4. Applied Field Research

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4.1 Development of web-based Filariasis Information Management System (FIMS) for filariasis control programme in India. (A.Elango, K. Krishnamoorthy, A. Srividya, DPH Tamil Nadu & P.K. Das; IM 0101 AFR; Duration: 3 years, Nov 2001-Oct 2004)

The aim of the project was to develop a web-based Filariasis Information Management System (FIMS) for effective implementation and management of large-scale mass annual single dose DEC to control LF. The components of this system are data inputs through on-line data entry and outputs of user-friendly interactive reports in the form of tables and graphs. Ultimately, this system will be operationalized with Control Programmes.

The technical aspect of FIMS version 1.0 was given in the previous annual report. This system was tested using data from two large-scale field studies carried out at VCRC (2000-2004) and improved further on data entry and output formats. An operational manual has been prepared for user reference. This system, along with the operational manual, is made available to programme managers at national and state levels as well as to regional and international research organizations and LF elimination support centres, to explore its scope for wider application. Networking with state level programme managers in Pondicherry and Tamil Nadu has been initiated to operationalize the programme. Database on demography has been completed for these two states. For easy installation, this programme is now made available as an installation/setup file. In order to facilitate on-line data entry at district level in these states, steps have been initiated to launch the programme in the Pondicherry National Informatics' Centre web server.

4.2. Feasibility of LF elimination using mass annual DEC single dose supplemented with DEC fortified salt in endemic areas. (K.Krishnamoorthy, S.Subramanian, B.Nanda, S.L.Hoti and DPH Tamil Nadu; EM 9914 AFR; Duration: 5 years, Nov 2001-Oct 2006)

The overall objective is to develop a strategy to eliminate persistent transmission foci and so progress towards filariasis elimination. The specific objectives include: (i) to prepare plan of implementation of DEC fortified salt as a supplementary measure to MDA; (ii) to assess the operational feasibility; (iii) to evaluate the impact; and (iv) to compare the cost effectiveness of the interventions.

The process of producing adequate quanity and quality of DEC salt involving local salt (cart) vendors was developed and reported in the previous annual report. DEC salt distribution network has also been established to substitute regular salt in this two arm (MDA alone and MDA supplemented with DEC fortified salt in transmission persistent foci) study. All the activities during the reporting year are focused on assessing operational feasibility and effectiveness of DEC fortified salt supplemented with MDA.

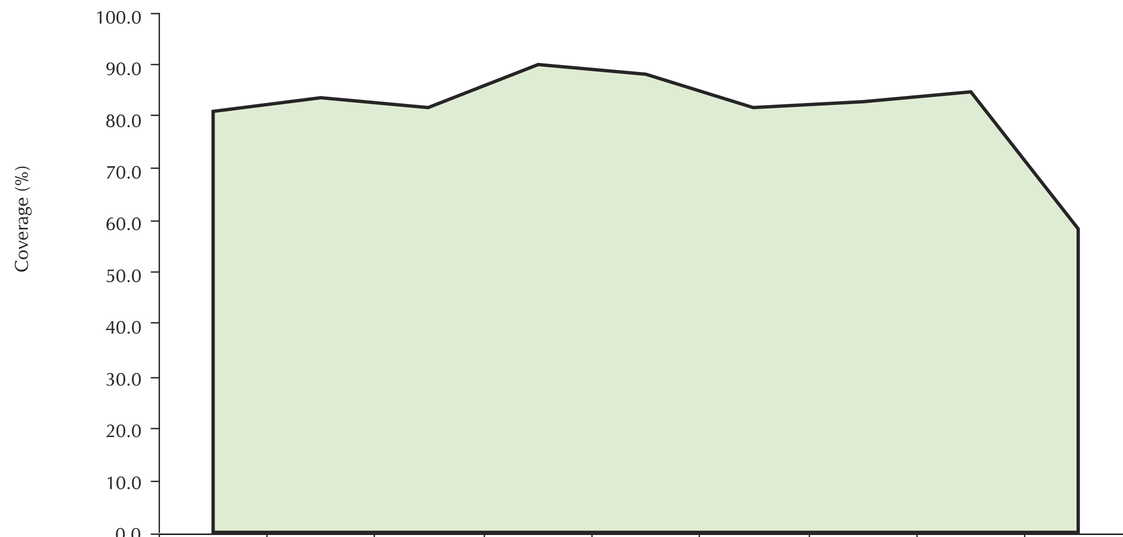
A total of 840 kgs of DEC powder was used to fortify 420 metric tons of salt at the concentration of 0.2%, to cover a target population of 1,37,779 in 88 villages between April and December 2004. Fortification is done by trained salt vendors in the stocking sites using mobile/stationary mechanical mixing drums to ensure sufficient stock of DEC salt for distribution by the cart (salt) vendors. Fortification and supply of DEC salt ranged from 33.5 (December) to 51.5 (July) tons per month. The coverage of salt supply against estimated monthly requirement of 57.4 tons ranged between 58.3% and 89.7% (Fig. 4.1). Substitution of this salt for regular salt in the targetted areas has thus been integrated with the regular salt distribution system. Monitoring of distribution showed that all the target villages were covered. Out of 45 salt (cart) vendors, 41 were active during the current period and all the major venodrs were involved in fortification and supply. The majority of the vendors normally lift their salt directly from the manufacturer. Small vendors take their requirement from the retailers locally. The number of such vendors varied depending on their engagement in other seasonal activities. It was also ensured that the retailers supply fortified salt to these small vendors. Fortification and supply, the first step in the process of promoting the use of DEC salt, was assessed using the coverage of supply to the salt vendors for distribution.

Coverage of DEC salt distribution was ascertained by household surveys (20 respondents in each village at fortnightly intervals) on the use of DEC salt. The number of villages and households covered in different months varied from 33 and 79, to 700 and 3400, the total number of respondents being 29289. The percentage of households reported using DEC salt ranged from 49 to 81 in different months (Fig. 4.2). Salt samples collected from the household surveys were subjected to simple salt (qualitative) test, using colorimetry, for the presence of DEC. As many as 2909 samples were analyzed and the percentage of salt samples showing DEC ranged from 47.6 to 65.2 (Fig. 4.3). Frequency of villages with different levels of DEC salt use (Fig. 4.4) showed that a majority of villages (67%) was in the category of 60% and above consumption rate. Comparison of colorimetry results of 474 samples with that of household information showed an agreement of 64.14% with the household information. Salt vendors continued to be preferred as source of salt, with an average of 79.6% of the 26473 respondents reported to have purchased the salt from the cart vendors. Awareness among respondents showed an increase from 32% (April) to 77% (December). Preliminary survey indicated interpersonal communication through salt vendors and display of messages on the cart of salt vendors were effective tools for social mobilization. In analysis of 1545 salt samples, reported to have been purchased by households from cart vendors, 58.4% of the samples were found to contain DEC by colorimetry.

As many as 357 and 505 vector mosquitoes were collected from sentinel sites in areas with MDA alone and MDA+DEC salt, respectively. From each sentinel site a total of 18 houses, (nine fixed and nine random) were searched for indoor resting vector mosquitoes. Collections were made at fortnightly intervals during the peak abundance season (November to January). The infection rate was 3.64%, with 0.56 infectivity, in the area with MDA alone. In the area with MDA and DEC salt, only 0.79% of the mosquitoes were found to harbour filarial parasite and none at an infective stage, indicating interruption in transmission. The mean parasite larval count was 0.02 in the areas supplemented with DEC salt while it was 0.14 in the areas with MDA alone.

