as an intervention measure. In particular, the MDA received some attention from the policy maker (WHO 1994 and Chodukewitz 1995). Although mass chemotherapy is recognized as a safe and affordable form of helminth control, which is immediately effective in reducing both morbidity and transmission, the design of more effective and cost effective methods of drug delivery still remains a challenging research area (Guyatt et al 1993). Mass treatment is more cost – effective than selective treatment (treatment of individual screening) in high prevalence areas and at observed prices (Warren et al 1993). No study so far addressed the cost of deploying the various chemotherapy alternatives. Until such costs are integrated with programme effectiveness, the affordability and cost effectiveness of delivering filariasis chemotherapy to endemic communities will remain uncertain (Michael et al 1996).

A study from Tanzania has shown that, the four different mass DEC chemotherapy regimens (i) standard dose, (ii) semi - annual single dose, (iii) low monthly dose, (iv) DEC -
medicated salt - in reducing microfilarial (mf) prevalence at the community level. Costs were estimated for each intervention in relation to both ingredient and activity, by the derivation and use of detailed itemized cost menus. The study concludes, that the expensive and most effective strategy in reducing community mf prevalence over two years was DEC salt intervention, followed in order of costs 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).

The review of literature and empirical evidences on socio economic impact of tropical diseases including filariasis clearly shows the need for costing and cost - effectiveness analysis, which are essential for developing and or re-planning appropriate treatment strategies for control of parasitic diseases. Many studies have examined the efficacy of different dose regimens of DEC and Ivermectin both singly in various combinations, in different parts of the World (WHO 1994, Meyrowitch et al 1996 a and b, Wu - chun cao et al1997, Ottesen et al 1997, Ottesen et al 1999, Ramaiah et al 2000b, and Das et al, 2001a).

It is therefore necessary to identify the low-cost (affordable) and highly effective control strategies for diseases to ensure maximum benefits possible from the scarce resources at their disposal. The CEA can be used as a guideline for the planners and programme managers to undertake disease control strategies at micro/macro levels. The above review thus provides the perspective for drawing up specific
study of the cost effectiveness of filariasis control programmes, which is scanty even at the global level.

III.3. OBJECTIVES

The researcher sets before himself the following objectives for the purpose of present study.

1. To assess and analyse the provider’s cost of various activities of the three filariasis control strategies.

2. To assess and analyse the provider’s cost of resource inputs of the three filariasis control strategies.*

3. To assess and analyse the consumer cost (opportunity cost) of the control strategies.

4. To study the various effectiveness indicators so as to assess the programme effectiveness.

5. To work out the cost – effectiveness ratios of the three control strategies and find out the low-cost strategy for the public health care system.

* *(S1) Bi - Annual and annual mass chemotherapy with single dose of Diethylcarbamazine (DEC) (6 mg/kg body weight)

(SII) Bi - Annual and annual mass chemotherapy with single dose of Ivermectin (IVER) (400 mcg/kg body weight).

(SIII) Annual mass chemotherapy with combination of both (DEC : IVER) (IVER 200 mcg/kg + DEC 6 mg/kg body weight).
III.4. HYPOTHESES

The adoption of suitable treatment strategies will be affected by a number of factors, of which the most common and justifiable are the environmental and hygienic conditions prevailing in the study villages. Further, it indicates that the educational and social status of the people in those villages may be causative in determining the successes of the control strategies. All the factors identified above, are likely to have an impact upon the cost of treatment and hence one may surmise that the per capita treatment cost may show significant variations among the selected villages. So the hypothesis formulated is,

1. There is no significant difference among the study villages in the adoption of the treatment strategies in respect of the per capita costs.

The outcome of the treatment, or in other words the efficacy of the treatment introduced is bound to vary from village to village in the study area and apart from the existing environmental conditions, the type of control strategy adopted may also have an impact on the efficacy. Therefore, the hypothesis towards this is formulated as,

2. There is no significant variation among the study villages in respect of the average degrees of efficacy in the mf prevalence (E1) and average mf count (E2) achieved in the adoption of the three control strategies.

