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COMPUTERIZED MATHEMATICAL MODEL OF M. LEPRAE POPULATION DYNAMICS DURING MULTIPLE DRUG THERAPY*

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ABSTRACT : *A computerized mathematical model of* M. leprae *populations during multiple drug therapy (MDT) was constructed. Relevant published information available to date was fed into it, and reasoned assumptions were made. From the model, it seems likely that MDT steadily selects bacteria resistant to the most powerful of the three drugs used: unless the individual bactericidal potencies of the drugs balance one another. If the drugs used have differing potencies, cure probably hinges on treatment being continued until all metabolically active bacteria are killed. Withdrawal of treatment before that could lead to relapse with bacteria resistant to the most powerful of the drugs used.*

INTRODUCTION

Mathematical models of human populations allow theoretical predictions that are more accurate than rough guesses. Bacterial populations can be similarly analysed. Simplistic guesses about the outcome of chemotherapy are often misleading.

This model is offered as a beginning. As more information becomes available from investigations, the model should expand to incorporate it. Computer programs have been written to solve the mathematical equations involved. The model should help explain observations, indicate areas deserving research, and give clues to the results of long-term trials of MDT.

METHODS

Population dynamics of bacteria

Bacterial population growth (and death) can be described by the equation :

$$P_t = P_o e^{Rt} \quad \ldots\ldots (1)$$

where Po - is the initial number of viable bacteria, at time O;

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P_t — is the number of viable bacteria at time t;

e — is the base of natural logarithms;

R — is a constant for a given set of conditions affecting growth;

t — is the time elapsed between time 0 and time t.

This equation should adequately describe increases or decreases in viable bacteria (except near the asymptotic limits).

R, the growth constant for a given set of conditions

The most important factors affecting the population dynamics of *M. leprae* are :

(1) Bacterial doubling.

(2) Killing/clearance by host responses.

(3) Killing/inhibition by drugs.

(4) Mutation of bacteria to drug resistance.

Appropriate rates were assigned to these factors, based on published data wherever available. The following data were used:

(1) *Bacterial doubling :* The "doubling time" of *M. leprae* in the mouse foot pad is 11.1 days (Levy, 1976). That is, one viable *M. leprae* at the end of 11.1 days gives two viable *M. leprae*.

Hastings and Morales (1982) have pointed out that if a change in bacterial staining (from "solid" to non-"solid") indicates death of *M. leprae*, the bacterial life-span must be very short. This in turn would mean that *M. leprae* need to divide approximately once a day, to maintain a doubling time of about 10 days. As soon as a consensus is reached on this question, it will be possible for this model to include bacterial generation time, rather than doubling time, in calculations. Until that time, we choose to abstain from the controversy by using the doubling time of viable bacteria — the net result of generation time and bacterial life-span.

(2) *Killing/clearance by host responses :* Lepromatous patients on dapsone monotherapy show a steady decline in numbers of *M. leprae* : 0.58 $\log_{10}$ units per year, measured by the logarithmic biopsy index. In lepromatous patients with borderline features, the decrease was 2.51 $\log_{10}$ units per year, (Ridley, 1967).

(3) *Killing/inhibition of growth, by drugs :* The ideal bactericidal drug may be arbitrarily defined as one that kills 99.9% of drug-sensitive bacteria during the time taken for one doubling of viable bacteria. The ideal bacteriostatic drug prevents all drug sensitive bacteria from multiplying, without altering the action of a bactericidal drug. The effect of drugs given simultaneously is presumed to be additive.

(4) *Mutation to drug-resistance :* Most mutants in nature occur with a frequency of about one in 10^6 (one in 10^3 to one in 10^{10}). Apparently, direct measurements of the spontaneous mutation rate of *M. leprae* to resistance against various drugs have not been made. The frequency of any mutants is presumed to be one in 10^6.

Drug-resistance may be defined for the present purpose as resistance to the highest attainable concentration of drug in the host.

Also for the present purpose, all drug-susceptible and drug-resistant *M. leprae* are considered to have identical rates of multiplication, and back-mutation from drug-resistance to drug-susceptibility is excluded.

$$R = r_1 + r_2 + r_3 \quad \ldots\ldots (2)$$

where R — is the growth constant for a given set of conditions;

r_1 — constant for bacterial doubling;

r_2 — constant for host response;

r_3 — constant for bactericidal action of drug.

The constants r_1, r_2 and r_3 can each be derived from the observations, in an easy calculation. For example, if each unit of time is taken as 11 days (one doubling of viable bacteria) and if a bactericidal drug kills 99.9% of bacilli in one unit of time, then:

$$r_3 = \log_n P_1/P_o = \log_n 0.001 = -6.91$$

Number of viable bacteria before treatment

Lepromatous (LL) patients are presumed to harbour 10^{10} viable *M. leprae* before treatment. Borderline lepromatous (BL) patients are presumed to harbour 10^7 viable bacteria.

Viable bacteria alone are considered in the mathematical model and computer displays. It must be emphasized that the total number of bacteria in skin smears includes the many dead bacteria that accumulate during bactericidal treatment. Dead bacteria presumably do not contribute to the population equations and therefore do not appear in the computer printouts.

Computer programs

Programs were written in BASIC, for the PDP-11 and PC 350 computers manufactured by Digital Equipment Corporation. Sample problems were run through the computer program and independently verified on calculators. Table 1 is taken from a computer print-out, indicating the variables for which any desired values can be entered. Any imaginable combination of the listed factors can be followed in the computer program. Table 1 shows the actual values used for MDT in an LL patient.

TABLE 1 : **Sample text of computer printout**

```
VIABLE BACTERIA ALONE are considered.
Assumed : LL(.1E + 11 bact.)/bact. gen. time = 11d./mutants — 10E-6
Enter (n) if you prefer other assumptions : ?n
The generation time (DAYS) of bacteria is not 11 but? 11
The initial no. of VIABLE bacteria is not 0.1E + 11 but? 0.1E11
The frequency of mutants is ONE IN not 0.1E7 but? 0.1E7
The clearance constant is MINUS not 0.042 but? 0.042
The bacterial growth constant is not 0.69 but? 0.69
The bactericide constant is MINUS not 6.91 but? 6.91

Symbols used in the log scale display of VIABLE bacteria:
..... = sensitive bacteria = 'sens'.
xxxxxxxx = resistant to (bacterio) static drug = 'res. (stat)'
******* = resistant to cidal drug = 'res. (cide)'
Do you want to print the present screen display (y/n)? y

Treatment option no. 6
Bacteria : res. (stat) = .584291E-04 sens. = 58.429
res. (cide) — 8917.82          total = 8976.25
Display bacterial population (y/n)? n

Time elapsed till now is Oy. 1m. Ow. Od.
Total VIABLE bacteria = 8976.25
```

The total number of viable bacteria, and the sub-populations of drug-susceptible and drug-resistant bacteria, can be monitored during treatment—daily, weekly, monthly or yearly, as desired (interchangeably). Table 2 shows the interchangeable options available for treatment. Only options 4 and 6 were used, being considered closest to currently popular forms of MDT.

"Option 4" — 2 bacteriostatic drugs;

"Option 6" — 2 bacteriostatic + 1 bactericidal drug.

TABLE 2 : Treatment options

Monitor bacteria at : d)aily w)eekly m)onthly y)early intervals.
Enter selected letter? d
Enter the no. of your treatment option :

No treatment	1
1 static drug only	2
1 cidal drug only	3
2 static drugs	4
1 static + 1 cidal drug	5
2 static + 1 cidal drug	6

Selected option no.? 6

Therapeutic situations

Changes in viable bacteria have been followed during MDT of — "LL" and "BL" patients

—with 1 bactericidal (cidal) and 2 bacteriostatic (static) drugs, given as follows:

Treatment 1 — "Intermittent" : Cidal — once monthly + 2 static — daily.

Treatment 2 — "Continuous" : Cidal — daily + 2 static — daily.

Treatment 3 — "Initial": Cidal — daily, for 3 weeks only + 2 static — daily, continuously.

Limitations of model

The poorly explained phenomenon of drug-sensitive "persistor" bacteria cannot be incorporated until a reasonable theoretical basis for it is formulated. Only metabolically active viable bacteria are considered here.

Patients in a hyper-endemic area may be at constant risk of fresh infection from external sources. The literature seems silent on this important question, and for present purposes, the risk is considered to be negligible.

The assumption that bacteriostatic drugs do not attenuate the potency of bactericidal drugs against *M. leprae* seems precarious, but it is made in the absence of definite evidence to the contrary. The same assumption seems to be made by advocates of MDT combining bacteriostatic and bactericidal drugs.

The constants used in the equations are based on the published evidence available. Future findings may modify the values assigned For example, it may be found that drug-resistant *M. leprae* multiply less quickly than drug-susceptible *M. leprae*.

Nevertheless, comparison between the three regimens should remain unaltered. The relative differences between the regimens should not be prejudiced by a change in mathematical constants that are common to the regimens. Interpretation of the results should therefore focus on the relative, rather than the absolute, durations of the three treatments.

RESULTS

The figure presents the results in graphs, based on the computer printouts. The four lines in each graph of the figure represent (from top to bottom) : bacterial index (BI), total number of viable bacteria, bacteria resistant to the bactericidal drug, bacteria resistant to either one of the bacteriostatic drugs.

Many interesting features can be spotted in the graphs. Only a few prominent ones are listed here.

(1) Viable organisms are killed much more rapidly than the bacterial index (BI) suggests.

(2) Initial killing of *M. leprae* (during the first few weeks of treatment) is remarkably better with the "continuous" treatment 2, than with the "intermittent" treatment 1.

(3) In an LL patient on MDT, bacteria resistant to the most powerful of the three drugs used, do attain a majority. However, if treatment is continued without interruption, the two weaker drugs ensure that bacteria resistant to the strongest drug do not multiply. These drug-resistant bac-

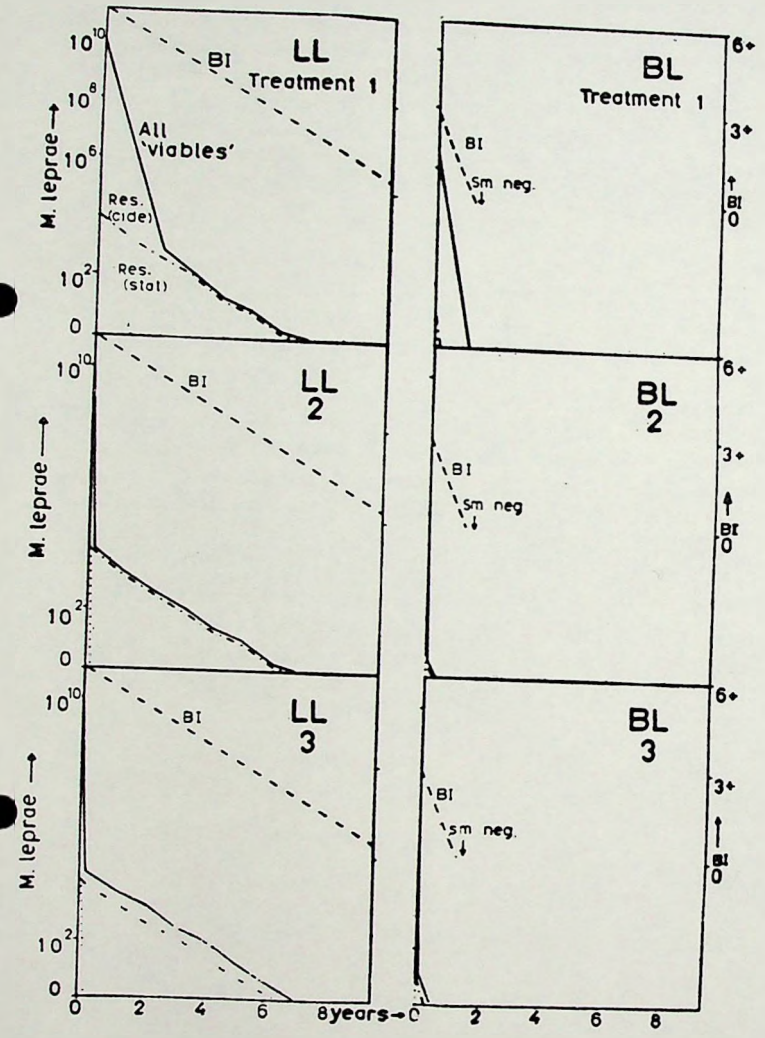

Fig. 1. Bacterial populations during multiple drug therapy of LL and BL leprosy patients.

teria are then slowly removed over a period of years, by the host responses—provided the two weaker drugs are not prematurely withdrawn.

(4) In LL patients, the three MDT regimens (intermittent, continuous and initial) take equally long to kill all viable *M. leprae*.

(5) In BL patients, killing of bacteria is so much quicker than in LL patients, that the lines representing viable bacteria in the Figure, are scarcely distinguishable from the y axis: particularly for treatments 2 and 3. One point of interest in the BL graphs is that drug-resistant bacteria do not attain a majority at any stage of treatment. Also, in BL patients, "continuous" three-drug treatment 2 kills all viable bacteria in less than half the time taken by "intermittent" treatment.

(6) Within weeks of starting treatment, viable bacteria are no more than a minute population scattered among vast numbers of dead bacteria.

DISCUSSION

MDT (multiple drug therapy) kills *M. leprae* more quickly than the fall in BI suggests. However, from the graphs in the figure, it is evident that the initial rate of killing is not sustained. This is apparently due to selection of mutant bacteria resistant to the most powerful of the three drugs used.

The model only underlines what common sense might have predicted. Bacteria resistant to the powerful bactericidal drug are acted on relatively slowly, by the two weaker drugs. The remainder of bacteria are rapidly killed by the bactericidal drug. Thus bacteria resistant to the most powerful drug are relatively favoured, and attain a majority among the surviving bacteria. Fortunately, if treatment is not prematurely withdrawn, these resistant bacteria are contained by the weaker drugs — to be removed slowly, by the immune responses of the host. Eventually, no viable bacteria remain.

Bacteria resistant to the most powerful drug can only be contained if the weaker drugs are ingested regularly, until no metabolically active bacteria remain.

MDT kills bacteria so rapidly at first, even when given "intermittently", that viable bacteria are soon masked by huge numbers of accumulated dead bacteria. The remarkably slower killing of bacteria by "intermittent" as compared to "continuous" or "initial" schedules of MDT, is unlikely to be demonstrable by currently used methods. Neither mouse foot pad inocula-

tion of bacteria from skin biopsies, nor BI or morphologic index (MI) measurements are likely to uncover this important difference. This is probably because the enormous numbers of dead bacteria obscure the difference. However, the model suggests that the "intermittent" schedule of MDT lags well behind "continuous" MDT in the initial killing of bacteria.

Bacteria resistant to the most powerful drug are steadily selected, and therefore the initial rate of bacterial killing is not maintained. A slower phase of bacterial clearance by host immune responses follows, during which the weaker drugs inhibit bacteria resistant to the most powerful drug. This "slow phase" in LL patients lasts so much longer than the rapid initial killing, that all three schedules of MDT achieve "cure" (no metabolically active bacteria) within approximately the same interval after starting treatment.

The "initial" schedule of MDT, employing the bactericidal drug daily for a limited initial period, achieves rapid initial killing of *M. leprae*. It also avoids wastage of the powerful bactericidal drug after the surviving bacterial population has become predominantly resistant to that drug.

MDT with the few drugs available emerges as a calculated risk. The benefits of rapid initial killing by the bactericidal drug will be useless unless the weaker drugs are ingested regularly, for long enough. Otherwise, bacteria resistant to the most powerful of the drugs might multiply again to produce drug-resistant relapse. Only when the imbalance in potency between the single powerful bactericidal drug and the other drugs is remedied, will MDT be free of the risk of selecting drug-resistant *M. leprae*. This emphasizes the need to find new potent drugs, if only to balance the potency of the one strong drug now available.

This picture of bacterial population dynamics during MDT is less naive than many popular guesses. It provides food for thought, and suggests areas deserving more research.

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Relapse Rates in Lepromatous Leprosy According to Treatment Regularity[1]

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Patients with lepromatous leprosy may now hope for a limited period of treatment instead of life-long therapy ([1-4]). The study of relapses after skin smears become "negative for *Mycobacterium leprae*" will help determine the optimal duration of treatment. We therefore continued our previous analysis of relapses among smear-negative lepromatous (LL) and borderline lepromatous (BL) patients on dapsone (DDS) monotherapy ([2]) to find out whether continued treatment during smear negativity has as much influence on relapse rates as previous treatment during smear positivity.

Much data is available on the magnitude of relapse rates among treated "multibacillary" leprosy patients ([4, 6-13]), including that from our own previous report ([2]). However, none of these studies considered the regularity of treatment during smear positivity separately from that during smear negativity.

MATERIALS AND METHODS

The well-documented leprosy control program of the Schieffelin Leprosy Research and Training Centre (SLR&TC), Karigiri, India, among the 450,000 inhabitants of Gudiyatham Taluk in South India, has previously been described in detail ([1]). The most relevant points alone are repeated here. The whole population in the area is regularly examined for leprosy. All known patients are registered for treatment, which they collect at monthly village clinics near their homes. Details on each patient are carefully maintained in an individual patient record.

All 1580 LL and BL patients residing in Gudiyatham Taluk (area = 1320 km^2) were listed on 31 December 1977 from the treatment register of SLR&TC, Karigiri. Data were assembled for each patient, from the date of registration up to 28 February 1981, from individual patient records; 157 of 1580 patients had insufficient data. Of the remaining 1423 patients (90.1%), all were included who had been smear positive and had had at least two consecutive negative skin smears at any time after registration; 1008 patients satisfied these criteria.

DDS monotherapy was used throughout the study period, and smear-negative patients continued on treatment. Smears were taken annually from a minimum of four skin sites: earlobe and chin on the right, forehead and buttock or thigh on the left.

"Relapse" is taken to mean the re-appearance of *M. leprae* in the skin smears of a smear-negative patient, excluding those cases where a single bacillus was found at only one skin site on an isolated occasion. The "period of smear negativity" for a patient is defined as the single longest period after registration which started with, ended with, and included only negative skin smears. The sum of the periods of smear negativity for a group of patients yields their "person-years of smear negativity." "Regularity of treatment" during a stated period is defined as the percentage of months throughout the period during which the patient attended a monthly village clinic to collect tablets. Those who collected fewer tablets were assumed to have ingested fewer tablets, on the average, than those who collected tablets regularly. In the interest of clarity, it was decided before analysis that treatment regularity during smear negativ-

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ity should not have class intervals identical to those for regularity during smear positivity.

"DDS-resistant infection" ([1]) had been diagnosed among patients whose annual skin smears showed a continuing increase in the number of bacilli, despite >50% regular treatment overall. Some patients with enough bacilli [bacterial index (BI) ≥ 2+] for successful inoculation of the mouse foot pad were also tested for the presence of DDS-resistant bacilli ([3]).

The chi-squared test with correction for continuity was used to determine the statistical significance of observed differences.

RESULTS

The lowest relapse rate during the initial three years of smear negativity was found among the patients with the better treatment regularities during both past smear positivity and smear negativity (The Table). For example, until the third year of follow up, patients with a history of less regular (≤66.7%) treatment during past smear positivity had 4.9% relapses per year (17 + 11 = 28 relapses during 279 + 288 = 567 person-years of smear negativity); whereas those with more regular (>66.7%) treatment had only 2.8% relapses per year (26 relapses during 946 person-years). The difference is statistically significant ($p < 0.05$).

A striking finding, however, is that from the fourth year of follow up onward, patients treated more regularly during past smear positivity did not have lower relapse rates than those treated less regularly. On the other hand, more regular (>75%) treatment during smear negativity was consistently accompanied by lower relapse rates than less regular (≤75%) treatment even seven or more years after the attainment of smear negativity (The Figure).

Patients with >75% regular treatment from the seventh year of smear negativity (The Table) had 1919 (551 + 1378) person-years of observation. Twenty patients relapsed, giving a relapse rate of 1.0% per year; 16 of these patients eventually became smear negative again while continuing on DDS monotherapy. Two of the remaining patients were demonstrated to harbor DDS-resistant bacilli by the mouse foot pad test ([3]), one of whom showed a continuing increase in bacilli in successive skin smears and, hence, was diagnosed to have DDS-resistant infection ([1]).

THE TABLE. *Relapses among smear-negative LL and BL patients by regularity of treatment during smear negativity and regularity of treatment during smear positivity.*

Duration of smear negativity (yrs)	Treatment regularity during smear negativity	Treatment regularity during smear positivity[a] ≤66.7%	>66.7%
1–3	≤75%	17/279 (6.1%)	9/191 (4.7%)
	>75%	11/288 (3.8%)	17/755 (2.3%)
4–6	≤75%	10/209 (4.8%)	6/123 (4.9%)
	>75%	1/206 (0.5%)[b]	9/521 (1.7%)
≥7	≤75%	13/557 (2.3%)	8/297 (2.7%)
	>75%	4/551 (0.7%)	16/1378 (1.2%)

[a] Number of patients relapsed/person-years smear negativity.

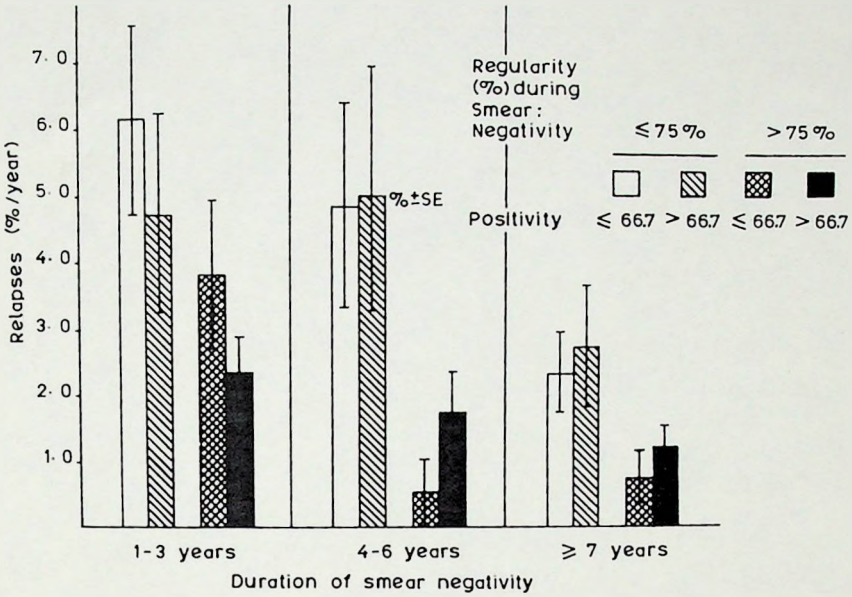
[b] Significantly less than ≤75% treatment regularity during 4–6 years of smear negativity; $p < 0.005$, chi-squared test.

DISCUSSION

"Relapses" in lepromatous leprosy can occur due to "endogenous" *M. leprae* from within the patient, or "exogenous" *M. leprae* from external sources, or both. During the initial three-year period of follow up, more regular treatment during past smear positivity was associated with lower relapse rates. Perhaps inadequately treated *M. leprae* resume multiplication and manifest as a relapse within this initial period of smear negativity. Beyond this period, relapse rates are no lower for the patients treated more regularly in the past than for those with less regular past treatment.

Relatively regular treatment during smear positivity seems to have no salutary effect on the risk of relapse after the third year of smear negativity. Perhaps this is because "endogenous" *M. leprae* (from within the patient) do not pose as great a threat as "exogenous" bacilli after the third year of smear negativity.

Beyond the initial period of smear negativity, the risk of "endogenous" *M. leprae* multiplying should tail off, and relapse rates similarly tail off, unless "exogenous" sources of *M. leprae* (outside the patient) are avail-



THE FIGURE. Relapses among smear-negative LL and BL patients by regularity of treatment during smear negativity and smear positivity.

able. In the one non-endemic area where treatment was stopped after using four drugs for a period ([7]), none of 80 LL and BL patients with negative smears had relapsed. The risk of relapse from "endogenous" *M. leprae* may have been minimized in that study by the use of four drugs. However, the low (possibly zero) relapse rates are consistent with the view that few "exogenous" *M. leprae* were available in that non-endemic area.

The frequency with which "exogenous" sources of *M. leprae* may lead to detectable bacilli in the skin of an individual was partly measured by a total population study of apparently noninfected persons in a leprosy-endemic area ([5]); 5.8% of about 7000 persons with no sign of leprosy were found to harbor acid-fast bacilli in the skin of one earlobe. The corresponding figure among patients with apparently "resolved" leprosy was 13.33%. That these bacilli were *M. leprae* was suggested not only by their failure to grow on routine mycobacterial media but, more strongly, by the higher-than-average incidence of subsequent clinical leprosy among the apparently noninfected persons harboring the bacilli.

One interesting group in the present study is the 20 patients who "relapsed" after having been smear negative for seven or more years, despite >75% regular treatment during smear negativity (The Table). Although bacilli reappeared in their skin smears, 16 of them went on to become smear negative again while on DDS monotherapy. DDS-resistant infection, therefore, seems an unlikely explanation of their transient smear positivity. If "endogenous" *M. leprae* had multiplied to give the positive smears, those patients treated more regularly during past smear positivity should have a lower "relapse" rate than those less regularly treated. Instead, their relapse rate is at least as high: 1.2% per year for those with more regular (>66.7%) treatment during smear positivity compared to 0.7% per year for those with less regular (≤66.7%) treatment. This is consistent with the explanation that the bacilli could have come from "exogenous" sources and were, therefore, unaffected by previous treatment during smear positivity.

The rarity of DDS-resistant infection, or even of sufficient bacilli to inoculate the mouse foot pad, among the patients who "relapsed" after years of smear negativity is in keeping with our earlier studies ([1]). We had found that smear negativity indicated a significantly reduced risk of DDS-resistant infection.

SUMMARY

In Gudiyatham Taluk, South India, 1008 lepromatous (LL) and borderline lepromatous (BL) patients were studied. They had previously been smear positive, had attained smear negativity, and continued on DDS monotherapy. "Relapse" was defined as the reappearance of *Mycobacterium leprae* in skin smears. The area is endemic for leprosy.

The lower relapse rates in the first three years of smear negativity alone were associated with more-regular treatment during both past smear positivity and smear negativity. From the fourth year of smear negativity onward, only the more-regular treatment during smear negativity was associated with lower relapse rates; whereas patients with more-regular treatment during past smear positivity had no lower risk of relapse than those with less-regular treatment.

The finding that regularity of treatment during smear positivity seems to have no effect on relapse rates beyond the third year of smear negativity is discussed. In a leprosy-endemic area, it is argued that beyond the first three years of smear negativity in an LL or BL patient, sources of *M. leprae* outside the patient may be more responsible for relapse than the patient's own bacilli.

RESUMEN

Se estudiaron 1008 pacientes lepromatosos (LL) y lepromatosos intermedios (BL) en Gudiyatham Taluk, al sur de la India. Los pacientes que previamente habían sido baciloscópicamente positivos, alcanzaron la negatividad baciloscópica y continuaron con monoterapia a base de dapsona (DDS). Se consideró que hubieron recaídas cuando reaparecieron bacilos en los extendidos de linfa cutánea. En el área estudiada la lepra es endémica.

Las bajas frecuencias de recaída en los primeros 3 años de negatividad baciloscópica se pudieron asociar con un tratamiento muy regular tanto durante la positividad baciloscópica previa como durante la etapa de negatividad. A partir del cuarto año de negatividad, las bajas frecuencias de recaída sólo se pudieron asociar con un tratamiento muy regular durante la etapa de negatividad baciloscópica. Los pacientes con un tratamiento muy regular durante la positividad baciloscópica previa tuvieron igual riesgo de recaída que aquellos pacientes con tratamiento menos regular.

La regularidad del tratamiento durante la positividad baciloscópica no parece tener efecto sobre la frecuencia de recaídas después del tercer año de negatividad. Se argumenta que en un área con lepra endémica, las fuentes de *Mycobacterium leprae* externas son más importantes que los bacilos del propio individuo como causa de recaída en un paciente LL o BL después del tercer año de negatividad baciloscópica.

RÉSUMÉ

On a étudié 1008 malades lépromateux (LL) et lépromateux dimorphes (BL), dans le Gudiyatham Taluk, en Inde du Sud. Ces malades avaient été antérieurement bactériologiquement positifs; ils étaient négatifs au frottis cutané, ils étaient toujours sous monothérapie par la DDS. Les "récidives" ont été définies comme la réapparition de *Mycobacterium leprae* dans les frottis cutanés. Cette région est endémique pour la lèpre.

Un taux réduit de récidives au cours des trois premières années à bactériologie négative était associé avec un traitement plus régulier avant la négativation, tant au cours de la période précédente de bactériologie positive, qu'au cours de la période caractérisée par une bactériologie négative. A partir de la quatrième année à bactériologie négative, et au cours des années suivantes, l'abaissement du taux de récidive n'était associée qu'avec un traitement plus régulier au cours de la période négative. Les malades ayant poursuivi leur traitement de manière plus régulière au cours de la période à bactériologie positive, ne présentaient pas un taux de récidive plus faible que ceux qui avaient eu un traitement moins régulier au cours de cette période.

On discute cette observation que tend à montrer que la régularité du traitement au cours de la période de bactériologie positive semble n'avoir aucun effet sur les taux de récidives au-delà de la troisième année de bactériologie négative. Dans une région endémique pour la lèpre, on peut défendre l'hypothèse qu'au-delà des trois premières années de bactériologie négative chez des malades LL ou BL, les sources de *M. leprae* extérieures au malade peuvent être davantage responsables pour les récidives que les bacilles du malade lui-même.

Acknowledgments. We thank all of the staff of the Department of Epidemiology and Leprosy Control and the Division of Laboratories, particularly Mr. J. Samuel. Mrs. Reeny S. Charles typed the manuscript.

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Spot Test for Detection of Dapsone in Urine: An Assessment of Its Validity and Interpretation in Monitoring Dapsone Self-administration[1]

Han Huikeshoven and Monina G. Madarang[2]

In 1965, de Castro, *et al.* ([2]) described a simple spot test for the detection of dapsone in urine, employing filter paper impregnated with a modified Ehrlich's reagent. Spots of urine on the impregnated paper show a yellow ring at the periphery caused by urea and an inner spot of orange when the drug is present. Noordeen and Balakrishnan ([6]) reported the test to be reliably positive in urine collected before 48 hours following the administration of 10 to 75 mg of dapsone to children. Ellard, *et al.* ([3]) could not affirm this high degree of sensitivity. In their hands, one day after giving single doses of 200 mg of dapsone to 34 patients only 23 (68%) urine samples were positive. Recently, however, Irudaya Raj, *et al.* ([5]) reported positive spot tests in the urine of 13 (59%) out of 22 patients six days after a last daily dose of 100 mg dapsone, while all urines were positive one day after the last dose.

The present study aims to clarify the sensitivity and, hence, the validity and interpretation of this simple test for monitoring dapsone self-administration.

MATERIALS AND METHODS

Urine samples. After giving their informed consent, 20 volunteers (15 men and 5 women) ingested four consecutive daily doses of 100 mg dapsone. Urine samples were collected at 9 a.m., immediately before the dapsone doses were taken, and at the same hour on each of ten days following the last dapsone intake; the urine used was never the first morning specimen. Dapsone was added to pairs of randomly selected, pretreatment urine samples of the volunteers to final concentrations of 1, 2, 3, 4, 5, 7.5, 10, 12.5, 15, and 20 μg/ml, respectively, to serve as internal standards. The specimens were preserved by thimerosal in a final concentration of 0.02%; they were coded and randomized prior to testing.

Spot tests. The method of de Castro, *et al.* ([2]) was employed with the following modifications. Chemicals for the impregnation of the paper were dissolved completely in 70% ethanol, thus giving brighter spots than before when very little nacconol was dissolved in absolute ethanol. The color intensities of 50 μl urine spots on the impregnated paper were compared with that of a standard spot using acidified urine containing 5 μg dapsone per ml (final HCl concentration = 0.1 N) both before and after the addition of 50 μl drops of 1 N HCl to the spots. Portions of the urine specimens were sent to Cebu City, Philippines, where a second observer (MGM) repeated the tests. Both observers repeated the tests once again on duplicate portions of the specimens.

D:C ratios and T½ values. The dapsone:creatinine (D:C) ratios in urine specimens were determined as described by Ellard, *et al.* ([3]). Individual values for the half-time (T½) of dapsone elimination were derived from the linear regression of the logarithm of the D:C ratios in the first six urines obtained after the last dapsone intake with deduction of the blank "D:C ratio" found in the pretreatment urine sample of each volunteer.

RESULTS

Results obtained with the 20 internal standards indicate that generally assessments were correct. However, in standards containing dapsone concentrations of (or near) the reference value of 5 μg/ml, the first observer was more inclined to positive assessments than the second observer. Table

[1] Received for publication on 6 February 1985; accepted for publication in revised form on 5 August 1985.

[2] H. Huikeshoven, Ph.D., Research Officer, Royal Tropical Institute, 1092 AD Amsterdam, The Netherlands. M. G. Madarang, M.T. (ASCP), B.S. (Pharm.), M.B.A., Chief, Technical Services, Leonard Wood Memorial Center for Leprosy Research, Cebu City, The Philippines.

There is no reason to delay or avoid the declaration of "Cure" for these patients.

(4) The impact of dapsone therapy on transmission judged by the case detection rate is slow. For the last 20 years, this rate remains between 1 and 2% per year but shows a definite decline.

These facts on dapsone therapy are just reminded because Centres or Institutions who can not assure a good level of treatment, of supervision and follow up could continue to use Dapsone alone except in cases clinically suspect of dapsone resistance. There is a fresh danger in using Rifampicin and Clofazimine in an indiscriminate manner.

EFFICACY OF DAPSONE MONOTHERAPY IN NON-LEPROMATOUS LEPROSY : K. JESUDASAN, D. BRADLEY, M. CHRISTIAN

1,701 non-lepromatous patients treated with dapsone monotherapy for at least four and a half years and released from control, were followed up and examined, for evidence of relapse. They contributed a total of 5,254 person years of risk, there were 51 relapses (3%), giving an overall relapse rate 9.7 per 1000 person years of risk. This paper examined the effect of various factors, on the risk of relapses, such as age, sex and classification of the disease; duration and regularity of treatment; percentage of attendance; deformity grade; number of patches and lepromin status. Some of the factors studied such as age, sex classification, percentage of attendance and the number of patches in association with the lepromin status were found to significantly influence the risk of relapse in these patients. Therapy in non-lepromatous leprosy was discussed in the light of these findings.

Resume of Discussions

P.N. Neelan (to *K. Jesudasan*) : (a) Regarding the ten cases of relapse with bacteriopositivity, were attempts made to identify drug-resistant organisms by the mouse foot pad test in these ? (b) Did the lepromin reaction change in these cases at the time of relapse ?

K. Jesudasan : (a) No attempt was made to identify drug resistant organisms by the mouse foot pad test in the ten cases of bacteriologically positive relapses. But all of them have responded well to dapsone monotherapy. (b) There was no evidence of change in lepromin status at the time of relapse.

P.D. Samson : Did different doses of Dapsone have any relation to relapse rate in your study ?

K. Jesudasan : There was no evidence that different dosage or of treatment had anything to do with.

DISCUSSION ON "EVALUATION OF DAPSONE MONOTHERAPY IN THE FIELD"

Date : **Friday, the 18th November 1983**

Time : **4.15 P.M. to 5.00 P.M.**

Leader	:	DR. C.J.G. CHACKO
Rapporteur	:	DR. G.Y. JOSHI
Participants	:	DR. J.G. ALMEIDA
		DR. C. VELLUT
		DR. K. JESUDASAN
		DR. A. THOMAS
		SHRI S.S. NAIK
		DR. P.N. NEELAN

ABSTRACTS AND RESUME OF DISCUSSIONS

C.J.G. Chacko : I am honoured to be asked to organise this symposium on "Evaluation of Dapsone Monotherapy in the Field". Data from five well known leprosy control programmes in India known for their high quality of work and maintenance of good records will be presented at this Symposium.

Some of you may wonder as to why should this topic be discussed at the present juncture when new regimens are being tried out in different parts of the country. Evaluation is a well recognised principle in management and we should analyse the data from well known control programmes to see what has been achieved and this will form the baseline data against wh ch results of the newer drug regimens can be compared.

EVALUATION OF DAPSONE MONOTHERAPY FOR LEPROMATOUS LEPROSY IN GUDIYATHAM TALUK : J.G. ALMEIDA, C.J.G. CHACKO

The paper reports results upto 1981, obtained in Gudiyatham Taluk, the leprosy control area of the Schieffelin Leprosy Research and Training Centre, Karigiri. Some relevant features of the leprosy control programme from 1963 have been : house-to-house surveys in the entire population of about 450000, health education, and careful maintenance of individual patient records. DDS (dapsone) monotherapy was used during the period under review. Smear negative patients continued on DDS.

1423 LL (lepromatous) and BL (borderline lepromatous) patients were studied. 90.9% had attained smear negative status (Figure 1). Smear negativity was found to be an important prognostic sign. Firstly, the

risk that *M. leprae* would reappear in skin smears decreased progressively after the attainment of smear negativity. During the initial two years of smear negativity, *M. leprae* reappeared in 2.8% of patients per year. In contrast, from the ninth year of smear negativity onwards, *M. leprae* reappeared in only 0.9% of patients per year. 77.7% of the 1423 patients had been smear negative for 3 or more years, and from the third year of smear negativity, *M. leprae* reappeared in 1.1% of patients per year.

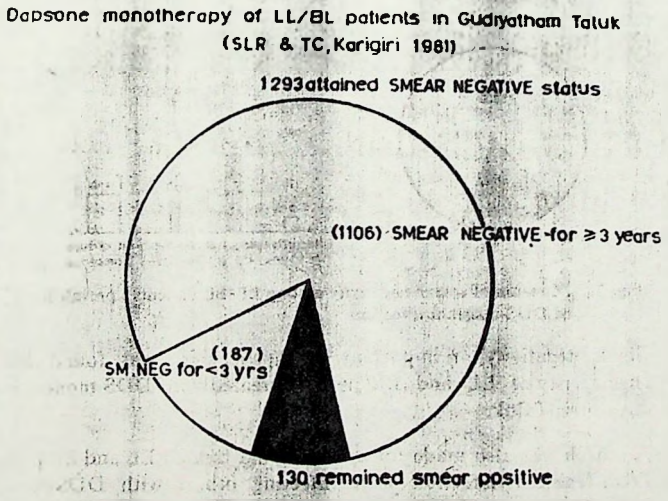

Fig. 1. Dapsone monotherapy of LL/BL patients in Gudiyatham Taluk.