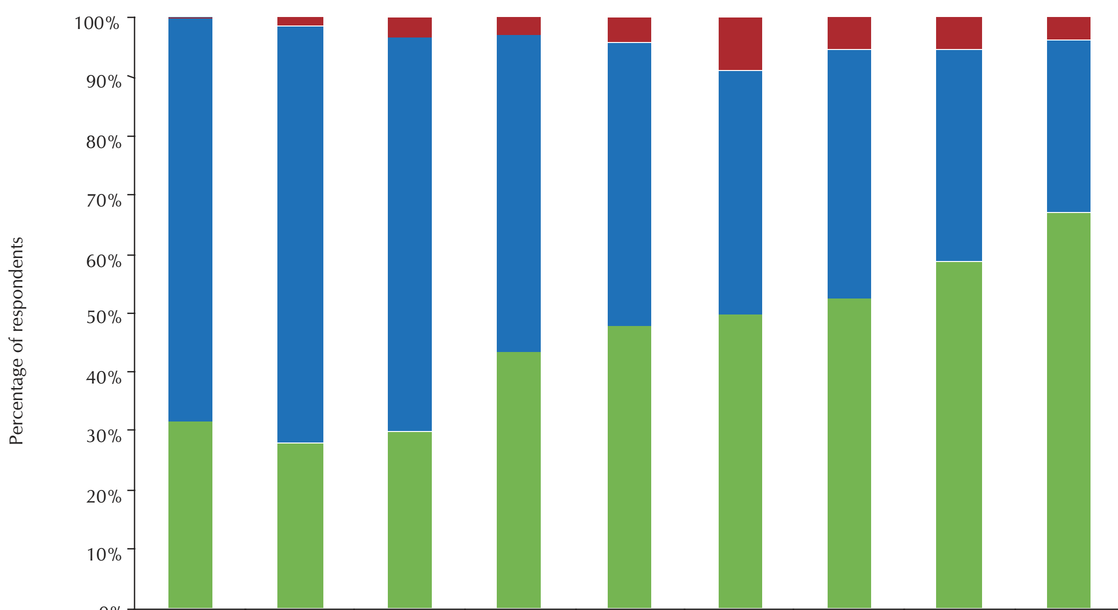
After five months of DEC salt distribution, a sample survey was carried out in two sentinel villages for microfilaria prevalence.

Fig. 4.1. DEC fortified salt supply against monthly requirement of 57.4 metric tons



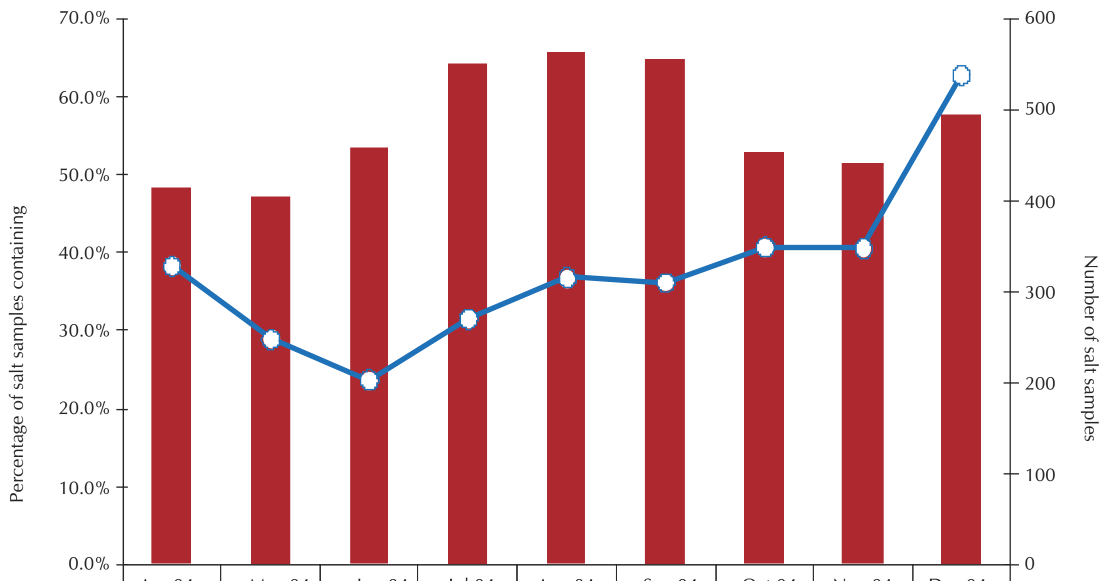
	Apr-04	May-04	Jun-04	Jul-04	Aug-04	Sep-04	Oct-04	Nov-04	Dec-04
Coverage (%)	80.9	83.6	81.8	89.7	87.9	81.8	82.7	84.4	58.3
Quantity supplied (in metric tons)	46.5	48.0	47.0	51.5	50.5	47.0	47.5	48.5	33.5

Fig. 4.2. Usage of DEC salt reported by the households



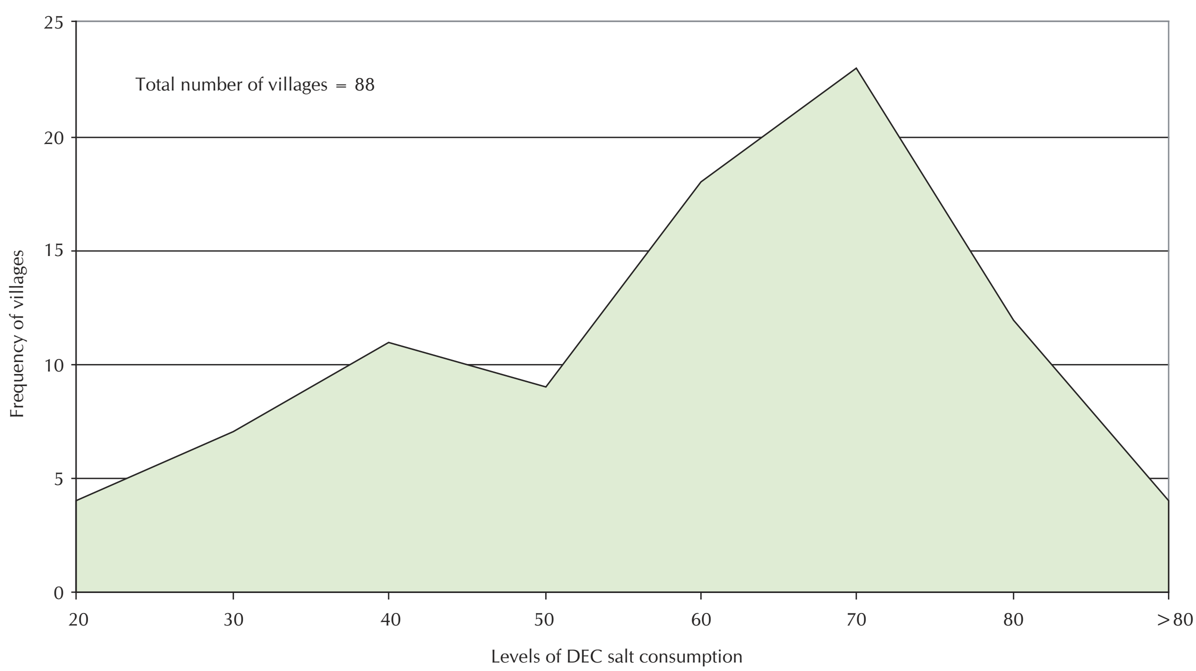
	Apr-04	May-04	Jun-04	Jul-04	Aug-04	Sep-04	Oct-04	Nov-04	Dec-04
Not using DEC_salt	1	31	64	86	137	261	188	168	125
Do not know	477	1497	1282	1643	1508	1161	1425	1097	933
Using DEC_salt	222	589	572	1330	1509	1418	1787	1794	2141

Fig. 4.3. Consumption of DEC salt as evident from DEC content analysis of kitchen salt samples



	Apr-04	May-04	Jun-04	Jul-04	Aug-04	Sep-04	Oct-04	Nov-04	Dec-04
%	48.5%	47.2%	53.5%	64.4%	65.7%	64.8%	53.0%	51.7%	57.7%
No. samples	328	248	202	270	315	310	349	348	539

Fig. 4.4. Frequency of villages in relation to consumption based on DEC content analysis of household samples from April to December 2004



Mf prevalence was reduced from the baseline level of 7.43% to 1.83%. Similarly, the mean mf density was reduced from 1.6 to 0.08. The annual per capita cost of DEC salt distribution was estimated to be Rs. 16.00, including the consumer's cost of Rs. 8.60. The results showed that it was operationally feasible to fortify and supply over 80% of the requirement through salt vendors. Consumption of DEC salt at levels between 50% and 60% could be achieved.

4.3. Determination of disability weight for (LF) for estimating disease burden (A. Krishna Kumari, L.K. Das, K.T. Harichandrakumar & K. Krishnamoorthy; IM 0202 AFR; Duration: 3 years, Nov 2002-Nov 2005)

This project aims to derive disability weight for different clinical manifestations/symptoms of LF through expert and community rating.