The efficacy achieved is taken to be the dependent variable. The inputs, personnel cost (Cost1), transport cost (Cost2), other supplies cost (Cost3), facilities cost (Cost4), capital
cost (Cost5), drug cost (Cost6) and supportive medicine cost (Cost7), contribute to the efficacy. These constitute the regressors in the statistical model. To examine which regressors make a significant contribution, the regression co-efficients are tested for their significance. Hence the hypothesis in this direction is formulated as,

3. All the chosen regressors (independent variables) make a significant contribution to the variations in efficacy E1 and E2 over all the study villages together.

It is a common phenomenon that the per capita cost is one of the major determinants of the degree of efficacy achieved; hence a significant correlation between these two can be expected. To test this relationship for its significance, the following hypothesis is formulated as,

4. There exists significance correlation between the per capita cost and efficacy E1 and E2 with regard to the three different control strategies in the study villages.

In the control of the infection, three different strategies are adopted and it is quite possible that for the same amount of per capita cost for treatment under the three control strategies, there may arise significant variations in the amount of efficacy achieved. Hence, it is necessary to examine whether, the variations in the efficacy differ significantly for the same amount of the per capita cost under three control strategies. This leads to the following hypothesis to be put to test.

5. All the three different control strategies involve the same amount of per capita cost for achieving a particular degree of efficacy.
III.5. METHODOLOGY

III.5.1. Source of data

The period of the study covered is 1993-2000. However, the data for the cost of control programmes correspond to the Mass Drug Administration (MDA) period, 1994-1998. The data on cost have been collected from the records of staff (Health Personnel) movement register, drug uses register, field hand book for other supplies and logbook for transport utilization. The pre and post efficacy data, base line information on demographic, socio economic status of the population and health condition of the community have been collected from annual reports and papers published by VCRC/ICMR Pondicherry from 1993-2000. The present researcher could gain personal experience in the field survey that facilitated the creation of database by the centre, as he was a Health Economist participating in the exercise during the period of 1993 – 2000. However, the data lent scope for still further research from the policy perspective and the present researcher chose to prosecute the study in the direction of cost effectiveness analysis*.

*The secondary database used in the study is the outcome of a project, sponsored by WHO / TDR/ UNDP, entitled "Evaluation of impact of mass chemotherapy with DEC, Ivermectin (IVER) and combination of both (DEC + IVER) on transmission of lymphatic filiasis" was conducted by the Vector Control Research Centre (VCRC) Pondicherry India. The objectives include evaluation of mass chemotherapy with DEC, IVER and both (DEC + IVER) on (i) Transmission (ii) microfilaraemia (mf) (iii) incidence of acute disease and (iv) prevalence of chronic disease. The study covered a population of 25882 in 15 endemic villages of Villupuram District in Tamil Nadu. The 15 study villages were divided into three groups, each group consisting of 5 villages viz., A, B and C. The allocation of villages to the groups was such that the overall prevalence of disease was largely uniform and shared similar epidemiological factors (VCRC 1993). The base line data on the transmission intensity prevalence of microfilaraemia (mf), morbidity rate (MR) and incidence of acute adenolymphangitis (ADL) of the target population were collected with reference to the period prior to the mass drug administration (MDA). The data pertaining to the different inputs used Labour (Health Personnel), Medicine, Transport and other supplies) for different programme activities were recorded separately.
From the secondary data, one could reach certain broad results on cost and efficacy of the three intervention strategies. For the first time in India, ivermectin was used at community level to control/eliminate filarial infection. Nevertheless, comparative study on cost and efficacy of filariasis control programme even at global level is scanty. Using the secondary data available, the present researcher has attempted to make an in-depth analysis of cost effectiveness of intervention programmes. The present study has used two efficacies of control strategies: the mf prevalence and average mf count. The kinds of efficacy achieved are designated as E1 and E2 respectively. The costs of surveillance and drug distribution were compiled. The variable cost (VC) of the different inputs and activities was calculated with the prevailing market price of 1997. And the 2003 price was also calculated with the help of consumer price index (Economic Survey 2003-2004). The design of the programme is given in the footnote.