Secondly, smear negativity was found to indicate a significantly reduced risk of the subsequent appearance of DDS-resistant infection. A continuing increase in the number of *M. leprae* in successive annual skin smears despite DDS treatment was taken to indicate DDS-resistant infection. 1224 LL and BL patients who were not absentees were studied for DDS-resistant infection. 93.8% of the 1224 patients had attained smear negative status. The prevalence of DDS-resistant infection among the 1000 patients who had at some point in treatment been smear negative for 3 years or more was only 1.2%. In contrast, the prevalence among the 76 patients who remained continuously smear positive was significantly higher, 23.7% (Figure 2).

Duration of smear negativity among LL-BL patients :
Prevalence of DDS-resistant infection
(Gudiyatham Taluk DDS-resistance survey :
Schieffelin Leprosy Research & Training Centre, Karigiri.)

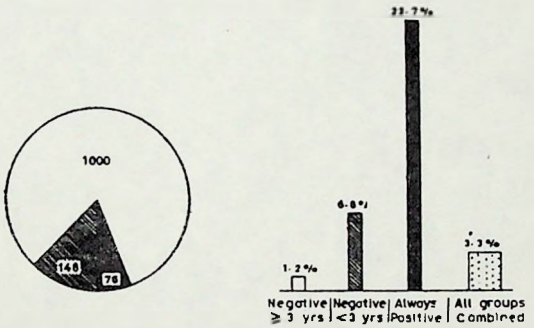

Fig. 2. Duration of smear negativity among LL-BL patients : prevalence of DDS-resistant infection.

Smear negativity, an important prognostic, sign, was found among the vast majority of LL and BL patients treated with DDS monotherapy in Gudiyatham Taluk.

A search was also made for evidence that treated LL and BL patients with DDS-resistant infection were infecting others with DDS-resistant *M. leprae*. *M leprae* with "low grade resistance" (to small but not large doses of DDS) were much less common than *M. leprae* with "high grade resistance", among treated patients. Newly diagnosed patients infected by those with DDS-resistant infection should show a failure of response to DDS-monotherapy. Not a single one of the several hundred newly diagnosed LL and BL patients seen over the years in Gudiyatham Taluk showed such failure of response at the start of treatment.

Secondly, as the prevalence of DDS-resistant infection among treated patients increased each year, the proportion of newly diagnosed patients infected with DDS-resistant *M. leprae* should correspondingly have increased. Patients starting treatment relatively long ago should show a better response to DDS-monotherapy than those starting more recently. The observation, on the contrary, is that 148 LL and BL patients registered in the years 1971 to 1973 responded as well to DDS-monothe-

rapy as 391 patients registered in 1964 to 1966. In fact, at the 5th, 6th and 7th years after the start of treatment, a significantly higher proportion of smear negative patients was found among those registered in 1971 to 1973 (Figure 3). Interestingly, only 15.1% of those starting in 1964-66 had an initial BI of 3+ or more, whereas 46.9% of those starting in 1971-73 did so.

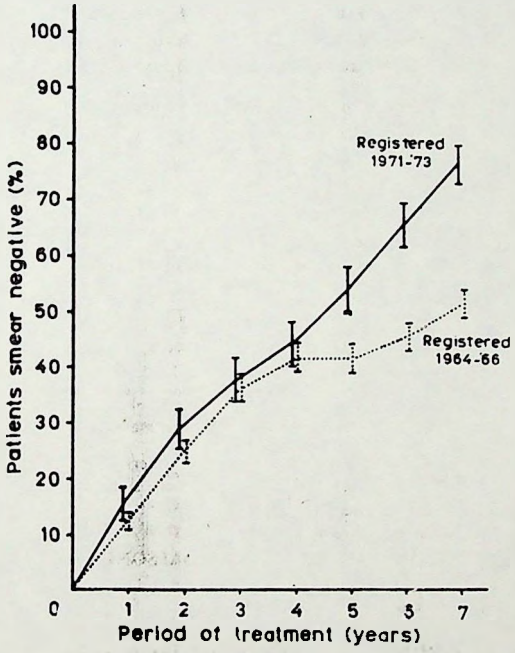

Fig. 3. Attainment of smear negativity among 2 groups of LL/BL patients on DDS monotherapy.

This evidence does not support the hypothesis that treated patients with DDS-resistant infection commonly transmit DDS-resistant infection to others.

The status of all 58 surviving patients with lepromatous leprosy on DDS-monotherapy for 20 years or more was examined. 51 of 58 (88%) could be pronounced "smear negative" and "clinically inactive".

In summary :

(1) DDS monotherapy renders over 90% of LL and BL patients smear negative.

(2) Smear negative patients have a reduced risk of developing DDS-resistant infection.

(3) The evidence available does not support the hypothesis that treated patients with DDS-resistant infection commonly transmit DDS-resistant infection to others.

(4) After 20 years or more of DDS monotherapy, 51 of 58 surviving patients with lepromatous leprosy are "smear negative" and "inactive".

Resume of Discussions

J. Prakash and N.K. Jain : How can we rely on Dapsone monotherapy when we do not know the actual blood level of Dapsone required for its bacteriostatic action?

J.G. Almeida : I think we do know the blood level of dapsone required for its bacteriostatic action. I can't remember the exact figure, but I'm sure that the information is available in the literature.

G. Ramu : Primary Dapsone resistance has been shown as 35% in Chingleput and 51% in Ethiopia. Have you any observation to make ?

J.G. Almeida : The figures of 35% and 51% refers, I think to DDS resistant *M. leprae* detected in the mouse test. This is not the same as a failure to response to DDS monotherapy in the patient.

SOME FACTS ABOUT 25 YEARS OF DAPSONE MONOTHERAPY AT KILAMBAKKAM : C. VELLUT

This is not a study but a reminder about results of dapsone monotherapy.

(1) Out of 937 lepromatous patients treated for 25 years 228 cases (25%) were regular for treatment. 97.8% cases were and remained negative for AFB in skin smears.

(2) Dapsone treatment shows slow results. It takes 4 years to make 50% of the I-T-BT group to become inactive and 7 years to make 50% of the lepromatous become inactive.

(3) The relapses in the non-lepromatous and borderline group are rare ±4 to 5%/year (without relation to the time of observation).

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Lepr Rev (1983) **54**, 185–191

Studies on dapsone-resistant *Mycobacterium leprae* in leprosy patients of Gudiyatham Taluk, the leprosy control area of the Schieffelin Leprosy Research and Training Centre, Karigiri. 2. A progress report

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Summary The 1580 LL and BL leprosy patients in a community of 480,000 persons in South India were studied for the occurrence of dapsone-resistant *Mycobacterium leprae*, between March 1978 and February 1981. Patients with a BI ≥ 2+ were biopsied for mouse inoculation, even if they were improving on dapsone monotherapy. Between 89 and 116 patients per 1000 patients screened were estimated to harbour dapsone-resistant *M. leprae*.

Introduction

Gudiyatham Taluk of North Arcot District in Tamil Nadu, the leprosy control area of the Schieffelin Leprosy Research and Training Centre, covers an area of approximately 1320 sq km with a population of 480,000 (1981 Census). The area is hyperendemic for leprosy, and in December 1977, 6880 patients were on the treatment register at 44 peripheral clinics within the control area. Dapsone monotherapy has been extensively used in this area since 1963, and fairly accurate records of patients have been maintained systematically throughout this period. The objectives of the study were: 1, to determine the number of registered patients who harbour dapsone-resistant *Mycobacterium leprae*; and 2, to identify risk factors associated with the occurrence of dapsone-resistant *M. leprae*.

Materials and methods

The denominator chosen for the study was all LL and BL cases on the treatment

this institution at the end of December 1977, who resided within the control area. Every patient in the denominator was clinically examined by a medical officer, and skin smears were taken from 4 routine sites as well as from other sites at which there was evidence of activity.

Patients with a BI $\geq 2+$ at any one site were biopsied, preferably from the site with the highest index (avoiding the face). In order not to underestimate the number of patients harbouring dapsone-resistant *M. leprae*, biopsy was performed on all patients with a BI $\geq 2+$, and not only on those showing evidence of active disease, as in the studies reported to date.[1-13] It must be emphasized that those biopsied included patients improving on dapsone monotherapy, who would not ordinarily be suspected of harbouring dapsone-resistant *M. leprae*. Biopsies were usually taken in the field and transferred to the base laboratory on wet ice for mouse foot-pad studies, which were performed by methods already described.[14,15]

The patients whose *M. leprae* failed to grow even in untreated mice, and those in whom the test did not detect resistant *M. leprae*, were rescreened and biopsied again if eligible.

Results and interpretation

All 1580 registered LL and BL patients residing within the area were enumerated in December 1977. The screening began in March 1978, and the activities undertaken during the next 3 years are summarized in Table 1. Of the total, 1431 patients were screened in the first year, forming a cohort that was subjected to annual screening, and biopsied when eligible.

In the first year 149 patients evaded screening. A 10% random sample of these patients were subsequently screened, and none was found eligible for biopsy. The

Table 1. Numbers of patients screened annually

	Year of survey		
	1978–79	1979–80	1980–81
Enumerated	1580	1431	1320
Migrated or died during the previous year	—	56	48
Resistant bacilli demonstrated in previous year	—	33	27
Eligible for screening	1580	1342	1245
Acutally screened	1431 (90·6%)	1320 (98·4%)	1208 (97·1%)

149 patients were therefore not included in any subsequent procedures or analysis.

As shown in Table 2, 9 patients among the 1431 screened had been shown earlier by mouse inoculation to harbour dapsone-resistant *M. leprae*. Table 2 also shows the number of patients found eligible for biopsy (BI $\geq 2+$) during each year of the study, and the number of patients subjected to biopsy. The large proportion of biopsies done during the third year of survey did not reflect an increase in the number of patients attaining eligibility for biopsy during that year, but resulted from an improved operational capacity for handling biopsy specimens. A total of 188 patients were found eligible for biopsy, of whom 142 have thus far been subjected to the procedure.

The results of biopsy and mouse inoculation are presented in Table 3. Of the 188 patients eligible, 46 escaped biopsy for a variety of reasons. Of the 142 mouse foot-pad studies carried out, the results of 17 are still not available. In 26 studies the inoculated *M. leprae* failed to multiply in both control and dapsone-treated mice. Dapsone-resistant *M. leprae* were detected in 89 studies. The resistant *M. leprae* in 81 of these studies manifested resistance to the highest concentration of dapsone used (0·01 g%). 10 studies did not detect any dapsone-resistant *M. leprae*. It is of great interest to note that an eleventh study, which on one occasion did not detect dapsone-resistant *M. leprae*, was repeated on the same patient after a period of 12 months. On the second occasion, dapsone-resistant *M. leprae* were detected, that manifested resistance to the highest concentration of dapsone used.

Thus, of the 188 patients eligible for biopsy and mouse inoculation, the results of mouse foot-pad studies have so far been obtained for only 99. Because 89 patients for whom no results are available comprise so large a fraction of the total, it is necessary to make some assumptions regarding them, in order to estimate the number of patients harbouring dapsone-resistant *M. leprae*. It appears reasonable to assume that among the 46 patients not subjected to biopsy and the 17 for

Table 2. Numbers of patients with positive smears and numbers biopsied annually

No. of patients	Pre-1978*	Year of survey 1978–79	1979–80	1980–81	Cumulative†
Smear positive	—	336	330	179	—
BI $\geq 2+$	9	114	86	82	188
BI $\geq 2+$ with clinical relapse	9	46	49	34	87
Biopsied for mouse inoculation	9	26	28	80	142

* 9 patients among the 1431 screened had already been shown by mouse inoculation to harbour dapsone-resistant *M. leprae*.

† A patient who appears to more than 1 year is counted only once in the cumulative total.

Table 3. Results of biopsies and mouse inoculation

	Number of specimens				
	Year of survey				
	Pre-1978	1978–79	1979–80	1980–81	Cumulative
Biopsied	9	26	28	80	142
No growth of *M. leprae*	—	—	—	26	26
No DDS-resistant *M. leprae* detected	—	2*	1	8	10
DDS-resistant *M. leprae* detected	9	24	27	29	89
Resistant to DDS, at mouse diet concentration of:					
0·0001 g%	—	—	—	1	1
0·001 g%	—	2	2	3	7
0·01 g%	9	22	25	25	81
Study in progress	—	—	—	17	17

* One of these patients was later biopsied again and shown at that time to harbour resistant organisms; he is included only once in the cumulative totals.

whom results are awaited, the proportion who harbour dapsone-resistant *M. leprae* is the same as among those for whom results are available. The 26 patients whose organisms failed to multiply in control mice are problematic, however. It could be argued that these patients harbour no dapsone-resistant *M. leprae* because such a large proportion of the organisms from these patients had been killed during dapsone treatment that no organisms grew even in untreated mice. However, it is possible that viable dapsone-resistant *M. leprae* were present, although the inoculum contained too few to produce growth in the mouse foot-pad. To allow for this uncertainty, a separate estimate of the total number of patients harbouring dapsone-resistant *M. leprae* has been made for each of the alternative possibilities.

It has already been pointed out that some patients who showed improvement on dapsone monotherapy were biopsied only because they had a BI $\geq 2+$; these patients would not ordinarily have been suspected of harbouring dapsone-resistant *M. leprae*. They differ markedly from the rest of the patients biopsied, in showing a decrease in BI in successive smears at the time of biopsy. Until the significance of this difference is more fully understood, it appears important to maintain the distinction between this group of patients and the rest. Therefore the 188 patients eligible for biopsy have been divided in 2 groups: 142 who showed an increase in BI in successive smears at the time of biopsy; and 46 who showed a decrease in BI.

Table 4 shows the estimation of the total numbers of patients harbouring

Table 4. Estimation of total number of patients harbouring dapsone-resistant *M. leprae*

	Number of patients		
	Successive smears show increasing BI	Successive smears show decreasing BI	Total
Eligible for biopsy	142	46	188
No results available*	27	36	63
No growth of *M. leprae*	22	4	26
Resistant *M. leprae* detected	84	5	89
No resistant *M. leprae* detected	9	1	10
Predicted additional number with resistant *M. leprae*:			
alternative no. 1†	$\frac{84}{(93+22)} \times 27 = 20$	$\frac{5}{(6+4)} \times 36 = 18$	38
alternative no. 2‡	$\frac{84}{93} \times 49 = 44$	$\frac{5}{6} \times 40 = 33$	77
Total number with resistant *M. leprae*:			
alternative no. 1	84 + 20 = 104	5 + 18 = 23	127
alternative no. 2	84 + 44 = 128	5 + 33 = 38	166

* Includes patients not biopsied, and those whose results are pending.
† *M. leprae* that failed to grow in mice assumed not resistant.
‡ *M. leprae* that failed to grow in mice assumed susceptible and resistant in same proportions as those that multiplied in mice.

dapsone-resistant *M. leprae* in each of the 2 groups. The assumption has been made that none of the 26 patients whose *M. leprae* failed to multiply in mice harbours dapsone-resistant organisms, whereas, among the remaining 63 patients for whom no results are available, the proportion who harbour resistant organisms is the same as among the 99 patients for whom results are available. With these assumptions, a total of 104 patients from the first group and 23 patients from the second group, altogether 127 patients, were estimated to harbour dapsone-resistant *M. leprae*.

Instead, if among the 26 patients whose *M. leprae* failed to grow in control mice, the proportion who harbour resistant bacilli is considered to be the same as the proportion among the 99 patients whose results are available, then, by similar calculations, an alternative estimate is obtained. According to this alternative estimate, 128 patients from the first group and 38 patients from the second group, altogether 166 patients, were estimated to harbour dapsone-resistant *M. leprae*.

The number of registered LL and BL patients residing in Gudiyatham Taluk,

who harbour dapsone-resistant *M. leprae*, is therefore estimated to be between 127 and 166 patients, of a total of 1431 patients screened annually. Expressing these figures as fractions, between 89 and 116 per 1000 patients screened are estimated to harbour dapsone-resistant *M. leprae*. It appears reasonable to assume that the true figure must fall somewhere between these two estimates.

Discussion

As reported earlier,[15] the crude estimate of the prevalence of dapsone-resistant leprosy in Gudiyatham Taluk after the first year of this study was 23 per 100. This may be explained partly by our earlier inability to test in mice all of all the patients eligible for biopsy during a given year, and partly by the fact that biopsy during the first year was done only on patients who were deteriorating, by smear and clinical criteria.

The unexpected finding that patients who were improving on dapsone monotherapy were also shown by the mouse foot-pad test to harbour dapsone-resistant *M. leprae* raises problems of interpretation. It would appear premature to make a decision on this until a detailed analysis of our data can be completed.

Analysis of risk factors has also been deferred. However, careful records have been kept of the treatment and progress of all the patients screened, from the date of diagnosis. An analysis of the prevalence of dapsone resistance, and its causation and consequences in the individual and in the community, will be undertaken in subsequent publications.

Acknowledgements

We wish to thank Mr Samuel Joseph and Mr G Sarangapani for expert technical assistance; Mr J Samuel for help in the field work; Mr N Christopher for secretarial services; and all the staff of SLR & TC, Karigiri, particularly the Department of Epidemiology and Leprosy Control, without whose enthusiasm the study could not have succeeded.

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Persistence of Langhans' Giant Cells in Rapidly Downgrading Leprosy Lesions

To the Editor:

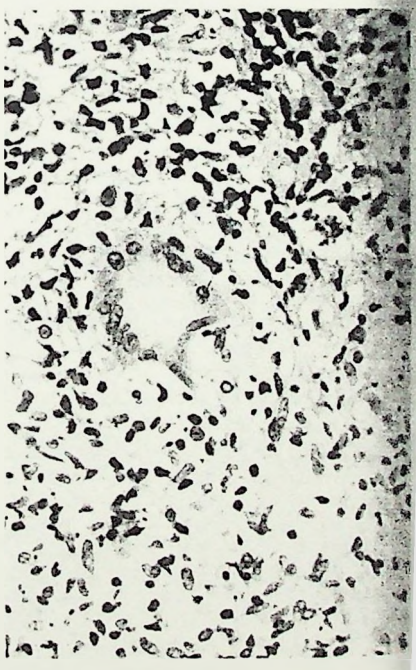
Inflammatory giant cell formation occurs in many diseases and is usually associated with granulomatous infiltration. Langhans' giant cells are a feature of the histopathological cell types found in lesions of tuberculoid and, to a lesser extent, borderline tuberculoid leprosy. They are not a feature in mid-borderline or lepromatous leprosy.

Cell-mediated immunity in borderline leprosy is unstable and, in a review of the outcome of reactions in 12 patients, it was shown that Langhans' giant cells were produced and persisted following upgrading reversal reactions but were not conspicuous in downgrading reactions ([1]).

We have recently observed Langhans' giant cells in the histopathology of rapidly downgrading leprosy.

Case A presented one month after the emergence of hypopigmented macules on his thigh and upper arm. A biopsy showed mid-borderline leprosy. Six weeks later he returned with an increase in the number of lesions, some of which were slightly erythematous. A biopsy of the left radial cutaneous nerve showed a cellular infiltration containing a few epithelioid cells, foamy macrophages, lymphocytes, and Langhans' giant cells. Acid-fast bacilli were also seen. With the exception of the Langhans' giant cells, the histological picture was that of borderline lepromatous leprosy (The Figure).

Case B was seen four months after the appearance of multiple hypopigmented lesions with poorly defined edges. The lesions had rapidly increased in number; some were marginally elevated but all had near normal sensation. Histopathology showed border-



The Figure. Langhans' giant cell in an otherwise borderline lepromatous histological field from Case A

line lepromatous to subpolar lepromatous leprosy with acid-fast bacilli. Langhans' giant cells were also present.

Case C was a patient who had been seen three times over a period of ten months. On her first presentation, she had typical hypopigmented anesthetic lesions of borderline tuberculoid leprosy. She was seen again four months later. During this period she had not taken her treatment, and the lesions were more inflamed and obvious nerve involvement was present. A biopsy showed borderline tuberculoid leprosy in reversal reaction. She was subsequently seen six months later. The disease had progressed and the lesions, which were more pleomorphic, were clinically borderline lepromatous. A biopsy confirmed this diagnosis but, in addition to the expected histological appearance, Langhans' giant cells were also seen.

The histopathology and the history in these three patients were quite similar, and all had borderline lepromatous or subpolar lepromatous leprosy. In addition, all had rapidly downgraded. Since these observations, we have seen two other patients with similar histopathology who were also considered as downgrading.

The presence of Langhans' giant cells in rapidly downgrading leprosy suggests that either these cells are capable of remarkable longevity or that the factors stimulating their formation remain present despite a diminution of cell-mediated immunity. Their persistance, together with the cellular types expected at the lepromatous end of the spectrum, may be a useful histopathological sign of rapidly downgrading leprosy.

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DDS-resistant Leprosy

To the Editor:

With reference to the paper by Almeida, *et al.* on "DDS-resistant Infection Among Leprosy Patients . . ." appearing in the September 1983 issue of the Journal (pp. 366–373), the following comments are offered:

Firstly, exclusion of 149 "not screened cases," 198 "absentees," and cases with less than 80% treatment from analysis introduces a bias in estimation. Taking overall treatment regularity as criteria for comparison does not appear to be correct since it does not discriminate the treatment regularity in the crucial initial period of treatment in a patient.

In their paper, "prevalence" is worked out as a percentage of the total number of cases "fully studied" over an unspecified period of time; whereas "incidence" is expressed as the average annual percentage of total person-years of treatment experience. It is like cutting the cake to suit the needs of the situation. If we cut a lamb into a certain number of pieces, we do not get that number of lambkins, only lamb chops considered to be a culinary delicacy. Use of person-years to work out rates in Tables 2 and 3 seems unnecessary and makes it difficult to apply statistical tests for comparison, in the way they are presented. "Prevalence" and "incidence" figures are projected in many papers on studies on DDS-resistance. Can someone elucidate the appropriate methodology for a study to find out prevalence and especially incidence rates of DDS resistance? We are in total disagreement with the interpretation of the findings in Table 3. Cases with less than 50% treatment as well as those with 50–79% treatment should have been included. If, after their inclusion, the results were found to be similar to what is projected in the table, the

one way it could be interpreted is that in cases on low initial doses of DDS, the occurrence of DDS-resistant infection seems to be postponed or delayed; it appears to be quicker in cases on higher initial doses.

In their discussion, the following statements are made which invite comments:

a) "attainment of smear negativity appears to be a favorable prognostic sign, indicating a significantly reduced risk of DDS-resistant infection"—Risk of DDS-resistant infection cannot be assessed by comparing the "prevalence" figures given earlier.

b) "Patients deteriorating on DDS treatment are likely to harbor a greater proportion of DDS-resistant *Mycobacterium leprae* than those improving on DDS treatment"—This is not supported by any finding presented in the paper. It could be stated the other way also. Carrying out more frequent serial harvests using more animals in each MFP experiment, to find out how soon DDS-resistant infection is identified in patients and also noting the multiplication factor in such positive test harvests, may perhaps give an indication of the relative proportions of resistant and sensitive organisms in such patients.

c) "the demonstration of DDS-resistant *M. leprae* by the mouse test (Ref) should not be regarded as synonymous with failure of response to DDS monotherapy"—It depends on what one accepts as response to treatment. This statement could be countered by stating that the (apparent) response to DDS monotherapy should not be regarded as insurance against subsequent development of DDS-resistant disease on continued DDS monotherapy, using the same argument put forth by the authors in the first part of the paragraph on page 371.

The criteria for growth in mouse experiments in their study do not seem to conform to the accepted standards established by the WHO Workshop held in 1979.

With reference to Almeida, *et al.* "Response to Dapsone (DDS) ... 1960s vs 1970s":

The statement in their discussion that "although negative findings cannot be used to disprove hypotheses, these data do not support the claim that DDS-resistant infections have been increasing in frequency since the introduction of DDS monotherapy" is grossly misleading and irrelevant to the findings presented in the paper. We got similar findings on the analysis of data on cases treated in the 1960s and 1970s in our field area at C.L.T. & R.I. which are being published in another journal. These findings only show that the overall level of efficacy of DDS in the treatment of leprosy in either period was not very high, and this might still be reduced if the relapses among them are included in the computation. However, the efficacy does not appear to have diminished over the years. This finding only supports the case for inclusion of DDS in the multidrug regimens recommended and accepted for treatment of leprosy in the present context.

With reference to Almeida, *et al.* "Results of Long-term Domiciliary DDS Monotherapy for Lepromatous Leprosy ...":

The use of surviving LL cases only in the analysis in this paper introduces bias and hence limits the value of the findings. A better method would be cohort analysis. It is known that mortality is higher among lepromatous cases who do not respond to treatment and worsen clinically.

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Response to Drs. Neelan and Reddy

To the Editor:

We welcome this letter with its painstaking critical approach. All the points raised can be answered.

We stated fully in our paper why the "exclusion" of some patients probably did not alter the findings. We repeat the most important points.

Of the patients enumerated 77.5% were fully studied. Of the remainder, 149 who had earlier escaped screening were not ignored but were pursued in 1981; 122 were screened, and the prevalence of DDS-resistant infection among them was no higher than among the fully studied patients. The 198 "absentees" were excluded from both the numerator and denominator of the estimates because methods had not yet been developed to distinguish between relapses due to a simple lack of treatment and those due to drug resistance. The "drug-resistant proportion test" using the mouse foot pad has been described only recently [1], and will avoid the former problems of interpreting "mouse footpad drug resistance" [2]. Moreover, we found no association between regularity of treatment and incidence of drug resistance. The wisdom of our approach has subsequently been confirmed by the findings of Warndorff-van Diepen, *et al.* [4], who showed that reliance on mouse foot pad test results leads to inflated estimates of drug resistance. The third group of patients said to have been excluded, those with a treatment regularity of less than 80%, were in fact included among the 1224 patients fully studied.

Treatment regularity in the initial period is claimed to be crucial to drug resistance. No reference or evidence is offered for this hypothesis. Until this claim is substantiated, treatment regularity following the "initial period" must be considered equally crucial.

Regarding the prevalence, contrary to the allegation we stated clearly the period concerned was 31 December 1977 to 28 February 1981. The use of person-years to work out rates in Tables 2 and 3 was considered by us to be quite necessary, to allow for standardization by duration of treatment. The difficulty said to be experienced by them in applying statistical tests for comparison was not shared by us. Many parametric as well as nonparametric techniques are appropriate to the data presented.

We are in total disagreement with their suggestion regarding Table 3, that cases with differing regularity of treatment should be pooled together in analyzing for association between initial dosage of DDS- and drug-resistant infection. The alternative preferred by us was to standardize first for regularity of treatment and, within a regularity "slab," to compare various initial dosages. This ensured that any differences found were not due to differing regularity of treatment. We would also want to consider tests for the statistical significance of differences before making declarations like the one suggested by the correspondents, about initial dosage of DDS and DDS resistance.

In our discussion, the inference that "attainment of smear negativity in a patient appears to be a favorable prognostic sign indicating a significantly reduced risk of DDS-resistant infection" seems inescapable. The prevalence of DDS-resistant infection among the group of 76 patients who never attained smear negativity was 12.4 times that among the group of 1148 who did attain smear negativity. Only if the group that remained smear positive had been treated on the average 12.4 times longer than the smear negative group, would the risk of DDS-resistant infection be equal in the two groups. On the contrary, we found that the 76 patients had a shorter average duration of treatment than the rest. Since our point was already made beyond reasonable doubt by the figures for prevalence, this supporting finding was judged superfluous.

We have investigated, with some success, the problem of obtaining quantitative rather than merely qualitative results from the mouse foot pad test for drug-resistant *Mycobacterium leprae*. We have demonstrated that the mouse test can classify strains with only 1 in 1000 drug-resistant *M. leprae* as drug resistant. Further, we have described the "drug-resistant proportion test" to quantify the proportion of *M. leprae* in a sample that are resistant to a drug. The correspondents' speculation on "multiplication factor" in positive harvests is not likely to be useful; no accurate estimate of the number of viable *M. leprae* inoculated can be made at the time of inoculation, and the final plateau of growth is not known to be different for drug-resistant *M. leprae* or drug-sensitive *M. leprae*.

The third part of their response to our discussion has been rendered an academic exercise by the paper of Warndorff-van Diepen, *et al.* [4]. That study demonstrated that 7 out of a sample of 18 patients who yielded DDS-resistant *M. leprae* in mouse foot pad tests subsequently responded to DDS

monotherapy for the entire duration of observation—5 to 9 years. When one considers that a single high-grade DDS-resistant *M. leprae* bacillus dividing once in 12 days should yield 10^{12} *M. leprae* in only 1½ years, the observed response to DDS monotherapy seems spectacular. Previous assumptions that mouse test drug resistance was, in the long run, equivalent to clinical drug resistance in patients seem contrary to accumulating evidence.

Our criteria for growth in mouse experiments require a sixfold or greater increase in the number of *M. leprae* remaining in the foot pad 24 hr after inoculation ([3]). In fact, we observed a 12-fold or greater increase in every experiment. This is unlikely to be due to chance.

We are glad to know that the correspondents will publish findings similar to ours on the response to DDS monotherapy compared between the 1960s and 1970s. They agree that the efficacy of DDS monotherapy has not diminished over the years. We are content with the corroboration afforded by their observations. Our own inferences have been fully spelled out in the paper, and will be judged by the readers. We obviously do not oppose the use of DDS suggested by the correspondents.

The interesting claim that "mortality is higher among lepromatous cases who do not respond to treatment and worsen clinically," is not supported by any evidence in the letter or by a reference.

We hope that previous papers by other workers on DDS resistance will receive a similar critical evaluation by the correspondents.

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Drug Sensitivity Testing of *M. leprae*

To the Editor:

We have been surprised by the content of the discussion and the conclusions reached by the authors in the Almeida, *et al.* paper that appeared in the 1983 September issue of IJL (1983 **51** 366–379); namely, a) that patients may respond to dapsone (DDS) monotherapy despite a high degree of dapsone resistance, and consequently b) that results of mouse foot pad sensitivity tests do not indicate whether patients will respond to DDS monotherapy.

Concerning the first point, the conclusion of the authors is not fully supported by the data they present. Actually, their whole reasoning is based upon the results of bacterial smears under routine DDS monotherapy. When the BI decreases, patients are considered as having DDS-sensitive infection, and when the BI is reported to increase, patients are considered as having DDS-resistant infection. When the authors biopsied 128 patients treated with DDS for at least three years with increasing BI and inoculated the specimens into the foot pads of mice for sensitivity testing, they observed 26 failures to grow *Mycobacterium leprae* (20%). Among the 102 *M. leprae* strains that grew, 90 were DDS resistant (77 with high-degree DDS resistance). When the authors biop-

sied 14 patients treated with DDS for at least three years with decreasing BI and inoculated the specimens for sensitivity testing. they observed 8 failures to grow (57%); among the 6 strains that grew, 1 was DDS sensitive and 5 resistant to DDS (high degree). It is well known that all steps in the preparation, staining, and reading of skin smears are difficult to standardize. Thus we would conclude that, in the published data, there is a good correlation between the assessment of clinical deterioration by skin smears and the mouse foot pad assessment. The five observed discrepancies would form the few exceptions that confirm the rule. Therefore, we would certainly not support the conclusion of the authors that the mouse test cannot discriminate between patients deteriorating and patients improving, especially when there is no evaluation of the accuracy and adequacy of their method used to diagnose deterioration or improvement.

Moreover, one would not support the authors' implicit conclusion that the mouse food pad sensitivity tests are unreliable. It is true that it is by analogy with *M. tuberculosis* that wild strains of *M. leprae* are assumed to contain about one drug-resistant mutant in 10^6 sensitive organisms. Such a proportion has practical implications in the performance of drug sensitivity testing in tuberculosis. If the inoculum used for the sensitivity test contains as many as 10^9 viable units, a situation which is easily realized, a fully sensitive wild strain of *M. tuberculosis* will give confluent growth of colonies on drug containing medium, and thus may be considered as drug resistant. To prevent false conclusions due to the use of heavy inocula, Canetti, *et al.* (1) strongly recommended the use of defined and low inocula (about 10^2 and 10^4 viable units) for sensitivity testing, a recommendation now widely understood and accepted by those who work in the field of tuberculosis chemotherapy.

Let us now consider the conditions under which drug sensitivity tests are done in leprosy. First of all, the inoculum used for *M. leprae* drug sensitivity testing has always been low, about 5×10^3 AFB (of which perhaps 10–20% are usually viable). Given the assumed proportion of 10^{-6} drug-resistant mutant in a wild strain of *M. leprae*, the probability for a drug-resistant mutant to have been inoculated is very low, as thus is the probability for a fully sensitive strain to be considered as resistant. Secondly, the sensitivity to DDS is judged by the growth of AFB in the foot pads of mice that have been fed with three different concentrations of DDS in the diet. The highest concentration, 0.01% in the diet, is selected to give blood levels in the mouse as high as those obtained in patients treated with a full daily dose of DDS (100 mg or 1.6 mg/kg). When *M. leprae* is able to grow in the foot pads of mice fed with 0.01% DDS in the diet, it is also able to grow in man despite treatment with a full dose of DDS. Twenty years' experience has shown this in a number of studies. Therefore, correlation between mouse foot pad data and clinical data under chemotherapy should be excellent. When exceptions are now found, the accuracy of the newly collected data should be considered.

For mouse foot pad sensitivity testing, accuracy means not only a low inoculum but also adequate concentrations of the drug in the mouse diet and an assessment of *M. leprae* growth in the drug-treated mice as soon as the control mice are positive. The first condition has already been mentioned. The second condition is self-evident. The third condition is important because a strain which would have been considered as partially resistant might well be interpreted as fully resistant . It is because every specialist is aware of such risks that mouse sensitivity testing is done everywhere with great care and in a strictly standardized manner.

Concerning the accurate assessment of whether a patient is deteriorating or improving under chemotherapy, we would like to point out two essential ideas.

1. For routine assessment of multibacillary patients under chemotherapy, the use of a standardized BI technique is certainly commendable. However, there is ample evidence of the limitations of this technique.

2. In view of these limitations, when the purpose is to demonstrate a possible need to reconsider the whole concept of drug sensitivity testing of *M. leprae* then comprehensive data, including clinical, bacteriological, and histopathological findings, are needed, as well as the accurate assessment

of the drug intake. What has been necessary to establish the present concept itself should be used to challenge it.

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—C. C. Shepard, M.D.

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Response to Dr. Grosset, *et al.*

To the Editor:

We thank the correspondents for their interest in our papers, and are happy to note that they do not dispute those of our findings of most practical importance. Our population-based study in an established leprosy control program directly observed dapsone resistance in a leprosy-endemic area. Previous estimates had relied on clinic- or hospital-based studies.

One thousand out of 1224 lepromatous and borderline lepromatous patients on dapsone monotherapy in the 1320 km² area of Gudiyatham Taluk, India, were found to have been smear negative for three years or more. Smear negativity was found to indicate a markedly reduced risk of dapsone (DDS)-resistant infection. Seventy-six patients, a very small group, remained continuously smear positive despite treatment, and only this group had a high prevalence of DDS-resistant infection.

This small "high-risk" group that emerges during dapsone monotherapy deserves the fullest possible concentration of efforts and resources. Theoretical predictions that dapsone-resistant infections would threaten every "multibacillary" patient are not supported by evidence from leprosy control programs in endemic areas. On the contrary, data showing the continuing efficacy of dapsone monotherapy, after two decades, were presented by independent investigators from Polambakkam, Chingleput, and Salur (all in South India) at the biennial conference of the Indian Association of Leprologists in November 1983.

The correspondents seem to feel that mouse test drug resistance is equivalent to clinical drug resistance in patients. In our view this is not supported by the evidence which, in fact, comes from several sources. Pearson, *et al.* (4) found patients who responded for over 53 months (4½ years) to DDS monotherapy, after the mouse foot pad test had grown high-grade DDS-resistant *Mycobacterium leprae*. Jacobson (3) observed that patients diagnosed by the mouse foot pad test to harbor primary dapsone-resistant *M. leprae*, and treated initially with DDS monotherapy, showed a response that was "completely normal as measured by all the usual criteria." Warndorff-van Dieper (6) showed that after even "high-grade" dapsone-resistant *M. leprae* grew in mice, patients yielding such organisms attained smear negativity and clinical inactivity despite continuing on dapsone monotherapy.

It seems to us that the mouse foot pad test for drug resistance has suffered from the omission of a control group of patients. While patients deteriorating on DDS monotherapy invariably yielded dapsone-resistant *M. leprae* in mice, it was assumed that patients responding favorably to DDS monotherapy would not do so. No "control" group of responding patients was ever tested. Such a control group has now become available from our study, and 5 out of 6 responding patients yielded *M. leprae* resistant to high-dosage dapsone (0.01% w/w) in the mouse diet.

The mouse foot pad test for drug resistance, as described by Pettit and Rees (5) seems exquisitely sensitive to the presence of a few drug-resistant *M. leprae* in predominantly drug-sensitive strains. We have subsequently demonstrated that strains of *M*

leprae with only 1 in 1000 bacilli drug resistant can grow drug-resistant *M. leprae* in the mouse foot pad test (1). It is likely that the more carefully and expertly the mouse test is performed, the more exquisitely sensitive will it prove to minute proportions of drug-resistant *M. leprae*. In order that a distinction be made between predominantly drug-resistant and predominantly drug-sensitive strains, the "drug-resistant proportion" test (2) has now been described. The technique previously described by Pettit and Rees (5) required that harvests be done "at intervals of six to ten months from the day of inoculation." The reliability of that technique is likely to be enhanced by the "drug-resistant proportion" test (2), where harvests are performed before the plateau of bacillary growth is reached in untreated mice.

Theoretical predictions are often contradicted by practical experience. However, the evidence in this case comes over a long period, and from several independent sources. We feel that a more realistic view of dapsone resistance in leprosy is required.

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Follow-up of Lepromatous (LL and BL) Patients on Dapsone (DDS) Monotherapy After Attainment of Smear Negativity in Gudiyatham Taluk, South India[1]

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Patients with lepromatous leprosy appear to show no improvement in their specific immune response to *Mycobacterium leprae* even five years after their Bacterial Index (BI) ([2]) has fallen to zero ([3]). This could mean that smear negative lepromatous patients remain susceptible to reinfection even if chemotherapy can rid them of all persisting *M. leprae*. The risk of reinfection is likely to be most prominent in areas where leprosy is endemic. It appears important to measure the frequency with which lepromatous patients "relapse" once they have attained smear negative status.

The objectives of this study were: 1) to determine the frequency with which *M. leprae* reappear in skin smears among smear negative lepromatous (LL) and borderline lepromatous (BL) patients on dapsone monotherapy, and 2) to determine whether the duration of smear negative status in such patients influences the risk of *M. leprae* reappearing in skin smears.

Gudiyatham Taluk is the leprosy control area of the Schieffelin Leprosy Research and Training Centre, Karigiri. The prevalence of leprosy in the area has been over 15 per 1000, and about a fifth of all registered patients are clinically diagnosed to have LL or BL leprosy. Fairly accurate records are available of the treatment and progress of each patient from the start of treatment. DDS monotherapy was widely used until 1981, and DDS tablets were delivered to the patients at village clinics for domiciliary treatment. Intensive case detection is effected by repeated house-to-house surveys and health education. A well-equipped base hospital supports the program.