Disability weight is the numerical value assigned for the time lived with a given disease condition (health state) and is a key component of Disability Adjusted Life Years (DALY), which is a summary measure of the effect on health. These weights ultimately reflect the reduction in functional capacity. Since the degree of disability varies with the disease condition, it is necessary to assess and incorporate it in the estimation of disease burden to enable comparison across diseases.

The two steps involved in deriving disability weight are the development of a descriptive system for a given health state and health state valuation. The descriptive system for different health states of filariasis, developed from two groups of respondents -- LF patients between ages 15 and 60 and medical experts well conversant with the patho-physiology and management of the disease -- was given in the previous annual report. A modified standard European Quality of Life (EuroQol) instrument (7D5L) comprising seven health dimensions grouped into physical (mobility, self care, usual activities, pain), mental (anxiety/depression, cognitive function) and social (participation in social events) effects of health and five severity levels (no problem, mild problem, moderate problem, severe problem and extreme severe problem) was used. Analysis of data using most frequently perceived and reported severity levels showed that patients and experts ranked the health states similarly in the order of severity but the severity levels given by patients were higher than that of experts.

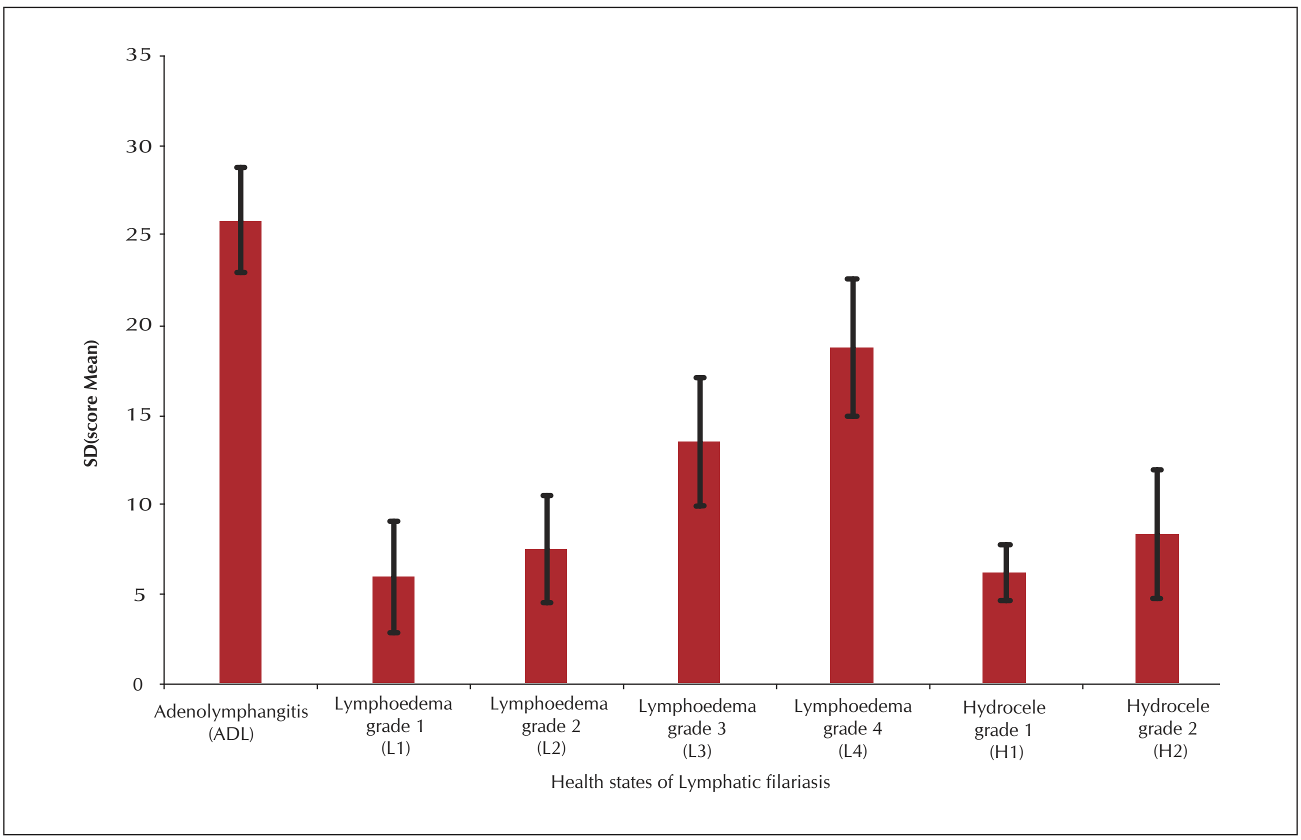
Adenolymphangitis (ADL), an acute episode of LF, was found to have the highest severity levels in all domains of health, followed by lymphoedema grade 4 (L4), lymphoedema grade 3 (L3), hydrocele grade 2 (H2), lymphoedema grade 2 (L2), lymphoedema grade 1 (L1) and hydrocele grade 1 (H1). Psychosocial problems were more severe than physical problems in persons with higher grades of lymphoedema and hydrocele. The severity levels perceived by patients were transformed into scores and the mean severity score of ADL (25.8 on a scale of 0-28) was significantly higher compared to lymphoedema (10.5) and hydrocele (7.2) ($P<0.05$) (Fig. 4.5). In males, the mean score of lymphoedema (11.3) was significantly higher in comparison with hydrocele ($P<0.05$). The higher the lymphoedema and hydrocele grading, the higher was the severity score. Severity scores are dependent on the progression of lymphoedema but are independent of gender. The percentage of overall severity for each manifestation was calculated and categorized according to international classification of functioning, disability, and handicap (ICF). It was highest for ADL with 92% (severe) and lowest for L1 with 21% (mild). The overall severity was moderate for L2 (27%), L3 (48%), and H2 (30%), severe for L4 (67%) and mild for H1 (22%). Morbidity is severe in all the chronic cases associated with ADL, which is considered as co-morbidity and is short lived. These findings indicate that LF has considerable impact on the physical, mental, and social domains of health. It is suggested that the existing morbidity management programmes be broadened to include counseling, rehabilitation, and health education to manage the psychosocial problems due to LF. Development of Health-Related Quality of Life as an indicator to evaluate morbidity management programmes under the Global Programme for Elimination of LF (GPELF) can also be considered.

4.4. Estimation of National Burden of Disease (NBD) due to LF (K. Krishnamoorthy, L.K. Das, K.T. Harichandrakumar & A. Krishna Kumari; IM 0102 AFR; Duration: 3 years, Nov 2002-Oct 2005)

Realistic estimates of DALY to quantify disease burden largely depend on the availability and quality of demographical and epidemiological data. In this context, an exhaustive literature review was carried out to address: (i) availability of data on LF disease prevalence (overall and sequale wise), age and gender distribution of disease, data on mortality and relative risk for life expectancy, morbidity management, natural history (remission pattern, conversion from infection to disease, duration of irreversible sequale), severity of the disease sequale; and (ii) identification of data gaps. As many as 174 articles referring to the prevalence of disease and infection due to LF in India were compiled. Out of 593 districts, information on LF prevalence was available for 315 districts of which 269 are endemic for filariasis. These districts were distributed to the respective states to identify the states and union territories endemic for filariasis. Reports from National Filaria Control Programme (NFCP) showed that the number of diseased individuals was 26.7 million. Based on the descriptive epidemiology, age-specific prevalence of the disease was calculated and state-wise DALY was estimated for the year 2001, to arrive at a national figure. The national burden due to LF was estimated at 2.22 million. State-wise contribution to the national burden is given in Fig. 1. Bihar recorded the greatest burden, followed by Uttar Pradesh and West Bengal.