The present study compares the results of the three intervention strategies of (i) biannual and annual mass chemotherapy with single dose of DEC (6 mg/kg body weight), (ii) biannual and annual and annual mass chemotherapy with single dose of IVER (400 mcg/kg body weight), and (iii) annual mass chemotherapy with combination of both (DEC + IVER) (IVER 200 mcg/kg + DEC 6 mg/kg body weight). These interventions, designated hence forth as strategies, I II, III were implemented in three endemic groups viz A, B and C respectively. For the first time in India, ivermectin was used at community level to eliminate filarial infection. 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 the DEC and combination arms also. Pregnant women, lactating mothers and seriously ill people were also excluded for treatment from 1994 to 1998. The effect of different cycles of mass treatment on infection in the population was evaluated by comparing the prevalence and mean intensity of microfilaraemia between pre and post periods of three control interventions. Mf surveys were conducted in all study villages about 1 week prior to each mass treatment. In each village and each survey mf survey, the 7 percent of the total households were randomly selected and all members were blood sampled. About 60 mm$^3$ of blood was collected, between 20.00 and 24.00 hours, from each person by finger pricking and prepared into three separate smears of 20 mm$^3$ each on clean slides (Sasa 1976). Next day morning, the blood smears were processed and the mf prevalence, mean intensity of mf and positive cases was recorded (Ramuliah et al 2002). Comparison of results between pre and post chemotherapy indices is expected to give the efficacy of these control strategies.
III.5.2. Statistical tools

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 etc. Multiple regression analysis has been used to identify those variables, which influence the efficacy, achieved through treatment.

The correlation coefficient 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 analysis of variance technique has been applied to examine the significance of the difference between the means, (i) of per capita treatment cost between the different villages and (ii) the average amount of efficacy achieved, in the study of two types of efficacies (E1 and E2). Further, based on the research level costing (Micro), the cost minimization analysis (CMA) (Macro) has been carried out for PHC. In the estimation of programme per capita financial cost at the PHC level, cost projection has been made for five years to cover the entire population at risk of filarial infection in India.

III.6. LIMITATION

In carrying out the multiple regression analysis to identify the regressors that influence the regessents E1 and E2 separately, the members and the different strategies of treatment were pooled together, so that the application of multiple regression analysis was viable. The possibility of taking the individual efficacies of a chosen random sample of individuals from each study village would facilitate carrying out regression analysis for each treatment strategy. But the limitation of the
study is its reliance entirely on the secondary data, which do not contain the detailed information required.

### III.7. EPIDEMIOLOGICAL AND DEMOGRAPHIC INDICATORS

The present research centers on cost analysis and its efficacy. From database provided by VCRC/ICMR, the scholar could compute table 3.3 with the details of certain indicators, which could be accommodated in the analysis of cost effectiveness to be taken up later. The base line data on epidemiological and demographic indicators are important to calculate the cost effectiveness of each strategy. The total treated population is necessary for unit cost calculation. And the rate of side reaction is important for opportunity cost estimation. The pre chemotherapy data on infection, morbidity and intensity are necessary for efficacy assessment. The coverage (treated population) ranges from 60 to 69 percentages in the three control strategies. Based on the mf prevalence and morbidity rate, it implies that the study villages are highly endemic for filariasis.