PATIENTS AND METHODS

All known LL and BL patients resident in Gudiyatham Taluk were enumerated from the village clinic register maintained by the institution. Data on these patients were compiled from the individual records of each patient. Smears had been taken from four routine sites (earlobe and chin on the right side, forehead and buttock/thigh on the left side) as well as apparently active sites, generally at one-year intervals. Reading of smears was done by trained personnel at the base hospital, who were given no information about the patient. Techniques and criteria for smears remained unchanged throughout the period under study.

The period of smear negativity in a patient is defined as the single longest period during which the patient was continuously smear negative while under treatment. The sum of the periods of smear negativity for a group of patients yields the "person-years" of smear negativity for that group of patients. "Relapse" is taken to mean the reappearance of *M. leprae* in skin smears after smear negativity. This could be due to reinfection from other patients, or to the patient's own persisting organisms, or both.

RESULTS

A total of 1580 LL and BL patients were on the treatment register on 31 December 1977. Information was available from the start of treatment in each patient up to 28 February 1981 for 1423 (90%) of these patients. Of those 1423 patients 131 had re-

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THE TABLE. *Annual "relapse" rate by period of smear negativity among LL and BL patients on DDS monotherapy.*

Period of smear negativity (yrs)	No. patients observed	No. person-years of smear negativity	No. patients with "relapse"	Annual "relapse" rate (%/yr)
Initial 2	1293	2494	70	2.8%
>2	1106	8299	92	1.1%
>8	620	2945	26	0.9%

mained continuously smear positive up to 28 February 1981. The 1293 (90.9%) out of the 1423 patients who had at some time been smear negative are included in the analysis.

Of the 1293 patients, 1106 had been smear negative for >2 years. These 1106 patients had 8299 person-years of smear negativity from the third year onwards, with 92 "relapses"; yielding an annual relapse rate of 1.1% per year in this group. Similarly, 620 of the 1293 patients had been smear negative for >8 years. These 620 patients had 2945 person-years of smear negativity from the ninth year onwards, with 26 relapses; the annual relapse rate in this group is thus 0.9% per year.

In contrast, during the initial two years of smear negativity, the 1293 patients had a total of 2494 person-years of smear negativity with 70 relapses; a relapse rate of 2.8% per year. The Table lists the relapse rates in these different groups of patients.

Of the 1293 patients, 694 (53.7%) had collected ≥80% of their prescribed DDS tablets during the period in which they had had negative smears. Six hundred six (606) of these 694 patients had been smear negative for >2 years. These 606 patients had 4553 person-years of negativity from the third year onwards with 31 relapses, yielding an annual relapse rate of 0.7% per year.

DISCUSSION

The "relapse" rate for smear negative LL and BL patients on DDS monotherapy is found to show a progressive decrease as the duration after the attainment of smear negativity increases. During the first two years of smear negativity, the relapse rate is 2.8% per year. From the third year onwards, the "relapse" rate is only 1.1% per year, and by the eighth year it has fallen to 0.9% per year. This means that if 100 LL and BL patients who have been smear negative for two years are observed for a further period while on DDS monotherapy, only one of them on the average is found to "relapse" each year. Further, among smear negative LL and BL patients who collect ≥80% of their prescribed DDS tablets, the relapse rate from the third year of smear negativity onwards is only 0.7% per year. Over half of the smear negative LL and BL patients were found to collect ≥80% of their tablets.

The low rates of relapse found in this study are in keeping with a previous report by Noordeen [1] on 125 South Indian lepromatous patients on DDS monotherapy. The suggestion made in that paper that "probably 6 years of treatment, after a case of lepromatous leprosy becomes smear negative, may be adequate," deserves consideration. Over half of the lepromatous patients on DDS monotherapy in Gudiyatham Taluk were found to have been smear negative for more than six years. Noordeen pointed out that after six years of smear negativity, the risk of relapse "was not affected by whether the patients took treatment regularly or irregularly" [1]. Therefore, cessation of DDS monotherapy after six years of smear negativity may not increase the risk of relapse in a patient. Concurrent comparison of relapses following limited periods of either DDS monotherapy or combination drug therapy in smear negative LL and BL patients should yield valuable information.

SUMMARY

At the Schieffelin Leprosy Research and Training Centre, Karigiri, India, an analysis of "relapse" rates was undertaken on all the 1293 residents of Guidyatham Taluk who were known to have lepromatous (LL) or borderline lepromatous (BL) leprosy and had attained "smear negative" status. "Relapse" was defined as the reappearance of acid-fast bacilli (AFB) in skin smears, whether by reinfection from other patients or from the patient's own persisting organisms. The "relapse" rate decreased steadily with the time elapsed after the attainment of smear negativity: 2.8% (2.8 per 100 patients per year) in the initial two years; 1.1%

from the third year onwards; and 0.9% from the ninth year onwards. Of the 1293 patients, 694 (53.7%) had taken ≥80% regular dapsone (DDS) treatment during smear negativity. In this group, the "relapse" rate from the third year onwards was only 0.7% per year.

The vast majority (90.9%) of LL and BL patients on DDS monotherapy in the area had at some point attained smear negative status. It appears important to study whether a limited period of DDS monotherapy after the attainment of negative skin smears would be an effective alternative to life-long DDS treatment in LL and BL patients.

RESUMEN

En el Centro Schieffelin de Investigación y Adiestramiento de la Lepra, Karigiri, India, se hizo un estudio sobre el grado de recaídas en 1293 residentes de Gudiyatham Taluk que habían tenido lepra lepromatosa (LL) o intermedia (BL) y que habían alcanzado el estado de negativos según los resultados de las preparaciones de linfa cutánea. La "recaída" se definió como la reaparición de bacilos ácido resistentes (BAAR) en las preparaciones de linfa cutánea por reinfección a partir de otros pacientes o de los microorganismos persistentes en el propio paciente. El grado de "recaídas" disminuyó sostenidamente con el tiempo transcurrido después de alcanzar la negatividad en las preparaciones de linfa cutánea: 2.8% (por año) en los dos años iniciales; 1.1% del tercer año en adelante, y 0.9% después del noveno año. De los 1293 pacientes, 694 (53.7%) habían seguido un tratamiento con una regularidad del 80% o mayor a base de DDS y en este grupo, el grado de recaídas del tercer año en adelante fue sólo del 0.7% por año.

La gran mayoría (90.0%) de los pacientes LL y BL bajo tratamiento solo con DDS alcanzaron en algún momento el estado de negativos según las preparaciones de linfa cutánea. Parece importante estudiar si un período limitado de monoterapia con DDS después de alcanzar la negatividad en las preparaciones de linfa cutánea, podría ser una alternativa al tratamiento de por vida con DDS en los pacientes LL y BL.

RÉSUMÉ

Au Schieffelin Leprosy Research and Training Centre, de Karigiri, en Inde méridionale, on a procédé à l'analyse des taux de récidive dans l'ensemble des 1293 résidents du Guidyatham Taluk connus pour être atteints de lèpre lépromateuse (LL) ou dimorphe lépromateuse (BL), ayant atteint le stade de négativation bactériologique dans les frottis. Une "récidive" a été définie comme la réapparition de bacilles acido-résistants dans des frottis cutanés, soit à la suite de réinfection à partir d'autres malades, ou par réinfection endogène par des organismes persistant chez le même malade. Le taux de récidive a décru régulièrement avec le temps, après qu'un état de négativité bactériologique ait été obtenu. Ce taux était de 2.8% (2.8 pour 100 malades par an), au cours des deux premières années; 1.1% à partir de la troisième année et ensuite; de 0.9% à partir de la neuvième année. Parmi les 1293 malades, 694 (53.7%) avaient continué à suivre un traitement régulier par la dapsone (DDS), à raison de ≥80% de la dose prescrite, au cours de la période de négativité des frottis. Dans ce groupe, le taux de récidive à partir de la première année et au-delà n'a été que de 0.7% par an.

La grande majorité (90.9%) des malades LL et BL, soumis à la monothérapie par la DDS, dans cette région, a, à un moment ou l'autre, présenté des frottis négatifs. Il apparaît important d'étudier si une période limitée de monothérapie par la DDS, après que les frottis cutanés soient devenus négatifs, pourrait constituer un moyen efficace de substitution au traitement à la DDS prolongé pour toute la vie, chez les malades LL et BL.

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DDS-resistant Infection Among Leprosy Patients in the Population of Gudiyatham Taluk, South India. Part 3. Prevalence, Incidence, Risk Factors, and Interpretation of Mouse Foot Pad Test Results[1]

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"The wide variation among estimates of the prevalence of secondary dapsone resistance" among leprosy patients was pointed out in October 1980, by the Scientific Working Group of the World Health Organization's THELEP program ([14]). The present study assesses the problem of dapsone (DDS) resistance in the Gudiyatham Taluk of South India. Gudiyatham Taluk, in Tamil Nadu, South India, with an area of about 1320 km^2 and a population of about 480,000 (1981 census), is the leprosy control area of the Schieffelin Leprosy Research and Training Centre, Karigiri, India. Most of the population is engaged in agriculture, and migrations in or out of the area are not common. The area is hyperendemic for leprosy and in December 1977, 6880 patients were on the treatment register at 44 village clinics. DDS monotherapy given as domiciliary oral treatment was introduced in 1955, and has been used throughout the area since 1963. Intensive case detection by repeated house-to-house surveys and health education, and careful maintenance of individual patient records, are features of the program launched in 1963.

The objectives of the present study were: a) to determine the prevalence and incidence of DDS resistance among treated patients in the area, and b) to identify the risk factors associated with the occurrence of DDS resistance.

PATIENTS AND METHODS

All known lepromatous (LL) and borderline lepromatous (BL) patients resident in the area were enumerated on 31 December 1977, from the treatment register maintained by the institution; excluding patients who had previously died or emigrated. Patients had been seen by a physician at the village clinic every three months, if not more often. Individual patient records allowed access to information dating back to the start of treatment for each patient. Data on the patients continued to be assembled up to 28 February 1981. Every patient included had been treated for a minimum of three years by 1981.

Annual skin smears had been taken from apparently active sites as well as four routine sites (earlobe and chin on the right; forehead and buttock or thigh on the left). Reading of smears was done by trained staff who were given no information regarding the patient. In comparing successive smears to decide whether the number of bacilli was rising or falling, the average Bacterial Index (BI) ([13]) of the routine sites was considered, except when this was contradicted by the change in the highest single reading. In the event of such conflict, the comparison was based on successive highest readings.

"Regularity of treatment" is defined as the percentage of months throughout treat-

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ment in which the patient collected DDS tablets. This is based on the assumption that those who collect fewer tablets also ingest fewer tablets, on the average, than those who collect tablets regularly. The "initial dosage" of DDS in a patient is defined as the average dosage of DDS during the first 26 weeks in which tablets were collected by the patient.

Lepromatous (LL) and borderline lepromatous (BL) patients can deteriorate solely through failure to take DDS. Therefore patients who had been absent for >50% of the entire period of treatment ("absentees") were excluded from both the denominator and the numerator in the calculations of prevalence and incidence.

In the remaining patients, DDS-resistant infection was diagnosed when review of skin smear results showed a continuing increase in the number of bacilli in successive smears. Smear results from the start of treatment were reviewed in each patient. It was thus possible to identify the point at which DDS-resistant infection first manifested itself in skin smear readings. This criterion was used to calculate the prevalence and incidence of DDS-resistant infection.

The "duration of smear negativity" in a patient is defined as the single longest period during which the patient remained continuously smear negative at any time from the start of treatment up to 28 February 1981. For example, in a patient who had been smear negative from 1971 to 1975, smear positive from 1976 to 1979, and again smear negative in 1980, only the single period of smear negativity from 1971 to 1975 would be considered, since that was the longest period for which the patient remained continuously smear negative.

The "person-years" of treatment for a patient is the sum of the years of treatment undergone by that patient up to 28 February 1981. In the person-years of treatment for a particular period of treatment, only those years of treatment within the specified period are included.

In addition, a separate approach was used to estimate the frequency with which DDS-resistant *Mycobacterium leprae* occurred in patients, regardless of whether or not the patients responded to DDS monotherapy. Between March 1978 and February 1981, patients with a BI ≥2+ were biopsied for the mouse foot pad test. All other clinical and historical criteria were disregarded in selecting patients for biopsy. (Not all patients with a BI ≥2+ could be biopsied, however, since some refused biopsy, others died or migrated before they had been biopsied and, in some, the BI subsided to <2+ before the biopsy could be taken.) The mouse foot pad test was performed by methods already published ([1, 12]). The detection of $\geq 2 \times 10^4$ *M. leprae* per foot pad ≥6 months after inoculation with 1×10^4 *M. leprae* per foot pad, in mice continuously treated with DDS from the day of inoculation, indicated the presence of DDS-resistant *M. leprae* ([5]). Samples of mouse feed were tested for DDS content to ensure that the required concentration of DDS was achieved in the feed ([4]). Some mouse tests were unsuccessful, failing to grow *M. leprae* in even untreated control mice and, therefore, allowing no conclusion about the drug sensitivity of the *M. leprae* inoculated.

RESULTS

A total of 1580 patients with lepromatous (LL) or borderline lepromatous (BL) leprosy were enumerated from the treatment register. Of these, 1224 patients (77.5%) were fully studied. One hundred forty-nine patients were not screened from 1978 onwards. Another 198 patients were "absentees," having missed >50% of their treatment. The records of the remaining nine patients were not available.

The 1224 fully studied patients were divided into three groups according to their "duration of smear negativity" during treatment. The prevalence of DDS-resistant infection in each of the three groups is shown in Table 1. Among the 76 patients who had remained smear positive throughout treatment, DDS-resistant infection was diagnosed in 18 patients (23.7%). Among the 148 patients who had been smear negative for <3 years during treatment, DDS-resistant infection was diagnosed in ten patients (6.8%). Among the 1000 patients who had been smear negative for ≥3 years during treatment, DDS-resistant infection was diagnosed in 12 patients (1.2%). DDS-resistant infections were significantly more frequent among the patients who remained smear positive throughout treatment than

TABLE 3. *Incidence of DDS-resistant infection among patients with ≥80% regular treatment, by "initial DDS dosage" and period of treatment.*

Period after start of treatment (yrs)	Patients with initial DDS dosage								
	≤70 mg/week			71–200 mg/week			>200 mg/week		
	Person-years of treatment (no. persons)	No. with resistant infection	Incidence (%/yr)	Person-years of treatment (no. persons)	No. with resistant infection	Incidence (%/yr)	Person-years of treatment (no. persons)	No. with resistant infection	Incidence (%/yr)
0–2	188 (94)	0	0.00	368 (184)	0	0.00	654 (327)	0	0.00
3–5	282 (94)	0	0.00	545 (184)	0	0.00	913 (327)	5	0.55
6–10	447 (93)	0	0.00	768 (176)	2	0.26	992 (241)	0	0.00
11–15	332 (84)	1	0.30	415 (110)	1	0.24	592 (153)	3	0.51
16–26	15 (6)	0	0.00	9 (4)	0	0.00	141 (39)	2	1.42

108 successful tests detected DDS-resistant *M. leprae*. It is interesting to compare the proportion of successful tests which detected DDS-resistant *M. leprae* in the different groups of patients tested. Patients in the first column showed an increase in the number of *M. leprae* in successive skin smears preceding biopsy, even though they had not been absent from treatment. In contrast, patients in the third column showed a definite response to DDS as manifested by a decrease in the number of *M. leprae* in successive smears preceding biopsy. Among those in the first column, 26 (100%) out of 26 successful tests detected DDS-resistant *M. leprae*; however, among those in the third column, 5 (83.3%) out of 6 tests also detected resistant *M. leprae*. The difference is not statistically significant ($p > 0.10$, Fisher's exact test).

The occurrence of tests failing to grow *M. leprae* in untreated mice is significantly more

TABLE 4. *Results of all mouse tests performed.*

	Number of patients			
	Successive smears show number of bacilli			
	Increasing		Decreasing	Total
	Not absentees	Absentees[a]		
BI ≥2+[b]	31	111	46	188
Biopsied	29	99	14	142
Failure to grow *M. leprae*	3	23	8	34
Test successful[c]	26	76	6	108
Only DDS-sensitive bacilli grown	0	12	1	13
DDS-resistant bacilli detected	26	64	5	95
Highest concentration at which bacilli grew (g% DDS in mouse diet)				
0.0001	3	1	0	4
0.001	3	6	0	9
0.01	20	57	5	82

[a] Patients absent from >50% of their treatment.
[b] Bacterial Index ≥2+ at any time during the period 1 March 1978 to 28 February 1981.
[c] *M. leprae* grew in untreated control mice.

corresponding failure of response to DDS monotherapy. Pearson, *et al.* (9) reported uninterrupted response to DDS monotherapy in patients who yielded DDS-resistant *M. leprae* in the mouse test, even when patients were observed for a further 4½ years. It appears difficult to maintain that every patient who yields DDS-resistant *M. leprae* in the mouse test will fail to respond to DDS monotherapy. The explanation is likely to be as follows.

The frequency of DDS-resistant *M. leprae* in an untreated population of *M. leprae* is believed to be about 1 in 10^6. Since every untreated LL or BL patient is likely to have $>10^6$ *M. leprae,* every such patient probably harbors DDS-resistant organisms. During treatment with DDS, approximately 99.9% of the *M. leprae* are "killed" within four months (15). Only 10^3 out of 10^6 *M. leprae* survive, including all of the DDS-resistant *M. leprae.* The frequency of DDS-resistant *M. leprae* among the surviving bacilli would have now reached ≥ 1 in 1000. With the continuation of DDS monotherapy, the frequency of DDS-resistant *M. leprae* in the steadily diminishing total bacillary population can only increase. It appears, therefore, that the "threshold proportion" above which the mouse test can detect resistant bacilli may be exceeded at some stage of DDS monotherapy in every LL and BL patient. Yet no more than 3.3% of such patients failed to respond to DDS monotherapy. In the remaining 96.7% of patients, unknown factors must have operated to avert DDS-resistant infection. The demonstration of DDS-resistant *M. leprae* by the mouse test (Almeida, *et al., Leprosy Review,* in press) should not be regarded as synonymous with failure of response to DDS monotherapy. Estimates of DDS resistance based on the mouse test are likely to indicate the frequency of DDS-resistant *M. leprae,* rather than the frequency with which patients fail to respond to DDS monotherapy.

Because the mouse test has a low "threshold" for the detection of DDS-resistant *M. leprae,* areas where relatively many mouse tests were done are likely to report higher estimates of resistance than areas where relatively fewer tests were done. This is reflected in the estimated prevalence of 2.5% (25 per 1000) in Malaysia, the lowest of all available estimates (8). A carefully supervised trial of DDS monotherapy had been used in that study to exclude from the mouse test patients who responded to DDS. In contrast, one study in Ethiopia reported a prevalence of 19% (190 per 1000) and an incidence of 3% per year (8). Patients with predominantly DDS-sensitive *M. leprae* can deteriorate solely through failure to take DDS. It appears difficult to avoid the inflation of DDS-resistance estimates with such patients unless they are given a well-supervised trial of DDS treatment before being subjected to the mouse test.

These findings merely confirm what has long been known in the related field of tuberculosis chemotherapy. In a report on the Geneva international consultation of specialists, Canetti, *et al.* (3) stated that "all strains of tuberculosis contain some bacilli that are resistant to anti-bacillary drugs. However, in resistant strains, the *proportion* [italics added] of such bacilli is considerably higher than in sensitive strains." They pointed out that sensitivity tests that do not discriminate between a predominantly sensitive strain and a predominantly resistant strain may misclassify sensitive strains as resistant. They remarked that, "Paradoxically, sensitivity testing might even result in actual harm by leading to unnecessary changes of chemotherapy from effective and acceptable regimens." (3) Smear examination "to assess the progress of therapy at intervals" was accorded priority over sensitivity tests in tuberculosis control programs (3). It might prove prudent to reconsider the interpretation of sensitivity tests in leprosy. Regular skin smear examination retains its value in monitoring the response to treatment as well as the occurrence of drug-resistant infection, in both individual leprosy patients and in epidemiological studies.

SUMMARY

At the Schieffelin Leprosy Research and Training Centre, Karigiri, India, a study of the population of Gudiyatham Taluk revealed that the prevalence of dapsone (DDS)-resistant infection among lepromatous (LL) and borderline lepromatous (BL) leprosy patients treated for a minimum of three years was 3.3% (33 per 1000), with an

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Results of Long-term Domiciliary Dapsone (DDS) Monotherapy for Lepromatous Leprosy in Gudiyatham Taluk, South India[1]

Joel G. Almeida, Melville Christian, and Chinoy J. G. Chacko[2]

The Schieffelin Leprosy Research and Training Centre, Karigiri, has used dapsone (DDS) monotherapy in the treatment of leprosy patients for over 20 years. Formerly, patients attended the center to be examined and to collect a month's supply of DDS tablets. Beginning in 1963, however, the leprosy control program extended these services to the villages of Gudiyatham Taluk. Fairly extensive records of treatment and progress are available for each patient, and a well-equipped base hospital serves the program.

This background made it convenient to study the present status and past history of lepromatous leprosy (LL) patients who had been treated with DDS for >20 years.

PATIENTS AND METHODS

All surviving LL patients registered for treatment in 1960 or earlier and resident in Gudiyatham Taluk, India, were enumerated in March 1981. Data on each of these patients were assembled from the individual patient record. Skin smears had been taken, generally at one-year intervals, and read by trained personnel. A record was kept of the amount of DDS collected by the patient on each visit to the clinic.

RESULTS

Fifty-eight patients with the clinical diagnosis of lepromatous leprosy (LL) at registration have been included. They had all been registered in 1960 or earlier, and were still alive in March 1981.

Only seven of these 58 patients remained smear positive in 1981. Four of these seven patients were subjected to the mouse foot pad test for the detection of DDS-resistant *Mycobacterium leprae*. All 4 yielded *M. leprae* resistant to 0.01% w/w DDS in mouse diet but, during subsequent DDS monotherapy, the number of bacilli in successive annual skin smears was found to be increasing in only 2 of these patients and decreasing in the other 2. Of the remaining 3 patients, 1 was absent from treatment, while 2 were improving on DDS monotherapy.

Among these 58 patients, of 36 who had at some point in treatment been continuously absent for ≥6 months, 6 (16.7%) were found to be smear positive in 1981. Of the 22 who had not been absent, only one (4.5%) was found to be smear positive. This difference is not statistically significant.

Among these 58 patients, 32 had at some time a Bacterial Index (BI) ≥2+. Seven (21.9%) of the 32 were found to be smear positive in 1981. Among the remaining 26 patients who had had a maximum BI <2+, none were found to be smear positive in 1981 ($p < 0.05$).

DISCUSSION

DDS monotherapy is found to be effective among LL patients, even when the results 20 years after the start of treatment are considered. Fifty-one of the 58 patients were smear negative and clinically inactive in 1981. The findings of this community-based study appear more favorable than the report from a clinic-based study in the United States ([1]), where only three out of 13 LL patients who were alive 30 years after starting on sulfone therapy could be pronounced inactive.

Patients whose BI had at some point been ≥2+ were found smear positive in 1981

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The Significance of Dapsone (DDS)-resistant *Mycobacterium leprae* in Untreated Patients[1]

Joel G. Almeida, Chinoy J. G. Chacko, and Melville Christian[2]

The finding that untreated leprosy patients can harbor *Mycobacterium leprae* which withstand the action of dapsone (DDS) ([7, 10, 14, 16–18]) has caused alarm ([5]). We report a study done in a stable rural population of South India, to find how many previously untreated patients harbored such resistant *M. leprae*.

The area studied, Gudiyatham Taluk, is the leprosy control zone of the Schieffelin Leprosy Research and Training Centre, Karigiri, and has a population of 480,000 (1981 census). DDS monotherapy, given as domiciliary treatment, has been extensively used in the area since 1963. Intensive case detection by regular surveys and health education, careful maintenance of individual patient records, and a continuing search for treated patients harboring resistant *M. leprae* are features of the control program. A total of 7157 patients were on the treatment register of the institution on 31 December 1980. This background made it convenient not only to study the occurrence of resistant *M. leprae* in untreated patients, but also to relate the findings to the picture of leprosy in the community as a whole.

PATIENTS AND METHODS

Between 1 May 1980 and 10 August 1981, all residents of Gudiyatham Taluk newly discovered to have borderline lepromatous (BL) or lepromatous (LL) leprosy had skin biopsies taken. Those who could reasonably be suspected of having previously taken DDS and those with a Bacterial Index (BI) $<2+$ were excluded from the mouse foot pad test. The mouse foot pad test, to detect *M. leprae* resistant to DDS, is usually not successful on specimens with a BI $<2+$. Altogether, 18 subjects qualified for the test: 5 were clinically diagnosed to have LL leprosy; 13, to have BL leprosy.

Ethical considerations did not allow DDS to be withheld from patients once they were diagnosed to have leprosy. Biopsies could sometimes only be taken after DDS therapy had been started. In no case did the delay exceed a month.

Biopsies were processed for the mouse test by methods described previously ([1]). Growth of *M. leprae* in mice treated with DDS was taken to indicate the presence of *M. leprae* resistant to DDS at the concentration used. If no growth occurred in even the untreated control mice, the concerned test was regarded as a failure, allowing no decision about the occurrence of resistant *M. leprae*.

A list was made of all treated patients in the area who were already shown to harbor DDS-resistant *M. leprae* by the mouse test. The places of residence and of work during the preceding ten years were noted for each of these patients, as well as for each of the 18 subjects. Treated patients shown to harbor resistant *M. leprae* were considered as "contacts" who had possibly passed resistant *M. leprae* to a subject, if they had shared a workplace, or even a village, with the subject, during the preceding ten years. In addition, a separate list was made for each of the 18 subjects, of all leprosy patients who had at some time in the preceding ten years, actually lived in the same house as the subject.

RESULTS

The Table indicates that 12 mouse tests yielded a result; 5 tests detected *M. leprae*

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resistant to DDS, while 7 tests did not. Among the 5 tests that detected resistant bacilli, 3 detected bacilli resistant to the highest concentration of DDS used (0.01% w/w DDS in mouse diet); while in 2 tests the bacilli were found resistant to only a lower concentration of DDS (0.001% w/w DDS in mouse diet). It is not possible to decide whether any resistant bacilli were present in the six patients who failed to yield growth of *M. leprae*.

Among the 12 subjects successfully tested, 4 had shared the house of at least 1 treated leprosy patient, and none of the 4 yielded resistant *M. leprae*; whereas of the 8 who had not shared the house of a leprosy patient, 5 (62.5%) yielded resistant *M. leprae*. The difference however, is not statistically significant ($p > 0.10$, Fisher's exact test).

A comparison was made among the 12 subjects successfully tested, between those who did have identifiable contact with a treated patient shown to harbor resistant *M. leprae*, and those who did not. Of 9 subjects with contact, only 3 yielded resistant *M. leprae*; whereas of 3 subjects without contact, 2 yielded resistant *M. leprae*. However, the difference is not statistically significant ($p > 0.10$, Fisher's exact test).

Among the 9 subjects who did have identifiable contact with a treated patient shown to harbor resistant *M. leprae*, the 3 who yielded resistant *M. leprae* had, on an average, only 3.0 such "contact" patients each; whereas the 6 who yielded no resistant *M. leprae* had, on an average, 6.0 such "contact" patients each. The difference, however, is not statistically significant (*t* test, $p > 0.1$).

DISCUSSION

Leprosy patients treated with DDS may possibly transmit *M. leprae* which are resistant to DDS. If this happened commonly, it might be cause for alarm.

The data presented do not support the hypothesis that treated patients are likely to be the only source, or even the major source, of resistant *M. leprae* in untreated patients. Known contact with a treated patient in the ten years preceding the diagnosis of leprosy did not significantly increase the risk of DDS-resistant *M. leprae* occurring in an untreated, newly diagnosed patient. These data share the limitations inherent in any study

THE TABLE. *Results of the mouse test for the detection of* M. leprae *resistant to DDS.*

No. untreated patients tested	Growth of *M. leprae* in mice fed (g% DDS in diet)				Detected *M. leprae*
	Nil	0.0001	0.001	0.01	
3	+	+	+	+	Resistant to 0.01
2	+	+	+	−	Resistant to 0.001
7	+	−	−	−	Sensitive to 0.0001
6	−	−	−	−	(Failure of test)

of the spread of leprosy, and involve small numbers of patients; however, no other data of this nature appear to be available.

The findings are easily explained by analogy with tuberculosis. Tubercle bacilli resistant to isoniazid (INH) were isolated in 1948 [9], several years before INH was first used for the treatment of tuberculosis. This is consistent with the bulk of evidence accumulated in bacteriology, which indicates that bacterial populations include mutants that develop before exposure to a selective agent [3, 4, 6, 11, 12]. In the case of drug resistance, this means that resistant bacteria exist in bacterial populations before any contact with the drug. The prevalent concept, implying that all "strains" of *M. leprae* which have not come into contact with DDS form homogeneous groups in which there is no real variation in sensitivity to DDS, seems to ignore the bulk of evidence available [2–4, 6, 8, 9, 11–13, 15–18].

There are at least two possible explanations for resistant bacilli in an untreated patient: 1) the bacterial population in the patient may contain naturally resistant mutants or 2) the resistant bacilli may have been acquired from a treated patient. The evidence in tuberculosis indicates that the latter "rarely happens" [13, 15]. Further, the finding in untreated patients of tubercle bacilli resistant to INH (sometimes called "primary INH resistance") ceased to cause alarm when it was pointed out that the "primary resistance" showed no increase over several years [2, 8, 13].

The limited evidence available in leprosy does not support the view that treated patients are the major source of resistant *M.*

leprae in untreated patients. It would seem important to know whether the proportion of untreated patients who harbor DDS-resistant *M. leprae* has been increasing. *M. leprae* from untreated patients were reported to grow in mice treated with DDS as early as 1965 ([16, 17, 18]). In recent years there have been more reports of DDS-resistant *M. leprae* in untreated patients ([7, 10, 14]). It is not clear whether these reflect an actual increase in the occurrence of resistant *M. leprae*, or merely an improved surveillance.

The monitoring of drug resistance among untreated patients, especially before a drug is pressed into general use in an area, is of great aid to subsequent evaluation of drug resistance in that area. It is hopefully not too late to do this for rifampin and clofazimine, which are being used increasingly in leprosy.

SUMMARY

In a stable rural population of South India, 18 consecutive untreated persons newly discovered to have leprosy with a Bacterial Index (BI) ≥2+ were tested for *Mycobacterium leprae* resistant to dapsone (DDS) by the mouse foot pad test. Of 12 successful tests, five detected resistant *M. leprae*. Known contact with a treated patient in the ten years preceding the diagnosis of leprosy was not found to increase the risk of DDS-resistant *M. leprae* occurring in an untreated, newly diagnosed patient.

This data is consistent with the bulk of evidence in the field of bacteriology, which makes it seem unlikely that treated patients are the only source, or even the major source, of resistant *M. leprae* in untreated patients. Bacterial mutants resistant to a drug have been shown to precede initial use of the drug. Tests for drug-resistant bacteria in untreated patients before a drug is widely used in a community are likely to be important for subsequent evaluation of resistance to the drug in that community.

RESUMEN

Usando el método del cojinete plantar en el ratón, se investigó la presencia de *M. leprae* resistentes a la dapsona (DDS) en 18 personas con lepra no tratada de reciente diagnóstico y con un Indice Bacterial de 2+ o mayor. El estudio se realizó en una población rural estable del sur de la India. En 5 de 12 pruebas exitosas se encontraron *M. leprae* resistentes al DDS. Las personas en contacto por 10 años o más con un paciente tratado no aumentaron el riesgo de que los casos recientes de lepra, no tratados, desarrollaran *M. leprae* resistentes a la dapsona.

Este dato indica que es poco probable que los pacientes tratados sean la única o la principal causa de la aparición de *M. leprae* resistentes al DDS en los pacientes de reciente diagnóstico aún no tratados. Se ha demostrado que las mutantes resistentes a la droga aparecen antes de que ésta haya sido utilizada. Las pruebas para establecer la resistencia a una droga de las bacterias de pacientes no tratados, antes de administrar esa droga en una comunidad, podrían ser importantes para la evaluación subsecuente de la resistencia a la droga en esa comunidad.

RÉSUMÉ

On a procédé à une étude de la résistance de *Mycobacterium leprae* à la dapsone (DDS), au moyen de l'épreuve sur coussinet plantaire de la souris, chez 18 malades consécutifs non traités, et récemment découverts porteurs d'une lèpre avec Index Bacterien (BI) ≥2+. Cette étude a été menée dans une population rurale stable de l'Inde méridionale. Parmi 12 tests pratiqués avec succès, cinq ont permis de mettre en évidence des *M. leprae* résistants. Il est apparu qu'un contact connu avec un malade traité au cours des dix années ayant précédé le diagnostic de la lèpre, n'entraînait pas une augmentation du risque de résistance à la DDS de *M. leprae*, chez des malades non traités récemment diagnostiqués.

Ces données sont en accord avec tout ce que nous savons dans le domaine de la bactériologie, dont il ressort qu'il est peu probable que les malades traités soient la seule source, ou même la source principale, de *M. leprae* résistant chez les malades non traités. On a montré que des mutants bactériens résistant à un médicament pouvaient apparaître avant l'utilisation initiale du médicament. Avant qu'un médicament soit largement utilisé dans une communauté, il paraît important de procéder à des épreuves portant sur la résistance médicamenteuse des bactéries chez des malades non traités, et ceci afin de permettre une évaluation ultérieure de la résistance au médicament dans cette communauté.

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Response to Dapsone (DDS) Monotherapy in Leprosy Patients of Gudiyatham Taluk, South India: Comparison Between the 1960s and the 1970s[1]

Joel G. Almeida, Melville Christian, and Chinoy J. G. Chacko[2]

Dapsone (DDS) has long been the cornerstone in the treatment of leprosy. The low cost and relative rarity of toxic effects are outstanding features of DDS therapy. However, the efficacy of therapy must be the prime consideration in the choice of therapeutic agents. The recent reports of *Mycobacterium leprae* which are resistant to DDS ([1-6]) suggest the need to determine whether the efficacy of DDS has changed over the years.

A direct measurement of the response to DDS in a patient can be obtained by noting the clearance of *M. leprae* from skin smears. Patients infected relatively long ago can then be compared with patients infected more recently, for response to DDS.

Gudiyatham Taluk, with a population of 425,000 (1971 census), is hyperendemic for leprosy. In 1963, the leprosy control program was launched by the Schieffelin Leprosy Research and Training Centre, Karigiri, employing DDS monotherapy given as domiciliary treatment; backed by repeated house-to-house surveys and health education, and careful maintenance of individual patient records. DDS monotherapy remained in use until 1981.

The objective of this study was to determine whether the efficacy of DDS in the treatment of leprosy showed a change with the passage of time.

PATIENTS AND METHODS

All residents of Gudiyatham Taluk registered for the treatment of leprosy in the years 1964 to 1966 or 1971 to 1973, with a clinical diagnosis of lepromatous (LL) or borderline lepromatous (BL) leprosy and acid-fast bacilli in skin smears, were included in the analysis. Data for each of these patients were obtained from the individual patient record. Skin smears had been done annually from four routine sites (ear and chin on the right, forehead and buttock/thigh on the left) as well as apparently active sites and read by trained personnel at the base hospital. Techniques and criteria for skin smears remained unchanged throughout the period under consideration. The attainment of skin smear negativity in a patient during the initial seven years of treatment was compared in two groups of patients: 1) those first registered in the years 1964 to 1966, and 2) those first registered in 1971 to 1973.

For the purpose of this study, "maximal" DDS treatment has been defined as the collection of $\geq 80\%$ of the prescribed DDS tablets, with no interruption of treatment exceeding six months.

The standard error of a proportion was determined by the formula $\sqrt{(p \times q/n)}$ where p is the number of n individuals in one category and q the number in the other.

RESULTS

A total of 391 patients registered in the years 1964 to 1966 and 148 patients registered in the years 1971 to 1973 were included in the analysis. The proportion of patients in each group who were "smear negative" after each year of treatment is shown in Table 1 and Figure 1. Among patients registered in 1964 to 1966, the proportion of patients smear negative rose from 0% at the start of treatment to 51.9% after

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TABLE 1. *Attainment of smear negative status by period of treatment in two groups of patients on DDS monotherapy.*

Period of treatment (yrs)	No. (% ± standard error) of patients smear negative registered during the years	
	1964–1966[a]	1971–1973[b]
0	0	0
1	48 (12.3 ± 1.66)	23 (15.5 ± 2.97)
2	98 (25.1 ± 2.19)	43 (29.1 ± 3.73)
3	143 (36.6 ± 2.46)	56 (37.8 ± 3.99)
4	165 (42.2 ± 2.50)	66 (44.6 ± 4.09)
5	165 (42.2 ± 2.50)	81 (54.7 ± 4.09)
6	179 (45.8 ± 2.52)	98 (66.2 ± 3.89)
7	203 (51.9 ± 2.53)	114 (77.0 ± 3.46)

[a] A total of 391 patients were registered in 1964 to 1966.

[b] A total of 148 patients were registered in 1971 to 1973.

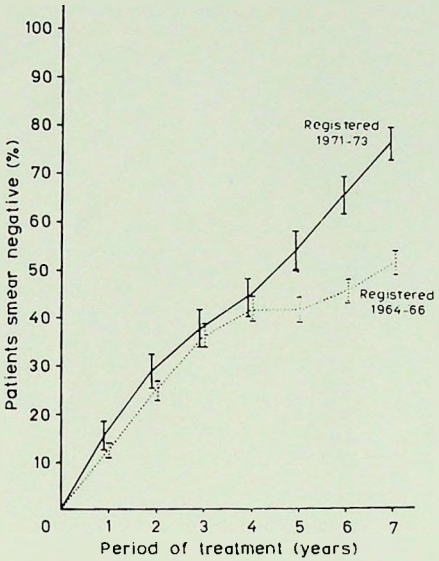

FIG. 1. Attainment of smear negative status by period of treatment in two groups of patients on DDS monotherapy. Percentages are shown ± standard error of the percentage: $100 \times \sqrt{(p \times q/n)}$.

seven years of treatment. Among patients registered in 1971 to 1973, the corresponding figures were 0% at the start of treatment and 77.0% after seven years of treatment. After 5, 6 and 7 years of treatment, respectively, the occurrence of smear negative status was significantly more frequent among patients registered in 1971 to 1973 than among those registered in 1964 to 1966 (p in each case <0.05).

However, only 135 (34.5%) of 391 patients registered in 1964 to 1966 had received "maximal" DDS treatment; whereas 69 (46.6%) of 148 patients registered in 1971 to 1973 had done so ($p < 0.05$).

Table 2 and Figure 2 show the attainment of smear negative status among patients with "maximal" DDS treatment. Among such patients registered in 1964 to 1966, the proportion with negative smears rose from 0% at the start of treatment to 74.8% after seven years of treatment. The corresponding proportions among patients registered in 1971 to 1973 were 0% and 85.5%. The differences between the two groups do not attain statistical significance at any stage of treatment ($p > 0.05$).