The sources of data on LF disease prevalence are NFCP reports on delimitation surveys, line listing of cases under Mass Drug Administration programmes and research studies. While the sampling designs are the strength of NFCP data, the limitations include: (a) survey conducted at different time periods and hence

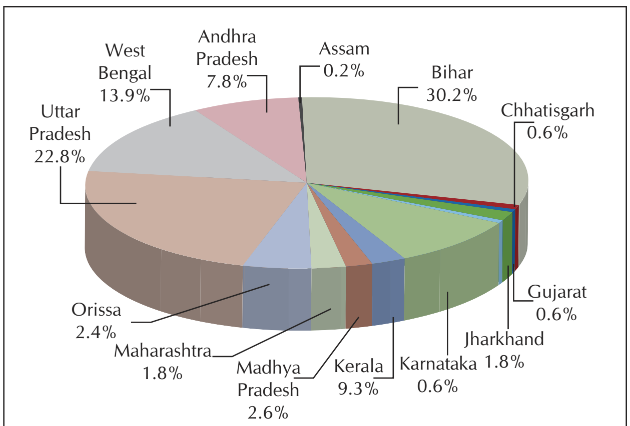
Fig. 4.5. Mean (+ SD) severity score perceived by filarial patients with different clinical manifestations of LF



current situation not available; (b) still more than 100 "endemic" districts to be surveyed; (c) age, gender and manifestation (grade) wise breakups not available; and (d) current figures being extrapolated estimates. The other source of prevalence data consists of the control units of NFCP. Data from the operational programme of MDA give the more recent and absolute number of LF diseased cases, but this is available for only 13 districts in seven states. Further, enlisting of LF cases is done by verbal autopsy and not by physical examination and therefore there is every chance of underestimation, particularly of hydrocele cases. The limitation of the data on LF disease prevalence from research studies is that the results are available only for limited areas.

Data obtained from different sources are compared and the results suggest that in Tamil Nadu, NFCP data which was assessed during the 1950s showed a higher prevalence, while the current situation as assessed under the MDA programme was much lower. Prevalence assessed by NFCP in 1957 was lower than that reported in a research study in Pondicherry in 1986. While the prevalence of lymphoedema remains unchanged, there has been a four- to five-fold increase in the prevalence of hydrocele. This could be due to improvement in the screening procedure and acceptability of physical examination in the community. These analyses suggest that source of data on LF prevalence is an important consideration when making disease burden estimates.

Fig. 4.6. State wise DALYs due to LF



4.5. Development and testing of new strategies for mass drug distribution for LF elimination in urban areas. (K.D. Ramaiah, K.N. Vijayakumar, P.K. Das & Director of Public Health, Govt. of Tamil Nadu, Chennai; EM 0105 AFR; Duration: 3 years, Mar 2003 – Dec 2005)

In continuation of the work done during the previous year, baseline qualitative and quantitative information (required to formulate appropriate drug delivery strategy) was collected to assess: (i) people's knowledge of transmission route, risk and prevention of elephantiasis; (ii) the number of households affected with elephantiasis and/or hydrocele; and (iii) people's willingness to accept DEC tablets under the MDA programme. The base-line data were collected from four different socio-economic groups of people: (i) High Income Group (HIG); (ii) Middle Income Group (MIG); (iii) Low Income Group (LIG); and (iv) Very Low Income Group (VLIG). In each of the four socio-economic strata, seven to nine key informant (KI) interviews and, in MIG, LIG and VLIG areas, three to four Focus Group Discussions (FGDs) were held, to elicit information. Besides, a household questionnaire survey was also carried out in 100 households each in the four socio-economic strata. Microfilaria surveys were carried out in two streets each of ten selected VLIG and ten selected LIG areas, in order to assess the prevalence of infection. Mf surveys were restricted to only VLIG and LIG areas as they are the worst affected, with poor sanitation and high mosquito nuisance. The qualitative data were analyzed using Atlas/ti (Scientific Software Development, Berlin) software package and the quantitative data were analyzed using SPSS.

Source of treatment and perceptions of government health services

A vast majority of the residents in HIG and MIG areas seek treatment from private hospitals (Table 4.1). LIG people seek treatment from private hospitals for minor ailments and government hospitals for serious health problems that entail

Table 4.1. Sources of treatment for various socio-economic groups

% seeking treatment Source	HIG	MIG	LIG	VLIG
Private hospitals	83	78	38	40
Government hospitals	3	6	52	54
Corporation hospitals	0	0	6	6
Private practitioners	0	10	1	0
Doctors within family	3	2	0	0

expenditure. Thus, private hospitals and private practitioners (nearly 10,000) form an important source of treatment and can influence treatment seeking; hence they constitute an important stakeholder in MDA in urban areas.

While the higher and middle income groups expressed dissatisfaction with the government run health services on account of lack of concern for patients, casual attitude, delays and inadequate medicines, the poorer people appreciated the services offered by some hospitals and resented the costs imposed by private hospitals. All the four socio-economic groups depended upon the government hospitals for treatment of malaria, widely prevalent in Chennai city.

Fig. 4.7. Percentage of families with reported cases of elephantiasis or hydrocele

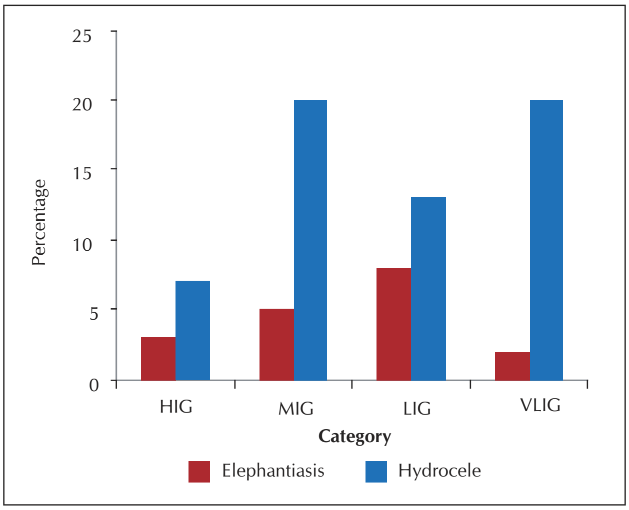
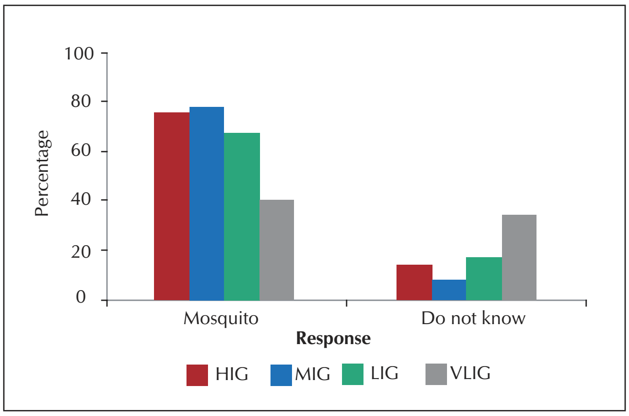


Fig. 4.8. Knowledge on the mode of transmission of elephantiasis



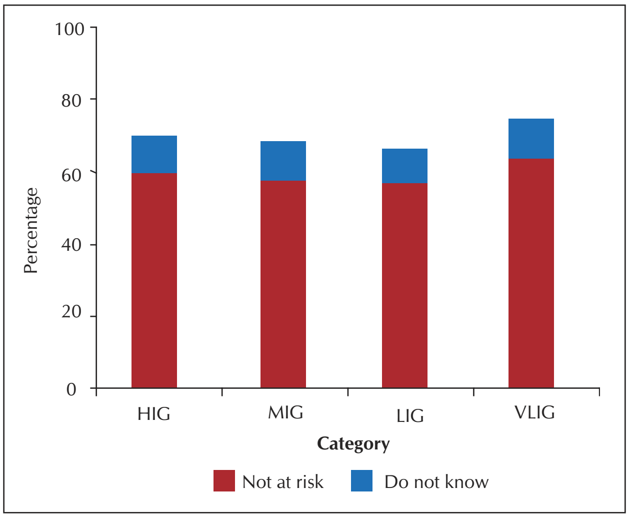
Burden and knowledge of LF

Household questionnaire survey revealed that prevalence of lymphoedema/elephantiasis ranged from 2% of families in VLIG areas to 8% in LIG areas; of hydrocele, from 7% of the families in HIG areas to 20% in VLIG and MIG areas (Fig. 4.7). At the average family size of four, the prevalence of lymphoedema/elephantiasis works out to 0.5% to 2.0% (mean = 1%) and that of hydrocele in men, to 3.5% to 10.0% (mean = 3.75%) in different study areas of Chennai city. The night blood surveys showed an Mf prevalence of 0% to 3.5% in different VLIG areas and 0% to 3.0% in LIG areas.

More than 95% of the population in all the four groups had heard of elephantiasis disease and 65% to 79% had heard of hydrocele. About 40% in VLIG areas and 78% in MIG areas knew that mosquitoes transmit elephantiasis. About 30% in VLIG areas did not know the mode of transmission of elephantiasis (Fig. 4.8). About 31% in VLIG areas to 43% LIG areas said that they do not know the cause of hydrocele. Only 4% in HIGs and 1% in LIGs felt that hydrocele is caused by filarial infection.