#### TABLE 3.1. BASE LINE EPIDEMIOLOGICAL AND DEMOGRAPHIC INDICATORS

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Strtey.I*</th>
<th>Strtey.II</th>
<th>Strtey.III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Households</td>
<td>1972</td>
<td>1705</td>
<td>1494</td>
</tr>
<tr>
<td>Total Population</td>
<td>9889</td>
<td>8527</td>
<td>7467</td>
</tr>
<tr>
<td>Target Population</td>
<td>7774</td>
<td>6819</td>
<td>6384</td>
</tr>
<tr>
<td>Treated Population</td>
<td>5181</td>
<td>4657</td>
<td>3841</td>
</tr>
<tr>
<td>Coverage (%)</td>
<td>66.65</td>
<td>68.29</td>
<td>60.16</td>
</tr>
<tr>
<td>Compliance (%)</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>SR.rate (%)</td>
<td>4.97</td>
<td>9.15</td>
<td>6.71</td>
</tr>
<tr>
<td>Mf Prévalence (%)</td>
<td>13.2</td>
<td>14.5</td>
<td>14.7</td>
</tr>
<tr>
<td>Disease rate (%)</td>
<td>12.96</td>
<td>13.34</td>
<td>13.30</td>
</tr>
<tr>
<td>Av.mf count</td>
<td>140</td>
<td>87</td>
<td>72</td>
</tr>
</tbody>
</table>

*Source: VCRC 1997-1998

*Strategy
III.8. DESCRIPTION OF PROGRAMME ACTIVITIES

The researcher had in-depth discussion with the scientists of VCRC/ICMR for the programme activities and mode of implementation. Based on the personal interview with the scientists, the researcher identified the following principal activities of the programme: a) Information, Education and Communication (IEC) for the study communities (Social Mobilization), b) Mass Drug Administration (MDA), c) Monitoring, recording and management of side reactions due to mass drug administration (Side reaction management). All these have much significance from the perspective of in-depth economic studies, with policy implications. Detailed information on programme activities is necessary for cost estimation, CEA, cost minimization and cost projection analysis for future. Each one of the activities is explained in the passages, which follow. The researcher reckoned these costs in his computation. The rationale and the significance of these costs are spelt out here.

III.8.1. Health Education (Social Mobilization)

Information Education and Communication (IEC) are the three important components for the success of any health programme. Health education focuses on learning. The goal of health education is to help people learn to help themselves to solve health related problems (William 1996). Inadequate communication between the community and health services is a major bottleneck in any disease control programmes (Barnett 1996). In the filariasis control programme by VCRC, the IEC was done to educate the people about the disease, to inform them about the control strategy and its outcome and finally to ensure their co-operation for the programme.
IEC for these control interventions was done in three stages, in the first stage, street dramas were performed by native folk art artists who were trained by VCRC. These dramas were based on mythological stories dramatized with dialogues containing information about filariasis, its implications on health and necessity of consuming the tablets that were to be administered to them by VCRC health workers. In the second stage, popular films were screened. This was, interspersed with slide shows on the life-cycle of the parasite, transmission and progression of diseases with various clinical manifestations, its socio-economic impact on individuals and community that were shown in the villages. In the last stage, these audio-visual programmes were supplemented with the health workers establishing personal contact with the villagers one week prior to mass chemotherapy and to clear doubts and questions regarding the disease and the programme. The above said IEC programmes were carried out by a team of four staff - a health worker with effective public speaking capacity, an electrician and two helpers under the guidance of public health nurse and close supervision of VCRC scientists involved in the programme.

III. 8.2. Mass Drug Administration (MDA)

Camping for five days in each study village did the mass drug administration. Each team was assigned an area to accomplish the task of administering the drug to the individuals personally and under supervision by making a door-to-door visit. Every individual was identified using the updated census data, which included individual’s weight and family details, and administered the drug personally. Maximum coverage was attempted during the first two days of camp. In the subsequent two days, two teams covered the remaining population who did
not receive the drugs during the first two days. A total of 10 teams, each consisting of health worker and a local casual labourer, carried out the mass drug administration. The mass drug administration was carried out between 17.00 and 21.00 hours Indian Standard Time. This time being the late evening and early night hours, was ideally suited for MDA because, the villagers were available at home during this time period.