The Bacterial Index (BI) (7) at the time of registration was analyzed in each group. Only 59 (15.1%) of 391 patients registered in 1964 to 1966 had a BI $\geq 3+$, as against 69 (46.9%) of 148 patients registered in 1971 to 1973 ($p < 0.002$).

DISCUSSION

Patients registered in 1971 to 1973 were found to respond as well to DDS monotherapy as patients registered in 1964 to 1966, as indicated by clearance of *M. leprae* from skin smears during the initial seven years of treatment. A significantly higher proportion of patients registered in 1971 to 1973 received "maximal" DDS therapy, when compared to patients registered in 1964 to 1966. This could be explained by the steadily improving rapport between the institution and the inhabitants of Gudiyatham Taluk. This seems to explain why a larger proportion of those registered in 1971 to 1973 than those registered in 1964 to 1966 were smear negative after 5, 6 and 7 years of DDS treatment. Despite the disadvantage of including a higher proportion with an initial BI $\geq 3+$, patients registered in 1971 to 1973 did not attain smear negative status any more slowly than those registered in 1964 to 1966.

The exact date of infection in a patient is

TABLE 2. *Attainment of smear negative status by period of treatment in two groups of patients on "maximal" DDS monotherapy.*

Period of treatment (yrs)	No. (% ± standard error) of patients smear negative registered during the years	
	1964–1966[a]	1971–1973[b]
0	0	0
1	27 (20.0 ± 3.44)	11 (15.9 ± 4.40)
2	44 (32.6 ± 4.03)	21 (30.4 ± 5.54)
3	66 (48.9 ± 4.30)	27 (39.1 ± 5.87)
4	79 (58.5 ± 4.24)	32 (46.4 ± 6.00)
5	89 (65.9 ± 4.08)	41 (59.4 ± 5.91)
6	95 (70.4 ± 3.93)	51 (73.9 ± 5.29)
7	101 (74.8 ± 3.74)	59 (85.5 ± 4.24)

[a] A total of 135 patients registered in 1964 to 1966 received "maximal" DDS monotherapy.
[b] A total of 69 patients registered in 1971 to 1973 received "maximal" DDS monotherapy.

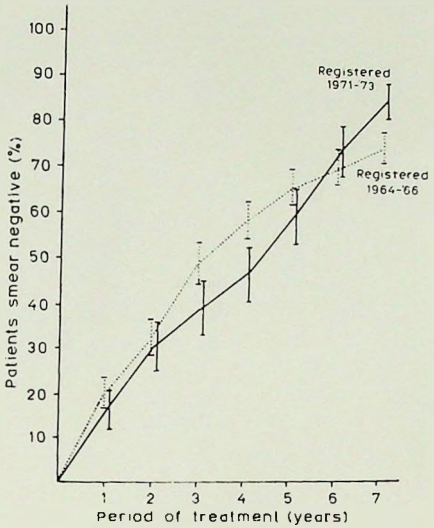

FIG. 2. Attainment of smear negative status by period of treatment in two groups of patients on "maximal" DDS monotherapy. Percentages are shown ± standard error of the percentage: $100 \times \sqrt{(p \times q/n)}$.

difficult to pinpoint. It appears reasonable, however, to assume that patients registered in 1971 to 1973 were infected more recently than those registered in 1964 to 1966. In the interval of time between the two groups, the responsiveness of *M. leprae* to DDS appears to have shown no marked change. Although negative findings cannot be used to disprove hypotheses, these data do not support the claim that DDS-resistant infections have been increasing in frequency since the introduction of DDS monotherapy.

SUMMARY

At the Schieffelin Leprosy Research and Training Centre, Karagiri, India, 148 lepromatous (LL) and borderline lepromatous (BL) leprosy patients registered for treatment in the years 1971 to 1973 were found to respond as well to dapsone (DDS) monotherapy as 391 LL and BL patients registered in 1964 to 1966, as indicated by clearance of *Mycobacterium leprae* from skin smears during the initial seven years of therapy in each patient. Apparently, the efficacy of DDS monotherapy has not been progressively diminishing since the introduction of DDS monotherapy into the area.

RESUMEN

En un estudio realizado en el Centro Schieffelin de Investigación y Adiestramiento de la lepra, Karigiri, India, se encontró que 148 pacientes lepromatosos (LL) e intermedios (BL) registrados para tratamiento en los años de 1971 a 1973 respondieron a la monoterapia con dapsona (DDS) tan bien como 391 pacientes LL y BL registrados de 1964 a 1966. Esto se concluyó en base a la eliminación de *M. leprae* observada en las preparaciones de piel de cada paciente durante los 7 años iniciales de terapia. Aparentemente, la eficacia de la monoterapia con DDS desde su introducción, no ha disminuido con el tiempo en el área estudiada.

RÉSUMÉ

Au Schieffelin Leprosy Research and Training Centre, à Karigiri, en Inde méridionale, on a observé que 148 malades atteints de lèpre lépromateuse (LL) ou dimorphe (BL) enregistrés au traitement au cours des années 1971 à 1973, répondaient aussi bien à la monothérapie par la dapsone (DDS), que 391 patients LL et BL enregistrés entre 1964 et 1966. Cette observation a été basée sur des études de l'immunisation de *Mycobacterium leprae* dans des frottis cutanés au cours des sept premières années du traitement chez chaque malade. Il apparaît dès lors que l'efficacité de la monothérapie par la dapsone n'a pas diminué progressivement dans cette région, depuis l'introduction de la monothérapie par la DDS.

Acknowledgments. We thank the staff of the departments of Epidemiology and Leprosy Control, and Laboratories, particularly Mr. J. Samuel. Mr. Raja Rao typed the manuscript.

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SILVER JUBILEE

OF

Leprosy Relief Rural Centre

CHETTIPATTY 1956 — 1981

Report of Activities.

(Dr. E VOMSTEIN)

It is a pleasing task for me, to present-in the name of the Staff this report of the activities of the Centre from its inception 25 years ago.

The joy is heightened by the fact, that a good number of Staff-members and friends of the "first hour" are still with us.

The Centre came into existence through the single-hearted devotion of Marie Denis to the cause of Leprosy and the understanding assistance of Mgr. Dr. V. Selvanather, the then Bishop of Salem.

During the first few years the work of the Centre was localised and confined to Chettipatty village and its surroundings. It was recognised within the scheme of N. L. C. P. (National Leprosy Control Programme) in 1960 and has then been allotted a Project area, within which its activities are carried out in alignment with the directives of N. L. C. P.

The Project Area comprises Omalur Taluk and two thirds of Mettur Taluk, about 1200 sq. kms., with a population of 4,09,646 lakhs (Census 1971)

The first mobile Clinic was functioning at Pusaripatty at a distance of 10 km. To date 23 Clinics are run regularily at selected suitable spots at the road-side or in the premises of Govt. Hospitals or Health Centres.

Mass-treatment in Clinics became possible with the advent of a cheap effective Drug-DAPSONE.

Paramedical Assistants are posted permanently in villages. From there they go about their important tasks: House to house Survey, case detection and upkeep of personal records of the patients. In this way the patients are linked with the Clinic and with the Head quarter-Hospital. and regular treatment can be secured.

We are reaching out in a radius of rough'y 25 kms. Since the start 25,599 Patients have gone through our Clinics. They were examined, recorded and taken under treatment. 11,817 patients have left the area permanently. Migration here is much above average. This can be attributed, among other reasons, to progressive Industrialisation in the adjacent Taluks, (for instance Salem Steel Plant, which made the shifting of entire villages necessary; then Mettur industries attract workers) A notable migrant Group characteristic for Salem Dt. are the professional stone-breakers, who are sought after throughout India. Regular Control and follow-up of these people is impossible.

1281 patients died; in most of the cases not directly due to Leprosy.

5252 Persons are cured

7249 Patients are on rolls.

2796 are "inactive", denoting that the progress of the disease is contained.

4453 are still 'active", indicating the current combat between the invading Bacilli and the defence-mechanism of the host.

The number of cases detected and registered every year remained for 15 years fairly constant around 1200. Since 1979 we notice a considerable drop to between 600 to 700. The greatest part of the patients (51%) are voluntarily reporting for examination and treatment- Evidently a considerable awareness has been created among Population.

As a result of School Survey, covering a great number of schools, the number of newly detected Patients will show an increase. But as these are children with early mild signs of the infection, we can be sure, that they will be cured in the foreseeab e future and shall not be subjected to the stigmatising symptoms and their dreadful consequences.

As part of our endeavours to bring to all Leprosy patients under treatment in the early stages, we have made arrangements to treat the school-going children in the school itself. An everage of 600 children per year are treated under this scheme. Luckily we have met with the sympathetic ready co-operation of the school-authorities and teachers. A hearty "thank you" to them.

A somewhat similar scheme is the "Factory-treatment" in 3 factories in Mettur under which 50 workers are taken care of.

For teachers, factory-workers of other areas (Magnesite Ltd.) etc. treatment is given at "Sunday-Clinics" in Chettipatty itself. A total of 100 persons are benefitting from this arrangement.

We have to concentrate our efforts on the multibacillary cases, who are perhaps the sole agent for effective propagation of the infection. 15% of the known patients in our area are of this type. Of these 44% have become bacteriogically negative-thus no longer spreading the disease. Among the new cases we register yearly the rate of "positive" cases is down to 5% only.

The Deformity-rate presents the same tendency. Overall there are 12.43% cases with some deformity (0.2% not visible). This rate will remain more or less constant with the present generation of patients Many of them had already severe deformities when they first reported for treatment.

Since several years now among the newly registered cases per year there have been 4-5% of persons with some type of deformity.

In 1981 only 2% of the newly registered cases have a deformity.

These definite remarkable reductions in the portion of Infectiousness and in Deformties in newly registered cases, is interpreted, I hope justly so-as an indication that our struggle has brought us nearer the ultimate goal.

The above given datas refer to persons from our Project area only. Added to these we have an average of 300 patients from outside the Project area under regular treatment with us.

HOSPITAL OR IN-PATIENTS' DEPARTMENT :

The Hospital with a capacity of 90 beds was inaugurated on 1st January 1970.

Since then an average of 639 patients were admitted every year. Invariably 25% of these patients have been referred from neighbouring Control Units or came voluntarily.

The great majority of Patients need hospitalisation for treatment of Trophic Ulcers and Reaction (a severe medical complication in Leprosy).

A sequel to the destruction of peripheral nervs and one of the most serious ccmplications is the occurrence of Ulcers in the feet.

70% of the patients, hospitalised for this kind of ulcers are more than 40 years old. Their number is increasing in direct relation to increase of age. Admissions for more than once-upto 10 times and more - are also characteristic for the patients in the advanced age group. These peoples too, when reporting for treatment 15—20 years ago, had already ulcers. It is evident, that long standing anesthesia, contractures, and injuries of the soft tissues, break down of the bony structures combined with the natural regressions of the normal functions of the body, make the foot extremely vulnerable. All sorts of protective footwear cannot prevent the occurence of ulcers. Therefore, it must be our endevour to prevent the first ulcer.

In 1981, 117 patients were admitted for ulcers of the feet 49 of them only were from our project area.

An average of 250 operations for simple and complicated ulcers are performed per year.

Since 1967, 434 operations for the correction of partially paralysed hands and feet have been performed.

REACTION :

This is a complicatian significant for and direcfly related to Leprosy. It occurs almost exclusively in the multibacillary type of the disease.

In 1973 the multi-drug regimen, namely RIFAMPYCIN, ISOPRODIAN or Rifampycin combined with other antileprotic drugs, was introduced. Upto now 296 patients have been treated with this drug-combinations. The results are gratifying. Besides attaining non-infectivity more speedily - or per haps because of it-ever since we can note a steady decrease in admissions for reaction ; from 162 in 1973 to 54 in 1981 (21 of these came from ouside our area). Average

stay at the Hospital equally shortened from former 49 days to the present 28 days. We are deeply indebted to Prof. Dr. Freerksen and German Leprosy Relief Assn. for the introduction of this treatment, which by now is the internationally recognised expedient, to attain negativity in multibacillary cases or at least bring the bacillary load drastically down and reduce their pathogenic capacity to nil.

All newly detected multibacillary cases are now treated with this comb. drug regimen.

LABORATORY :

At least 2600 skin smears are examined every year. Besides these about 7000 other tests; Blood, Urin Stool, Sputum are carried out, of 110 blood smears (1981) 37 were confirmed Malaria Pl: positive.

SPUTUM : 41 were found AFB-positive (Tuberculosis).

PHYSIOTHERAPY-ORTHOPEDIC DEPARTMENT COBBLER'S WORKSHOP :

Physiotherapy is a most important component and indispensable for the treatment of deformities in Leprosy or in any other physically disabling diseases.

Our Physiotherapists are busy with hundreds of various applications during the year.

502 pairs of special chappals and sandals for the protection of feet are yearly made and supplied to the patients.

"Prevention of u'cers is better than any subsequent cure"

In 1976 we could announce the opening of our Orthopedic Workshop. Salem District has been sore'y lacking an Orthopedic and Prosthetic Centre. We knew, we would be faced with innumerable difficulties and problems by taking up this project, But a deep concern for the handicapped peoples impelled us to go ahead and tackle the problems when and as they cropped up. The then Collector of Salem. Mr. V. Karuppan, declared the workshop 'open'. In his inaugural address he expressed his pride about the fact that Salem now had one more amenity for the public. He was p'eased to note that it was a Leprosy Control Unit, that was offering such vital facility to the people, a most valuable contribution to the Health Services. This Orthopedic Centre was not meant only for Leprosy patients, but for all the physically handicapped persons, to whom it could render competent service.

The appliances manufactured are :

a) MAJOR ones, such as long and short leg braces, Patella tendon bearing brace (PTB), fixed ankle brace walker (FAB), artificial limbs ... ...

b) MINOR, Elbow crutches, moulded shoes, metal insoles' foot-drop springs, alkathene splints etc.

250 major and 244 minor appliances have been supplied since the opening of the workshop.

213 major appliances were made for children, victims of Poliomyelitis and a few with congenital deformities All the children were admitted in the Hospital for not less than 3 weeks upto several months - depending on the extent of the deformity and the severity of their disability.

OUT-PATIENTS--DEPARTMENT :

This facility offered for ambulatory medical services builds a bridge between persons afflicted by Leprosy and those with general complaints and ailments. It is thus a place and opportunity of integration, as all are treated together in the same locality.

Most of the peoples who attend OPD suffer from skin disorders. Many of them are given medicines for weeks together to spare them travelling problems and expenses.

About 450 persons who called on the OPD with dermatological complaints, are each year found suffering from Leprosy. Usually they are not living in our project area. We direct them for treatment to the respective Control Units.

Some 80 persons are seen daily in the OPD-total consultations in 1981 — 18,000.

HEALTH EDUCATION :

This always played an integral part along with the other activities. Educative Public meetings, slide shows in schools, addresses to teachers, various Clubs, and in all Clinics to patients and bystanders. We are most fortunate that the generosity of G. L. R. Assn. made the acquisition of a 16 mm Photophone Film-Projector possible.

A number of patients and former patients are vocationally **settled with the Centre** :

Shoemakers, Gardeners, Poultry farm attender, Weavers, Attenders in Wards and OPD.
7 severely disabled Persons have found a permanen home with us.

ADMINISTRATION :

The administrative and clerical staff has been kept very limited in number throughout the years. We have not yet succumbed to the Law of Parkinson! This position is being taken as a testing challenge which we faced and handled bravely enough, I presume.

The assets of the Centre are assets of the Diocese of Salem. The Bishop of Salem is the Patron of the Centre, which is a branch of Salem Diocese Society.

Financially we are dependent entirely on Grants and contributions from abroad and Benefactors from India. We are most indebted to German Leprosy Relief Assn,, which over all these years has borne the largest part of our financial requirements. Its uninterrupted help and deep understanding have assured the increasing extension and improvement of our activities, without causing us too much worries. Patients and staff join me in expressing our grateful thanks and wishes for God's blessings on this organisation and the peoples, who make its admirable performance possible.

With Grants from MISEREOR / Germany we have constructed the Hospital. For many years now substantial contributions to our Budget have come from the Belg an organisation Amis du Pere Damien from Foundation Raoul Follereau France, from LEPRA and ORDER of CHARITY ENGLAND, from LEPRAHILFE EMMAUS SCHWEIZ - not to forget PAX CHRISTI Movement and CARITAS VERBAND GERMANY. To all of them our heartfelt thanks. Last but not least our hearts go out in thanksgiving to all the personal friends in India and abroad, who make our task easier by their moral and material support.

To the Government of India, we owe thanks for the first vehicle a Willy's station wagon and for intermittend supplies of DAPSONE in appreciable quantities. We are equally grateful for the approval and appreciation and guidance we always received from the State and Centre Authorities.

All this said I can not omit to express my heartfelt personal gratitude and appreciation to the patients and to the Staff, whose trust and reliance were and are imperturbable, whatever problems and

difficulties we had to takle. They are faithful "for better, for worse"!

The future will find us together in the same Team spirit, pursuing the same objectives. We certainly will do our very best to improve our performance, to overcome shortcomings, to eliminate any lacunae and in this effort contribute effectively to the N. L. C. P.

The Patient will remain our principal commitment. He, our fellow-man who is attacked by a pathegenic organism, that can and often does, devastate his body. He has to carry the Cross of suffering, for which instead of being respected by fellow humans, he all too often is despised and removed from their midst, helplessly left to a merciless fate.

If Leprosy Control should be successful, the co-operation of the sufferer himself is needed above all else. This cardinal requirement seems at times forgotten in otherwise very intelligently and meticulously worked out erradication schemes.

The Honourable Prime Minister has given new impetus to N. L. C. P. by her urgent request and wish, that Leprosy must be wiped out by the year 2000. Let us hope, that N. L. C. P. in co-operation with dedicated VOLUNTARY INSTITUTIONS is able to create an attitude and social and spiritual climate, that inspires confidence and gives the patient security and peace of mind on his extremely trying route to final cure. Only with his unreserved consent will India eventually overcome this serious Public Health Problem.

MAY GOD GIVE HIS BLESSINGS !

health technology

directions

PATH Program for Appropriate Technology in Health

Leprosy

Leprosy is a chronic, infectious, mycobacterial disease that affects about 10 million people, mainly in developing countries. The World Health Organization (WHO) estimates that approximately 1.6 billion people currently live in regions where the prevalence of the disease exceeds one case per 1,000 persons.

Leprosy, also known as Hansen's Disease, primarily affects peripheral nerves, skin, and mucous membranes. The disease exacts a high social as well as physical toll. If left untreated, leprosy can result in deformity and disability, causing those afflicted to be needlessly shunned and feared in many parts of the world because of myths and prejudices associated with the disease. Although effective drugs to cure leprosy have been available for several decades, many sufferers are reluctant to identify themselves by seeking treatment. This is partly because they fear that families, friends, community members, and employers may reject or ostracize them. Yet leprosy is curable, and if it is diagnosed and treated early, deformity and disability can be prevented.

During the 1980s, several new technologies were developed that have led to major improvements in the treatment and control of leprosy. The most important of these is multidrug therapy (MDT), which uses a combination of drugs to treat the disease and was developed to address the problem of drug resistance associated with single drug therapy. Other technologies related to program management, service delivery, patient and community education, and the prevention and correction of disabilities also have led to more effective leprosy control activities worldwide.

This issue of DIRECTIONS describes leprosy and reviews the technologies used in its diagnosis, treatment, and prevention.

Description and Diagnosis

Treatment and Prevention

Program Management

Volume 9, Number 3 ISSN: 0730-8620 1989

Description and Diagnosis

Description
Mycobacterium Leprae, the bacillus (rod-shaped bacteria) that causes leprosy, is a slow-growing organism closely resembling the tuberculosis bacillus. Because *M. Leprae* has never been cultivated successfully *in vitro*, knowledge about it is limited.

Leprosy generally is more common among males than females. This difference, which is less pronounced in children, may exist because adult males in many societies have greater mobility than their female counterparts and thus more opportunities for exposure to the bacillus. Leprosy's average incubation period ranges from two to seven years and sometimes longer.

Transmission: The exact mode of leprosy transmission is still unclear. For many years, leprosy was believed to be transmitted through direct skin-to-skin contact. Because leprosy bacilli usually are not found on the skin's surface, however, experts now consider this mode unlikely. Instead, they believe that *M. Leprae* is transmitted primarily via the upper respiratory tract, which may harbor millions of leprosy bacilli. With each cough or sneeze, the bacilli are discharged on droplets or dust particles that healthy individuals then inhale. Prolonged, close contact with infectious persons is likely to increase the risk of transmission.

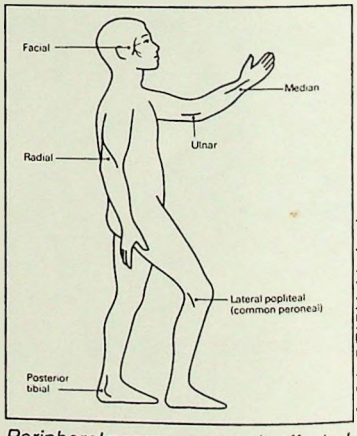
Susceptibility: The incidence and distribution of leprosy varies widely and irregularly within endemic regions, suggesting that the risk of acquiring the disease varies among individuals. Thus, while leprosy bacilli may be transmitted easily, perhaps 95 percent of people who are infected with the bacilli never develop the disease. Cell-mediated immunity (CMI), or the ability of individual cells to resist infection, is the mechanism that protects against leprosy. CMI also influences the type of leprosy that develops.

Factors influencing the strength of the CMI response in individuals include prior exposure to other mycobacteria, pregnancy, the presence of other diseases, and genetics. For instance, experts have known for years that a relationship exists between leprosy and tuberculosis (TB), which is also caused by a mycobacterium. Where TB is widespread, declines in leprosy incidence have been observed, possibly due to a cross-immunological effect between the two diseases. (For more information on TB, see DIRECTIONS, 6(1), 1986.)

Pregnancy may lead to the development of active disease in women already infected with the bacillus or to exacerbation and relapse in untreated or inadequately treated existing cases. This may occur because elevated estrogen levels associated with pregnancy lower CMI. WHO recommends that women with active leprosy postpone pregnancy until completion of treatment.

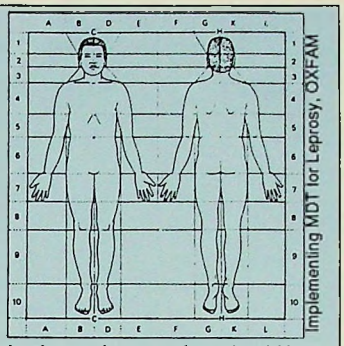
Some experts fear that the increased incidence of human immunodeficiency virus (HIV) infection, which causes acquired immune deficiency syndrome (AIDS) and is associated with depressed CMI, may lead to an increase in leprosy incidence or deterioration in existing cases. More research is needed, however, to confirm such a relationship.

Diagnosis
Because individual resistance to leprosy varies, the disease appears in many different forms and exhibits a wide range of signs and symptoms. This sometimes makes diagnosis difficult, yet early diagnosis is critical to prevent disability and deformity.



Peripheral nerves commonly affected by leprosy.

Slit-Skin Smears



Lesion and smear sites should be documented on a body diagram.

Skin smear examination is important for accurately diagnosing, classifying, and treating leprosy. High standards are vital when performing the procedure; smears that are mishandled or interpreted incorrectly after they are stained yield misleading results. Selection of smear sites should be made by an experienced leprosy clinician. Smears usually are taken from at least one ear lobe and from the most active edges of two to four typical skin lesions. They should be taken in good light so that lesions can be seen easily. After the samples are fixed to slides, they are stained using the Ziehl-Neelsen technique. The density of the stained bacilli in smears is called the bacterial index (BI). The morphological index (MI) indicates the percentage of uniformly stained bacilli in the slide. Taking good smears requires clean microscope slides and a slide box; slide labels or a grease pencil for marking slides; a sharp, sterile scalpel; matches, spirit, and a spirit lamp (if possible); cotton wool swabs; and surgical gloves.

After taking a smear, all materials contaminated with blood should be sterilized, if possible, or disposed of safely. To reduce risk of infection, especially with HIV, health workers should use scalpels with sterile, detachable blades that are discarded after a single use. Reusable scalpels or blades require steam sterilization or high-level disinfection by boiling between uses. Chemical disinfection is much less reliable and should be avoided. Where possible, workers should wear surgical gloves when taking smears and handling slides to prevent contact with blood or smear material. For information on resources regarding smear collection and interpretation, see Materials Available, page 12.

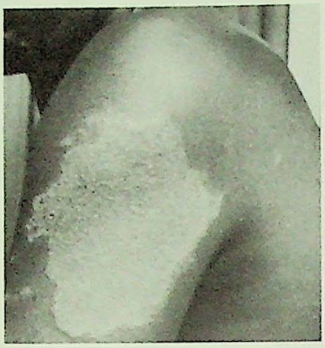
The three definitive diagnostic signs of leprosy are: (1) reduction or loss of feeling in skin lesions, (2) enlargement and tenderness of one or more peripheral nerves, and (3) the presence of acid-fast bacilli in a skin smear. Diagnosis is made when one or more of these signs is present. Technologies for diagnosis are limited, but health workers at all levels of the health care system can use basic clinical and laboratory techniques to improve diagnostic accuracy.

Skin lesions often are among the first signs of leprosy. While other diseases may cause lesions, only leprosy lesions have impaired sensation. A wisp of cotton wool, a nylon thread, thin paper, or a feather can be used to test for sensory loss. After asking the patient to close both eyes, the examiner touches normal and affected skin with one of these items. With eyes still closed, the patient points to the spot where sensation is felt. This test is repeated in affected and unaffected areas. Sensitivity to temperature is tested the same way with two test tubes, one filled with hot water and the other with cold. WHO recently field tested a new, inexpensive, battery-powered thermal sensibility tester. About the size of a pen, it provides a quick and easy way to test thermosensitivity. Pain sensitivity is tested by pin-prick.

Peripheral nerves may be tender and enlarged due to leprosy infection. (See diagram, page 2.) Nerve damage symptoms include sensory loss, muscle weakness, paralysis, and tingling sensations, especially in the face, hands, and feet. Impaired eyelid function, corneal anesthesia, and inflammation of the iris can lead to eye damage. Since nerve damage often results in painless injuries and burns, potentially leading to ulceration and disability, early identification of nerve involvement is crucial.

Slit-skin smear results are used to confirm leprosy diagnosis, classify the disease, and monitor the efficacy of chemotherapy. Accurate interpretation of smears depends on effective training and supervision of health workers and laboratory personnel and on the condition of laboratory equipment such as microscopes, glassware, and reagent supplies. (See box above.)

When clinical and bacteriological examinations are inconclusive, skin biopsies can provide needed information. Nerve biopsies are recommended in exceptional



The Leprosy Mission International

Paucibacillary leprosy lesion.

cases where peripheral nerves are enlarged, but skin lesions are absent. Major sensory and motor nerve trunks should not be biopsied.

Skin and serological tests to detect subclinical leprosy infection currently are under development. If adequately sensitive and specific, such tests could facilitate early identification and treatment and enhance understanding of risk factors relating to leprosy infection and disease.

Leprosy classification helps to determine treatment strategies and identify patients who are highly infectious or at risk of disease complications. The different forms of leprosy are classified along a continuous spectrum of disease. Three different classification systems are in use: the Madrid system, the Ridley and Jopling system, and the WHO system.

The Madrid system divides leprosy into three forms: (1) the lepromatous form, which is the most severe and indicates that the patient's CMI is extremely weak or nonexistent; (2) the tuberculoid form, which is the least severe; and (3) the borderline form, in which the patient shows some resistance but may have a variety of symptoms, depending on the strength of resistance.

The Ridley and Jopling classification system is somewhat more precise and divides leprosy into five groups from least to most severe: (1) polar tuberculoid, (2) borderline tuberculoid, (3) mid-borderline, (4) borderline lepromatous, and (5) polar lepromatous.

Both of these classification systems also recognize an indeterminate form of leprosy in which patients have one or a few ill-defined skin lesions. Peripheral nerves usually are unaffected, and skin smears are negative. Sensory impairment, however, is always present. These cases may develop into more serious forms of the disease or may resolve without treatment.

The WHO classification system divides leprosy into two groups: paucibacillary and multibacillary. Paucibacillary leprosy is usually noninfectious. It includes all smear-negative polar tuberculoid, borderline tuberculoid, and indeterminate forms. Multibacillary leprosy includes all smear-positive mid-borderline, borderline lepromatous, and polar lepromatous cases. The multibacillary patient has little or no resistance to leprosy bacilli and may be very infectious until treated.

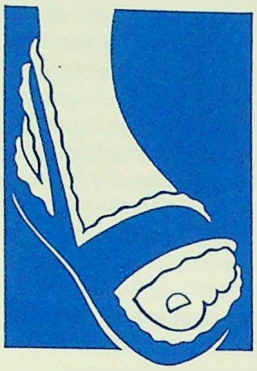
Of these systems, the Ridley and Jopling system places the disease most precisely on the immunological spectrum, while WHO's classification is simplest and most applicable to developing country control programs. The WHO system's primary goal is to ensure that leprosy patients receive the appropriate MDT regimen. The relationship among the three systems is illustrated below.

The lepromin test, which consists of an intradermal injection of autoclaved *M. Leprae* into the patient's forearm, sometimes is used to classify the disease after diagnosis by indicating the strength of a patient's CMI response. Paucibacillary patients will have a positive test result, indicating a strong immune response. Multibacillary patients will have a negative test result, indicating that there is little or no resistance to infection. In mid-borderline and indeterminate cases, the results vary. The long waiting time (three to four weeks) between administration and interpretation of the test, however, makes follow-up difficult, especially in rural areas. Obtaining lepromin and training health workers to use the test add to the logistical difficulty.

CLASSIFICATION SYSTEMS	SPECTRUM OF LEPROSY				
Ridley & Jopling	Polar Tuberculoid	Borderline Tuberculoid	Mid-borderline	Borderline Lepromatous	Polar Lepromatous
Madrid	Tuberculoid		Borderline		Lepromatous
WHO	Paucibacillary			Multibacillary	

ALERT/German Leprosy Relief Fund

Treatment and Prevention



After diagnosis and classification, appropriate treatment is selected. Chemotherapy is the most important technology for treating leprosy and managing complications such as changes in immunological status (reactions) and relapse. If chemotherapy is started early, recovery from leprosy usually is complete, and disability can be prevented. New treatment and prevention technologies, such as vaccines, also are under development. Technologies to control disabilities include tools and techniques to facilitate physical functioning and protective devices to prevent further damage.

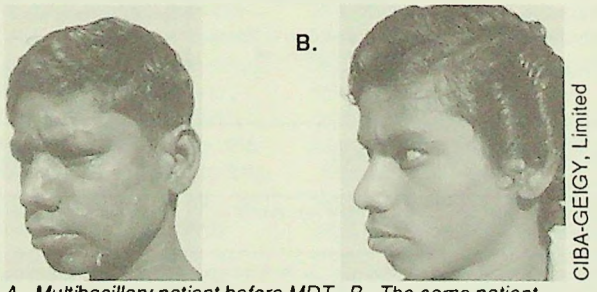
Chemotherapy: For nearly 40 years, leprosy has been treated with a single sulfone drug called dapsone. Dapsone revolutionized leprosy control. Isolation of leprosy patients no longer was considered necessary, and patients could treat themselves with daily doses at home. Dapsone is inexpensive, has few side effects at recommended dosage levels, and is very effective in arresting leprosy and its transmission. Complete cure, however, may require treatment for three years to a lifetime, which often results in poor patient compliance. Compliance problems, as well as exclusive reliance on a single drug administered in low doses over a long period of time, have led to the emergence of dapsone-resistant strains of *M. Leprae* in over 40 countries. Resistance causes frequent relapse or failure to improve with treatment, and patients resume infectiousness. (For details on drug resistance, see DIRECTIONS, 3(2), 1983.)

Treatment failure due to resistance can be avoided by combining drugs to treat leprosy. In 1981 WHO recommended that multidrug therapy (MDT) replace dapsone monotherapy for treating leprosy. The goals of MDT are to eliminate patients' infectiousness, interrupt disease transmission, shorten the duration of treatment, and prevent or overcome further development of drug resistance. WHO defined specific drug regimens for paucibacillary and multibacillary patients that are effective and feasible under a variety of field conditions. (See box, page 6.)

MDT uses three anti-leprosy drugs: dapsone, rifampicin, and clofazimine. Multibacillary patients receive all three, while paucibacillary patients receive only dapsone and rifampicin. Rifampicin is well-tolerated and very effective; a single 600 milligram dose kills almost all bacilli within several days, leaving the patient noninfectious. Multibacillary and paucibacillary patients both receive monthly, supervised doses of rifampicin.

In addition to dapsone and rifampicin, multibacillary patients take daily and monthly doses of clofazimine. Though very effective, clofazimine side effects can include reddening of skin lesions and darkening of skin exposed to sun, which causes some patients to object to its use. If a patient refuses clofazimine, a thiomide (ethionamide or protionamide) may be considered. Thiomides, however, are much more toxic than clofazimine, possibly causing liver damage when taken with rifampicin, and generally are not advisable.

MDT is a major development in leprosy treatment and control. Sustained use of MDT may reduce leprosy prevalence by 75 percent in five years, making possible the eventual eradication of



A. Multibacillary patient before MDT. B. The same patient after one year of MDT.

leprosy. Patients can be completely cured in six months to two years (depending on the form of leprosy), and those who receive MDT early in the course of the disease are much less likely to develop permanent disabilities.

Vaccines: Research on leprosy vaccines has been under way for many years. Progress has been slow mainly because *M. Leprae* cannot be cultivated *in vitro*, and large quantities of the bacillus can be obtained only from experimentally infected, nonhuman sources such as the armadillo. The Bacillus of Calmette and Guerin (BCG) vaccine, which protects against tuberculosis, was the first vaccine considered for leprosy because of possible cross-immunological benefits. BCG's protective effect against leprosy has been tested in four field trials. Because results ranged from 20 percent protection in Burma to over 80 percent in Uganda, BCG is not recommended for use against leprosy.

Current research is focusing on a vaccine combining heat-killed *M. Leprae* (HKML) with BCG to induce strong CMI responses in leprosy patients who previously had little or no response. Combining these mycobacteria may prevent infection as well as generate immune responses in patients already infected. Field trials of HKML alone and in combination with BCG began in Malawi and Venezuela several years ago. Study results will not be available for almost ten years.

Treatment of reactions: Reactions are acute episodes associated with changes in the patient's immunological status. They can occur in all forms of leprosy except indeterminate leprosy, regardless of whether or not the patient is on chemotherapy. Unless reactions are treated promptly and adequately, they can lead to severe and permanent neural and tissue damage.

Two basic reactions occur in leprosy patients. Type One lepra reactions, also known as reversal reactions, primarily occur in borderline cases and involve a sudden strengthening of the CMI response. Of greatest concern are the changes in peripheral nerves, which swell rapidly, become painful, and impair nerve function. If untreated, severe and permanent nerve damage may result, causing loss of sensation, muscle contractures, and permanent paralysis. Corticosteroids should be given to treat inflammation, and analgesics may be administered to relieve pain.

Type Two lepra reactions occur in lepromatous patients. They are caused by changes in humoral (systemic) immunity response and also are called erythema nodosum leprosum (ENL) reactions, which means red nodes of leprosy, because of their clinical features. Like Type One reactions, ENL reactions often affect nerve functioning. Unlike Type One reactions, however, they also may involve eyes, kidneys, spleen, testes, joints, and muscles. Corticosteroids and thalidomide or clofazimine are used to treat ENL reactions. Women of childbearing age should be given clofazimine instead of thalidomide, which can cause serious birth defects.

For either reaction, patients on MDT should continue the prescribed regimen, rest affected limbs, and limit activity until the reaction has passed. Severe reactions may require hospitalization.

Disabilities: Approximately 30 percent of registered leprosy patients suffer from deformities and disabilities. Damage to peripheral nerves, which maintain skin sensation and muscle movement, causes the majority of disabilities. Complications such as blindness, paralysis, and loss of

MULTIDRUG THERAPY FOR LEPROSY

	PAUCIBACILLARY LEPROSY	MULTIBACILLARY LEPROSY
WHO Recommended Regimen	Rifampicin--600 mg once-monthly, supervised Dapsone--100 mg (1-2 mg/kg body weight) daily, self-administered	Rifampicin--600 mg once-monthly, supervised Dapsone--100 mg (1-2 mg/kg body weight) daily, self-administered Clofazimine*--300 mg once-monthly, supervised, and 50 mg daily, self-administered
Duration of Treatment	Six months	At least two years or, when possible, until skin smears are negative
Surveillance after Completion of Treatment	Annual exams for at least two years	Annual exams for at least five years

*If patients refuse clofazimine, substitute ethionamide or protionamide in daily, self-administered doses of 5-10 mg/kg body weight.

skin sensation are preventable with early diagnosis, treatment, and patient education. If disabilities develop, prompt measures to control them and prevent further damage are critical.

Although all areas of sensory loss are at risk of injury, the feet and hands are most susceptible. Infected wounds leading to ulceration of the foot is one of the most common problems of leprosy. Almost all ulcers heal with rest over time. If the patient does not detect the wound due to sensory loss and continues to walk without protection, however, severe tissue damage and eventually bone loss may result. Untreated hand injuries lead to similar problems including loss of fingers. Leprosy also may impair skin secretions, such as the ability to sweat, and affected areas often become dry, cracked, and therefore susceptible to infection.

Protective devices help prevent injury to hands, feet, and eyes. For example, gloves should be worn to avoid hand burns when cooking or tending fires, and shoes or sandals should be worn at all times. Deformed feet require specially designed shoes to fit abnormal contours and distribute weight evenly. Footwear with stiff soles and insoles of microcellular rubber or plastazote (a soft, heat-moldable foam plastic) are ideal. Extra high arch supports relieve pressure on toes, and soft, cotton sandal-strap lining protects against chafing and blistering. Nails never should be used in shoes for leprosy patients.

About 250,000 people may be blind due to leprosy, yet leprosy-related blindness is preventable

Churchill Livingstone

Modified sandal for dropped foot.

in most cases. Blindness may occur for several reasons. Muscles in the eyelid may be paralyzed due to peripheral nerve damage, thereby preventing blinking; the cornea may lose sensitivity (corneal anesthesia), making the patient unaware of eye damage or infection; or the iris may become inflamed during a Type Two reaction, potentially causing permanent damage.

Dark glasses can protect eyes from dust and dirt. A low-cost eye shield made of transparent plastic and adhesive also can be worn for protection.