More than 55% in all the four groups believed that they were not at risk of being affected with elephantiasis (Fig. 4.9). The reasons cited for this optimistic view were the use of personal protection measures against mosquitoes, maintaining good hygiene in and around the houses, not many people being affected in their locality, or the blind belief that they will not be affected by as bad a disease as elephantiasis. More than 60% in HIG and MIG areas and 36% in VLIG areas

Fig. 4.9. % of people saying they are not at risk of being affected by elephantiasis



believe that elephantiasis is preventable. 52% to 65% in different groups felt that hydrocele is curable. While 40% felt that surgery is the method of choice to cure hydrocele, 11% and 2.5% cited non-surgical allopathic treatment and traditional medicine respectively.

Opinion about implementation of MDA

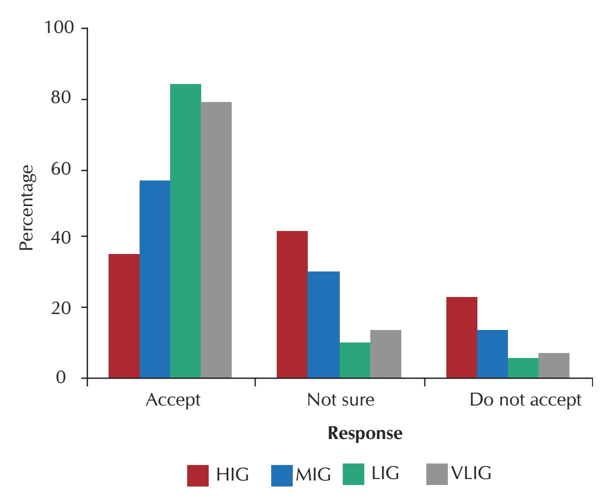
People in HIG and LIG areas felt that LF is not a major health problem in their areas and were doubtful about the necessity of MDA. However, the VLIG population felt that MDA, being a government-sponsored preventive programme, is likely to be beneficial and expressed their willingness to participate in the programme. It was strongly expressed by different groups of people that massive education campaign highlighting the importance and preventive value of the programme, risk of elephantiasis, incurability of chronic elephantiasis condition and harmful effects of high mosquito densities is necessary to successfully implement MDA. This can be understood from the comment of an FGD participant: "*Two to three months before drug distribution itself, we should start propagating about the programme among the public.*"

A vast majority of people also preferred drug distribution by health service personnel because of their official status, rapport with people and ability to defuse any problem that may arise out of drug distribution (such as side effects, etc.). An FGD participant said: "*When the local people distribute the drug, people will not accept it due to lack of faith and fear, hence this should be done by health department people.*" A KI said: "*The message about the drug should come from medical personnel to create trust among the people.*"

Involvement of community members, NGOs and CBOs was felt to be necessary to successfully implement the programme. A KI said: "*Your task is so huge; you need to employ everybody because of the volume of work (drug distribution).*" Some NGOs were also confident that communities can be successfully oriented to participate in MDA. Many people, however, also cautioned that communities may not enthusiastically come forward to accept the DEC tablets because not many families are affected by elephantiasis. A key informant expressed his opinion: "*I really welcome this scheme since it is a preventive programme to control a disease, but it is difficult to convince the people to consume the drug because this tablet is for elephantiasis disease.*" They, however, felt that successful distribution may be possible if the programme (i) is designed and executed according to the principles of the pulse polio campaign, which was given the highest priority nation-wide, and the rain water harvesting scheme, which was enforced through strict civic laws; (ii) involves the state Chief Minister and popular cine artists, as part of IEC campaign and advocacy, to motivate people to take the tablets; (iii) is implemented on Sundays, when most people will be available at home. People from HIG areas suggested that quality and well-packed drugs from reputed manufacturers should be distributed. When specifically asked, only 35% of the HIG population expressed willingness to consume the drug, compared to 79% in VLIG areas and 84% in LIG areas. About 40% of HIG group felt that they will accept the tablets after eliciting the information on the necessity and importance of treatment from family doctors or private medical practitioners (Fig. 4.10).

The study shows that the community do not view LF prevalence as a major health problem or feel its control to be an important need.

Fig. 4.10. % of the population of different groups willing to accept DEC tablets



This is because the perceived socio-economic impact of LF is low in urban areas due to low prevalence of elephantiasis or absence of disease in some localities, high population density and individualistic life style. On the other hand sanitation-related issues and malaria and mosquito control, among others, have been cited as priority issues for the community. While hydrocele prevalence, as estimated from household questionnaire survey, is much higher than that of elephantiasis, its incidence was attributed to various reasons other than LF. While these factors suggest the low perceived public health importance of LF in urban areas, drug distribution in these areas needs to be implemented effectively, because of the potential of these areas to maintain and spread the infection. Thus, evolving effective drug distribution strategies for urban areas is a major task for LF elimination programme managers.

The data also suggest that in large towns and cities, the middle and, more particularly, the high-income groups may not readily accept DEC treatment under the MDA programme. Hence, allocation of resources to and the necessity of MDA in HIG areas is debatable because of probable low infection prevalence, antipathy towards treatment under MDA, extensive use of personal protection measures and the support of private practitioners/hospitals and/or family doctors. On the other hand, concentration of efforts in low income areas, where the risk of infection is expected to be high, may yield more cost-effective results.

People in all socio-economic groups expressed concern about the necessity of MDA for the entire population, as, in their perception, they are unlikely to be affected by LF and/or overall only a few people are affected by the disease. This is expected because people have little or no information on the LF elimination strategy that envisages treatment of entire endemic populations. Therefore, as suggested by some people, it may be necessary to launch very convincing advocacy measures on the importance of DEC treatment and LF elimination programme to create demand for DEC treatment.

4.6. Dengue surveillance and forecasting in Pondicherry (G. Rajendran, L.K.Das, S.L.Hoti, P.K.Das & R. Ravi; IM 0301 AFR; Duration: 5 years, Jan 2003-Dec 2008)

The objective of the project is to set up a vector surveillance system in Pondicherry for *Aedes* mosquitoes and to study vector dynamics in relation to dengue outbreak.

During the reporting year, 5% of the total nagars/colonies (n=43) located in urban and rural areas in Pondicherry were randomly selected for vector surveillance studies.

Aedes breeding indices (House Index, Container Index, Breteau Index), pupal production per person/per hectare and relative adult density (for indoors and outdoors) were estimated. During the year under report, entomological

Table 4.2. Aedes breeding potential and resting density

		Pre-monsoon	Monsoon
% of containers positive		4.62	9.50
Pupae/person		0.060	0.077
Pupae/hectare		3.99	5.10
Per man hour resting density	Indoor	0.243	0.617
	Outdoor	0.083	1.119

Table 4.3. Aedes breeding potential in urban and rural areas

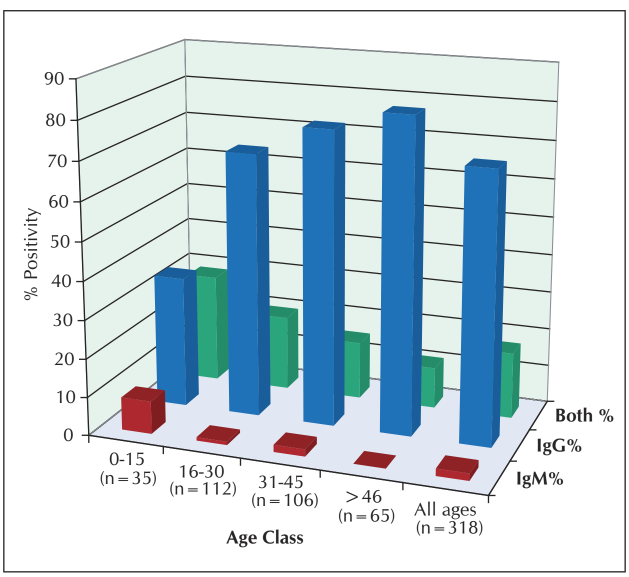
Parameter	Urban PHC (Lawspet)		Rural PHC (Madukarai)	
	Pre-monsoon	Monsoon	Pre-monsoon	Monsoon
Breteau Index	10.28	21.00	21.65	35.00
House Index	7.48	14.00	14.43	20.00
Pupae per person	0.15	0.19	0.50	0.44
Pupal Index	67.29	87	221.65	198

surveys were completed for pre-monsoon (Jul. – Sep) and monsoon (Oct – Dec) seasons (Table 4.2).