III.8.3. Side Reactions Management (SRM)

A medical outpost manned by well-trained medical personnel along with vehicle round the clock was made available to monitor and record and manage side reactions, if any, due to mass drug administration, and to treat minor ailments. Both passive and active surveillance was done during MDA, to record the nature and duration of side reactions. Active surveillance of side reactions was done for 15% of the households. Every household was visited in person by the health workers to elicit history regarding severity, duration, and details of side reactions due to drug administration. This information was duly recorded in forms designed and tested for the purpose.

III.9. ASSESSMENT OF COSTS

Cost is the value of resources used to produce goods and services, including a specific health service or a set of services (as in a programme) (WHO 1994). The programme was carried out at village level and, therefore, village has been considered as the level of costing. The programme costs were estimated from “providers” perspective. The cost primarily reflects the direct financial costs related to the implementation of mass drug administration (Michael et al 1996). However, since the risk of side - reaction is known to be important for the DEC treatment
(Ottesen 1987), a cost component for treating side effects was also included. All costs are presented in Indian Rupee and US$ (RS.39.00) 1997 prices. They were estimated both by activity and input. In most of the health related studies, the consumer cost (opportunity) has been overlooked. In this study, the time cost (income foregone) of workdays lost due to side effects was also worked out at prevailing market wage rates in rural areas of Tamil Nadu. Though opportunity cost was not included under the programme implementation cost, it was mentioned in view of providing total economic cost of the programme. The programme cost was also calculated for the year of 2003 with help of consumer price index (US$ 45.00) (Economic Survey 2003). To convert expenditure in current prices to the prices of base year of the study (i.e. to constant prices), the expenditure in current prices was multiplied by the index number for the study base year and divided by the index number for the year of expenditure (Margaret et al 1993).

i.e.,

Programme cost for 2003 =

Programme cost in the year of 1997 × \frac{2003\text{ consumer price index}}{1997\text{ consumer price index}}

III.9.1. Personnel (Labour)

Labour costs in this study were estimated only for those personnel directly involved in programme implementation. These include Medical Officer, Health Nurse, Health workers and Drivers. Six health workers were recruited for the mass drug administration component of the project; this was apart from the existing staff, which consisted of a Medical Officer (MO), a Nurse, three Health workers and two Drivers. They were involved both in
mass drug administration as well as for monitoring and evaluation activities.

The data pertaining to time allocation of the staff involved in health education, mass drug administration, and side reaction management were recorded separately; this process is called “cost allocation” (WHO1994). The total cost of each itemized activity was worked out by multiplying the product of time spent with units of official wage rates (Ministry of Health and Family Welfare, Govt. of India 1997).

III.9.2. Transport

Two vehicles (one van and one jeep) were used for mass drug administration. The distance traveled by each vehicle was recorded for each itemized activity. The running cost of travel per kilometer was arrived by dividing the cost per annum which included the cost of maintenance, insurance, registration fees, the spare parts, tyres, batteries, POL (Petrol, Oil and Lubrication) with the number of kilometers run during the period for the given purpose.

i.e.

\[
\text{Running cost per km for the given vehicle} = \frac{\text{Total operational and maintenance cost per annum}}{\text{No. of kms. Traveled per annum (during one financial year)}}
\]

For this control programme, the travel cost for each function/activities was worked by multiplying the total number of kilometers traveled with per kilometer running cost.
III.9.3. Consumables (Supplies)

The consumables used were DEC, Ivermectin, supportive medicines such as paracetamol and perinorm (to treat side reactions and minor ailments), kerosene and stationeries. The cost of all these items were recorded carefully and worked out with the current market price of 1997. Ivermectin was supplied free of cost by the WHO/TDR/UNDP, market price of IVER was not available in the global level. WHO steering committee members and other experts in the field of drug policy research have recommended that, the DEC price is the alternative price for Ivermectin. Therefore, the present study has taken the price (Shadow Price) of DEC (alternative drug) for cost estimation (VCRC 1996). For the consumable items additional 10% of the cost had to be included as wastage.