Self-care techniques: Patients suffering from sensory loss must conduct regular, daily exams of hands, feet, and eyes to check for minor infections and injuries. To prevent infection and moisturize the skin, leprosy patients should soak affected hands and feet in water for 20 to 30 minutes every day. After soaking and patting the skin dry, the patient should apply petroleum jelly or a vegetable oil over the skin to help retain moisture. If eyelid muscle weakness is evident, patients should close eyes regularly as tightly as possible ("think and blink"), apply antibiotic eye ointment, and flush eyes with specially formulated disinfectant or tear substitute, or for iris inflammation, with steroid drops.

Clinical care: If ulcers develop, they should be cleaned thoroughly with soap and water. Adhesive zinc tape or other dressings or in severe cases, a plaster cast for about five weeks to rest the limb also may be necessary. A cast should not be used, however, until the ulcer is clean and the infection is controlled.

Physical therapy: Simple, daily exercises such as repeatedly extending paralyzed fingers can prevent muscle wasting and contractures and increase muscle strength. Conditions such as dropped foot or claw hand may require splints or braces to prevent further damage. Plaster or molded plastic splints also stabilize affected limbs during reactions, reducing pain and preventing contractures. To facilitate the use of small objects, gripping aids made of epoxy putty can be molded to items such as tools, pens and pencils, and eating utensils.

Surgery: Common surgical procedures include removing dead bone, draining abscesses, and debriding ulcers. Tendon transfer to straighten clawed fingers and toes and correct dropped feet, as well as reconstructive surgery to rebuild collapsed noses or replace lost eyebrows, also are possible. Severe deformity or infection may warrant amputation. Surgery also may be required to treat eyelid paralysis. Unfortunately, most leprosy control programs are not equipped to provide such specialized care.

Program Management

The essential components of successful leprosy control programs are: (1) early case-finding and treatment; (2) effective monitoring and follow-up of patients under treatment; (3) education of the patient, family, and community; (4) training and supervision of health care personnel at all levels of the system in leprosy diagnosis, case management, and referral; (5) program monitoring and evaluation; and (6) social integration and rehabilitation of persons with leprosy.

Early case-finding and treatment: Early case identification and registration allows prompt administration of chemotherapy to prevent disabilities and eliminate infectiousness. WHO defines a leprosy case as "a person having clinical signs of leprosy with or without bacteriological confirmation of the diagnosis, and requiring chemotherapy." WHO recommends that this definition be adopted worldwide so that data may be compared among different countries.

Both active and passive case-finding methods commonly are used. Case-finding activities, however, are valuable only if efficient, reliable treatment services are available for every case identified. Essential service components include well-trained personnel; well-organized, fully-stocked clinics; accessible laboratory facilities for smear and biopsy analysis; and referral facilities for patients with reactions, drug side effects, or deformities requiring surgical corrections.

Active case-finding methods include contact surveillance and screening of schoolchildren. In contact surveillance, health workers obtain smears and conduct clinical examinations on all previously identified patients and their household contacts to confirm diagnosis. It is most useful in areas of low to moderate endemicity and in urban slum areas, where cases often are clustered. Screening schoolchildren is useful in highly endemic areas. In Bombay, India, school surveys have been conducted since 1970.

Active methods with more limited use include total population surveys, job site screening, and rapid surveys. Total population surveys are useful only in highly endemic areas. Job site screening can be effective but may result in job loss for workers identified as having leprosy. Rapid surveys, usually organized at centrally located screening sites, are particularly effective when combined with general health examinations.

The Leprosy Mission International

Active case-finding methods include screening schoolchildren.

Despite these efforts, most cases are identified through self-reporting, referral, and notification. These passive methods absolutely require effective health education to dispel myths about leprosy, teach people to recognize early signs of the disease, and inform people about available treatment services.

Once cases are identified, MDT should be initiated immediately. Unfortunately, the pace of MDT implementation has been slow. Of the estimated 10 million leprosy cases worldwide, about 5 million cases are officially registered, and of this number only about 2.1 million cases, or less than half, have been put on MDT. In Africa, less than 20 percent of leprosy cases are receiving MDT.

Several factors contribute to this problem. First, initial costs of MDT are higher than dapsone therapy. The duration of MDT, however, is much shorter, especially for paucibacillary leprosy (six months instead of three to five years), making the long term cost-effectiveness of MDT much greater than dapsone therapy. In addition, drug costs are dropping steadily, as are total expenditures for treating disabilities, since disabilities occur less frequently among patients receiving MDT.

Blister Calendar Packs

Blister calendar packs provide a one-month supply of all necessary drugs for MDT. The upper portion of the pack contains the drugs to be taken monthly under supervision. The clinic worker tears off and retains this portion when the drugs are dispensed. The lower portion contains the daily doses of dapsone, organized by weeks into four rows. Different packs are available for both paucibacillary and multibacillary adult patients as well as for paucibacillary child patients. Multibacillary leprosy in children is rare, making blister calendar packs less cost-effective for this group. Study results from India, the Philippines, and Thailand indicate that patient compliance improves when these packs are used. In addition, non-medical personnel can be trained to dispense the packs, and time previously spent counting out pills and instructing the patient can be devoted to other control activities. Blister calendar packs appear to facilitate drug planning and supply, improve delivery of proper treatment from peripheral health posts to rural populations, reduce drug wastage and misuse, and improve clinic attendance. They are more expensive than "loose" drugs, however, and although it appears that using blister calendar packs is cost-effective, further studies are needed to confirm this.

Experience over the last seven years has shown that effective MDT programs need adequate resources and well-trained personnel to carry out support activities related to MDT. Prior to implementing MDT in an area, all registered cases must be reviewed and those patients no longer requiring treatment should be released from the registers. In areas where resources are limited, MDT should be introduced on a small scale in one area or district and then slowly expanded to other areas as resources become available. A systematic method of tracing patients who have dropped out of treatment also should be established.

Follow-up: Monitoring and follow-up of patients on MDT is crucial to promote compliance and minimize interruption of treatment. Drug intake can be monitored by consulting with the patient and counting remaining tablets or capsules or by taking urine samples to test for the presence of anti-leprosy drugs. Dapsone is easily detected in urine using a spot test on filter paper treated with Ehrlich's reagent; a yellow ring immediately appears if the urine contains sulfones. Simply checking the urine for a reddish color will indicate if rifampicin has been taken in the last six to ten hours. Health workers also should make home visits to remind patients of appointments.

Because MDT regimens require coordinating the supply of different drugs and taking a mixture of daily and monthly dosages both at home and under supervision, assuring timely and correct drug intake can be difficult. One innovation to improve treatment compliance is the development of blister calendar packs to facilitate the delivery of drugs. (See box above.)

Once the prescribed course of treatment is completed, WHO recommends that, if possible, paucibacillary patients and their household contacts be kept under surveillance for at least two years, with annual clinical examinations. Multibacillary patients and their household contacts require five years of surveillance. Patients who have completed treatment should be instructed to return to the clinic at the first sign of relapse.

Health education: Because leprosy inspires such fear and misunderstanding, programs to control the disease require intensive health education for patients, families, and the community to dispel myths and reduce prejudice. Training people to recognize leprosy signs and symptoms also is important. Health education campaigns must take into account local attitudes and beliefs about leprosy. Campaigns are most effective when respected community members such as village chiefs, traditional healers, religious leaders, and school teachers are involved. Existing leprosy education materials can be adapted to specific settings to support effective leprosy education campaigns. (See Materials Available, page 12.)

CIBA-GEIGY, Limited

Health worker explains importance of foot care to leprosy patient.

Patient education begins at diagnosis. To improve compliance, patients must understand what chemotherapy can accomplish and how long treatment is required. They also must develop a personal sense of responsibility for preventing disabilities and deformities and have a clear understanding of appropriate self-care techniques.

The patient's family also must be educated about the disease so that they do not reject or ostracize the patient. If family members understand the disease and the need for regular treatment, they can play an important role in achieving patient compliance with MDT and self-care.

Mass media can help educate the general public about leprosy. For example, in India, posters and billboards with simple phrases such as "leprosy is curable" and "leprosy is not hereditary" have been posted throughout the railway and bus systems in certain provinces. Similar messages are printed on railway timetables. Exhibitions and check-up stations allow waiting passengers to see videos, read pamphlets, and be screened for leprosy, if desired.

The Leprosy Mission International

Keeping accurate records is an essential component of effective leprosy control programs.

Radio and film presentations, pamphlets, community education campaigns, and school-based health education also can reduce the social stigma and prejudice often associated with leprosy. In Sierra Leone, a local theater staged several performances about a person with leprosy to raise community awareness.

Training and supervision: MDT implementation and other new control activities make training of health care personnel at all levels very important. Clearly defined tasks accompanied by good supervision increase efficiency, develop skills, and promote positive work attitudes. A manual with all essential information on leprosy diagnosis, treatment, management, and prevention must be developed for health workers. Adequate training in leprosy must be included in the curricula of medical and paramedical training institutions, especially in countries where the disease is endemic.

Monitoring and evaluation: Simple, standardized information systems should be established to monitor and evaluate the operational, clinical, and epidemiological aspects of leprosy control. Ideally, the following data should be collected: number of registered cases, case detection rates, disability rates among new cases, MDT coverage and drop-out statistics, and relapse rates. At a minimum, leprosy control programs should maintain patient record cards or a treatment register for active patients. Patient record cards should contain demographic information, diagnosis, treatment initiation and completion dates, and follow-up examination results.

To ensure accurate statistics, program managers should establish routine quality control systems. The nature and extent of random quality control checks depends on the availability of supervisory staff and laboratories. Activities that should be reviewed routinely include leprosy diagnoses and classification, smear results, record-keeping systems, and statistical calculations.

To determine the effectiveness of leprosy control activities, WHO has helped develop the OMSLEP Recording and Reporting System, which is used in many countries. The system can be adapted to the specific information system used in each country, and its standardized format facilitates the comparison of data among different countries. Information can be compiled and interpreted with or without the use of microcomputers.

Social integration: The social isolation of leprosy patients, though less prevalent than in the past, is one of the last remaining barriers to the eradication of leprosy. Social isolation is unnecessary and inflicts untold suffering on patients and their families. Community programs help encourage social integration of leprosy patients. For example, community-based rehabilitation (CBR) for the disabled integrates leprosy patients by treating disabilities through existing health services within the community. CBR promotes awareness and responsibility for care among community members, increases self-reliance, and encourages the use of simple, affordable, and culturally acceptable methods and technologies for physical therapy and rehabilitation.

NATIONAL PROGRAM STRATEGIES

When establishing a national leprosy control program, important considerations include whether or not it will be integrated into general health services and how MDT will be introduced. In most countries, separate, vertical, leprosy control programs have been established. It is generally agreed, however, that leprosy care should be integrated into primary health care where possible. Although specialized care for leprosy patients still is needed, integration helps to reduce the stigmatization of leprosy patients, to improve access to comprehensive and continuous care, to prevent duplication of services, and to minimize dependence on donor agencies.

Integration requires extensive planning, a well-supported primary health care system, and effective supervision of staff. In highly endemic areas (more than 5 cases per 1,000 persons) a vertical program may be necessary to avoid overloading the system until additional resources are available. In India, which has an estimated four million leprosy cases, integration is occurring in phases. In highly endemic districts, leprosy control is organized vertically. In remaining districts, the program is managed through the general health care system.

MDT introduction has been a national policy in India since 1983, with the goal of curing all known cases by 2000. As of March, 1989, MDT had been introduced in phases into 112 of 201 highly endemic districts, with 2.3 million people receiving MDT. These phases are outlined below. In ten districts where MDT has been available for five years or more, overall prevalence rates for all districts have dropped from 20.7 cases per 1,000 to 2.4 cases per 1,000. The incidence and disability rates also are declining.

PHASES OF MDT IMPLEMENTATION

Mobilization	Planning and Preparation	Intensive	Maintenance
• organize positioning of infrastructure	• perform rapid surveys to detect remaining cases	• deliver MDT to eligible patients	• monitor patients completing MDT
• provide basic training to staff	• conduct sample surveys to validate existing data and obtain baseline figures	• follow-up on MDT drop-outs	• conduct ongoing case detection: screen household contacts, school children
• conduct active case-finding surveys to detect at least 80% of cases	• screen all cases to verify classification and MDT eligibility	• monitor drug intake	• general health care staff assume more responsibility
	• conduct intensive public awareness campaigns		• phase out vertical program as prevalence declines

Adapted from report by Dr. N.S. Dharmshaktu, Ministry of Health, India

Conclusions

Leprosy is a serious public health problem affecting millions of people worldwide. In addition to physical suffering, leprosy patients often endure social ostracism and prejudice because of myths and misconceptions surrounding the disease.

Yet never before have the prospects been better for controlling and eradicating leprosy. New diagnostic, treatment, and program management technologies are being developed that may revolutionize the control of the disease. The most important of these is MDT, which represents a crucial breakthrough in the treatment of leprosy. Where chemotherapy has been introduced and sustained, marked reductions in leprosy prevalence have occurred. The future development of technologies such as vaccines to prevent and treat leprosy also promise to have profound effects on the control of the disease. In addition, health education and program management techniques to encourage public support of leprosy patients are receiving greater attention. For patients who have developed disabilities and deformities, rehabilitation tools and techniques now exist to improve functioning and prevent further physical deterioration.

All of these technologies can reduce the needless physical and psychological suffering of leprosy. Concerted efforts to improve health care delivery to leprosy patients and educate the public about the disease must continue, however, so that people with leprosy will seek and receive the treatment they need without fear of social reprisal.

Materials Available

WHO has produced several excellent publications on leprosy. They include: **A Guide to Leprosy Control, Second Edition**; **Epidemiology of Leprosy in Relation to Control**; **Chemotherapy of Leprosy for Control Programmes**; and **WHO Expert Committee on Leprosy**. All publications are available from WHO, Leprosy Unit, Division of Communicable Diseases, 1211 Geneva 27, Switzerland, or from WHO regional offices.

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Implementing Multidrug Therapy for Leprosy, by Dr. A. Colin McDougall, covers all essential issues related to MDT introduction. It is available for US$7.95 per copy (includes shipping costs). Write to: OXFAM, 274 Banbury Road, Oxford, OX2 7DZ, U.K.

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Many resources are available from The Leprosy Mission International (TLMI). For example, **Preventing Disability in Leprosy Patients**, by Jean M. Watson, contains basic information and illustrations on care and prevention of disabilities. **Health Education in Leprosy Work** is an excellent manual for training health care workers. For details on taking smears, consult the **Technical Guide for Smear Examination for Leprosy by Direct Microscopy**. TLMI also produces a magazine every six months called **Partners**. It is available at no charge to leprosy health workers. For a complete list of English language teaching and learning materials and ordering information, contact: The Leprosy Mission International, 80 Windmill Road, Brentford, Middlesex, TW8 0QH, U.K.

Two comprehensive and well-illustrated guides entitled **Leprosy: Basic Information and Management** and **Leprosy for Medical Practitioners** are available in limited quantities free of charge from CIBA-GEIGY, Ltd., CH-4002, Basle, Switzerland.

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Teaching Aids at Low Cost (T.A.L.C.) produces a wide range of training materials, slide sets, and guides on leprosy for training medical and paramedical personnel. For more information, write to: T.A.L.C., Box 49, St. Albans, Hertfordshire, AL1 4AX, U.K.

☐

David Werner's books, **Where There Is No Doctor** and **Disabled Village Children**, contain excellent sections on the diagnosis and treatment of leprosy and on the care and prevention of disabilities resulting from leprosy. For ordering information, write to: Hesperian Foundation, P.O. Box 1692, Palo Alto, CA 94302, U.S.A.

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A bibliography on leprosy is available from PATH.

CORRECTIONS

In the last issue of DIRECTIONS ("Immunization," 9(2), 1989), the sentence at the bottom of the Vaccine Storage Temperature chart on page seven should have stated that DPT, IPV, and TT vaccines freeze at temperatures below -3° C, not -30° C.

On page ten, STERItimer's™ color change due to heat exposure was described as being irreversible. In fact, it reverts back to the original color as it cools.

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LEPROSY IS CURABLE

LEPROSY has been shrouded in mystery since ancient times. There are many misconceptions, false beliefs and supersitions about this disease.

Leprosy is an infectious disease caused by a germ known as Mycobacterium Leprae. All leprosy cases are, however, not infectious. Only 25 per cent of the leprosy cases in India are infectious and they can transmit the disease to healthy people by close contract. Leprosy is neither hereditary nor veneral in origin. Nor is leprosy a curse of God or supernatural forces. It is a problem of prolonged sickness and deformity and sometimes destitution arising out of social stigma and ostracism people often wrongly associate with the disease.

Leprosy is now curable by modern methods of treatment. Regular treatment from the early stages of the disease cures the patient without deformity.

Early signs:

Most of the leprosy cases start with a discoloured skin patch, accompanied by loss of sensation or with numbness in one or more fingers and toes. Leprosy may also begin with a reddish patch or discolouration of the face often associated with small nodules in the face or in the margin of the ears.

These patches usually tend to persisit and do not itch or sweat, and hence dry. Sometimes the patches many look smooth, glistening with ill-defined margins but without definite loss or sensation in patch. But then the smears from the patch will show leprosy bacilli as a sign of infectivity of the case. Some other symptoms of leprosy are thickening of nerves in exposed parts of the body, flattening of nose, nasal dis-charge, clawing of fingers, recurrent chronic ulcer in the sole of the feet.

Treatment:

Anybody showing these signs should consult a medical practitioner or a doctor of the Primary Health Centre or Leprosy Control Unit and take treatment regularly. The treatment should be continued as long as advised by the doctor. Patients can stay in their own homes and continue their normal occupations alongwith regular outdoor treatment. The patients should not be ostracized or treated as social outcastes but must be persuaded to come forward for early and regular treatment. A sympathetic attitude towards the patient will greatly alleviate the discomfort of leprosy patients and promote the programme of early detection and timely treatment of new cases. It will also help in rehabilitation of the cured patients.

....2

Only infectious patients should be kept in separate rooms with separate arrangements till they become non-infectious. Child contacts of infectious patients should be given regular preventive treatment-oral DDS tablets. Non-infectious child patients should not be refused admission in schools not should they be discriminated against in any manner.

Rehabilitation is possible:

With the introduction of sulphone drugs, emphasis in leprosy treatment has now shifted from isolation in colonies to outdoor treatment on domiciliary abmulatory pattern which helps the patient to remain with his own family, thereby preventing him to become either a permanent colony patient or a beggar and continue his occupation. One of the specific achievements of progress of medical sciences over the years is the advancement in physiotherapy, occupational therapy and reconstructive surgery which help rehabilitate even a deformed leprosy patient by correcting largely the physical deformities.

It is possible to use the results of modern advancements only if leprosy is detected early and the patient put on regular treatment. Thus deformities, if any, may not go to the incorrigible stage. While regular and proper treatment is an important requirement for cure and rehabilitation, a congenial atmosphere in the patient's home and a sympathetic attitude is also called for to boost up his morale. These help in early cure. A cured or non-infectious leprosy patient can work in any field, according to his abilities. He is no danger to others. A medical certificate as to the non-infectivity or cured status of the patient can be taken as a criterion for accepting him in any job as any other healthy person.

Voluntary organizations engaged in leprosy control work have been encouraged and schemes for leprosy control work, training of personnel and social welfare schemes for rehabilitation of leprosy patients, alongwith other handicaps have also been provided respectively by the Health and Social Welfare Departments of the Government, of India.

Leprosy is curable and preventable. People should accept it as a disease just like any other communicable disease. They should, of course take necessary precautions for cure and prevention. And, the patients should be shown the same compassion as is shown to any sick person.

...3

Control and preventive measures;

Leprosy is preventable by avoiding contact with infectious patients and controllable by the use of "Dapsone" (DDS) tablets). Administration of "Dapsone" is particularly effective and is advised for children below 15 years who are living with or are in contact with infectious cases of leprosy.

The National Leprosy Control Programme was launched by the ~~Programmexwas~~ Government of India in 1955 with these objectives in view. Leprosy Control Units, Survey, Education and Treatment Centres, etc., have been established in different parts of the country to provide early diagnostic, regular follow up and treatment services for all leprosy patients through outdoor and indoor services.

SOURCE: SWASTH HIND -- March/April 1979.

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Lepr Rev (1982) 53, 205–209

Leprosy and Primary Health Care: the Mandwa Project, India

N H ANTIA
The Foundation of Medical Research, 84-A R. G. Thadani Marg, Worli, Bombay 400 018, India

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No disease can be controlled, however effective the remedy, if there is failure in detection and regularity of treatment is not assured.

Leprosy control programmes were commenced in most endemic countries of the world about a quarter of a century ago based on the availability, for the first time, of a drug against the disease which was not only highly effective but also safe, cheap and orally dispensable. A separate service was started for leprosy as for many other major health problems like malaria, tuberculosis and smallpox. These were the days of euphoria when we believed science had the answers to most human problems. Twenty-five years later we remain sadder but wiser.

Even in diseases like those which are sexually transmitted and where a single injection can ensure cure, we have failed in achieving success in countries where knowledge is widespread and facilities for treatment are freely available to all. This sad tale has repeated itself for all the diseases where hopes of control were high because of availability of cheap and effective drugs, vaccines or insecticides. Smallpox was the only exception. The blame for such failure has been attributed to many causes such as inadequate funds, nonavailability of drugs, suitable personnel, transport; ignorance and apathy of the people and their rulers, and finally the development of resistance to drugs and insecticides and the nonavailability or the exhorbitant cost of alternative treatment.

Yet we know that most of these diseases were eliminated from the developed countries long before drugs or vaccines were available for their control. Education combined with improvement of the social and economic conditions therefore remains the only certain way of controlling communicable diseases. They are therefore more amenable to social and political action rather than purely medical measures.

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Failure to achieve results despite vast inputs of men and money could have been condoned in the early phases as a genuine lack of appreciation of these factors, but the continuation and expansion of services which have proved to be inadequate or ineffective can only be attributed to the vested interest of professionals, bureaucracy, pharmaceutical industry and politicians in propagating the empires built by them on various diseases. Any new approach, however well based on scientific and/or social reality, is firmly resisted on administrative or technical grounds. Unfortunately, those who have a vested interest in maintaining the status quo are also generally the persons in whom society has vested responsibility for bringing about the necessary changes. In such a system it is also unfortunately true that those whose interests are primarily at stake are seldom involved in making decisions for their own welfare and are treated as passive recipients of health or illness care. In the poor and chiefly rural societies of developing countries this implies that decisions are made by a small coterie of the urban elite, who even if well intentioned, have little concept of the actual problems of the majority of the people with whom they have little physical or cultural affinity.

In the case of leprosy, where the problem of stigma far overrides the problem of technology, our whole approach has been of an almost entirely technical nature. While we have a vast number of medical and paramedical personnel there are hardly any social scientists in the field; by which I do not mean social workers. While we spend increasingly more on research of the scientific aspects of leprosy, including the vaccine, we almost totally ignore research into the equally important social aspects of the disease. Even if an effective vaccine was available, which is problematic, why do we think it will not go the way of all the other vaccines and immunizations? For millions still suffer and die of infectious diseases like tuberculosis, tetanus, poliomyelitis and diphtheria. The failure has been in the delivery of the drugs and vaccines and not in their potency.

Why is it then that despite the availability of drugs and vast investment in manpower and other resources leprosy continues to remain a major health hazard? This is not to say that no benefits have accrued; the problem may have been worse without such programmes. But it is also clearly evident that mere detection and distribution of pills cannot succeed. The answer lies in the fact that the techno-bureaucratic approach has failed to understand or has ignored the significance of stigma which plays a predominant role in this disease and without whose appreciation no programme for leprosy control can ever succeed.

Should we then not try to study the real causes of the stigma as it affects the various segments of our population and how they perceive the disease and its sufferers? Should we not find out why the medical profession itself has such an unscientific fear of the disease as it has of no other? Can we expect health education of the public to succeed when the medical profession which is

looked to for guidance on medical problems refuses to handle leprosy patients and admit them to hospitals? In actual fact the stigma is most marked in the educated and not so great among the less educated masses. Yet being the decision makers, whether in medicine or employment they play a major negative role.

The approach of the patient to this disease also affects early detection, regularity of treatment and his rehabilitation for without his co-operation little can be achieved. A better understanding and appreciation of the human aspects of this disease is essential in devising any programme for its control, the lack of which has been the major cause of our failure. While a special leprosy programme has some advantages it has several disadvantages, such as too large an area of coverage per worker, the attachment of stigma to him with resultant lowered acceptability by the people and inability to get motivated doctors to provide leadership A vertical programme also suffers from all the other disadvantages of a government service such as lack of supervision and accountability, repeated transfers which prevent build up of rapport with patients and the community, and lack of administrative and technical support. Though few in-depth evaluations of such services are available it is generally accepted that except in a few states the performance is poor, especially when compared with the voluntary agencies. A considerable percentage of the cases are not detected and the regularity of treatment is generally less than 50% as judged by the WHO criteria.

Recently attempts have been made at integrating the leprosy service with the other health programmes at the paramedical level in the hope that this will eliminate the stigma attached to the workers, reduce the area of coverage and help establish greater rapport with the people. Unfortunately, such integration has been firmly resisted on the basis that there is a danger of losing whatever has been gained over the years.

It should be realized that many of these problems afflict the whole health delivery system of which leprosy is only a small segment. A recent joint report of the Indian Council of Social Science Research and Indian Council of Medical Research has highlighted these problems and has recommended an integrated 'bottom up' rather than a 'top down' approach which should be firmly based within the local community which should assume responsibility for its own health and for which it should be assigned both administrative and financial powers. Wherever possible the staff should be recruited from the local community and answerable to them, and the pernicious system of transfers be eliminated. Only thus can there be peoples' involvement in their own problems and ensured rapport and accountability in the persons who are employed to help them.

The report further analyses the actual problems of health and its care on the basis of the experience of several microstudies. It states that about 90% of all health care including its most important components, whether preventive, promotive or even curative is of a relatively simple nature requiring a low level

of technical knowhow, but close cultural affinity with the people with whom it should be in close proximity. Hence it can be best carried out by the people themselves with some training and support. If any outside agency like the government tries to undertake or appropriate these tasks there results not only an increase in cost but also a failure to deliver the goods. Worse still, it generates a feeling of dependency among the community, with resultant loss of interest and absence of participation in activities for the improvement of their own health and welfare.

Leprosy fits this proposed model admirably like most other communicable diseases such as gastroenteritis, tuberculosis and malaria. In an experimental field project covering a rural population of 30,000 in north Alibag Taluka popularly known as the Mandwa project, we have trained local women as part-time health workers – one for each village of approximately 1,000 population. They are taught to undertake all forms of health care practices with special emphasis on the problems of women and children. They have also been taught the basic signs and symptoms of leprosy, namely, anaesthetic patches, thickening of the skin and ear lobules, loss of eyebrows, and palpation of the ulnar and greater auricular nerves; as also of other diseases like malaria and tuberculosis.

Prior to the commencement of the project the full-time 2-year trained government leprosy technicians working for over 10 years in the area had detected 63 cases of leprosy in this population. In a period of 3 years from 1977 to 1979, 90 other cases have been detected by this system, most of them (59) by our village workers and confirmed by the supervisory staff. It is interesting to note that most of these were early cases including those of the lepromatous variety, prior to the development of major deformities. Much more important, the regularity of dapsone treatment, as measured by the WHO criteria has increased from less than 50 to more than 90%. Since the workers are local women dealing with all types of health problems and visit each house in the village at least once a month (and the at-risk cases more frequently) there arise no problems of regularity, accessibility, rapport or communication. The women mix freely with the patients and invite them to their homes thus eliminating fear and stigma in the minds not only of the patients but also of the community. It is not surprising that such constant contact ensures early detection and regularity of treatment. The stigma of leprosy does not get attached to such a local worker who looks after all health activities of the village and her word often carries more weight within her community than that of an outsider.

While a detailed study of the project is in the process of being undertaken there is ample evidence to demonstrate the higher effective nature of such an approach to leprosy, at what turns out to be a much reduced cost.

This approach has proved equally effective for other diseases such as tuberculosis, malaria, and gastroenteritis and the immunization rate has increased from 15 to over 70%.

Unfortunately, the Government Community Health Worker Scheme based on such a model has failed to achieve similar results. This is because the concept of educating the community to look after its own health problems and providing only supportive service has not been acceptable either to the medical profession or paramedical workers. They see these community health workers as a threat to their practice and also as a means of ensuring accountability. The community is hardly aware of the true nature of this scheme and are not involved in the programme. Under these circumstances such a promising avenue for health care can hardly be expected to thrive. The potential, nevertheless, exists as revealed by our studies and other similar ones, and provides us with one of the most potent weapons in our armamentarium for the control of this disease at little, if any, increase in cost.

Strategy For a voluntary agency action in Leprosy Control in a Taluk.

1. Preamble
2. ~~Components of Strategy~~ Steps one to Three
3. Components of Four
4. Additional

II

Evolving Leprosy is not merely a major public health problem, it is primarily a social problem and it is this dimension that needs to be stressed and explored in any strategy that an NGO/voluntary agency adopts while complementing/supplementing the National control programme of the government.

The overall strategy for leprosy control has been outlined in the preamble. The programme as it has evolved in the governmental sector has been primarily

i) a top-down programme
ii) a medicalised programme
iii) a programme emphasising physical aspects at the cost of social/cultural/economic aspects
iv) a programme concentrating on individual patients not on groups or communities
v) a programme in which most of the health education is 'telling the patient' a set of dos and donts not making them aware and evolving action with them

vi) The voluntary sector especially the Missionary sector on the other hand has evolved a more institutional approach, caring for the patient and supplementing the medical programme with physical rehabilitation, corrective surgery, appliances for deformity and income generation activities while this has tackled the problem in a relatively more holistic way, it has created lot of

dependence, a charity consciousness, islands of charity cut off from the rest of society and in many ways isolated the problem from the community

While both the government and non-government response to date has its own particular relevance and logic and has definitely been responsible for creating a general awareness and some services for some patients - there is still need for a more community based, enabling approach stressing awareness building / education for health so that the patient with leprosy is integrated with the rest of the community and is able to function with his family as part of the social set up and contributing to the community according to his capacity. and does not get ostracised, marginalised or forced into beggary

The alternative approach will consist of many preliminary actions and processes through which a more relevant strategy can be evolved. Such an approach will necessarily require a group that will be committed to explore what may be a challenging and even difficult task, learning from existing projects using more orthodox approaches, but evolving more creative and 'patient supportive' strategies which are community based and non-formal education oriented.

Step One

Learning about the problem and the methods evolved by different groups to tackle it.
Assessing the strength and weaknesses of each approach by discussion with project team members
Meeting people with experience and reflecting with them on alternative approaches.

Step Two

Making a situation Analysis in the selected taluk.
a) Extent of the problem and distribution
b) Types of services available i) Government SET centres /PHC/Subcentres etc.
ii) Non-governmental voluntary agencies in the area
c) Problems and prospects as assessed by the team of the govt/non-govt projects. Stress should be on seeking feedback from the para-medics and field level workers directly in contact with the patient
d) The leprosy patients point of view - interviews with groups of patients exploring their experience through focus group discussion
e) Assessing community awareness and preparedness for participation in tackling the problem. The groups in the community to be focussed on specifically are village leaders formal & informal, school teachers, members of youth groups or mahila mandal.
F) From all the discussions clearly identifying the social/cultural/economic/religious and other factors that have a bearing on the problem.
It is important that this step is first informal and

thorough and not a formal questionaire survey to begin with

Step Three

This will evolve through a creative interaction with the findings of step one & step two. Among other things it should consist of some of these components. The exact nature, focus and type of activities in each will be determined by local situation

a) Community Awareness building/Health Education at School level involving teachers, high school students and reaching all sections of the community and family through child to child and child to family approaches

b) Community awareness building through school activity can be supplemented by involvement of youth groups and Mahila mandal.

Group process with Leprosy Patients

b) A process to be evolved with groups of patients with leprosy that improves self image, encourages collectivity and mutual support and promotes ~~self~~ individual and group self reliance. This process will have no doubt an educational dimension but the 'enabling' component in the attitudes/skills of the facilitator are crucial. The emphasis is on with the group of patients not for a group of patients

c) Continuing Education & Motivation of existing paramedics and health workers be they govt or non-govt. Staff motivation and supportive supervision are important. Both are invariably absent. The field workers perceptions and problems and ideas are seldom sought or built upon for policy generation. A group discussion process can generate ideas and action

Step Four

As three components of Step three evolve the facilitating group will develop and promote a new consciousness in the area about the problem and the possibilities Depending on the overall assessment of the situation and the existing/ongoing facilities/structures/services the group can decide on whether it wants to

a) Provide some services - curative/rehabilitative services of its own

b) empower patients and groups of patients and all those who are interested to do some work in the area to demand/pressurise /promote a better response from existing services

b) Supplement existing services with some efforts in survey, or income generation activities or community rehabilitation el

Depending on this decision further services could evolve

In terms of Phasing Step One to Step 3 should be allotted atleast $1\frac{1}{2}$ - 2 years. Step Four could evolve within 2 years and depending on option a), b) or c) further services/project components could be finalised.

If option ~~or~~ is chosen then ~~Some of those are outlined~~ some of the actions would include:

① Additional Reading

② Resources in Karnataka

1. Dr Neelchanke RCO
2. Simanchalli
3. Dr H. Sudarshan
4. Dr Paul Neelamkavil

5. Dr Bhojwani 6. Hubli Hospital for the Handicap.

(3) Projects in India

a) Baba Amtes Anandavan b) Tejpuram, Amravati

c) Missionaries of Charity Brothers in Calcutta. d) Karigiri Training Centre

e) Br Shanthi - Alampoondi f) Gandhi Lepr...

g) h)

of Magadi and Devanahalli Taluks As on Feb 1987.

Sl No	Name of the PHC's	Population	Total Leprosy Cases MB	PB	Total	Other Institutions PHU's / Govt. Ayurvedic Disp / Combined Disp.
1)	Kundana	45030	4	66	70	1) PHU Sadahalli 2) C.D. Devanahalli 3) GAD Heggenahalli
2)	Avalhi	53532	5	59	64	1) Godlumuddenahalli PHU 2) C.D. Vijayapura
3)	Nallur	33164	16	38	54	1) P.H.U. Budagere
	Total of Devanahalli Taluk	131726	25	163	188	Total 9 Institutions.
1)	Magadi.	91426	11	127	138	1) PHU Gejjagaraguppe 2) PHU B.G. Doddi 3) PHU. Chakrabavi.
2)	Kudur	41674	5	44	49	1) PHU Sankighatta 2) PHU Marur.
3)	Solur	41123	7	58	61	1) Gudemaranahalli PHU 2) GAD Motaganahalli
	Total of Magadi Taluk	174223	23	229	252	Total 10 Institutions.

District Leprosy Officer
Anand Rao Circle
Bangalore-9

Staff Pattern of Primary Health centre

1) Medical officer of Health / 2) Lady Medical officer
2) Pharmacist 3) C.H.V. Medical officer
3) Jr. Lab Technicians
4) F.D.C.
5) S.D.C.
6) Sr. Health Asst. (Male) – 2
(Sr. H.I's)
7) Sr. Health Asst (female) – 2
(LHV's)
8) Jr. Health Asst. (Male) — 5
(B.H.W, Vaccinator, Jr.H.I's) HSW, HSI)
(5,000 POP)
9) Jr. Health Asst (female) – 5
(ANMs, MWS) (5000 POP)
+ class 'D', Driver

PHU

1) Medical officer
2) Pharmacist
3) Jr. H A (F) (ANM)
4) Jr. HA (M) (JHA)
. Class 'D' - 2

1) Dist. Leprosy officer
2) Sr. Non-Medical Supervisor
3) Sr. Lab. Technician
4) Health Educator 5) Physiotherapist
5) Adm. Stat. Officer
+ 1) Dist. Health Edn. officer
2) Dy. H. Edn. Offic
3) Projectionist + vehicle

DIS 8.15

18.18

STRATEGY FOR A VOLUNTARY AGENCY ACTION IN LEPROSY CONTROL IN A TALUK

Contents

The overall strategy for leprosy control has been outlined in the preamble. The programme as it has evolved in the governmental sector has been primarily

i. a top-down programme;

ii. a medicalised programme;

iii. a programme emphasising physical aspects at the cost of social/cultural/economic aspects;

iv. a programme concentrating on individual patients not on groups or communities;

v. a programme in which most of the health education is 'telling the patient' a set of dos and donts not making them aware and evolving action with them.

The voluntary sector especially the missionary sector on the other hand has evolved a more institutional approach, caring for the patient and supplementing the medical programme with physical rehabilitation, corrective surgery, appliances for deformity and income generation activities. While this has tackled the problem in a relatively more holistic way, it has created a lot of dependence, a charity consciousness, inlands of charity cut off from the rest of society and in many ways isolated the problem from the community.

While both the governmental and non-governmental response to date has its own particular relevance and logic and has definitely been responsible for creating a general awareness and some services for some patients, there is still need for a more community based, enabling approach stressing awareness building/education for health so that the patient with leprosy is integrated with the

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the rest of the community and is able to function with his family as part of the social set up and contributing to the community according to his capacity and does not get ostracised, marginalised or forced into beggary.

The alternative approach will consist of many preliminary actions and processes through which a more relevant strategy can be evolved. Such an approach will necessarily require a group that will be committed to explore what may be a challenging and even difficult task, learning from existing projects using more orthodox approaches but evolving more creative and patient supportive strategies which are community based and non-formal education oriented.

S t e p O n e

Learning about the problem and the methods evolved by different groups to tackle it.
Assessing the strength and weaknesses of each approach by discussion with project team members.
Meeting people with experience and reflecting with them on alternative approaches.

S t e p T w o

Making a situation analysis in the selected taluk:

a. Extent of the problem and distribution

b. Types of services available--

i. Government SET Centres/ PHC/Sub-centre etc.

ii. Non-Governmental voluntary agencies in the area

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c. Problems and prospects as assessed by the team of the government/non-government projects. Stress should be on seeking feed back from the para-medics and field level workers directly in contact with the patient.

d. The leprosy patients points of view--interviews with groups of patients exploring their experience through focus group discussion.

e. Assessing community awareness and preparedness for participation in tackling the problem. The groups in the community to be focussed on specifically are village leaders--formal and informal--school teachers, members of youth groups or mahila mandal.

f. From all the discussions clearly identifying the social/cultural/economic/religious and other factors that have a bearing on the problem. It is important that this step is first informal and thorough and not a formal questionnaire survey to begin with.

S t e p T h r e e

This will evolve through a creative interaction with the findings of Step one and Step Two. Among other things it should consist of some of these components. The exact nature, focus and type of activities in each will be determined by local situation.

a. <u>Community awareness building/health education</u> at school level involving teachers, high school students and reaching all sections of the community and family through child to child and child to family approaches.
Community awareness building through school activity can be supplemented by involvement of youth groups and mahila mandal.

b. Group process with leprosy patients.
A process to be evolved with groups of patients with leprosy that improves self-image, encourages collectivity and mutual support and promotes individual and group self-reliance. This process will have no doubt an educational dimension but the 'enabling' component in the attitudes/skills of the facilitator are crucial. The emphasis is on with the 'group of patients' not for a group of patients.

c. Continuing education and motivation of existing para-medics and health workers be they government or non-government. Staff motivation and supportive supervision are important. Both are invariably absent. The field workers perceptions and problems and ideas are seldom sought or built upon for policy generation. A group discussion process can generate ideas and action.