On comparing the entomological parameters between urban PHC (Lawspet) and rural PHC (Madukarai), it was observed that the breeding indices were relatively higher in rural areas (Table 4.3). Besides, the species composition derived from the emergence of immature samples also differed in urban and rural localities. The composition of *Aedes aegypti* in the samples of urban and rural areas were 73.30% and 13.8% respectively and for the species *Ae.albopictus* in urban and rural areas, the values were 26.7% and 86.2% respectively.

Given the relationship of temperature, relative humidity and rainfall with dengue transmission, monthly data on these and other environmental variables were also collected.

Fig. 4.11. Proportion of individuals showing anti-dengue antibodies in 2004



Map 4.1. Distribution of anti-dengue IgM +ve cases, in and around dengue positive households, detected during 2004 contact survey

A total of 318 persons were tested through contact survey in Pondicherry and surrounding areas where dengue cases had occurred in 2003. Of these, 284 (89.3%) persons showed presence of dengue antibodies (IgM alone 6 (1.9%); IgG alone 223 (70.1%); and both IgM & IgG 55 (17.3%). This suggests that there has been past exposure as well as current infection in the community. All age groups appear to be affected (Fig. 4.11). The relatively large number of cases (n=55) showing both IgM and IgG antibodies is a matter of concern. Thattanchavadi and Olandai areas recorded majority of the IgM +ve cases (Map 4.1). As viral activity is continuing in Pondicherry, there is a risk of DHF/Dengue Shock Syndrome (DSS), if a different serotype of the virus enters, especially in the areas where high vector breeding potential is recorded.

KAP survey on dengue

A survey of Knowledge, Attitude and Practice (KAP) was initiated during the outbreak of dengue at Pondicherry (Annual report 2003). The survey was completed during April 2004. TV was found to be the main channel of information through which respondents heard about dengue both in positives (29.51%) and in controls (72.13%). On the cause of dengue transmission, only a few respondents mentioned the concept of virus in positive (8.20%) and control (9.84%) groups. While comparing the parameters on cause, transmission and prevention of dengue, a significant difference was observed between the knowledge of positives and controls ($p<0.05$). However, misconceptions prevailed about cause, transmission and prevention. It was noted that residents had to make their own arrangements for storage of water, as water was supplied at fixed time intervals. All people, irrespective of economic status, stored water for a short period. But, water containers were not properly covered both in positives (50%) and controls (36%). Concerning waste collection, 68.85% of positives and 63.93% of controls stated that they had not observed services of waste removal by the municipal authorities in their areas. 50% of the respondents in both groups mentioned insecticide spray/fogging only after the epidemic.

Outdoor placement of container/water receptacles was observed (>90%) in both groups. Container positive for *Aedes* was observed in 20% in positive houses and 3.28% in control houses. The study indicated that both types of respondents, those who had experienced dengue fever and those in control groups, do not take any action to reduce the potential larval habitats in their households. Majority of respondents (67% in positives; 60% in controls) mentioned stagnant water and drains as the breeding source of dengue mosquito. The community did not infer the role of water receptacles (93.44% in positives; 88.52% in controls) in relation to dengue mosquito breeding. Hence health education to improve the level of KAP on dengue is advocated for the community.

4.7. Evaluation of the impact of mass drug administration (MDA) with DEC or Ivermectin, or co-administration of DEC with Ivermectin or with Albendazole, on transmission of bancroftian filariasis (P.K.Das, S.P. Pani & K.D. Ramaiah; other scientists: J. Yuvaraj, P. Vanamail & S.Subramanian; EM 9201 AFR; Duration: 15 years, Nov 1993 – Dec 2007)

This study was initiated in 1993 to evaluate the impact of annual mass administration of DEC (6mg/kg body weight) alone or Ivermectin (400 mcg/kg) alone, or co-administration of DEC + Ivermectin (600mg/kg+400mcg/kg) or DEC + Albendazole (6mg/kg+400mg), on: a) microfilaria prevalence; and b) transmission dynamics.

During the reporting year 2004, MDA was carried out for the target population in 20 villages, covering a total population of 7000-

Table 4.4. Study arms and intervention details (numbers below the intervention show the % coverage of the target population).

Group	Popn	Nov-94	May-95	Sep-96	Dec-97	Jan-99	Feb-00	Apr-01	Mar-02	Apr-03	Sep-04
I	9889	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC	DEC
		73	71	54	68	67	61	60	64	62	54
II	8526	IVER	IVER	IVER	IVER	IVER	IVER	IVER	IVER	X	IVER
		75	71	57	69	68	64	64	62		56
III	7467	X	X	DEC+ IVER	DEC+ IVER	DEC+ IVER	DEC+ IVER	DEC+ IVER	DEC+ IVER	X	DEC+ IVER
				54	65	68	60	61	59		53
IV	8405	PLA	PLA	X	X	X	X	DEC+ ALB	DEC+ ALB	DEC+ ALB	DEC+ ALB
		75	73					69	72	69	62

Table 4.5. Impact parameters prior to 2004 MDA compared to baseline in different intervention arms

	Intervention Arms			
Paramter	DEC	IVER	DEC+IVER	DEC+ALB
Baseline Date in Year	1994-95	1994-95	1995-96	2000-01
No of Rounds before 2004	9	8	6	3
MF Prevalence % Baseline	13.20	14.50	14.70	8.10
Pre 2004 MDA	0.80	4.90	1.10	3.80
MF GMI Baseline	0.66	0.62	0.62	0.31
Pre 2004 MDA	0.10	0.30	0.10	0.03
Vector Infection Rate % Baseline	18.40	18.70	13.40	13.10
Pre 2004 MDA	1.90	5.10	3.39	5.93
Vector Infectivity Rate % Baseline	1.00	1.70	1.40	1.00
Pre 2004 MDA	0.06	0.74	0.68	0.51
Transmission Intensity Index Baseline	0.73	0.85	0.42	0.20
Pre 2004 MDA	0.02	0.37	0.42	0.18

8000 in each of the arms. The consumption rate of the drug(s) ranged between 53.0% and 62.0% (Table 4.4).

During the reporting year, 2649 persons were sampled for microfilaria in different arms. The Mf prevalence and its intensity continued to show a declining trend in the DEC arm; in the Ivermectin arm it showed a marginal rise (Table 4.5 & Fig. 4.12). This could be due to non-administration of Ivermectin in the 9th round.

In the entomological surveys, 7082 mosquito specimens were collected. The infection & infectivity rates in DEC and Ivermectin arms also showed a similar trend (Table 4.5 & Fig. 4.12). Community compliance in supervised drug consumption ranged between 50% and 60%. Even with this level of consumption, nine rounds of DEC showed a drastic reduction in microfilaraemia prevalence and intensity as well as in transmission parameters. However, this did not result in complete transmission interruption.

Persistent infection (Fig. 4.12) and transmission (Fig. 4.13) were observed in the communities in the last three to four years, irrespective of the drug. As there is a need to demonstrate complete interruption of transmission for successful elimination, it will be necessary to improve community compliance or introduce additional intervention, particularly DEC medicated salt or selective vector control, in some arms and to continue monitoring and evaluation for at least one more year.

4.8. Developing a model for monitoring JE mosquito vector(s) abundance through environmental determinants. (S. Sabesan, K.H.K. Raju, P. Vanamail, P.K. Das, R. Rajendran, CRME, & P. Manavalan, ISRO; IM 0302 AFR; Duration: 3 years, Apr 2004 - Mar 2007)

The objectives of the project are (i) to correlate Japanese Encephalitis (JE) mosquito vector(s) abundance with different stages of wet cultivation and other environmental variables; and (ii) to link remote sensing (RS) imageries corresponding to ground characteristics pertaining to JE vector breeding.