III.9.4. Facilities cost

The other costs included, cost for packing of drug in sachets for various weight categories, health education campaign like cost for conducting street dramas and charges for film screened, and rent for the house which served as field camp office in each village. The cost of all these were recorded separately and worked out.

III.9.5. Capital cost (Depreciation Values)

Inventories, which have more than one year life, like vehicles, generator, audio-visual equipments, weighing machines, and other field equipments were considered as capital goods. Their life expectancy was 10, 3, 10, 5 and 5 years respectively. The annualisation of capital equipments was worked out by using a uniform discount rate of 10% and annualisation factor tables (WHO 1994). For example, the
following exercise shows the method of calculation for the economic cost (Value foregone) of generator:

Current market price (Resale price): Rs 8,000
Useful life: 3 Years
Discount rate: 10%
Annualisation factor (from standard table): 2.487.
Annual cost (Economic cost): $8000 / 2.487 = Rs. 3216.73
Cost per day: $3216.73/365 = Rs 8.81
The capital cost of vehicles was determined in terms of per kilometer but not per day.

III. 10. PROGRAMME EFFICACY INDICATORS

The basic approach in estimating the effectiveness is to choose appropriate indicators of effectiveness and measuring the values for each of the interventions. The immediate outputs can be considered as service outcomes such as coverage, compliance and rate of side reaction. The second level of outcome measures is related to infection like mf clearance or cured, the percentage of mf mean burden reduction and number of new cases averted, which can be considered as intermediate outcome. The final outcome is the impact on disease prevalence. In the present analysis, number of mf cases cleared or cured, percentage of mf reduction of post - chemotherapy and the reduction of mean mf per person as a percentage of pre - therapy mean burden have been used as efficacy indicators. These represents the current intervention outcome measures studied in lymphatic filariosis (Chodakewita 1995).
For each measure, the effectiveness of each strategy will depend on a combination of behavioral and epidemiological parameters (Prescott 1993), and is modeled as follows:

\[ E = \text{Efficacy Rate} \times \text{Coverage} \times \text{Compliance} \times \text{Baseline prevalence or mean infection intensity} \times \text{Baseline population size} \]

Where \( E \) denotes the effectiveness or outcome of each programme measured either as the number of cases cured or percentage reduction in mean mf intensity per person; coverage is the proportion of eligible population treated, and compliance represents the compliance rate of treated individuals.

III.11. METHOD OF COST ANALYSIS (CA)

Methods and suggestions recommended for cost-effectiveness analysis of vector control programme (Phillips et al 1993), health care costing (Drummond et al 1987 and Creese et al 1994) and cost analysis of other parasitic diseases (Guyatt et al 1992, Guyatt et al 1995, Bundy et al 1992 and Hammer 1993) were also considered. Itemized unit cost menu was prepared by identifying the cost components under each activity of the programme. The magnitude of resources utilized was determined by using the number of units spent. Cost profile by resource input and principal activity categories was presented to identify the major cost component. The economic cost (Financial+Opportunity) of the programme was also presented. Per capita cost was calculated based on the treated population of each strategy in the study villages. Each strategy was run for a period of two years, thus obviating the need to discount total costs to present value. In this analysis, 5 percent discount rate was used for present value calculation of the total
implementation cost for CEA. Full details of the cost estimation, unit prices and number of units spent in all aspects in each control option are given in Annex 1-15. The approach of programme costing is presented in the flow chart (Annexure 16). The cost data were transmitted into spread sheets (Exel): from this, cost analysis has been undertaken.

III. 12. METHOD OF COST - EFFECTIVENESS ANALYSIS (CEA)

In the world as a whole, almost half the existing disease burden is from communicable diseases. It is primarily these problems that an appropriate package of cost effective care would address. Even the best-designed care package could not prevent all these health damage from these diseases because of the low cost effectiveness of some interventions and increasing marginal costs of even the best ones. When governments pay for health care in addition to regulating it, they have a 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). Therefore, CEA for health care programmes is very important to the State for equity in health care provision and increase the programme efficiency.