3. Components of a future strategy--Step Four

As three components of Step Three evolve the 'facilitating group' will develop and promote a new consciousness in the area about the problem and the possibilities. Depending on the overall assessment of the situation and the existing/ongoing facilities/structures/services the group can decide on whether it wants to:

a. Provide some services--curative/rehabilitative services of its own;

b. Supplement existing services with some efforts in survey or income generation activities or community rehabilitation etc;

c. Empower patients and groups of patients and all those who are interested to do some work in the area to demand/pressurise/promote a better response from existing services.

In terms of phasing, Step one to Step three should be allotted atleast 1½ - 2 years. Step four could evolve within 2 years and depending on option a., b., or c., further services/project components could be finalised.

If option a. or b. is chosen then some of the actions would include:

GENERAL

a. find out SET or any other NLEP working units working in this area and liaise with them;

b. involve local leaders and organizations including school teachers etc;

c. look for persons cured of leprosy and involve them;

d. try not to duplicate work of NLEP

CASE DETECTION

a. general survey of the entire population with a view to detecting cases;

b. priorities to school health check up and lower socio-economic strata;

c. locate all patients under treatment from existing sources;

d. concentrate efforts on villages with higher incidence and also the immediately surrounding villages.

CHEMOTHERAPY

Cases to be handed over to NLEP or any other existing organisation for treatment.

FOLLOW UP

Regular follow up for all patients and contacts.

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LEPROSY

Preamble

Leprosy occupies a special position among communicable diseases, because of the long duration of the disease, the frequency of disability and the attendant social and economic consequences.

Leprosy is caused by a bacterium called Mycobacterium Leprae and is characterised by one or more of the following cardinal features:

a) hypopigmented patches
b) partial or total loss of sensation in the affected areas;
c) presence of thickened nerves;
d) presence of acid-fast bacilli in skin smears

Out of 12mn. leprosy patients in the world India has 4mn. of them. The overall prevalence rate in India is estimated to be 5 cases per 1000 population. WHO suggests that a prevalence of over one per 1000 should be considered an important public health problem.

The only source of infection is a patient with active leprosy ie, person having bacteria in respiratory secretions or the skin. No non-human reservoir of infection is known. It is more common in men than women in the ratio 2:1. A high incidence of infection among children means the disease

is active and spreading.

The social factors favouring the spread of the disease are (a) low standards of living; overcrowding and lack of personal hygiene. Hence it is more prevalent in the lower socio economic groups.

Methods of Leprosy control

1) Case detection — The national leprosy control programme carries out case detection by two types of organizations (1) Leprosy control unit where prevalence rate is over 10 per 1000 and (2) Survey-Education-Treatment (SET) centres where the prevalence is lower.

It can be done by

(1) contact tracing where examination of all household contacts for a minimum period of 5-10 years is recommended by WHO, 1977
(2) mass surveys have to cover atleast 90% of the population to be effective.
(3) the useful technique which may be employed to detect maximum cases is:
   a. examination of school children
   b. examination of contacts of known cases
   c. surveys of population forming the lowest socio-economic strata
   c. if the detected cases are migrants in the past five years, other migrants from the place of origin of the case could also be examined.

2. Chemotherapy

Treatment with D.D.S (diamino-diphenyl and sulphone) is the short anchor of treatment. The Multi Drug Treatment (MDT) regime using Rifampicin in addition to DDS (Dapsone) renders cases non-infectious in a short period.

3. Follow up

The duration of treatment being long the occurrence of drop outs and irregularity in taking treatment are high. These contribute to the persistance of leprosy in a community. Hence, proper follow up is very essential for a leprosy control programme to succeed.

3. Rehabilitation

Approximately 20-25 per cent of leprosy patients suffer from physical deformities of various degrees. ⊗ Rehabilitation must begin as soon as the disease is diagnosed. ⊗ Physical rehabilitation for these people has become a reality while social and psychological rehabilitation is essential for all patients and can be done only through proper education.

4. Health Educations

Health Education could be directed
(a) to the general public
(b) to the patient and his/her family

(a) The general public should be aware that
i) leprosy is like any other illness;
ii) Leprosy is curable
iii) it is not highly contageous while on the contrary it is weakly infective
iv) 80% of the deformities are preventable while the rest are treatable
v) it is not hereditory
vi) of the importance of personal hygiene

(b) the patient and his/her family to be educated about the need for—
i) regular treatments;
ii) regular follow ups of all contacts;
iii) prevention of disabilities; and
iv) all that the general public should be aware of.

From the data available, the following inferences have been made: about the particular Taluks in which the project will be located.

Devanahally

Approx. population	2·1 lacs
No. of leprosy cases registered.	188
Incidence according to PHC report	1.5/1000
No. of cases expected	315

Magadi

Approx. population	2·4 lacs
No. of leprosy cases registered	252
Incidence according to PHC report	1.5/1000
No. of cases expected	360

Enclosed.

III/ Strategy that could be adopted in these areas at a later date if NGO wants to go beyond step III

1. General Guidelines would be:

a) Find out SET or any other NLEP units working in this area and liaise with them;

b) Involve local leaders and organizations including School teachers etc.

c) Look for persons cured of leprosy and involve them

d) Try not to duplicate work of NLEP

2. Case detection

a) general survey of the entire population with a view to detecting cases

b) priorities to school health checkup and lower socio economic strata

c) locate all patients under treatment from existing sources;

d) concentrate efforts on villages with higher incidence and also the immediately surrounding villages.

3. Chemotherapy

cases to be handed over to NLEP or any other existing organization for treatment.

4. Follow up

Regular follow up for all patients and contacts

5. Rehabilitation

a) Core team to be trained in Physical Rehabilitation

b) cases of deformities to be picked up and treatment to be initiated

6. Health Education

a) to be more in areas where incidence is high

b) Core team in addition to educating the general public, to take responsibility for educating patients and contact.

3.0 LEPROSY PROFILE AND PROGRESS OF NLEP IN THE COUNTRY

India has a population of 682 million as determined at the 1981 census; and of the current prevalence of 12.0 million cases of leprosy in the world, one third is estimated to be in this country. The estimated prevalence rate in India in 1981 was 5.7 per thousand population. Up to March, 1987, 3.33 million cases had been recorded; 2.88 million brought under treatment and up to the end of August 1987, 2.58 million discharged. Over 400 million people live in 196 leprosy endemic districts (prevalence rate 5 and over). Amongst the 435 districts in the country as on 1st September, 1987 in 80 the disease prevalence rate is below 1 case per 1000 persons; in 159 it ranges from 1 to 5 and in another 196 the prevalence rate exceeds 5. The multidrug treatment (MDT) programme, starting in two districts in 1982 now extends to 49 endemic districts, with 1.34 million leprosy cases. Additionally 5 leprosy low endemic districts were also brought under MDT on an experimental basis during 1987-88. Provision for MDT of dapsone refractory cases exists in every dapsone monotherapy district since 1987-88.

There are over 125 Voluntary Organisations sharing the activities under Leprosy Eradication Programme.

For the first time during the current year, the number of leprosy cases cured was higher than those detected and this trend is expeoted to increase consistently to achieve the goal of inactivity in all the leprosy cases by the year 2000 AD. The proposed annual targets for case detection and cure and the number of cases at the end of each year up to the year 2000 have been worked out in consultation with Dr. S.K. Noordeen, Chief Medical Officer, Leprosy Unit, WHO, Geneva and are given hereunder. The targets are subject to the availability of adequate resources to create additional infrastructure and to extend MDT to all the districts in a phased manner.

Year	No. of cases at the beginning of the year	New Cases	Discharges due to death, dapsone & self healing	Discharges due to MDT	No. of cases at the end of the year
1988	3.160	+0.500	−0.300	−0.500	=2.860
1989	2.860	+0.500	−0.300	−0.600	=2.460
1990	2.460	+0.500	−0.300	−0.600	=2.060
1991	2.060	+0.400	−0.300	−0.500	=1.660
1992	1.660	+0.400	−0.300	−0.500	=1.260
1993	1.260	+0.400	−0.200	−0.400	=1.060
1994	1.060	+0.300	−0.200	−0.400	=0.760
1995	0.760	+0.300	−0.100	−0.400	=0.560
1996	0.560	+0.200	−0.100	−0.300	=0.360
1997	0.360	+0.100	−0.050	−0.200	=0.210
1998	0.210	+0.050	−0.050	−0.100	=0.110
1999	0.110	+0.025	−0.030	−0.050	=0.055
2000	0.055	+0.010	−0.030	−0.035	=0.000

Statewise leprosy profile and the progress of NLEP is given in Table-1. The Districtwise problem of leprosy and infrastructure in each State are given in alphabetical order followed by the data in respect of Union Territories.

ST

S. No.	Name of State
1.	Andhra Pradesh
2.	Arunachal Prade
3.	Assam
4.	Bihar
5.	Goa
6.	Gujarat
7.	Haryana
8.	Himachal Prade
9.	J. & K.
10.	Karnataka
11.	Kerala
12.	Madhya Prades
13.	Maharashtra
14.	Manipur
15.	Meghalaya
16.	Mizoram
17.	Nagaland
18.	Orissa
19.	Punjab
20.	Rajasthan
21.	Sikkim
22.	Tamil Nadu
23.	Tripura
24.	Uttar Pradesh
25.	West Bengal
26.	Andaman & Ni
27.	Chandigarh
28.	D&N Haveli
29.	Delhi
30.	Lakshadweep
31.	Pondicherry

STATEWISE LEPROSY PROFILE AND THE PROGRESS OF NLEP IN INDIA 1987

S. No.	Name of State	Population 1981 in lakhs	Estimated prev. Rate	Regd. Prev. prev.	No. of Distts with PR <1	1-5	5+	Total	No.	Distts. under MDT Population	Cases	Cases on record	Cases under treatment.	Cases discharged	Cases under MDT
1.	Andhra Pradesh	535.5	11.8	8.6	—	1	22	23	10	251.54	358897	461598	424159	723172	78998
2.	Arunachal Pradesh	6.3	3.6	2.3	—	6	4	10	—	—	—	1466	1466	687	75
3.	Assam	199.0	1.5	0.9	3	13	1	17	Nil	—	—	17577	17577	8545	3861
4.	Bihar	699.0	5.4	6.2	—	15	16	31	1	10.80	15760	435337	395610	168960	12977
5.	Goa	10.9	5.0	1.9	—	3	—	3	—	—	—	2082	2082	3090	1639
6.	Gujarat	341.0	2.9	1.9	12	2	5	19	3	47.47	32703	71201	68216	54887	22106
7.	Haryana	129.2	0.08	0.1	12	—	—	12	1	13.41	206	1086	1086	212	206
8.	Himachal Pradesh	42.8	1.6	1.1	6	6	—	12	1	3.03	NA	4751	4751	1878	NA
9.	J. & K.	27.0	2.2	1.2	9	5	—	14	—	—	—	5412	5412	1919	Nil
10.	Karnataka	371.4	6.0	3.9	4	10	6	20	2	59.25	31184	144718	116349	61302	23601
11.	Kerala	254.5	5.8	3.0	—	4	10	14	1	18.95	10042	76041	67338	49948	4055
12.	Madhya Pradesh	521.8	2.3	3.9	—	23	22	45	2	30.57	20727	203496	199478	76838	4746
13.	Maharashtra	627.8	6.2	5.5	—	11	19	30	9	132.44	171178	342572	324028	322074	38482
14.	Manipur	14.2	4.5	3.8	—	5	3	8	—	—	—	5402	3350	2408	153
15.	Meghalaya	13.4	4.6	1.2	3	2	—	5	—	—	—	1573	1573	1043	Nil
16.	Mizoram	4.9	1.0	1.3	2	1	—	3	1	3.40	246	631	631	232	246
17.	Nagaland	7.8	3.9	2.3	4	2	1	7	1	0.79	1700	1767	1767	550	143
18.	Orissa	263.7	12.1	7.9	—	—	13	13	3	101.79	149677	208229	202901	138284	60585
19.	Punjab	167.9	0.1	0.2	12	—	—	12	—	—	—	3183	3124	2458	361
20.	Rajasthan.	342.0	1.6	0.5	8	19	—	27	1	17.71	6357	15648	14140	3679	6357
21.	Sikkim	3.2	7.8	1.1	—	—	4	4	—	—	—	338	338	98	237
22.	Tamil Nadu	484.1	12.9	11.3	—	—	20	20	10	235.13	404109	545129	451613	653970	58384
23.	Tripura	20.5	4.9	2.7	—	3	0	3	1	9.76	NA	5617	5617	2617	—
24.	Uttar Pradesh	1108.6	3.7	4.3	5	21	30	56	3	64.46	48766	479452	443527	206121	32092
25.	West Bengal	545.8	6.9	5.2	—	2	15	17	2	44.13	88793	284766	110321	74255	33100
26.	Andaman & Nicobar	1.9	4.9	4.9	—	1	1	2	—	—	—	940	940	1066	86
27.	Chandigarh	4.5	NA	1.3	—	1	—	1	—	—	—	595	595	24	555
28.	D&N Haveli	1.0	1.0	1.1	—	1	—	1	—	—	—	114	99	NA	Nil
29.	Delhi	62.2	0.4	1.6	—	1	—	1	—	—	—	9936	8752	NA	8752
30.	Lakshadweep	0.4	25.0	10.1	—	—	1	1	1	0.40	404	404	404	169	404
31.	Pondicherry	6.0	15.0	11.7	—	1	3	4	—	—	—	7008	5350	4306	336
		6818.3	5.7	4.9	80	159	196	435	53	1045.03	1340749	3338069	2882594	2582252	392537

4.6 GUJARAT

The Gujarat State has a population of 34.1 million with 67.5 per cent of the people living in the rural areas. It is amongst the low endemic states for leprosy. The estimated prevalence rate as in 1981 is 2.9. Of the 19 districts, in only 5 the prevalence rate exceeds 5 per 1000 persons. Three of the districts (Baroda, Valsad and Dangs) with an aggregate population of 47.47 lakhs are covered by MDT. The estimated case load is 1.0 lakh and one third of the patients are multibacillary.

State data

Total population (1981)		34085799 lakhs		
Rural		23004474 lakhs		
Urban		11081325 lakhs		
No. of districts by estimated prevalence rate		Prevalence/1000 population		
	Total	**10+**	**5-10**	**< 5**
	19	0	5	14
Districts under MDT	3	0	3	0
Estimated case load				
MB		30000		
PB		60000		
Total		90000		
Registered Prevalence Rate (1987)			1.9	
Distribution of cases (1987)				

		Total	MB	PB
On record		71201	27675	43526
Under treatment		68216	26806	41410
Monotherapy		46110	15882	30228
MDT		22106	8388	13718
Dapsone refractory		611	—	611
Cases discharged since inception of the programme		54887	—	—
Leprosy voluntary organisations in the State				17
Physical infrastructure				
SSAUs	1			
RSUs	2			
LRPUs	1			
LTCs	1			
Manpower deployed				
Medical officers	41			
Non-medical supervisors	161			
Para-medical workers	629			
Laboratory technicians	35			
Physio-technicians	17			
Health educators	14			

2 DISTRICTWISE PHYSICAL INFRASTRUCTURE UNDER NLEP

Sl. No.	Name of district	Population 1981 census	Prev. rate Estd	Prev. rate Regd	No. of cases discharged	No. of cases on record	LCU/MCU 3/86	LCU/MCU 3/87	ULC 3/86	ULC 3/87	SET 3/86	SET 3/87
1	Valsad	17,74,136	6.9	6.1	22,584	10,784	3	4	6	6	45	49
2	Surat	24,93,211	5.6	5.9	14,406	14,753	4	4	3	3	21	21
3	Bharuch	12,96,451	7.3	7.4	11,772	9,595	2	2	3	3	53	53
4	Vadodara	25,58,092	1.8	1.5	22,796	3,850	2	2	3	3	49	49
5	Panchmahal	23,21,689	5.2	0.3	9,112	12,240	3	3	2	2	22	22
6	Dangs	1,12,664	6.2	6.1	851	691	1	1	—	—	—	—
7	Kheda	30,15,027	0.9	0.9	1,775	2,607	1	1	—	2	—	—
8	Ahmedabad	38,75,794	0.4	0.4	1,104	1,483	—	—	2	—	6	6
9	Gandhinagar	2,89,088	0.2	0.2	39	64	—	—	—	—	1	1
10	Mehsana	25,48,787	0.4	0.3	305	783	1	1	—	—	—	—
11	Banaskantha	16,67,914	0.3	0.3	513	432	—	—	—	—	—	—
12	Sabarkantha	15,02,284	0.8	0.8	952	1,261	—	—	—	—	16	16
13	Bhavnagar	18,79,340	0.4	0.4	475	774	1	1	—	—	—	—
14	Rajkot	20,93,094	0.4	0.4	517	786	—	—	—	—	6	6
15	Junagadh	21,00,709	1.1	1.1	3,432	2,287	1	1	2	2	3	3
16	Jamnagar	13,93,076	0.7	0.7	591	974	—	—	—	—	14	14
17	Amreli	10,79,097	0.4	0.4	231	473	—	—	—	—	—	—
18	Surendranagar	10,34,185	0.1	0.1	11	89	—	—	—	—	2	2
19	Kutchi	10,50,161	0.1	0.1	11	84	—	—	—		3	3
	Total	3,40,85,799	2.9	1.9	91,477	64,010	19	20	21	21	241	245

4.10 KARNATAKA

The Karnataka state has a population of 371.4 lakhs as per 1981 census of which 71.1 per cent belong to the rural areas. The State is of moderate endemicity to leprosy with 6 of its 20 districts having an estimated prevalence rate of more than 5 and one of them more than 10 per 1000 persons. The estimated prevalence rate for the state as a whole is 6.0. The estimated case load is 2.42 lakhs. Two districts Belgaum and Dharwar, with the population of 59.25 lakhs, are covered under MDT.

State data

Total population (1981)	371.4 lakhs
Rural	264.1 lakhs
Urban	107.3 lakhs

No. of districts by estimated prevalence rates (1987)

		Prevelence/1000 population		
	Total	**10+**	**5-10**	**<5**
	20	1	5	14
District under MDT	2	0	2	0

Registered prevalence rate (1987) 3.9

Distribution of cases (1987)

	Total	**MB**	**PB**
On record	144718	35856	108862
Under treatment	116349	28116	88233

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RSUs
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Manpower c
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Monotherapy	92748	18923	73825
MDT	23601	8007	9783
Dapsone refractory	—	6101	17500
Cases discharged since inception of the programme			61302
Leprosy voluntary organisations in the State			32
Physical infrastructure:			
SSAUs	2		
RSUs	6		
LRPUs	3		
LTCs	4		
Manpower deployed			
Medical officers	75		
Non-medical supervisors	243		
Paramedical workers	1096		
Laboratory technicians	53		
Physio-technicians	49		
Health educators	—		

Sample survey cum assessment unit
Reconstructive Surgery unit
Leprosy Rehabilitation Promotion Unit
Leprosy training centre.

DISTRICTWISE INFRASTRUTURE UNDER NLEP

Sl. No.	Name of district	Popula-tion (1981)	Regd Prev-rate	No. of cases dischar-ged	No. of cases on record.	LCU/MCU		ULC		SET	
						3/86	3/87	3/86	3/87	3/86	3/87
1.	B'lore (U)	3492771	3.03	2405	10573	1	1	7	7	21	21
2.	B'lore (R)	1454839	1.97	1187	2869	—	—	1	1	42	42
3.	Chitradurga	1777499	1.49	845	2648	2	2	2	2	50	50
4.	Kolar	1905492	3.72	2852	7085	2	2	3	3	48	48
5.	Shimoga	1656731	0.77	816	1276	—	—	1	1	21	21
6.	Tumkur	1977854	1.96	2040	3883	1	1	1	1	31	31
7.	Belgaum	2980440	1.81	11999	5409	3	4	2	4	53	53
8.	Bijapur	2401782	5.87	5250	14089	3	4	3	3	49	49
9.	Dharwad	2945487	3.49	12115	10273	4	4	4	4	48	50
10.	U.Kannada	1072034	1.10	337	1180	—	—	1	1	14	14
11.	Bellary	1489225	8.85	6285	13187	4	4	4	4	25	25
12.	Bidar	995691	8.00	11282	7970	3	3	2	2	20	20
13.	Gulbarga	2080643	7.88	10689	16392	3	4	3	3	50	50
14.	Raichur	1783822	10.52	7797	18765	4	4	2	2	29	29
15.	Chickmagalur	911769	0.45	6	411	—	—	—	—	10	10
16.	D. Kannada	2376724	2.88	6414	6842	1	2	2	2	54	54
17.	Kodagu	461888	0.20	23	92	—	—	—	—	4	4

Sl. No.	Name of district	Population (1981)	Regd Prev-rate	No. of cases discharged	No. of cases on record.	LCU/MCU 3/86	LCU/MCU 3/87	ULC 3/86	ULC 3/87	SET 3/86	SET 3/87
18.	Hassan	1357014	0.19	158	260	—	—	—	—	15	15
19.	Mandya	1418109	3.80	1824	5387	1	1	1	1	38	38
20.	Mysore	2595900	6.21	9720	16127	2	2	4	4	48	48
	Total	37135714	3.90	94044	144718	34	38	43	45	670	672

RAJASTHAN

According to 1981 census the population of Rajasthan is 34.3 million and 7.9 per cent of the people reside in the rural areas. The state has a very low estimated leprosy prevalence rate of 1.6 per thousand population. In all the 27 districts the prevalence is less than 5. The estimated case load is 10,000 but approximately half the cases are multibacillary. Alwar district is covered by Multidrug treatment with the assistance of primary health care staff from 1987-88.

State data

Population (1981)	34262000
Rural	27051000
Urban	7211000

No. of districts by prevalence rates

		Prevalence/1000 population		
	Total	**10+**	**5-10**	**<5**
	27	0	0	27
Districts under MDT	1	0	0	1

Registered Prevalence rate (March, 1987)	0.5
Registered case load (3/87)	15648
MB	NA
PB	NA
Under treatment	14140

Monotherapy	7783
MDT	6357
Dapsone refractory	Nil
Cases discharged since inception of the programme	3679
Leprosy voluntary organisations in the State	17
Physical infrastructure:	
SSAUs	1
RSUs	Nil
LRPUs	Nil
LTCs	Nil
Manpower deployed	
Medical officers	—
Non-medical supervisors	—
Para-medical workers	—
Laboratory technicians	—
Physio-technicians	—
Health educators	—

2. DI

Sl. No.	Name of the District
1.	Alwar
2.	Ajmer
3.	Banswara
4.	Barmer
5.	Bharatpur
6.	Bhilwara
7.	Bikaner
8.	Bundi
9.	Chittorgarh
10.	Churu
11.	Dholpur
12.	Dungarpur
13.	Ganganagar
14.	Jaipur
15.	Jaisalmer
16.	Jalore
17.	Jhalawar
18.	Jhunjhunu
19.	Jodhpur
20.	Kotah

2. DISTRICTWISE PHYSICAL INFRASTRUCTURE UNDER NLEP

Sl. No.	Name of the District	Population 1981	Prev. rate		No. of cases discharged	No. of cases on record.,	LCU/LCU	ULC	SET
			Estd.	Regd.					
1.	Alwar	1771173	2.71	—	79	1364	1	—	2
2.	Ajmer	1440366	2.47	0.5	59	687	—	1	2
3.	Banswara	886600	1.42	0.5	117	397	—	—	5
4.	Barmer	1118892	—	—	—	—	—	—	—
5.	Bharatpur	1299073	2.62	1.0	113	1311	1	—	1
6.	Bhilwara	1310379	—	0.1	—	79	—	—	1
7.	Bikaner	848749	1.83	0.7	12	526	—	1	1
8.	Bundi	586982	1.19	0.3	34	166	—	—	2
9.	Chittorgarh	1232494	1.51	0.1	44	172	—	—	2
10.	Churu	1179466	0.72	0.1	18	107	—	—	1
11.	Dholpur	585059	1.08	0.4	258	210	—	—	3
12.	Dungarpur	682845	1.73	0.6	73	402	—	—	4
13.	Ganganagar	2029968	2.55	0.1	4	141	—	—	1
14.	Jaipur	3420574	2.04	1.2	482	4255	1	2	4
15.	Jaisalmer	243082	1.01	0.2	4	56	—	—	1
16.	Jalore	903073	—	—	—	175	—	—	4
						—			1
17.	Jhalawar	784998	—	0.2	—	369	—	—	—
18.	Jhunjhunu	1211583	0.75	0.3	193	606	—	—	
19.	Jodhpur	1667791	1.89	0.4	686	394	—	1	1
20.	Kotah	1559784	0.73	0.3	66	1980	1	—	5

Sl. No.	Name of the District	Population 1981	Prev. rate Estd.	Prev. rate Regd.	No. of cases discharged	No. of cases on record.,	LCU/LCU	ULC	SET
21.	Nagaur	1628669	1.29	1.2	542	126	—	—	2
22.	Pali	1274504	1.50	0.1	33	362	—	—	3
23.	S. Madhopur	1535870	2.69	0.2	102	270	—	—	5
24.	Sikar	1377245	1.29	0.2	138	108	—	—	1
25.	Sirohi	542049	2.24	0.2	24	14		—	4
26.	Tonk	783635	—	0.02	—	1371		1	1
27.	Udaipur	356959	2.44	0.6	24	NA			2
									1
									4
	Total	3,42,61,862	1.63	0.5	3105	15648	4	6	59

NATIONAL LEPROSY ERADICATION PROGRAMME

4th INDEPENDENT EVALUATION, 1991

LEPROSY DIVISION
DIRECTORATE GENERAL OF HEALTH SERVICES
MINISTRY OF HEALTH
NEW DELHI-110001

NATIONAL LEPROSY ERADICATION PROGRAMME

4th INDEPENDENT EVALUATION 1991

LEPROSY DIVISION
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Dated.....198

F O R E W O R D

The Indian Programme for Leprosy Control is one of the largest of its kind in the world. It witnessed phenomenal expansion in the past one decade. Starting with two districts in 1983, today it provides Multi Drug coverage to all of the 201 endemic districts. Rapid programme expansion often leads to dilution of the quality of services. Even as a system of day to day monitoring has been built into the NLEP, its independent appraisal by internationally renowned scientists will greatly contribute to its operational effectiveness.

We are pleased to have the World Health Organisation as our partners in this exercise. I thank them for their cooperation in providing the services of foreign experts to guide this venture.

The success of any leprosy control ultimately depends on men and women working for it, who must combine skills in the field of diagnosis and of management, and a sense of devotion.

This evaluation reflects the present status of the programme, the tasks that have been fulfilled and others that need attention.

It is my hope that this booklet will act as a spur to the State Governments to redouble their efforts towards seeing the end of leprosy from this country.

(Prof. G.K. Vishwakarma)

CONTENTS

Abbreviations

1.	DGHS	Director general of health services
2.	DLO	District leprosy officer
3.	HE	Health educator
4.	LCU	Leprosy control unit
5.	LRPU	Leprosy rehabilitation promotion unit
6.	LT	Laboratory technician
7.	LTC	Leprosy training centre
8.	MB	Multi-bacillary
9.	MDT	Multi-drug therapy
10.	MMDT	Modified multi-drug therapy
11.	MO	Medical officer
12.	MPW	Multi purpose worker
13.	NLEP	National leprosy eradication programme
14.	NMA	Non-medical supervisor
15.	PB	Pauci-bacillary
16.	PHC	Primary health centre
17.	PMW	Para medical worker
18.	SLO	State leprosy officer
19.	SET	Survey, education and treatment centre
20.	SSAU	Sample survey cum assessment unit
21.	THW	Temporary hospitalization ward
22.	ULC	Urban leprosy centre
23.	UT	Union territory
24.	VO	Voluntary organizations
25.	WHO	World health organization
26.	ZLO	Zonal leprosy officer

I

INTRODUCTION

1. The National Leprosy Eradication Programme

The leprosy control programme in India had been in operation since 1955, but only since 1980 did it receive a high priority. It was redesignated as National Leprosy Eradication Programme in 1983 aimed at arresting the disease in all the known cases of leprosy by the turn of the century. It was a 100% centrally sponsored programme since 1969, providing for total expenditure on its account to be borne by the Government of India.

(a) Magnitude

India ranked foremost among the countries saddled with leprosy sufferers, sharing nearly one fourth of the global leprosy load in estimated cases and over 70% of the registered cases (1991). There occurred a steady increase in the number of cases through successive decades starting with 1.5 million in 1941 and reaching 4.0 million estimated cases in 1981. The main factors to account for this progressive rise were a rapid increase in population, better case detection activities and greater community awareness leading to voluntary reporting.

About 15% of the patients were children. The proportion of multi bacillary cases ranged from 10 - 21% in different regions and the deformity rate was approximately 20%. The prevalence exceeded 5 per thousand in 201 out of 465 districts in the country. Nearly 450 million people lived in these 201 districts. The magnitude of the problem, as such, is vast.

(b) Distribution

The distribution of the disease was uneven, although it was present throughout the country. The inter-state variation in the prevalence rates and the percentages of population at risk were quite substantial. The areas of high prevalence were found mainly in the south - eastern and central regions of the country, comprising the states of Tamil Nadu, Andhra Pradesh, Orissa, Bihar, Madhya Pradesh, Uttar Pradesh, Maharashtra and West Bengal. These states amongst themselves accounted for 90% of the registered case load in the country.

(c) Strategies

In the main, the strategy was based on controlling the disease through reduction in the quantum of infection in the population through continuous treatment to break the transmission of infection. The main component of the strategy were :

- early detection and regular treatment of patients;
- providing multidrug therapy (MDT)* to all the patients on domicilliary basis;
- education of the patients, their families and the community members in general on leprosy and its curability; and social and economic rehabilitation of the patients.

Towards achieving a total coverage of all the infective population, the following operational plans were developed.

(i) MDT under vertical set-up

Over the years, a separate cadre of health workers were trained to provide anti - leprosy services. In 1983, MDT was started in 2 districts following the completion of the preparatory phase comprising :

- completion of infrastructure in the districts;
- adequate training of staff in MDT operations;
- rapid survey to enumerate undetected cases; and screening of all the recorded cases and preparation of individual case records.

The MDT was gradually extended by 1991 to 135 districts where the disease prevalence was 5 or more per 1000 population. Presently, these districts were at various stages of MDT implementation and provided MDT coverage to 75 percent of all the recorded cases, numbering 1.5 to 1.6 million leprosy sufferers.

(ii) Modified MDT set-up

Besides 135 of the 201 endemic districts where MDT operated, there still remained 66 districts where leprosy services were being provided by the existing health services personnel. These districts did not posses the infrastructure necessary for establishing vertical MDT set-up. At the same time it was essential to extend the benefit of multidrug treatment to nearly 0.6 to 0.7 million patients in these districts, without further delay, if the objective of leprosy eradication by the turn of the century was to be achieved. Therefore, control approach of modified multidrug therapy (MMDT) was developed(1).

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* Rifampicin, Clofazimine and Dapsone

(1) National Leprosy Eradication Programme in India Guidelines for modified MDT scheme in selected districts. Directorate General of Health Services, Ministry of Health & Family Welfare, New Delhi, 1991.

The modified MDT approach differed from the vertical programme essentially in the following respects :

- the district leprosy unit functioned under the overall charge of the district medical officer;

- the leprosy services were delivered through the primary health care staff supplemented by leprosy workers to the extent available in the district;
- the medical officer of the PHC was to be the over all incharge of MDT operations in the area,
- the treatment points were to coincide with the PHC, the subsidiary health centre, the community health centre, the dispensaries and hospitals; and
-cash assistance was envisaged to leprosy patients for collecting drugs from the treatment points with further cash incentive to those completing treatment.

It was realized that this approach would not only extend the overall cover of MDT benefit, but would also gear the primary health care services towards providing intensive leprosy care; thus promoting the integration of the two in the long run.

(d) Infra-structure

Over the years, a vast infra-structure came up under the NLEP. The magnitude of the case load and the high endemicity dictated the deployment of specially trained vertical staff for rendering leprosy services.

In the rural areas, the leprosy services were provided by the leprosy control unit (LCU) while in the urban areas these were carried out by the urban leprosy centre (ULC). Yet another centre called the survey education and treatment (SET) centre was attached to a primary health Centre (PHC) or a hospital existing in the low endemic areas. One LCU existed for every 4.5 lakh population , one ULC for every 50,000 and one SET centre for 25,000 population. A LCU was manned by four non-medical supervisor (NMS) and 20 para medical workers. The technical staff of an ULC comprised a para medical worker (PMW)/non medical supervisor (NMS). responsible to a medical officer (MO) of a dispensary or a hospital. The SET centre was served by a PMW under the guidance of a medical officer.

Separate training centres answered the need for trained manpower. In addition to organizing courses for training of medical officers, PMWs, NMSs, laboratory technicians and physiotherapists, these centres also conducted task oriented courses to fulfill special programme needs, such as training of manpower for MDT and MMDT.

Temporary hospitalization wards (THWS), were established to provide specialised services in leprosy. The THWs were supplemented by a limited number of reconstructive surgery units.

A district or zonal leprosy officer (DLO/ZLO) with a team of supporting staff functioned at the district level. The programme was executed through a central programme officer of the rank of a Deputy Director General. He was responsible for planning, programming, organization and implementation of the eradication programme, in keeping with the policy decisions of the National Leprosy Eradication Commission and under the direction of the National Leprosy Control Board.

The existing infrastructure is shown in table 1.

TABLE 1

Infrastructure under NLEP - 1991

Facilities	Number
Leprosy Control Units/Modified Leprosy Control Units	758
Urban Leprosy Centres	902
Survey, Education & Treatment Centre	6,099
Temporary Hospitalization Wards	291
Reconstructive Surgery Units	75
District Leprosy Units	277
Leprosy Training Centres	49
Sample Survey cum Assessment Units	41

(e.) Services

Important services provided for containment of infection in the community are briefly described below:

(i) Case detection

Early finding of new cases was the most important of NLEP activities. It promoted better results of treatment, prevention of deformities and an early cure. The several means employed for detection included population survey by physical examination in schools, industrial populations, contact examination and examination of slum populations in urban areas. Voluntary reporting was encouraged through health education campaigns. Total population surveys were organized in the villages.

(ii) Laboratory services

As a pre-requisite for disease classification before starting treatment, bacteriological examination of

skin smears was carried out. Bacteriologic surveillance also formed an essential part of disease follow-up. Additional laboratory facilities were available for the examination of urine, blood for hemoglobin and sputum for acid fast bacilli.

(iii) Treatment delivery

(a) Delivery point

Treatment was given at the out-door clinics held at fixed road side points for every 5-10 villages every week. This was affected by a team of a medical officer and a non-medical supervisor going in pre-determined circuits so that no patients traveled more than 1Km to collect his dose. Clinics were also held in dermatology or medical out patients departments in general hospitals and health centres.

(b) Case taking

As the new patients came for advice, a 'Case Card' was prepared for each, in which the clinical findings and the bacteriological status of the disease was entered. The personal data on name, age, sex and village identification was also noted.

(c) Drug regimen

Guidelines for multi.drug treatment were supplied to every paramedical worker and NMS. It described in detail the drug schedules for different age groups in multibacillary and paucibacillary types of disease, recognition of toxic reaction, monitoring of drug intake and surveillance throughout the period of treatment (2).

(f) Health education

As far as possible, the.patients were treated in their existing social setting. They were taught the care of the eyes, hands and feet to prevent deformities. Potentional patient trainees were identified for vocational and economic rehabilitation. An important component of health education was to increase awareness of leprosy, encourage self reporting, stress the need for continuous treatment and promote social acceptance of the programme.

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2. Leprosy, National leprosy Eradication Programme in India, Guidelines for multidrug treatment in endemic districts. Directorate General of health services, Ministry of Health & Family Welfare New Delhi; 1989.

(g) Monitoring & maintainance of records

The data generated in the field at the LCU,ULC and SET Centres was reported through the district to the state head quarters for transmission to the Programme Officer in the DGHS. The progress of the activities was reported in the form of monthly, quarterly and annual reports. The format for the various cards and the registers required to be maintained in an MDT district was prescribed. Officers at different levels were made responsible for the submission of reports in time, their analyses and initiating the required follow up actions.

OBJECTIVES OF EVALUATION

It was recognized that the primary objective of the evaluation was to determine how well the eradication programme functioned operationally as also to derive the trends of epidemiological estimates. There were three evaluations preceding the present one, being performed in 1986, 1987 and 1989. During these years the spread of the MDT greatly increased, covering 135 districts. A variant in the form of modified MDT programme was introduced in 1990 which was not still fully operational. It covered sixty six districts. It was necessary to know how well were these districts prepared to embark on MMDT activities.

The terms of reference for the Evaluation Teams were:

1. To assess the effectiveness of the various operational activities relating to the programme at the unit, district and state levels, including :

   (a) detection of new cases and discharge of inactive patients,
   (b) reliability of diagnosis and disease classification ,
   (c) regularity of drug intake and reasons for default ,
   (d) dependability of laboratory services;

2. to assess the utilization of infrastructural facilities including the training centres and sample survey cum assessment units as well as the effectiveness of the manpower deployed;

3. to validate the reported data through personal observations in the field and examination of records;

4. to assess the impact of health education in the community in providing knowledge about leprosy, including prevention of deformities, dispelling prejudice against the disease and promoting social acceptance of leprosy sufferers;

5. to assess the adequacy of information reporting system ;

6. to ascertain the preparedness of modified MDT districts for initiating programme activities ;

7. to examine the provision/creation of infrastructural facilities and ascertain the reasons for shortfall, if any ; and

8. to submit a report with collected data and make suitable recommendations on its basis.

III

METHODOLOGY

The Evaluation teams visited 24 of the states/UTs in the country from December 10 to 19,1991. An unbiased selection of certain districts in each state was made without prior knowledge of the performance rating of the districts. Since the sample selection was based on statistical principles, it can be expected that conclusions made on the basis of data collected from these areas reflected the national profile.

1. Sample Selection

The programme objectives and logistic reasons imposed certain restrictions in the selection of the samples. It was planned to have fifteen teams during the evaluation and the time period allowed was a maximum of ten days for visits, discussions and field investigations. It was considered that each team could not evaluate more than 5 to 7 districts within the time allotted , depending upon the logistics of travel.

The following considerations were important in affecting selection :

(a) Taking into account the epidemiological characteristics and logistic features, the states of india were combined in such a way that they formed fifteen groups, so that each team could be assigned to one group.

(b) It was desired that there should also be a representation of districts where the leprosy programme was funded by external agencies.

(c) The sample should include districts where MDT was introduced at different periods of time. For this purpose the following classification was made:

(i) Districts where MDT was introduced before 1987

(ii) Districts where MDT was introduced between 1987 and 1990

(iii) Districts where MDT was introduced after 1990

(iv) Districts where modified MDT operated

(v) Districts still on Dapsone monotherapy.