JE incidence varies in different countries. The highest occurrence is found in the rice-growing areas of a country. JE mosquito vector(s) breed

Fig. 4.12. Trend in microfilaria prevalence (top) and intensity (bottom) over time course in the different study arms (arrows show the points on intervention)

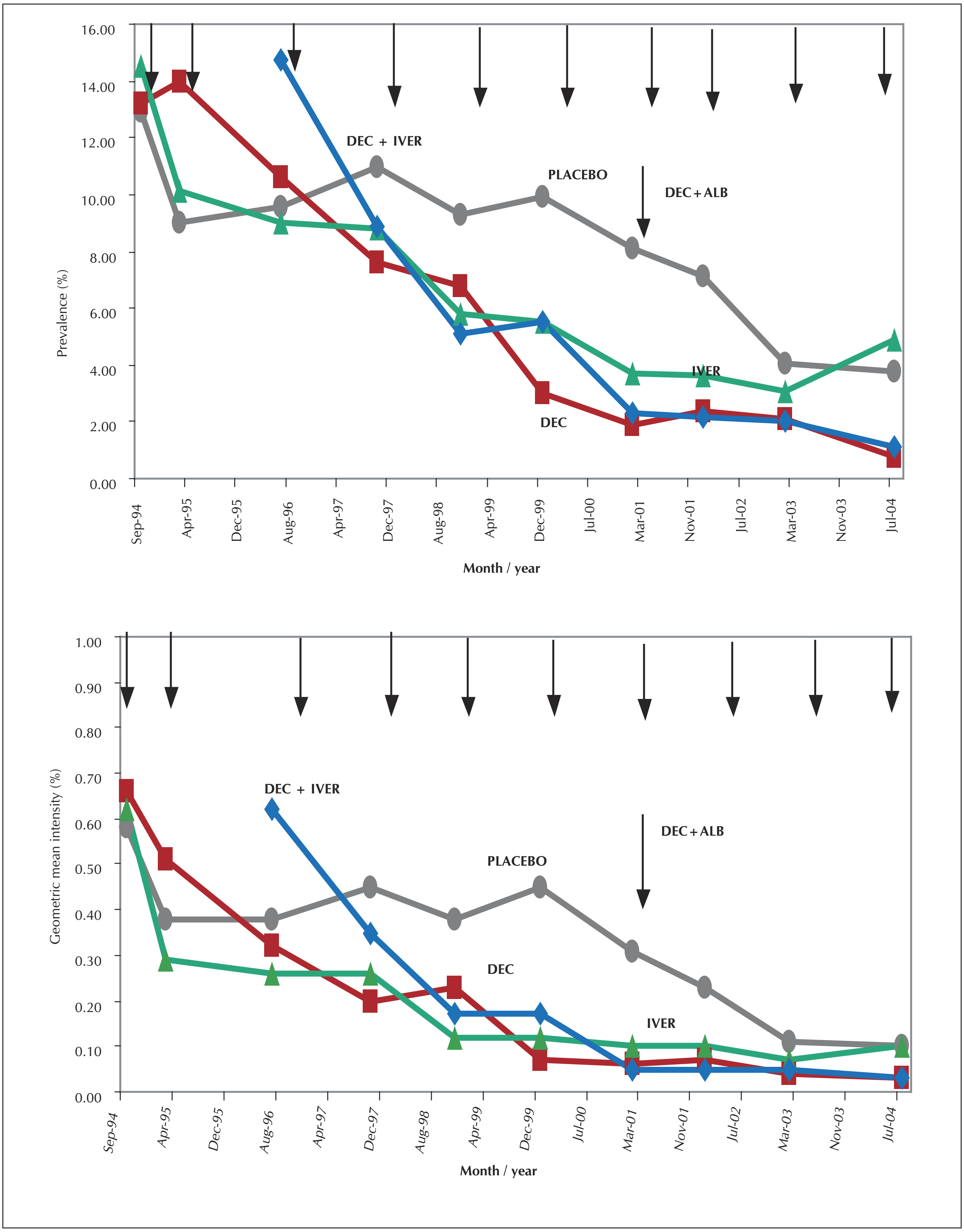
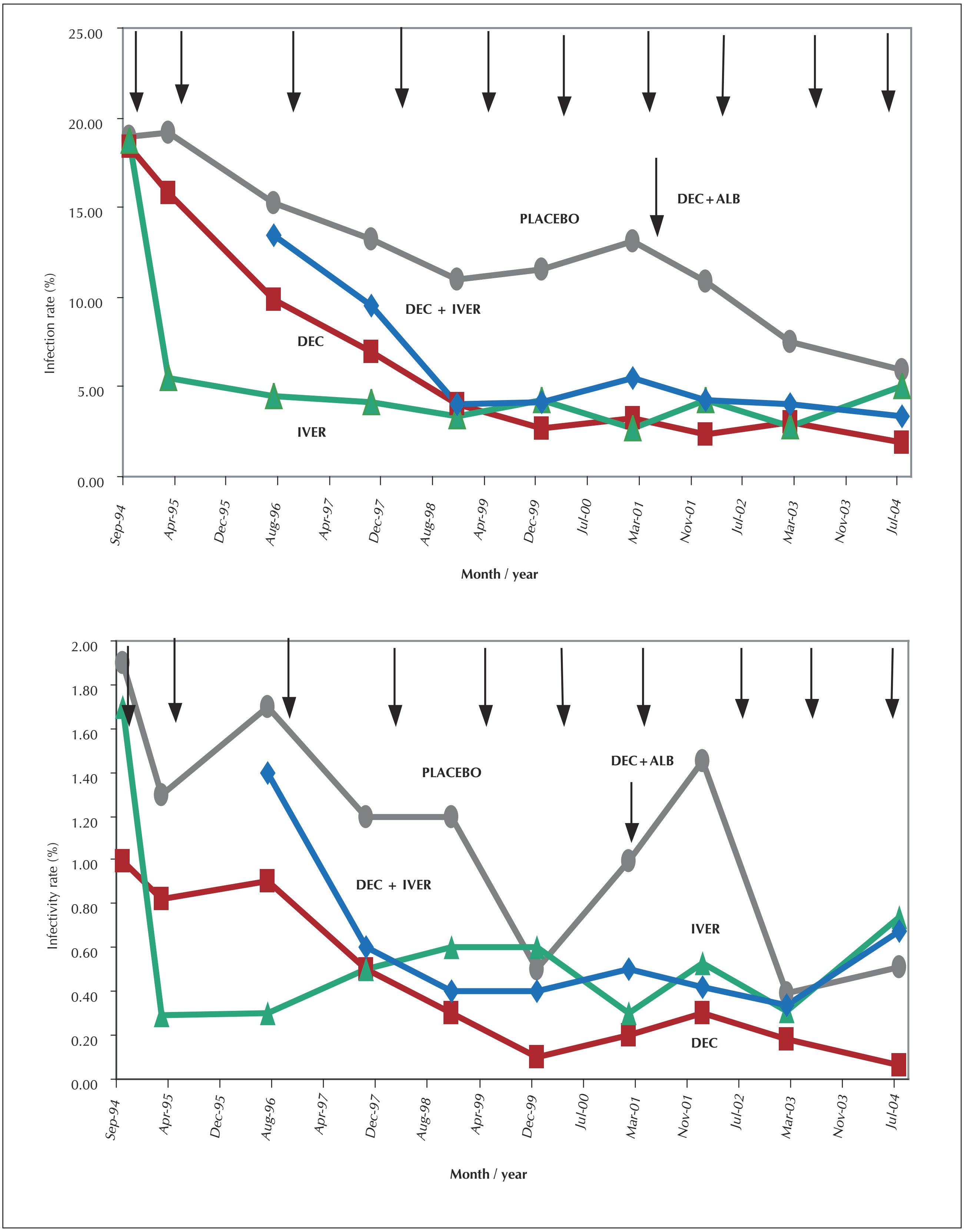