A CEA study should be done, if possible, whenever the health system has different choice of options for disease control in the context of financial constraints. India Health Report 2003 emphasized that, the absence of effective chemotherapy or cost effective options for filariasis control in India is still a major problem. The advent of low cost and effective strategy for communicable diseases is an essential
task for developing countries (Mahmud 2004). Thus, the CEA is potentially useful: by quantifying the trade off between resources consumed and health outcomes achieved with the use of specific interventions, the technique can help physicians, health planners, insurers, government agencies, and individuals to prioritize services and allocate scarce health care resources (Garber 1999). Therefore, it is necessary to study the relationship between costs and efficacy of the given control strategies.

Cost-effectiveness analysis refers to the health consequences of alternative control strategies to their costs in order to identify the intervention that yield optimum benefit/effectiveness per level of cost. The framework of cost-effectiveness analysis is presented in the annexure 17. The average Cost-effectiveness ratios (CER), evaluated against the baseline or reference option, is the net cost of a strategy divided by the total number of health averted, e.g. cost per case prevented or year of life saved (Haddix and Shaffer 1996). The CER of this study were calculated by dividing the total implementation cost of a given intervention by its effectiveness measures without regard to the alternatives. Incremental or marginal cost for the implementation of programme was calculated from the costs of more expensive intervention over the other. The effectiveness achieved by higher investments was analyzed for determining cost-effectiveness ratios. Sensitivity analysis was carried out for cost minimization by the implementation process with community participation. Therefore, in the present, study the cost-effectiveness of the given interventions was worked out with the outcomes of interventions. This includes per capita cost of the each
intervention, cost per infection case cured, reduction in mean mf burden per person in percentage, cost per 1 percent reduction in mean mf burden per person and cost per 1 percent mf prevalence reduction in the community. Based on this assessment, the low cost and most effective control strategy was identified.

III.13. METHOD OF COST MINIMIZATION ANALYSIS

Based on the research level costing, cost at PHC level was estimated and presented in 2003 price. Estimates were made by assuming a population of 30000 covered by 5 health sub centers (HSC), eligible population of 79 percent and total coverage of eligible population. The time allocation for drug distribution was assumed to be five days while for the rest of the activities one day each. As all the PHC staff will be engaged in actual drug distribution, only the medical officer will be left for the supervision. The prevailing market price of Rs 0.53/ 100 mg DEC used as unit cost on drug and for other inputs the same methodology was followed. Actual requirement of drug was calculated for 100mg using the general distribution pattern of different weight categories of study population with additional 10 percent on wastage and overhead expenditure (VCRC 1993 and Krishnsmoorthy et al 2000). The average distance of HSC from the PHC was assumed to be 10 kms.

III.14. METHOD OF COST PROJECTION

Even in a world of zero inflation, there are advantages in incurring costs later or receiving benefits earlier. Thus, it is necessary to incorporate the concept of time preference into an economic evaluation of health care programmes. The process of converting future costs into their
present value is called discounting. The quantitative measure of time preference is the discount rate. The panel on cost effectiveness in health and medicine, under the auspices of the public health service, recommended that CEA of health interventions use a 3% discount rate. To increase the comparability of the public health programmes, Shapper and Haddix in 1996 recommend the use of either a 3% or a 5% real discount rate for costs. To calculate the PV (present value) of a future value, the discount factor is \((1+r)^{-t}\) or \(\frac{1}{(1+r)^t}\) or \(PV\)

\[
PV = \sum_{t=0}^{n} F(1+r)^{-t}
\]

Where, \(PV =\) Present value, \(F =\) Future value at year \(n\),

\(r =\) Discount Rate, \(t =\) Time period and \(n =\) Analytic horizon

Based on this method, cost projection for five years was also done using the present value calculation on future cost for subsequent rounds of mass drug distribution at annual discount rate of 5 percent (Drummond et al 1987 and Haddix et al 1996). The per capita financial cost derived from this analysis was used to estimate total cost of this programme at national level to cover entire population at risk.