It was also important that the adequate

representation be made of districts with different levels of disease endemicity. For this purpose the districts were grouped as below :

(i) estimated prevalence rate of 10 and above per 1000 population

(ii) estimated prevalence rate between 5to10

(iii) estimated prevalence rate between 2 to 5

(iv) estimated prevalence rate less then 2

There were 45 districts funded by the overseas agencies like, UNICEF, NORAD, SIDA, LEPRA, Italian Leprosy Mission, US Leprosy Mission and the Damien Foundation. Out of these, eleven were chosen at random. Thus there remained only sixtysix districts that could be selected with due regard to their level of endemicity.

Two districts were initially selected at random from each of the 15 groups of States. Some of these random choices coincided with the selection made on the basis of funding agencies. A list of districts within reasonable traveling distance from the districts selected was drawn up and three more were selected, the selected districts are shown in Table 2.

TABLE 2

States, Union Territories and districts selected for evaluation

State/UT	District	Endemicity	MDT/MMDT Non MDT
Andhra Pradesh	Prakasam	5.4	MDT
	Nalgonda	15.3	MDT
	West Godawari	9.3	MDT
	Cuddappah	18.5	MDT
	Vishakhapatnam	6.4	MDT
Assam	Kamrup	1.3	
	Nagaun	1.05	
Bihar	Siwan	13.5	MMDT
	Patna	19:9	MMDT
	Ranchi	3.1	
	Singhbhum	15.4	MDT
	Rohtas	18.2	MDT
	Deogarh	10.8	MDT
Chandigarh	Chandigarh	1.3	
D.& N.Haveli	Nagar Haveli	1.1	

Gujrat	Ahemdabad	0.4	
	Surat	5.6	MDT
	Junagarh	1.1	
	Kheda	0.9	
Harayana	Ambala	0.05	
	Sonipat	0.2	
H.P.	Sirmor	2.6	
	Solan	0.4	
J & K.	Udhampur	1.07	
	Kathua	1.03	
Karnataka	Bangalore	3.0	MMDT
	Chitradurga	1.5	
	Bijapur	5.9	MDT
	Tumkur	1.9	
	Dharwad	3.5	MDT
	Bidar	8.0	
Kerala	Trivandrum	6.0	MDT
	Quillon	7.2	MDT
	Pathanamthitta	3.3	
	Palghat	10.0	MDT
	Iddukki	3.1	
Madhya Pradesh	Bilaspur	13.5	MDT
	Bastar	5.2	MDT
	Jabalpur	6.9	MMDT
	Durg	11.6	MDT
Maharashtra	Ahmad Nagar	2.7	
	Amravati	6.9	MDT
	Aurangabad	2.8	
	Jalgaon	4.1	
	Sholapur	8.5	MDT
Manipur	Bishanpur	8.4	MDT
	Tamenlong	7.0	MMDT
Meghlaya	East Khasi Hills	0.6	
	Jaintia Hills	0.4	
Mizoram	Aizwal	0.7	
Nagaland	Kohima	1.6	
Orissa	Balasore	8.6	MDT
	Keonjhar	4.3	MMDT
	Dhankanal	11.8	MDT
	Mayurbhanj	12.8	MDT
	Puri	10.5	MDT
Punjab	Roper	0.17	

Rajasthan	Alwar	2.7	
	Bharatpur	2.6	
	Jaipur	2.0	
Tamil Nadu	Chingleput	16.4	MDT
	Kamarajar	12.8	MDT
	Madras	14.3	MDT
	South Arcot	16.9	MDT
	Anna-Dindigul	8.5	MDT
	Madurai	14.3	MDT
Uttar Pradesh	Azamgarh	7.0	MDT
	Fatehpur	9.6	MMDT
	Gonda	5.9	MMDT
	Shahjahanpur	7.9	MMDT
	Kanpur-Rural	10.7	MDT
West Bengal	Burdhwan	10.0	MDT
	Jalpaiguri	7.0	MMDT
	Malda	6.0	MMDT
	Murshidabad	6.0	MMDT
	Purulia	7.9	MDT
Tripura	West Tripura	3.1	

2. Source Of Data

The data sources comprised the records and registers maintained at different levels of NLEP functioning. In addition, documents were made available by the state Director Generals Of Health services. Discussions were held at the state and district head quarters with officers incharge of NLEP to assess the adequacy of supervision, staffing and availability of drugs. It was possible to probe the perception of state and district officers on the strengths and weaknesses of the NLEP management. The unit level constituted the interface between the programme and the people. Therefore records maintained at the LCUs, ULCs,SET centres and the PHCs formed the key sources for the assessment of new case detection, disease profile, patient discharge and surveillance.

Much of the information, however, came from interviews with NMSs, PMWs, patients and the members of the community in the villages. This afforded opportunities to judge the progress of programme activities, technical competence and devotion of the staff, the role of health education in influencing social perception of the disease and acceptance of the programme in general.

3. Instruments Of Data Collection

Compared to earlier evaluations, the data base was considerably enlarged, not only in numbers but also to

include newer categories consequent upon introduction of the modified MDT scheme. As such 21 different proformae were developed for interviewing respondents operating at the state, district and unit (LCU/ULC/SET/PHC) levels. Separate questionnaires were constructed to elicit information from the patients and members of the community. The epidemiologic information on the MDT and MMDT districts was elicited on proformae specifically constructed for the purpose. The questionnaires had been extensively pre-tested before and may be seen at Appendices IELP - 1 to IELP - 21

4. Data Collection

Data from the field was collected by teams of investigators, each comprising an international specialist, an epidemiologist and a leprologists, besides a health administrator. The team composition is presented in Table 3.

TABLE 3

Coordinators

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These teams collected data in the field from Dec. 10th to 19th, 1991. At the district headquarter, each team randomly selected for their visit 2 LCU/Modified LCU or PHCs, if the district was under primary health care centre. Besides the ULCs, at least one third of the existing number of SET centres other than those attached to the LCUs, the training centres, voluntary organisations providing leprosy services, temporary hospitalization units and SSAUs falling within the geographic area of the district were also visited. In addition, 4 villages per LCU/PHC were randomly visited by the teams.

The respondents interviewed at the district head quarter included besides the DLO, at least one NMS, a health educator, a physio-therapist and a laboratory technician. Two PMWs, One NMS and one laboratory technician were selected for interview together with the medical officer at each LCU or PHC,if the district was under MMDT or was looked after by the primary health centre . In every village 15 leprosy patients and an equal number of community members were interviewed. The organizations and the respondents forming the data base may be seen in Table 4 and Table 5.

TABLE 4

Fourth independent evaluation of NLEP
data base

		Number
States/UTs	:	24
Districts	:	77
Urban Leprosy Centres	:	16
Leprosy Control Units	:	83
Modified Leprosy Control Units	:	4
Survey, Education & Treatment Centres	:	3
Primary Health Centres	:	19
Sample Survey & Assessment Units	:	10
Leprosy Training Centres	:	11
Villages	:	88
Voluntary Organisations	:	29

The data gathered in the field was summarized and a report presented at a plennary session, during which the members also highlighted their unrecorded observations before the Union Health Secretary and other officials of the Government of India and WHO, SEARO, New Delhi.

TABLE 5

Fourth independent evaluation of NLEP
respondents interviewed

Categories		Number
State Leprosy Officers	:	24
DLOs/MOs	:	198
Non Medical Supervisors	:	174
Laboratory Technicians	:	98
Para Medical Workers	:	167
Multipurpose Workers	:	15
Physio-therapist/Physio-technicians	:	34
Health Educators	:	41
Community members	:	424
Patients	:	466

Not all the questionnaires were properly filled. Data from completely filled proformae was fed for analysis into a computer. Conclusions were drawn from the entire consolidated data as also separately from data collected from the MDT and MMDT districts. Observations embodied in this report are based on these analyses.

IV

OBSERVATIONS

1. National Profile Of Leprosy

The total number of leprosy cases in the 77 districts spread over 24 states or Union Territories stood at 4,61,937 on April 1, 1991. One fourth of them were multibacillary. Disabled patients averaged 13% and in another 13% the disease was seen in children below 14 years. Likewise, in 1,14033 new cases registered in the current year (April 1990 to March 1991), the childhood leprosy occurred in 20.3% while those disabled constituted 17.3% of the MB and 8.4% of the PB forms. In the voluntary sector, among the 10,490 patients currently registered by 29 organisations, the MB and disability rates were 29.0% and 7.8%. At the village level 28% of the 8158 recorded cases were multibacillary and 2720 (33%) seen in the children. These figures are in close approximation and reveal an increase in the proportion of MB cases and those in children compared to the recorded national of average of 20% multibacillary cases and a child rate of 15% at the national level.

A rise in the proportion of multibacillary patients and an increase in the child rate could both be related to the extended coverage of multi-durg therapy brought about in the past few years. It is well recognized that the early phase of MDT was characterized by an increase in the proportion of MB cases consequent upon a relatively rapid elimination of the paucibacillary form of disease. Likewise, as the older cases yielded to MDT, the proportion of disease in the children appeared more. The significance of these epidemiological parameters would become clearer in the analysis of data from the districts that completed the intensive phase of MDT.

2. Case Detection And Treatment

The twin activities of prompt detection of new cases and their expeditious treatment constituted the hub of the leprosy control program. No less important was case holding. Leprosy Control Units were established on these principles. Case finding was a continuous on going activity, affected through mass and school surveys as well as house to house searches by the front-line leprosy workers.

Mass survey formed the single most effective mode of case detection in the Indian programme. In a population of 50,6190 examined by the NMSs in the past three months, 56.1% of the patients were detected through mass survey, 39.4% through school survey and only 4.5% through contact. Likewise, amongst the 1,320 leprosy patients identified by the PMWS, the mass, school and contact surveys were responsible for detection of 69.3, 20.5 and 10,2 per cent of

the cases. Greater emphasis on school survey was a commendable feature of case detection in recent years. That may also be the reason to account for an increase in the childhood leprosy among new patients. It not only led to the recognition of leprosy in the most vulnerable section of the population but also in an earlier phase of its development. Another encouraging observation was voluntary reporting of patients to the extent of 35.0% in the 2,41462 cases brought under MDT in the 35 districts.

In order to intensify the crucial activities of case detection and treatment, it had been the practice in the NLEP to allocate annual targets to the individual states for these activities. The performance of the program in this regard was measured on the basis of these two indices, namely,

a percent of the allotted cases detected during 1990-91,and

b percent of the detected cases treated in the same period.

The data on case detection, treatment and release of patients during 1990-91 is presented in the table 6. It showed that with the exception of the states of Himachal Pradesh, Madhya Pradesh, the eastern states of Meghalaya, Mizoram and Nagaland as well as West Bengal, the achievement in all other states exceeded the case detection target by 104 to 280%. Even in these states, except for the eastern region, the case detection was at least 80.0%. Since nearly all the detected cases were brought under treatment, the number of treated cases also exceeded the allotted target by 101 to 233%. The states that failed to bring under the treatment all the detected cases were Himachal Pradesh, Meghalaya, Mizoram, Nagaland and West Bengal. In Nagaland only 30% of the detected cases were treated followed by 60% in Meghalaya, 68% in West Bengal and 80% in the states of Himachal Pradesh and Mizoram. On an average 98.4% of all the detected cases were put on treatment in 24 states /UTs. This was a remarkable performance.

If treatment of all the cases was inescapable in the interest of program efficiency, it was even more important that they completed treatment. The patients listed as discharged in the table included not only those who completed treatment but also others who died or migrated from the area. Against 877.5 thousand cases targeted to be discharged at the aggregate level, those actually discharged numbered 981.7 thousand. Obviously, the latter included cases in the backlog besides others who migrated.

TABLE 6

Detection, treatment and discharge of cases(x1000)

STATE/UTs	UPTO 1.4.91			FROM 1.4.90 TO 31.3.91								
	CASES ON RECORD	CASES UNDER TREATMENT	CASES DISCHARGED	CASES DETECTED			CASES UNDER TREATMENT			CASES DISCHARGED		
				TARGET	ACHIEVEMENT	%age	TARGET	ACHIEVEMENT	%age	TARGET	ACHIEVEMENT	%age
ANDHRA PRADESH	214.23	214.23	1190.03	50.00	85.79	171.58	50.00	85.79	171.58	200.00	141.35	70.68
ASSAM	18.76	16.44	13.17	1.50	1.64	109.33	1.50	1.64	109.33	1.50	1.81	79.67
BIHAR	462.71	418.68	264.06	25.00	26.10	104.40	25.00	25.40	101.60	30.00	29.95	99.83
CHANDIGARH	.93	.87	.01	.05	.14	280.00	.05	.11	220.00	.05	.01	14.00
D & N HAVELI	.38	.36	.06	.05	.10	200.00	.05	.10	200.00	.05	.06	120.00
GUJRAT	24.90	24.86	128.23	8.00	9.72	121.50	8.00	9.70	121.25	25.00	13.39	53.56
HARYANA	1.28	1.28	.92	.10	.26	260.00	.10	.26	260.00	.10	.32	320.00
HIMACHAL PRADESH	3.95	3.95	3.25	.20	.16	80.00	.20	.16	80.00	.20	.53	265.00
JAMMU & KASHMIR	6.35	5.45	1.87	.20	.26	130.00	.20	.26	130.00	.20	.25	125.00
KARNATAKA	39.47	39.47	263.85	18.00	19.78	109.89	18.00	19.78	109.89	60.00	76.19	126.98
KERALA	65.81	53.54	79.20	6.00	7.31	121.83	6.00	6.17	102.83	9.00	10.06	111.78
MADHYA PRADESH	159.85	124.59	188.86	27.00	26.52	98.22	27.00	26.52	98.22	30.00	35.49	118.30
MAHARASHTRA	166.61	166.61	839.56	55.00	89.69	163.07	55.00	89.69	163.07	190.00	118.32	62.27
MANIPUR	1.36	1.36	4.66	.08	.12	150.00	.08	.12	150.00	.10	.13	130.00
MEGHALAYA	1.39	1.39	1.19	.05	.03	60.00	.05	.03	60.00	.05	.04	80.00
MIZORAM	.20	.19	.68	.05	.04	80.00	.05	.04	80.00	.05	.22	440.00
NAGALAND	2.03	2.03	.58	.10	.03	30.00	.10	.03	30.00	.10	.01	10.00
ORISSA	157.62	156.96	330.10	30.00	47.32	157.73	30.00	47.32	157.73	50.00	68.20	136.40
PUNJAB	3.29	2.99	4.65	.20	.55	275.00	.20	.55	275.00	.20	.73	365.00
RAJASTHAN	15.54	13.96	8.02	.80	1.01	126.25	.80	1.01	126.25	.80	2.64	330.00
TAMIL NADU	207.11	202.89	1171.89	75.00	94.79	126.39	75.00	90.57	120.76	200.00	249.33	124.67
TRIPURA	2.70	2.70	2.44	.15	.35	233.33	.15	.35	233.33	.10	.59	590.00
UTTAR PRADESH	361.56	316.93	368.71	45.00	50.96	113.24	45.00	49.56	110.13	50.00	42.03	84.06
WEST BENGAL	114.34	92.97	529.56	25.00	17.13	68.52	25.00	17.13	68.52	30.00	190.68	635.60
TOTALS	2032.32	1866.76	5395.61	367.53	479.80	130.55	367.53	472.29	128.50	877.50	981.70	111.87

The performance in respect of release of cases by individual states was not quite as striking as that for detection and treatment. As many as 8 of the states/UTs failed to keep up to the target, with Nagaland and Chandigarh being on one end of the spectrum discharging only 10 and 14 percent of the cases respectively, and Gujrat (53.5%) Maharashtra (62.2%), Andhra Pradesh (70.6%), Assam (78.6%) and Uttar Pradesh (84.0%) on the other end. Judged on the scale of achievement of targets , most of states were performing more than satisfactorily in respect of detection, treatment and discharge of cases . It was, however doubtful , if target achievement served as a true index for performance . Gross overshooting of target raised the doubt that the allotment of targets had been unrealistic.

It was observed that with the introduction of MDT in the control programme, exceeding of targets showed an increasing trend over the years. Table 7 compares the percent achievement of targets for detection, treatment and discharge

TABLE 7

Percent achievement of targets for case detection,treatment Coverage and discharge in selected states in 1986, 1987, 1989 and 1991

State	Case detection				Treatment coverage				Treatment completed			
	1986	1987	1989	1991	1986	1987	1989	1991	1986	1987	1989	1991
A.P.	154.9	86.7	138	171.5	100	86.4	164	171.5	153	-	107	70.6
Bihar	88	101	146	104.4	134	95.5	165	101.6	202	-	43	99.8
Gujrat	81.1	95	118	121.5	101	101	122	121.5	86	-	217	53.5
Ka'taka	132	142	158	109.9	100	142	142	109.9	162	-	82	126.9
Kerala	67	94	110	121.8	84	80	91	102.8	80	-	96	111.7
M.P.	93	89	111	98.2	100	89	111	98.2	113	-	120	118.3
M.P.	172	191	186	163.0	100	191	186	163.0	183	-	112	62.2
Orissa	92	98	140	157.7	99	67	140	157.7	155	-	146	136.4
T'nadu	96	97	149	126.3	83	88	142	120.7	145	-	92	124.6
U.P.	130	123	156	113.2	88	117	151	110.1	67	-	125	84.0
W.Bengal	60	75	89	68.5	89	75	89	68.5	33	-	122	635.6

of patients over the years in certain selected states to elucidate the point.

Some of the reasons why achievement exceeded the targets may be found in a massive increase in NLEP infrastructure simultaneous with the extension of MDT and adoption of rapid methods of screening leading to an increase in case detection. It is, however, for consideration whether target allocation should be continued save for exerting pressure on the states . One of its possible outcome could be an over diagnosis of disease under target pressure.

The credibility of the entire NLEP rested on the reliability of the figures maintained at the national level. The information collected at the state headquarters represented in an aggregate form the data generated at the level of LCU, ULC and SET centres and transmitted through the districts. To validate the authenticity of the achievement on detection , treatment and release of patients , the data

obtained at the state , district and unit levels were compared in table 8. It would be seen that the data in possession of the district and state headquarters faithfully reflected the field conditions.

3. Regularity Of Treatment

Drug defaulting was the bane of many a leprosy control programmes. It called for particular qualities of tact and patience in those responsible for ensuring that the treatment was carried out . The risks involved were far too serious to spare any effort in seeking out the defaulter to prevent interruption in treatment. With the incorporation of multidrug regimen in the NLEP, the continuity , regularity and completion of treatment became of paramount importance for the success of the programme. If the MDT ever failed to make its impact, it would not be so for want of technical reasons as for operational factors.

TABLE 8

Case detection, treatment coverage and completion at the unit, district and state levels (1.4.90 to 31.3.91)

Level	# detected			# under treatment			# discharge		
	Target	Actual	%	Target	Actual	%	Target	Actual	%
LCU/ULC/SET (121)	475481	46594	97	74075	72802	98	58743	56507	96
District (55)	103084	114033	110	78075	183579	235	110618	167916	151
State (406563)	367530	479800	130	367530	472290	128	877500	981700	111

In the 77 districts , there were a total of 4,61,937 patients of both MB and PB types of leprosy as on 31.3.1991. They represented patients on the register since the inception of the programme. Of these, 402347 (87.0%) were under treatment . The proportion of MB patients taking regular treatment was 88.6% while 73% of the paucibacillary were regularly taking drugs. To maintain an overall treatment compliance of over 75.0% in all the patients, which included many enrolled decades ago spoke of the commendable effort. Default rate of less than 15% in MB cases in aprogramme of this magnitude could not be viewed with alarm.

To access the regularity of treatment , the records maintained by 167 paramedical workers were analyzed . Amongst 8,158 patients looked after by the PMWs 1305 (16.0%) defaulted in collecting drugs in the past 3 months. Of these, 1017 (78%) were personally contacted by the PMWs and 440 motivated to start regular treatment. It was unfortunate that 577 patients were left out from personal contact otherwise, the default retrieval was quite satisfactory. At the village

level, likewise , 398 (96,1%) of the 414 patients were taking drugs regularly. The majority of the defaulters failed to assign any reason for not collecting the drugs. It certainly was not their lack of faith in the treatment, since 84.2% of the 414 patients interviewed in the villages admitted of benefit on the treatment given. In the absence of any response, the reasons for defaulting treatment could only be a matter of conjecture. The visiting teams ascribed absenteeism to an unwillingness on the part of the patients to accept the diagnosis, particularly in the absence of deformity or any other alarming symptom.

4. The MDT Program

Presently, there were 135 districts under the combined drug treatment covering nearly 28.5 crore of the population and accounting for 65.0 to 68.0% percent of the recorded disease load. Thirty four of these districts with a population of 673.5 lacks were included for assessment. These districts were at various stages of MDT implementation. Ten of the districts had compelled the intensive phase while in 6 others the programme began only in 1990.

(a) Infrastructure

Extension of combined drug therapy to a district entailed the establishment of additional infrastructure, ensuring the continued availability of trained personnel of every category at each level of operation. The existing manpower in these districts was examined for its availability and the training status. The observations are summarized in table 9.

TABLE 9

The availability of trained manpower in the MDT districts

Post	Number Sanctioned	In Position	Number Vacant	% Vacant	Number Trained	% Trained
M.O.	180	151	29	16.11	109	72.19
N.M.S	577	508	69	11.96	387	76.18
Lab.Tec.	237	192	45	18.99	159	82.81
P.M.W.	2714	2297	417	15.36	2229	97.04
	3708	3148	560	15.1	2884	91.6

The overall position of staff was satisfactory with only 15% of all posts remaining unfilled and over 90% of the staff being trained. However, one fourth of the doctors and the nonmedical supervisors were without training. This was an avoidable level of technical weakness in the MDT program. Very few posts of physiotherapists and health educators existed. Deformity prevention being an integral part of combined therapy program, the non-availability of physiotherapists was a serious lacunae.

(b) Case detection and treatment

The total number of cases in these districts at the commencement of MDT numbered 5,35,287. Out of these, 2,91566 had been released leaving a balance of 2,43,721. Of these, 2,13,060 patients (87.4%) were put under treatment. One fifth of all cases were multibacillary. Cases with disability averaged 13% and 18% were children below 14 years.

At the commencement of MDT, 77.5% of the cases were under regular treatment; their number increased to 84.4% by March 1990 while during the present year 85.5% of all cases were under regular treatment. Thus, not only was the number of patients brought under treatment satisfactory but also a high proportion of them continued with the prescribed regimen of the combined drug treatment. A discharge rate of 79.9% (88,452 out of 110658) implied that the programme functioned at a high level of efficiency.

There were 6,47,244 cases in total on combined drug therapy in all the districts of the 24 states/UTS as recorded at the state headquarters. Of these, 11757 were present in districts outside the MDT program. Whereas over 80% patients in the former group continued with regular treatment, only 63% in the latter received uninterrupted therapy. It was obvious that MDT delivery in the districts under vertical coverage was far superior to that provided through the primary health care services. The availability of trained manpower in the former made all the difference.

(c) Surveillance

In the combined drug therapy programme, clinical and bacteriological examinations were essential before the start of the treatment. Periodic examinations were also required during the subsequent period.

(i) Bacteriological surveillance

Skin smears were examined only in 46% of the 6,47,244 patients registered with all the states. In 24% of them the smears were positive. On the other hand, amongst 2,43721 cases currently on combined therapy in the 35 MDT districts, bacteriological coverage was available to 72.5% of the MB and 57% of the PB patients with an overall surveillance of 60.1%. The positivity rate varied from 0.77% in the PB to 47.6% in the MB types. The observations are summarized in table 10.

TABLE 10

Bacteriological coverage in the MDT districts

Disease type found	# of cases Detected	# of case Examined Bacteriologically	Cases Positive
Multibacillary (47.6%)	48,745	35,342 (72.5%)	16,867
Paucibacillary (0.77%)	1,94,976	1,11,136 (57.0%)	864
Total (12.1%)	2,43,721	1,46,478 (60.1%)	17,731

It will be seen that nearly one-fourth of the MB and 43% of the PB patients were left without pre-treatment bacteriologic cover. At the aggregate level 40.0% of the cases remained unexamined. Bateriologic examination was an important adjunct for classification of the disease, and a deficiency in this vital activity should be cause for serious concern to the program managers. There is no doubt, that there existed an inadequate infrastructure of laboratory services, characterized by lack of manpower, equipment and space in the face of mounting work.

In August 1985, a system of cross check of skin smears by selected institutions was introduced to ensure the quality of bacteriologic services. To determine the accuracy of skin smear reporting, the performance of 98 laboratory technicians was analyzed. The results are shown in table 11. There were 8114 referred for cross check of which ultimately 2200 turned out to be positive. However, only 1760 of them were found positive by the technicians.

This would imply that 20.0% of the positive smears were missed and reported as negative. It was, however, gratifying that only 1.9% of the negative smears were read as positive. Thus, the quality of bacteriologic surveillance was sub-standard. The reasons for the deficiency of laboratory services are discussed under manpower performance.

TABLE 11

Observations on bacteriological cross check

Number of slides sent for cross check	8114
Number of positive verified as positive	1760
Number of negative verified as positive	112 (1.9%)
Number of positive verified as negatives	440 (20.0%)

(ii) Clinical surveillance

The performance of clinical surveillance in the

programme was relatively better. In the states(24) a total of 11,57,102 inactive patients were targeted for surveillance. Of these, 67% were actually accessed. Similarly, amongst 70,602 inactive cases allotted to 121 LCU/ULC/PHC, those assessed numbered 56,664(80%). The 174 NMS interviewed who were required to complete surveillance of 56,912 inactive patients in the preceding 3 months, achieved nearly 75% of their target.

Surveillance was very weak in Madhya Pradesh. Large number of patients who completed the prescribed surveillance period were still awaiting their release from control . Similarly, the otherwise commendable performance in Tamilnadu suffered because of weak surveillance.

(d) Program performance

Program performance in the 33 MDT districts in respect of certain selected activates as summarized in table 12 indicated a distinctly satisfactory level of efficiency.

TABLE 12

Programme performance in the MDT districts

Indicator	Value
Average Population examined per PMW in the last 3 months	3280
Average population examined by PMW/day	36
Proportion of registered MB cases on MDT	76.18
MB cases on regular treatment	83.92
PB cases on regular treatment	81.66
Clinical surveillance rate	76.22

(e) Impact of MDT

The MDT Programme in the 34 selected districts had been in different stages of operation. While 10 of the districts had completed the intensive phase, in 7 of them it had been in operation only from 1-2 years. It would, therefore, not be justifiable to assess the impact of combined therapy on the overall status of the disease. Even so, in 20 of the districts the disease load significantly decreased as indicated by a decline in its prevalence rate.

It was, however, realized that application of certain selected epidemiologic indices to districts where combined therapy had operated for 5 or more years may indicate the trend in disease epidemiology. The parameters selected were:

- prevalence rate per 1000
- annual case detection rate per 1000
- proportion of MB cases among the new cases
- childhood leprosy rate among new cases%

- deformity rate %
- relapse rate per 1000 cases
- voluntary reporting%
- per cent of villages without active leprosy cases

Observations in respect of these parameters in 10 of the districts completing the intensive phase of operation are summarized in table 13.

Prevalence rate

A dramatic decline occurred in the prevalence rate in all the districts, the average fall being 71.6% from its pre-MDT value. The maximum decrease of 89.2% was witnessed in Vishakhapattanum while the least that occurred was 13.5% in Balasore. Since the detection of new cases in the districts had been thorough, the prevalence rate denoted the actual number of cases. There is no doubt that the case load in these districts declined simultaneously.

Annual case detection rate

Like the prevalence rate, the annual case detection also decreased uniformly in all the districts. The average decline was 44.5%. It was only in 3 districts that annual case detection decreased by more than 50%, in the remaining 7, the reduction averaged 40%. The true reflection of the disease in an area was its incidence. However, the measure of incidence of leprosy was particularly difficult to obtain. Instead most control programmes employed case detection rates.

MB Ratio in new cases

The proportion of multibacillary cases increased in 7 of the 10 districts, while in the remaining 3, it witnessed an average decrease of 11.0%. It was logical to expect an increase in the MB cases during the early stages of combined therapy. Some of the paucibacillary cases resolved on their own so that the duration of the disease, on an average, was shorter in PB compared to MB patients. The backlog of cases prevalent during the early stages of MDT would also disproportionately increase the multibacillary cases.

Childhood leprosy rate

An increase in the proportion of children among the new cases characterized all the districts compared to what it was at the commencement of combined therapy. The increase varied from 20.6% in Durg to 84.3% in Puri. The above age distribution may be related, to an extent, to the increasing its near absence earlier. As stated earlier, one fifth of the new cases were detected through school surveys.

TABLE 13

Selected epidemiological indices in districts completing intensive MDT Phase

	2			3		4	5		6
District	Prev. rate		Vari.	Annual Case Detection rate		% Vari.	MB ratio in new cases		% Vari.
	Prev.	Current.		Prev.	Current		Prev.	Current	
BALASORE	8.1	7.0	-13.5	0.8	0.6	-25.0	35	-33.0	-7.1
CHENGAI MGR	12.8	3.3	-74.2	2.4	1.6	-33.3	32.8	-27.6	-15.8
DEOGARH+DUMKA	10.8	1.9	-82.4	2.3	1.7	-26.0	31.0	+45.0	-
DHARWAD	6.2	1.0	-83.8	2.4	1.2	-50.0	27.8	-25.6	-10
DURG	9.0	2.7	-70.0	2.8	2.0	-28.5	29.0	+38	-
MAYURBHANJ	11.4	4.5	-60.5	5.7	2.0	-64.9	32	+50	-
PURI	10.5	2.0	-80.9	1.9	1	-47.3	19.0	+23.0	-
PURULIA	33.7	4.4	-86.9	2.6	1.7	-34.6	29	+31	-
VISHAKHAPATNAM	9.3	1.0	-89.2	4.9	1.0	-79.5	33.0	+35.8	-
WEST GODAVARI	6.6	1.7	-74.2	2.7	1.2	-55.5	12	+14	-

7		8	9		10	11		12	13		14
Childhood %		%	Disability rate in new cases		%	Relapse rate in new cases		%	Voluntary Reporting rate		%
Prev.	Current	Vari.	Prev.	Current	Vari.	Prev.	Current	Vari.	Prev.	Current	Vari.
12.7	49.0	+285	12.2	NA	NA	0	0	NA	20	60	+40
14.5	19.2	+32.4	6.8	2.4	-64.7	0.8	0.7	-12.5	23	360	+13
16.0	12.0	-25	15.4	10.1	-34.4	0.3	0.3	-	26	35	+9
13.0	20	+53.8	2.0	1.4	-30.0	.02	.01	-50	46	52	+8
18.6	21	+12.9	11.6	5	-20.5	0.5	0.2	-60	22	30	+8
15.0	19	+26.6	NA	NA	NA	0	0	-	15	25	+13
18.0	23.0	+39.0	6.4	1.0	-84.3	0.2	0.18	-50	21	34	+8
16.0	17.5	+9.3	9.6	5.8	-29.1	1.6	1.4	-12.5	19	27	+7
14.2	31.0	+118.2	3.4	2.0	-41.1	0	0	-	33	27	+8
15.6	38	+146.1	5.4	1	-81.4	0	0	-	36	51	+15

Prev. = Before MDT Vari. = Variation

Disability rate

The disability rate also showed a fall in each of the ten districts. It was dramatic in the districts of Puri and West Godawari, where the proportion of deformity came down by over 80%, followed by 64.7% in Chengi Anna. In the remaining 6 it varied from 20-4%. No information was available for the districts of Balasore and Mayurbhanj. It was not easy to comment on the decrease in the disability rate. There was no doubt that, in part, it was due to the effect of MDT. In several of these districts, the MDT had operated for more than 5 years. On the other hand, the point cannot be lost sight of that there was a large scale elimination of disabled patients during initial screening at the commencement of MDT.

Relapse rate

The relapse rate remained unaffected in 5 of the 10 districts. In the other five,it declined by an average of 37%

Voluntary reporting rate

An increase in self reporting varying from 8 to 40% in different districts was in fact a measure of the effectiveness of MDT and of an increasing awareness by the people of the availability of cure for leprosy.

Count down of villages with active leprosy cases was included as an additional indicator. The available information is tabulated in table 14. However, in the absence of information on number of villages without active leprosy patients prior to MDT,the indicator lost much of its meaning.

TABLE 14

Villages rendered leprosy-free since MDT commencement in districts completing intensive Phase

Districts	Total No. of Villages	No. of Villages without active cases	% of villages without active cases
BALASORE	1971	182	9.23
CHENGAI MGR	2324	448	19.28
DEOGARH+DUMKA	3338	1212	36.31
DHARWAD	1322	570	43.12
DURG	1869	499	26.70
MAYURBHANJ	3914	825	21.08
PURI	4802	1322	27.53
PURULIA	NA	NA	*****
VISHAKHAPATNAM	4293	3272	76.22
WEST GODAVARI	839	135	16.09
Totals	46255	14966	

NA = Not available

Even as the effect of MDT on the disease epidemilogy in the above districts was positive, it would be facile to explain away an increase in childhood leprosy among the new cases and a dramatic decline in the disability rate in some of the districts. In fact, it would be opportune now to initiate detailed epidemilogic studies in districts completing the intensive phase of MDT to get at the root cause of the changes.

5. The Modified MDT Programme

In 1990, the scheme of modified multi-drug therapy was introduced which entailed the fulfilment of certain administrative prerequisites before the treatment commenced. The assessment, as such, pertained primarily to the establishment of the required administrative structures.

In all 12 districts were visited. Save for the registration of the District Leprosy Society, other administrative steps were completed in only 3 of the 12 districts. The registration was done, perhaps, because, through it was to flow the financial assistance. Village-wise list of leprosy patients was ready in half of the districts. Reorganization of the units, redistribution of PMWs and to make the NMS headquarter co-terminus with the PHC/CHC largely remained undone.

Of the 12 DLOs interviewed, 9 had earlier experience of work in the field of leprosy but none of them was trained. Likewise, only 68 of the 250 medical officers at the primary health centres had received any training in leprosy. One fifth of the sanctioned posts of para-medical workers of all categories were unfilled. However, 98% of the multi-purpose workers were in position.

New cases detected during the present year numbered 9356. However, twice as many were on treatment. Eighteen percent of the new cases were multibacillary. No information was available on the child rate, the disability rate and the relapse rate.

Not much field activity was in evidence in the 11 PHCs visited. That was understandable since the scheme was yet to take off the ground. It was barely an year that the concept of MDT was formulated and orders issued for its introduction in some of the districts. Amongst the 1937 cases available for screening, 1620 were examined and 563 cases were found to be suffering from leprosy. Eighty percent of the 1107 cases registered at the PHC were on treatment.

Given the fact that in many of the districts in the country, integration of health services was presently being affected through the primary health care approach, it was important to consider the interrelationship between MDT implementation and the process of health services

integration. Changeover to an integrated approach was bound to lead to certain administrative difficulties in the gestation period.

The state of Maharashtra initiated an integrated programme in certain districts where the prevalence rate declined substantially, such as Amravati. Even as the medical officer and the staff of PHC shared the responsibility for leprosy control, areas such as case finding, documentation and management of complications were yet to pick up. Perhaps, these would be off-set following proper training of the officers.

In Himachal pradesh, the primary health care staff refused to undertake leprosy work unless incentives were paid. By and large the quality of services under the integrated system was yet to pick up.

6. Manpower Performance

The greatest handicap of the NLEP was the non-availability of motivated medical and para-medical functionaries in the required numbers. No matter how sound the strategy, eventually the success of disease control depended on the quality of men operating the programme. The manpower included besides the doctors, non-medical technical personnel like supervisors, laboratory technicians, physio-technicians and para-medical workers. The work at every level demanded not only considerable knowledge and experience, but also a highly motivated and sympathetic approach.

(a) Medical officers

Three levels of medical officers were engaged in the programme. They were the state leprosy officers (SLO), the zonal/district leprosy officers (ZLO/DLO) and medical officers (MO) in charge of units. These officers were the crucial functionaries in the NLEP, providing administrative and technical supervision and support to levels below them. They were responsible for programme planning and implementation. Correct perception of the programme and understanding of the underlying strategy of leprosy control on their part were necessary for ensuring optimal utilization of existing services and material resources.

Twenty four state level officers, 77 DLOs and 121 officers looking after units were interviewed. They were assessed in respect of their training status, technical soundness, supervisory and managerial functions as well as initiative in pushing the programme. The training status is summarised in table 15.

TABLE 15

Training status of medical officers at different levels of NLEP operation

Level	Number of respondents		
	Total	Trained	% Untrained
State	24	10	58.3
District	77	51	66.2
ULC	16	9	43.7
LCU	83	54	65.0
SET centre	3	1	33.0
PHC	19	8	42.1

It was found that about 40% of the entire medical manpower was untrained. More than one-third of the districts, LCUs and ULCs were manned by untrained doctors while at the state level only 42% had had training in leprosy.

An immediate outcome of lack of training was that it affected the technical soundness. As shown in table 16, only 48% of the doctors were adept and familiar with leprosy classification and recommended treatment schedules and the regimen of the therapy. These officers were supervising the adequacy of treatment by the staff under them. Such ignorance could contribute to an all round incompetence. It was further observed that the technical quality of the medical men suffered progressively over the years. Perhaps, a rapid expansion of the programme under the pressure of MDT compromised with the quality.

TABLE 16

Selected indicators of perrormance of medical officers

Parameter	Number of Respondents	# Performing Adequately	%
Technical knowledge	172	83	48.2
Regular assessment of junior staff	220	168	76.3
Regular submission of reports	95	65	68.4
X-notification of migrated cases	125	48	38.4
Received feedback on reports sent	125	62	49.6
Provided field support	149	112	75.1
Initiative for programme promotion	95	60	63.1
Providing home service	125	74	59.2

Assessment of the managerial and supervisory functions of medical officers as given in table 17 showed that nearly three-fourths of the medical officers regularly reviewed the work of staff under them. A high proportion of them (90.2%) could recollect the name of the best worker under them as also those who needed improvement. However, their own submission of reports was not so good. Sixty eight percent submitted their reports regularly. Report writing was

undertaken more as a routine procedure than a means of programme promotion. Only half of the junior officers admitted of having received any feedback on the reports submitted by them. It was, however, encouraging that 75% of the doctors regularly visited their staff in the field for on the job support which contributed to the technical excellence of these workers. Such support was essential for solving the practical problems. While most of the unit officers provided adequate supervision to the supervisors and para-medical workers, only 15 of the 24 SLOs made field visits. They spent on an average 10 days in the field in the past 3 months. Not many officers (60%) displayed the quality to push the programme on their own, such as visiting other organizations engaged in leprosy control or visiting and attending meetings of other district officers to elicit their support for programme promotion. Only 35% of the officers took the trouble of cross notification of the migrated cases.