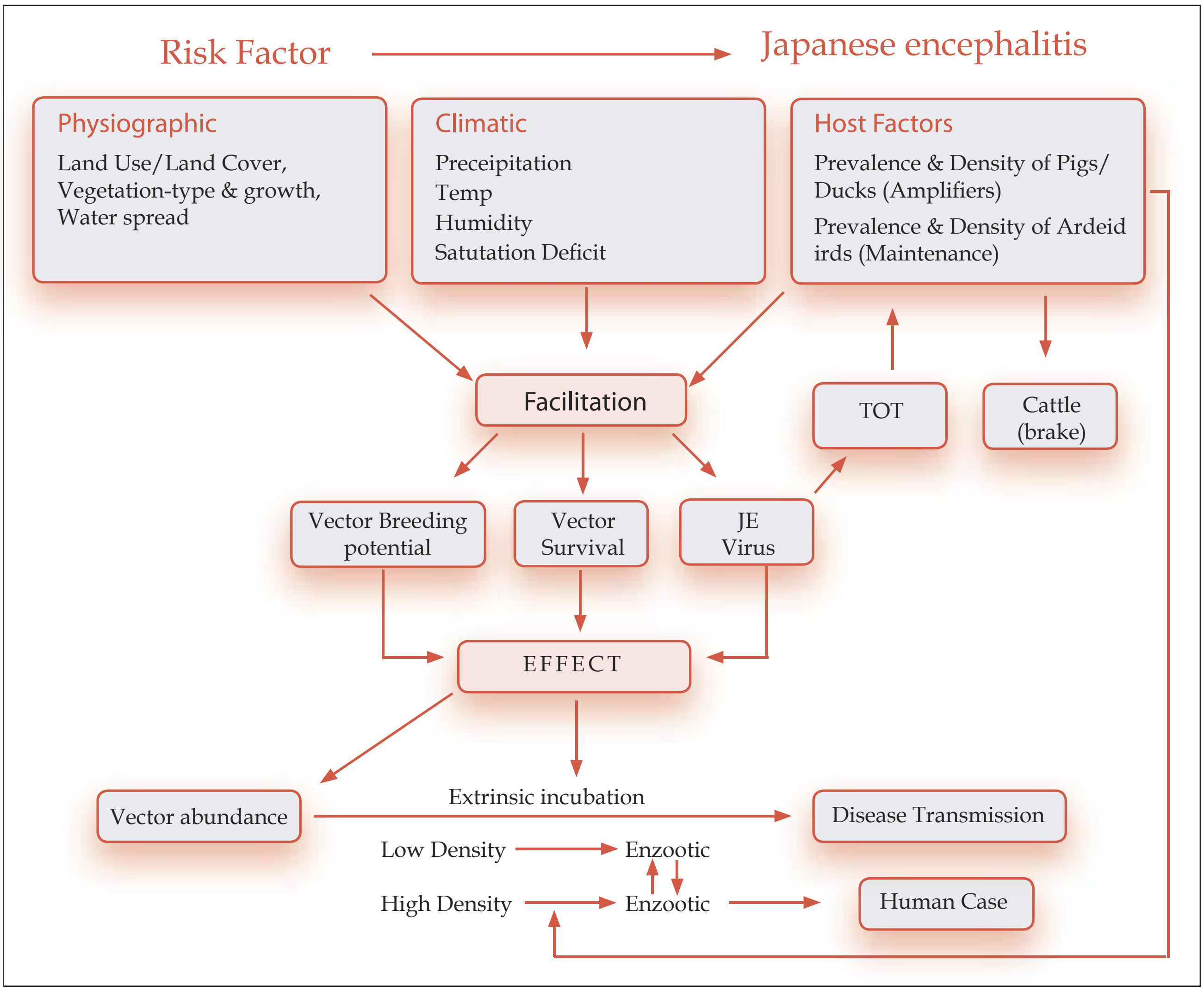
Fig. 4.13. Trend in infection (top) and infectivity (bottom) rates over time course in the different study arms (arrows show the points on intervention)



mainly in rice fields and human cases occur scattered over extended rural areas. Therefore, it is evident that there is an ecological connection with irrigation facilities and paddy cultivation. Further, increased water availability during a particular stage of paddy cultivation is reported to be a premonitory sign that can lead to markedly increased population of the vector mosquitoes. With this background a conceptual frame for JE transmission model has been created (Fig. 4.14).

All the suspected key variables involved in the transmission of JE were identified. When the vector density increases enormously, a few of them spill over to humans and thereby man is an incidental and dead-end host. Man to man transmission does not occur in nature. Cattle also act as dead-end hosts in the transmission cycle. As the cattle circulate only a low level of virus, they do not develop the disease. From Ardeid birds, JE is transmitted by mosquitoes to pigs/ducklings. The pigs/ducklings serve as amplifying hosts since the virus multiplies in them. Man or cattle get infected either from birds or pigs/ducklings through mosquitoes. Ardeid bird - mosquito - Ardeid bird and pig/duckling - mosquito -pig/duckling cycle exists in nature. The bird cycle is more stable, persistent and enzootic. The pig cycle appears to be temporary and epizootic. The epidemic in man appears to follow pig epizootics, and this coincides especially when the vector density shoots up. Though the JE virus transmission between mosquito via reproductive route ('transovarial' transmission) has been reported, it has not been considered seriously on account of a very low virus titre. Still, it bears epidemiological

Fig. 4.14. Conceptual frame for JE transmission model



significance, as the mosquitoes themselves maintain the virus during the non-transmission (lean) period. It would be possible to discern the environmental determinants of vector density by using such modern tools as Remote Sensing (RS) and Geographical Information Systems (GIS), which would provide reliable information on a desired spatial and temporal scale. Depending on the time of year (season), the values derived from remote sensing data can be used to identify the vegetation type and growth stage of plants and predict the possible vector breeding sites and density.

Three PHCs (Nallur, Sirumangalam and Pennadam) in Cuddalore district, Tamil Nadu, have been selected for the present study as they were reporting JE cases more than once during the last 10 years. A digital map based on Survey of India (SOI) for the study area has been created. GIS database including coordinates and other characteristics were collected for this area.

The land cover / use pattern has been identified, using the satellite images based on panchromatic (PAN) data. Collection of facts and figures on agricultural practice, irrigation pattern and animal husbandry has also been initiated.

With the entomological data generated from this area (Source: CRME) for the years 1996-’98, a relationship between vector density, the ground features and satellite images could be established, with the cloud-free multi-spectral data, which at present is not readily available. The ISRO / NRSA has been requested to procure the RS data, from appropriate sources.

4.9. Validation of geo-environmental risk model (GERM) for predicting filariasis risk areas. (P.K.Das, PI, S.Sabesan, K.H.K.Raju & A.Srividya; EM 0304 AFR; Duration : 6 months, Jul 2004 – Dec 2004)

One of the important outcomes of the project, “Application of RS & GIS in the epidemiology and control of LF” (ICMR Task Force: No.5/8 –7 (125)/99 – ECD – II) was the development of the geo-environmental risk model (GERM) for predicting the areas of risk for filariasis. Under the present project, the model has been validated.

With the GERM model, it is possible to identify areas where the transmission of LF does not occur. The model is based on some geo-climatic variables that form the Filariasis Risk Index (FRI). FRI was a significant predictor contributing to the status of filariasis in an area. Accordingly, the areas with FRI values <=14 are non-risk (non-endemic) for filariasis transmission.

To validate this, the grid sampling method was used to select 60 sites from Tamil Nadu, 35 from the non-risk area and the remaining from the risk area. About 58% of the sites were sampled from the non-risk area, in order to get more power for the validation. Sixty children in the age class 9-15 years were sampled from each site and their status of filarial antigenemia was tested, using ICT cards.

A total of 3600 children were examined for presence of filarial antigenemia from the selected 60 sites. Of the 60 sites surveyed, only eight were found to be positive for filarial antigeneamia. None of the 35 sites selected from non-risk area recorded any cases with filarial antigenemia (i.e., among the 2100 children surveyed), corroborating the model’s prediction.

Among those sites from the ‘risk’ area, a total of 28 individuals, among the 1500 examined, were found to have filarial antigen. The antigeneamia rates ranged between 1.67% and 10.00% in the eight sites. It was found that all these sites, which were positive for antigenemia, were predicted to be at risk for filariasis by the model.

The relationship between the model (predicted) and observed values was analyzed, using logistic regression and it was found that the model fitted well for the data (χ^2=2.27, D.F.= 6, P=0.892). The model could correctly classify

93.3% of the data with a sensitivity of 62.5% (95% limits: 25.9-89.8) and specificity of 98.1% (95% limits: 88.4 - 99.9).

Inferences

- The geo-environmental risk model developed on GIS platform could be employed for spatial delimitation purpose on a macro scale, particularly to identify 'non-risk' areas.

- The filariasis infection transmission at the 'macro' level depends on geo-environmental variables, and the occurrence of filariasis at the 'micro' level depends on 'human' factors under favourable environmental conditions.

- The demarcation of the areas which are endemic and non-endemic in terms of the Filariasis Risk Index, derived from geo-environmental variables using RS & GIS, is highly advantageous as a one time exercise; and, in view of its rapidity, reliability and cost effectiveness, it will be useful for replacing conventional methods in a country like India having a vast geographical area.