TABLE 17

Comparison of the technical soundness of medical officer through successive evaluations.

1986		1989		1991	
# resp.	# performing adequately	# resp.	# performing adequately	# resp.	# performing adequately
155	85 (74%)	174	87 (50%)	172	83 (48.2%)

resp. = Respondents

Utilization of existing facilities was unsatisfactory. Repair of unserviceable vehicles was tardy and the temporary hospitalization wards meant for providing specialised leprosy services remained under utilised. The average patient load per month in the 25 specialised care units was a meager 27% and the average bed occupancy rate was 37% (see the programme management)

On the whole, while the technical supervision was excellent, the overall performance of medical officers in other areas turned out to be below par.

(b) Non-medical supervisors

Non-medical supervisor was a functionary placed mid way between the medical officer and the front-line workers in the field. He was primarily responsible for providing technical guidance to the para-medical workers besides supervision in the field. Organising field surveys, checking treatment compliance, referral of patients to medical officers where required and arranging discharge of cured patients were some of the other duties assigned to NMSs.

The assessment of NMS was based on questioning 174 respondents posted at the district head-quarters, LCU, ULC

and the PHC. Their placement and training status are summarized in table 18.

TABLE 18

Training status of Non Medical Supervisors

Level of posting	Number of Respondents	Number Trained	Percent Trained
District	14	12	85.7
ULC	23	19	82.6
LCU	92	80	86.9
SET centre	5	5	100

In contrast to the medical officers, the great majority of NMSs at each level had received formal training and this was adequately reflected in their performance. Seventy five percent of them were found sound in their technical knowledge. The parameters against which the non-medical supervisor's performance was measured may be seen in table 19.

TABLE 19

Performance assessment of non medical supervisors

Functional parameter	Number of Respondents	Performing Adequately	%
Provided supervision and technical support to PMW	174	149	85.6
Carried out survey in last 3 months	174	109	62.6
Possessed adequate technical knowledge	174	130	74.7
Interacted with the community	174	138	79.3

In the last 3 months 109 of the 174 NMSs had participated in surveys for case detection in their allotted area. Total population surveyed amounted to 506190, averaging 1547 persons per NMS per month. This was a great achievement. However, the fulfillment of target for surveillance of inactive cases was disappointing. Only 55% of the 56912 allotted patients were assessed. Most of the NMSs (85.6%) regularly guided the PMWs in the field and offered them technical support at least once a month.

In the preceding 3 months, 4,387 patients were referred by the PMWs for the opinion of the NMSs. By themselves, more than half of the NMS sought opinion on the patients from the medical officers. These referrals were made to clarify disease classification or confirmation of reaction due to disease. Most of the NMS maintained rapport with the community leaders and sought their assistance for programme promoting activities such as health education and motivating drug defaulters.

Monitoring of treatment and finding drug defaulters were among the more important activities of the NMS. These activities were therefore, probed in some detail. The observations are presented in table 20.

TABLE 20

Assessment of treatment monitoring by non medical supervisors by patient coverage

Functional parameter	Number
Number of patients on treatment in the alloted area of NMS	72878
Number of defaulters contacted	12278
Number of defaulters	16904
Number of patients monitored by tablet count in last 2 months	11139

There were 72,878 patients on treatment under the charge of the NMSs. The number of drug defaulters among these was found to be 10,904 (15.0%). The number of patients contacted for tablet counting by NMS in the preceding 8 weeks was 11,139. Nearly 73% of the defaulters were personally contacted. As many as 120 of the 174 NMS were regularly meeting the patients under them for assessing drug compliance. Except for case detection through surveys, the performance of NMS was eminently satisfactory on all other counts.

(c) Paramedical workers

The position of paramedical workers was pivotal in the NLEP, among all the peripheral functionaries. Not a task was left out to which he did not contribute. Starting from detection of cases through house to house searches and contact, school and mass surveys, the PMW provided treatment and advised patients on physio-therapy as well as prevention of deformities. He assisted the NMS in drug delivery and treatment compliance and also the laboratory technician in preparing skin smears. He was the first line contact between the programme and the people. As such the performance of the PMW was crucial to the programme.

One hundred sixty seven PMWs were interviewed. They were assessed on certain selected parameters derived from their job requirements. The findings are given in table 21.

TABLE 21

Performance assessment of paramedical workers
(N = 167)

Function Assessed	Outcome
Case detection 1990-91 (% of targtted)	94.6
Case discharge 1990-91 (% of allotted)	130.4
Number of PMWs doing survey in last 3 months	140 (87.5%)
Avg. number of days spent for field survey in last 3 months	28 days
Cases assessed (% of due for assessment)	60.8
Avg. number of skin smears for PMW per month	108
Number of PMWs advising physiotherapy	147 (80.0%)
Number of PMWs receiving guidance on physiotherapy	62

Most of the PMWs were trained (96.0%), their training being the highest amongst all categories of NLEP personnel. The performance of the PMWs on most of the scores was found to be very good.

Over eighty seven percent of PMWs regularly participated in surveys for detection of new cases. This was in encouraging contrast to nearly 25% of them observed to avoid field survey in the last evaluation (1989). Nearly one-third of the working time was spent in the field. More than 100 skin smears were prepared by a PMW in a month and over 80% of them were conscious of their duty to advise patient on the prevention of deformities.

The case detection was absolutely satisfactory. Of the 5105 cases allotted in the current year, 4834 (94.7%) were detected. The target for discharging patients exceeded by 130%. However, the surveillance of inactive cases, in contrast, appeared below par, the assessed cases being only 61% of the targeted number.

In order to authenticate the technical competence of the PMWs, the team members were asked to verify the diagnosis and disease classification made by them through personal observations in the field. Of the 414 patients contacted the disease had been correctly classified in 398 (96.1%). Likewise, among the 88 patients registered as multibacillary the disease classification was doubtful only in 15% of them. There was no doubt that these workers possessed the required technical competence. An assessment ny NMS of PMWs working under them revealed that in 83.0% of the patients the disease was correctly diagnosed.

Like for the NMS, the activity of treatment monitoring by the PMW was examined in some detail. The

observations are recorded in table 22.

TABLE 22

Treatment monitoring by PMW

Function	Number
Number of patients under treatment	8158
Number of drug defaulters	1305
Number of defaulters contacted personally	1017
Number of drug defaulters motivated to resume	440

In a group of 8158 patients receiving treatment under the charge of the PMWs, 16% were irregular in collecting the drugs. Of these, 78% were personally visited to convince them for regularity in drug intake and 440 were motivated. Realizing how difficult it was to change attitudes, the failure to motivate the remaining 577 drug defaulters was understandable.

(d) Physiotherapist

For some unknown reason disability care and physical rehabilitation of the handicapped patient remained confined to the voluntary sector for a long time. Belated recognition of the importance of physiotherapy that it deserved was accepted under the NLEP only during the past one decade. It was therefore, not surprising, that physiotherapy remained the weakest link in the program even today.

There existed a total of 25385 posts of non-medical technical personnel in the NLEP; only 641 (2.5%) were meant for physio-technicians. Even among them more than one-third (35.5%) remained unfilled. Certain states, however, paid due attention to physiotherapy. In Assam, Tamilnadu and Uttar pradesh, all the posts were filled, while in Bihar only 5-6% were vacant. The West Bengal government did not create the post of physio-therapist.

Thirty four of the physio-therapists were interviewed and encouragingly all of them were trained. Fourteen had received retraining. In addition to patient care, the physiotherapist were required to educate, guide and supervise the PMWs who supplemented them in the task of physical rehabilitation.

On an average, 116 patients were attended to in the last 3 months, which would amount to providing physiotherapy to less than 2 patients in a day. This performance could not be justified on any account. It was not because facilities for physical treatment were deficient.

When questioned, 64% of the physiotherapists admitted that the facilities were adequate. In 4057 patients who required physical treatment, it was given to only 48.6%. Nearly half the patients were referred (46%) while the remaining came on their own.

An analysis of the work-time showed that on an average, one third of the physiotherapist's time was spent in the guidance and supervision of PMWs- and one-fifth in advising patients on the prevention of deformities. The remaining time was devoted to patient care. Thirty seven percent of the 167 PMWs confirmed receiving guidance from the physiotherapist. The performance assessment of physiotherapist may be seen in table 23.

TABLE 23

Assessment of the performance of physiotherapists
N = 34

Parameter	Observation
Average time spent in the past 3 months on	
Education, guidance & supervision of PMWs	17.7%
Care of ulcer patients	26.7%
Care of other deformities	25.0%
Education & guidance of patients	22.0%
Number who found facilities to be adequate	22
Average no. of patients seen in the past 3 month	116
Patients reporting voluntarily	63
Patients referred	53
Patients in need of physiotherapy in the current year	4057
Patients who received therapy	1972

Physical rehabilitation in general was not the strongest activity of the NLEP. Deformity care was yet to start in Bihar even by the voluntary organizations. In the governmental sector, it was confined only to advising on the care of anaesthetic hands and feet. In Andhra pradesh, NORAD conducted a physical care programme for the deformed that appeared promising. Tamilnadu was supplying micro-cellular footwear to the handicapped but only to a limited extent. The CLC project run by the state government in Gujrat with the aid from CIBA-GEIGY, at Borsad (Kheda) particularly emphasised deformity care, use of modulan grip aids and corrective surgery.In most other states, the programme for the care of the deformed needed considerable strengthening.

7. Laboratory Services

The importance of a reliable laboratory backup in furthering the effective operation of MDT programme cannot be over-emphasised. Despite this, the general standard of laboratory services under the NLEP was particularly poor. The results were unreliable, the manpower not available and if

available not trained. Many of the trained technicians did not have any exposure in the preparation and reading of skin smears. There was hardly a state that could take credit in maintaining good laboratory services.

The laboratory services were strengthened in the later part of the intensive phase in all the MDT districts. Even so, the laboratory technician's post constituted only 5.4% of the sanctioned posts of all the non-medical technical personnel. One third of the sanctioned posts of laboratory technicians were lying vacant. The states of Bihar and Madhya pradesh were most affected where only 12% to 18% of the technicians were in position. Andhra pradesh and Tamilnadu were in no happier situation. (See table 28A)

The assessment of laboratory technicians was based on interviewing 98 respondents. Only 60 of them were trained in reading skin smears. The average number of slides examined by a technician in one month came to only 11 and the average reporting time after receiving the smears was 11 days. This amounted to negligence of work. The number of fields examined before labelling the slide negative averaged 7. Forty three percent of the technicians did not care to send the slides for cross checking. The quality of bacteriologic services is discussed under Bacteriological surveillance.

Most members of the visiting teams found that the microscopes were in bad state of maintenance. The laboratory facilities were absent in several places in Karnataka and Bihar, while in Kerala the space alloted for laboratory was meagre.

8. Training

The switch over from dapsone monotherapy to combined drug treatment in the programme imposed its own requirements for the rapid training of additional manpower and orientation of the existing personnel.

In 1986-87, a WHO consultant visited 30 of the then 45 existing training centres and concluded that while the recruitment and training of PMWs was on the whole satisfactory, the same could not be said of medical officers, non-medical supervisors, laboratory technicians, physiotherapists and health educators. In fact, he warned that the situation had taken a critical turn and demanded action at the concerned levels. It was not known, if any changes were made since then.

Eleven of the existing 49 training centres were visited spread over 8 of the states. The assessment of these training centres was not done in any detail. No efforts were made to go into the educational content of the courses or the training technology for want of time. Further, no information was available from two of the centres in Boko in Assam and

Jalgaon in Maharashtra, while in another 3 the available information was sketchy. The observations regarding the remaining six centres is summarized in table 24.

TABLE 24

Utilization of training capacity of training centres

Category	Annual training Capacity	No. of Courses run	Average Duration	Number Trained
Medical officer	75	13	5	265
NMS	90	13	5	78
PMW	1025	10	34	356

Even as the number of centres examined was small, it clearly showed that the capacity utilization was extremely poor, the highest being 49.2% for the PMWs, followed by 31.6% for the NMS and 16.7% for the medical officers. In the face of substantial number of workers observed untrained in each category, idling of the training capacity of the training centres remained inexplicable. Almost identical observations were made during previous evaluations as well but the situation still remained unchanged.

It was observed that the training centre at Brombe (Ranchi) possessed a good library, classrooms, laboratory, operation theatre and even a hostel for 50 trainees, yet no trainees were sent to the centre from the state, even as the number of untrained staff in the state was the highest. Likewise, in Hyderabad and Madras, the utilization of training centres was sub-optimal despite very good infrastructural facilities.

There were 147 sanctioned posts of teachers in these institutions, of which 136 (92.5%) were filled. However, only 6.0% of the teachers had received any training themselves. This was a bad situation where new recruits to the NLEP were entrusted to teachers who themselves had not been exposed to any training in leprosy. No further reasons need be found to explain poor technical competence of some of the staff encountered during the evaluation.

9. Health Education

Recognition of the fact that health education formed an effective means of promoting leprosy control programmes was relatively recent. Age-long prejudice and ignorance on the part of the community regarding the nature of the disease and the possibility of arresting and curing it came in the way of leprosy control. A change in the general prevailing attitude would immediately sharpen the cutting edge of our available weapons against leprosy.

With the acceptance of MDT as the sheet anchor for arresting the disease, it became all the more important to prepare the community on the curative role of these drugs,

the need for continued treatment for prolonged periods, assistance in default retrieval and social integration of the general patients.

Health education in the programme aimed at :

a. creating awareness on the availability of free treatment;
b. developing knowledge on the nature of leprosy, its amenability to cure, recognition of early signs of the disease and prevention of deformities;
c. promoting social integration of leprosy patients; and
d. promoting community's committment to the programme.

The success of health education depended not only on the educational content but also on the availability of skilled communicators. In examining health education, therefore, both were assessed.

(a) Infrastructure

Forty one of the health educators were contacted. More than three-fourths of them had received training in health education. All of them possessed adequate amount of health education material by way of pamphlets, picture posters, flip charts and booklets. All but 4 of them had access to audio-visual facilities. In Tamilnadu, the SLO displayed initiative in innovating a light weight kit and an audio pack to be carried by all the health educators.

The health educators were questioned on their main target groups and on the effectiveness of the various methods of communication employed by them. The observations presented in table 25 revealed that all of them were primarily engaged in the education of the community members. Patients of leprosy were approached by 73% while the NLEP staff received the least attention (24.3%).

TABLE 25

Performance profile of health educators

Parameter	Number
Number of respondents	41
Number involved in the education of	
- Community members	41 (100.0%)
- Patients	30 (73.1%)
- Paramedical workers	10 (24.3%)
Number of patients advised on prevention of deformities in past 3 months	2486
Number of drug defaulters contacted in the past 3 months	1222
The most effective method of communication reported	
- Word of month	13
- Audio-visual	20
- Graphic aids	8

In the preceding three months, an average of 2486 patients were covered. This number was inadequate and more patients could have been contacted. Over 1200 drug defaulters were visited in their homes and of these 663 were motivated towards taking regular treatment.

Methods of communication employed included lectures and small group discussions with the help of educational aids. The common graphic aids employed were in the form of maps, charts, flip charts, flat pictures and flash cards, while the audio-visual aids comprised film strips, slides and over-head projectors. In Dhenkanal, the educational effort was strengthened through simulations with members of the community participating in the educational campaign through street plays.

In the experience of the majority of health educators (20), audio-visual communication was the most effective method of putting the message across while 13 found inter-personal communication to be superior. Only 8 respondents relied on graphic aids.

Lack of transport was the main impediment faced by many a health educator to extend their coverage.

(b) Educational content

For evaluating the educational content, questions were developed for the patients and members of the public to elicit information specific to the areas of programme awareness, knowledge regarding leprosy and their own role perception. The respondents included 424 members from the community and 466 patients drawn from 88 villages. The observations are tabulated in tables 26 and table 27.

(i) Awareness

A high degree of programme awareness prevailed in the community. A great majority of the villagers (71.2%) were aware of the leprosy workers visiting the villages. Nearly half of them knew the workers by name. As many as 65% were familiar with the work the PMW was performing in the villages. Many of them had been contacted by the workers for one reason or the other. When asked to narrate, the typical

TABLE 26

Community awreness and knowledge of leprosy

No. of Community members interviewed			424
No. who have seen leprosy worker visiting			302 (71.2%)
No. who can recollect the name of the worker			206 (48.5%)
No. with leprosy case in the family			53
No. who were familiar with the work of leprosy workers			278 (65.5%)
No. contacted by the leprosy workers			214
	Agree	Disagree	Uncertain
If a person once gets leprosy, he gets it forever	61	305 (71.9%)	58
Leprosy patient should not be kept in the family	103	284 (67.0%)	37
Leprosy spreads easily from one to another	113	250 (59.0%)	61
Deformities in leprosy can be prevented	317	33	74
If a woman has leprosy, her child will be born with it	86	241 (56.8%)	97
No. who feel treatment is most effective - allopathic			338
- homeopathic			12
- ayurvedic			14
No. willing to support NLEP			339

No. = Number

responses were: 'he came to find out about leprosy patients' or that 'he distributed pills'. Undoubtedly, the programme had percolated to the people. Community awareness, however, was not so good in West Bengal, perhaps because the state does not have any post of health educator.

TABLE 27

Socio-economic profile of patients

No. of patients interviewed		446
No. of these living with families		439 (94.2%)
Any other family member having leprosy		99
No. of patients employed		242
Of these patients		
	In service	23
	Self employed	116
	Daily wages	98
	Any other	5
No. reporting to doctor themselves		225
No. who felt improvment on treatment		395
No collecting drugs regularly		424
Who drew first attention to your illness		
	Family	20%
	Self	20%
	NLEP	45%
	Community member	15%

No. = Number

(ii) Knowledge about leprosy

Nearly 60% of the respondents believed that leprosy did not spread easily. More than 70% knew that the disease was curable while three fourths of them were aware that deformities in leprosy were not inevitable. A high proportion of the villagers (67%) knew that a leprosy patient could be safely kept in the family. A majority (57%) was knowledgeable about the non-hereditary nature of leprosy. While patients in several districts of Uttar Pradesh, such as Gonda, Shahjahanpur and Fatehpur did not know the cause for the disease nor what exactly would follow if they did not take treatment regularly, yet in general, people's knowledgability on leprosy was satisfactory.

(iii) Social perception

The general belief that the leprosy patients were shunned by one and all was not borne out by this assessment (table 27). More than 90% of the 466 patients lived with their families. Half of the respondents were occupied in one vocation or the other. The largest number of them (48%) were self-employed while 98 out of 242 patients worked on ad-hoc basis. However a very small proportion of them (9.5%) were in service. It is true, that to expect that prejudice against leprosy had completely disappeared was a far cry.

The general attitude towards the disease was positive. The proportion of self-reporting patients steadily went up over the years. In the 10 MDT districts studied in detail, self reporting accounted for 7 to 40% of the patients. Among the 466 patients interviewed in the 255 villages 48.2% came to the doctor themselves. While in the majority of the cases, the disease was first recognized by the NLEp staff, in one third of them, it was patients themselves who first became aware of their disease. In an equal proportion attention to the disease was drawn by a family member. In most of the instances (76%) the first sign of the disease noticed was the appearance of a patch. The belief of the vast majority lay in the efficacy of the allopathic form of treatment (table 27).

In the 24 states/union territories, the health education component of the programme needed strengthening in most. In Andhra pradesh, no specific plan existed for health education in many of the districts. The services of health educators were being utilized for some other work. Most units in Bihar were devoid of the services of a health educator. In Karnataka, both the coverage and quality of health education needed considerable improvement; while in Jammu & Kashmir, Assam. Madhya pradesh, Uttar pradesh and West Bengal, health education activities were patchy and inadequate. It was only in the states of Gujrat, Orissa and Maharashtra that health

education seemed to have made some impact. In Jammu & Kashmir, unlike most other states, widespread prejudice existed against patients with stigma of the disease.

10. Monitoring and Reporting

The NLEP maintained a well developed system of programme monitoring and reporting. It operated at all levels of administrative hierarchy. The data originated at the peripheral level of the units and was reported to the district headquarters which, in turn, forwarded it for aggregation to the state. An efficient management of the programme depended on continuous monitoring and initiating remedial measures in time. For this reason, an elaborate system of data collection, recording and reporting was prescribed in the programme. Monthly, quarterly and yearly reports were envisaged. Certain MDT districts were required to send special reports. Even the highest level of administrative control in the Government of India set a great store by regular programme monitoring. The Leprosy Commission, under the chairmanship of the Health Minister met at least once a year to lay down plan and policies for leprosy eradication which were implemented by the Leprosy Eradication Board. The latter held six-monthly meetings.

The system was assessed with regard to :

(a) Authenticity of data originating in the field;

(b) Timely reporting of information from the units, district and state head-quarters to the respective higher echelons; and

(c) Analysis and review of reports and the follow up action taken.

The field staff often operated under difficult conditions, and if this staff were to be motivated to collect data completely and accurately, they must understand its purpose and be able to make use of the data themselves. This was not so. In Madhya pradesh, many health workers did not have any understanding of why the reports were required. They did not receive any training in filling up the forms. Skills in interpreting data and using the information for programme management was inadequate even at certain supervisory levels in Kerala. In the district of Puri in Orissa, the case cards used were other than those prescribed by the NLEP, defeating the purpose of maintaining uniform reporting. Disability charting and recording of nerve involvement, reactions and side effects of drugs were observed to be perfunctory in the districts of West Godavary, Jaintia Hills and Puri.

A monitoring system can be only as good as the data upon which it was based. In this context a high degree of reliability existed in the reported information from the units with regard to case detection, disease classification and treatment coverage. The data on the parameters verified in the field through personal observations was found to faithfully reflect the documented information in the state. The discrepancy between the disease diagnosis and classification made in the field with that observed by the members of the evaluation teams was of the order of 4% and 15% respectively.

As the reliability of field data was a matter of satisfaction, so was its timely reporting. In a total of 323 districts of the 24 states/UTs, those regularly sending information to the state head-quarters were 259 (80.1%); only 4.6% did not send any report at all. Reports from over 90% of the LCus, ULCs and PHCs were received in the district on time. From the state headquarters, it was from Kerala and West Bengal that the reports often reached DGHS late. Otherwise, the reporting was regular and timely.

If submission of the reports was up to the mark, their review and follow up were not. Even though the reports were routinely reviewed in all the states and districts, their analysis was perfunctory. The collection of data was often used to initiate disciplinary action rather than to make better decisions for day-to-day programme management. Very few officers received any feed back from above. In Chandigarh, there was extensive documentation of data but its quantification was defective.

11. Programme Management

NLEP had considerable inputs that were vital to its functioning. A vast network existed under it. The programme maintained its own exclusive cadre of medical officers, non-medical supervisors, paramedical workers, laboratory technicians, physiotherapists and health-educators, numbering 26,788 persons in all. Centres were maintained to train manpower and facilities were created in the form of temporary hospitalization units and reconstructive surgical units to provide specialised care. These called for considerable managerial skill for their optimal utilization. In addition, it was essential to ensure a continuous supply of adequate anti-leprosy drugs, equipment and transport at all levels. If leprosy control was ever to flounder, it would not be for unsound technical strategy as for want of an efficient managerial system. For these reasons, an attempt was made to examine some of these aspects of the programme. While the technical component of the programme was quite satisfactory, the same cannot be said of its management.

(a) Cadre management

Cadre management presented many a lacunae in several states. The Swaminathan Commission recommended that the SLO being the chief co-ordinator and technical advisor to the state government on NLEP, his post should be held by a senior officer with adequate administrative experience, holding at least the rank of a Deputy Director of Health Services. He should remain in position for a minimum period of 10 years to enable him to take a long view of the problem. However, only 13 of the 24 SLOs possessed earlier experience of work in leprosy. The average stay of the SLO at his post was found to be only 1 year and 8 months. It was observed that the Joint Director of Health Services holding this position in Orissa was transferred 8 times in 3 years. Likewise, frequent transfers of MOs were affected in many of the states like Bihar, Karnataka, Orissa etc. In Kerala, the SLO was of the rank of an Assistant Director, while in Bihar he functioned under the Deputy Director of communicable diseases programme. In Rajasthan, the SLO was denied adequate administrative authority to monitor the programme. At the district level, the DLO and the leprosy workers were administratively under the control of the civil surgeon. Such administrative impediments came in the way of effective planning and efficient discharge of the duties of the concerned officer.

NLEP called for special committment on the part of its staff; but these trivial administrative setbacks could be the source of demotivation of the workers and generating an avoidable feeling of frustration.

(b) Vacant posts and untrained personnel

The overall vacancy position and the training status of the staff state-wise is shown in table 28, while the same by category of staff may be seen in table 29.

TABLE 29

Vacancy and training status by catgeory of staff

Post	Number Sanctioned	Number Vacant	% Vacant	Number Trained	% Trained
Zonal/DLO	271	75	27.6	148	75.5
Medical Officer	1132	320	28.2	516	63.5
Non Med. Supervisors	4034	717	17.7	2137	64.4
Para Med. Workers	19327	4249	21.9	14200	94.1
Lab. Technicians	1383	426	30.8	875	91.4
Physiotherapist	641	228	35.5	360	87.1
Health Educator	409	95	23.2	163	51.9

Nearly 23% of all posts lay vacant. The worst affected states were Bihar, Karnataka, West Bengal, UP,

TABLE 28

Vacancy and training status of staff by category and state

STATE/UT	# Zonal/District Leprosy Officers						# Medical Officers						# Non-Medical Supervisors					
	Sanct.	Pos.	Vac.	%Vac	Tran.	%Tran.	Sanct.	Pos.	Vac.	%Vac	Tran.	%Tran.	Sanct.	Pos.	Vac.	%Vac	Tran.	%Tran.
ANDHRA PRADESH	24	20	4	16.6	20	100.0	173	167	6	3.4	123	73.6	483	473	10	2.0	473	100.0
ASSAM	6	3	3	50.0	0	0.0	23	23	0	0.0	0	0.0	51	39	12	23.5	39	100.0
BIHAR	22	21	1	4.5	5	23.8	115	102	13	11.3	9	8.8	470	246	224	47.6	12	4.8
CHANDIGARH	0	0	0	*****	0	*****	0	0	0	*****	0	*****	0	0	0	*****	0	*****
D & N HAVELI	0	0	0	*****	0	*****	0	0	0	*****	0	*****	0	0	0	*****	0	*****
GUJRAT	7	7	0	0.0	7	100.0	27	24	3	11.1	18	75.0	152	126	26	17.1	126	100.0
HARYANA	0	0	0	*****	0	*****	0	0	0	*****	0	*****	0	0	0	*****	0	*****
HIMACHAL PRADESH	2	2	0	0.0	2	100.0	12	12	0	0.0	6	50.0	15	14	1	6.6	14	100.0
JAMMU & KASHMIR	1	1	0	0.0	1	100.0	4	2	2	50.0	0	0.0	9	9	0	0.0	5	55.5
KARNATAKA	20	16	4	20.0	8	50.0	64	57	7	10.9	20	35.0	268	175	93	34.7	175	100.0
KERALA	8	7	1	12.5	6	85.7	28	22	6	21.4	8	36.3	131	131	0	0.0	6	4.5
MADHYA PRADESH	23	1	22	95.6	1	100.0	85	32	53	62.3	19	59.3	392	389	3	0.7	70	17.9
MAHARASHTRA	24	24	0	0.0	21	87.5	65	65	0	0.0	65	100.0	375	347	28	7.4	347	100.0
MANIPUR	3	2	1	33.3	2	100.0	5	5	0	0.0	5	100.0	22	21	1	4.5	21	100.0
MEGHALAY	1	1	0	0.0	1	100.0	2	2	0	0.0	2	100.0	9	9	0	0.0	2	22.2
MIZORAM	1	1	0	0.0	1	100.0	2	2	0	0.0	2	100.0	8	5	3	37.5	5	100.0
NAGALAND	3	3	0	0.0	2	66.6	2	0	2	100.0	0	*****	22	22	0	0.0	13	59.0
ORISSA	11	11	0	0.0	3	27.2	83	75	8	9.6	56	74.6	236	144	92	38.9	144	100.0
PUNJAB	1	1	0	0.0	1	100.0	5	5	0	0.0	5	100.0	5	0	5	100.0	0	*****
RAJASTHAN	4	2	2	50.0	2	100.0	5	4	1	20.0	4	100.0	50	49	1	2.0	49	100.0
TAMIL NADU	23	20	3	13.0	20	100.0	154	145	9	5.8	130	89.6	423	410	13	3.0	410	100.0
TRIPURA	1	1	0	0.0	1	100.0	3	3	0	0.0	3	100.0	10	7	3	30.0	7	100.0
UTTAR PRADESH	72	39	33	45.8	33	84.6	135	65	70	51.8	41	63.0	541	469	72	13.3	89	18.9
WEST BENGAL	14	13	1	7.1	11	84.6	140	0	140	100.0	0	*****	362	232	130	35.9	130	56.0
TOTALS	271	196	75	27.6	148	75.5	1132	812	320	28.2	516	63.5	4034	3317	717	17.7	2137	64.4

Sanct. = Sanctioned, Pos. = Position, Vac. = Vacancy, Tran. = Trained

TABLE 28-A

Vacancy and training status of staff by category and state

STATE/UT	# Para-Medical Workers						# Laboratory Technicians						# Physiotherapist/Physiotech.					# Health Educators					
	Sanct.	Pos.	Vac.	%Vac	Tran	%Tran.	Sanct.	Pos.	Vac.	%Vac	Tran	%Tran.	Sanct.	Pos.	Vac.	%Vac	Tran	%Tran.	Sanct.	Pos.	Vac.	%Vac	Tran.	%Tran.
ANDHRA PRADESH	2146	1976	170	7.9	1976	100.0	221	163	58	26.2	163	100.0	109	76	33	30.2	76	100.0	53	53	0	0	0	0
ASSAM	462	401	61	13.2	401	100.0	18	18	0	0.0	18	100.0	14	14	0	0.0	14	100.0	11	5	6	54.5	5	100.0
BIHAR	2182	1182	1000	45.8	1079	91.2	107	19	88	82.2	5	26.3	55	50	5	9.0	3	6.0	37	11	26	70.2	0	0
CHANDIGARH	0	0	0	*****	0	*****	0	0	0	*****	0	*****	0	0	0	*****	0	*****	0	0	0	*****	0	*****
D & N HAVELI	3	4	-1	-33.3	2	50.0	0	0	0	*****	0	*****	0	0	0	*****	0	*****	0	0	0	*****	0	*****
GUJRAT	657	532	125	19.0	531	99.8	45	40	5	11.1	24	60.0	18	7	11	61.1	7	100.0	16	13	3	18.7	13	100.0
HARYANA	0	0	0	*****	0	*****	0	0	0	*****	0	*****	0	0	0	*****	0	*****	0	0	0	*****	0	*****
HIMACHAL PRADESH	85	64	21	24.7	61	95.3	6	5	0	0.0	1	16.6	7	0	7	100.0	0	*****	0	0	0	*****	0	*****
JAMMU & KASHMIR	72	68	4	5.5	50	73.5	6	3	3	50.0	1	33.3	4	2	2	50.0	1	50.0	1	1	0	0	1	100.0
KARNATAKA	1239	761	478	38.5	761	100.0	74	43	31	41.8	43	100.0	52	28	24	46.1	28	100.0	30	22	8	26.6	0	0
KERALA	654	280	374	57.1	280	100.0	36	25	11	30.5	25	100.0	10	10	0	0.0	10	100.0	5	5	0	0	5	100.0
MADHYA PRADESH	1248	980	268	21.4	980	100.0	98	16	82	83.6	8	50.0	38	10	28	73.6	9	90.0	32	32	6	15.7	24	75.0
MAHARASHTRA	1920	1920	0	0.0	1920	100.0	78	78	0	0.0	78	100.0	29	25	0	0.0	29	100.0	0	0	0	*****	0	*****
MANIPUR	100	95	5	5.0	81	85.2	8	3	5	62.5	3	100.0	6	2	4	66.6	2	100.0	6	5	1	16.6	2	40.0
MEGHALAY	43	43	0	0.0	17	39.5	2	1	1	50.0	1	100.0	2	2	0	0.0	2	100.0	2	2	0	0	1	50.0
MIZORAM	10	6	4	40.0	6	100.0	4	2	2	50.0	2	100.0	1	1	0	0.0	1	100.0	2	0	2	100.0	0	*****
NAGALAND	78	73	5	6.4	56	76.7	4	4	0	0.0	4	100.0	4	0	4	100.0	0	*****	4	4	0	0	1	25.0
ORISSA	1252	988	264	21.0	988	100.0	135	119	16	11.8	119	100.0	44	12	32	72.7	12	100.0	26	10	16	61.5	10	100.0
PUNJAB	13	5	8	61.5	5	100.0	5	4	1	20.0	4	100.0	0	0	0	*****	0	*****	5	5	0	0	5	100.0
RAJASTHAN	164	119	45	27.4	47	39.5	11	7	4	36.3	3	42.8	0	0	0	*****	0	*****	4	4	0	0	2	50.0
TAMIL NADU	2334	2259	75	3.2	2259	100.0	228	175	53	23.2	175	100.0	125	119	6	4.8	119	100.0	97	93	4	4.1	93	100.0
TRIPURA	80	74	6	7.5	64	86.4	5	3	2	40.0	0	0.0	2	0	2	100.0	1	*****	1	1	0	0	0	0
UTTAR PRADESH	2590	1783	807	31.1	1783	100.0	197	164	33	16.7	164	100.0	44	44	0	0.0	44	100.0	68	45	23	33.8	0	0
WEST BENGAL	1995	1465	530	26.5	853	58.2	95	64	31	32.6	34	53.1	77	7	70	90.9	2	28.5	3	3	0	0	1	33.2
TOTALS	19327	15078	4249	22.0	14200	94.1	1383	957	426	30.8	275	63.7	641	413	228	35.5	360	87.1	409	314	95	23.2	163	51.9

Sanct. = Sanctioned, Pos. = Position, Vac. = Vacancy, Tran. = Trained

Madhya pradesh and Kerala in this order, where 45% to 24% of the posts remained unfilled. The most affected category was that of the physiotherapist (35.5%) followed by those of laboratory technicians (30.8%) and medical officers (28.2%). A well thought out staffing pattern had evolved in the programme in keeping with the job requirements at various levels. It was a traversity of manpower management that deficiencies to the extent of 60% to 80% affected certain categories of posts in several of the states.

While the overall vacancy position was bad, the training status was no better. Half of the health educators had not received any training while more than one-third of the medical officers and non-medical supervisors remained untrained. In the face of unutilized training capacity observed in many of the training centres, presence of untrained workers within the programme was not good management.

None of the medical officers was trained in Assam, Bihar and West Bengal. Likewise, the states of Bihar, Himachal pradesh, Jammu & Kashmir, Madhya pradesh and West Bengal were content to employ untrained laboratory technicians. It was distressing to observe that in some states such as Andhra pradesh, Bihar, Karnataka, Tripura and Uttar pradesh, health education was imparted by educators who did not themselves had exposure to leprosy programme.

In the training centre at Boko in Naugaon district, the head of the centre as well as other trainers were untrained. They followed the Dharmendra scale of bacteriological index. The lack of training of staff was encountered as a major problem for the state of Meghalaya for committment to leprosy work.

It hardly needed emphasis that this specialised facility was being maintained at considerable cost to the exchequer. Its non-utilization amounted to waste of scarce resources.

(c) Supervision

The need of active and close supervision of NLEP related activities was, in general, recognized. While supervision at all levels was important, greater emphasis need be put on the technical supervision and support of peripheral non-medical technical personnel.

A general laxity of supervisory functions existed at several levels. As already brought out, a large number of posts were not filled; when they were filled the incumbents were untrained. Follow up action on the monthly, quarterly and annual reports was tardy. Six of the DLOs did not assess their staff. Bacteriological surveillance was a neglected field as the laboratory technicians did not get proper

guidance. The microscopes were ill-maintained and the quality of available stain poor. The task of case detection, confirmation of diagnosis, treatment and follow up of patients in Alwar, were left entirely to the para-medical workers without any supervision from the medical officers. One control unit looked after a population of 17 lakhs in this district and that too with only 17 PMWs.

A heartening feature, however, was the emphasis accorded by the MOs to the quality of performance by workers looking after the units. These officers, not only assisted the peripheral workers in their job on the spot but also developed a system of grading their staff. On the basis of review of 1022 workers in the field during the preceding one month, the MOs suggested the following actions for improving the quality of their work:

Re-training	638
Transfer	28
Punishment	338
Encouragement	18

Likewise, on the basis of field supervision, the NMSs recommended that 286 of the 1143 PMWs working under them required retraining.

Temporary hospitalization ward was the most mismanaged facility. With three-fourths of the physio-therapist without any work experience (73.3%) half of the medical officers (42.4%) untrained and one-fourth of the laboratory technicians (26.6%) without the requisite skill, the wards showed an average bed occupancy rate of only 37%. In Bihar, the THWs had been converted into office space. While in karnataka several of them did not function at all, the THWs were under dual administrative control of the Joint Director (Medical) and the DLO in Tamilnadu, with the result that at Cuddalore, the utilization of the ward was less than 40%. Temporary hospitalization wards for inpatient services were non-existent in West Bengal, with the result that ulcer and deformity prevention services were much neglected. None of the 14 THWs in Madhya pradesh had a full time medical officer. The THW earlier maintained by the Damien Foundation at Deeg in Bharatpur district, now handed over to the state government was languishing for want of funds. The THWs in West Godavary district were afflicted with inadequate budget. In Bihar, a total of 805 THW beds were available. These were however, not under use and many of the THWs had been converted into offices.

(d) Logistics of supplies

For implementing MDT, it was imperative to ensure a continuous supply of anti-leprosy drugs for at least 5 years. National logistics must ensure proper accounting of drugs and timely transfer of sufficient stocks to the

peripheral worker. Programme manager should spare no effort to make regular stock checks and take timely initiative to avoid programme interruption.

There was, however, shortage of drugs affecting the units, the districts as well as the state headquarter. Both rifampicin and clofazimin ran into short supply, particularly the latter. The shortage lasted for periods varying from a week to more than 3 months in one instance. It was observed that clofazimin was out of stock in Manipur, Rajasthan and Gujrat at the state head-quarter for 7,10 and 15 days respectively. Likewise, the 9 districts of Balasore, Mayurbhanj, Bilaspur, Prakasham, Vishakhapatnam, Singhbhum, Puri and Purnea reported non-availability of both rifampicin and clofazimin during 1989-90 and 1990-91. What was really disturbing was the interruption of therapy because of drug shortage in the LCus and ULCs. As many as 13 units experienced the break in receipt of drugs one time or another during the current year. These units were located in the districts of Balasore, Dhenkanal, Mayurbhnaj and Puri in Orissa; Amravati and Jalgaon in Maharashtra; Bilaspur and Bastar in Madhya pradesh; Surat in Gujrat; Purulia in West Bengal and Kanpur Dehat in Uttar pradesh. The break lasted for 1 to 5 days and the shortage was made good by diverting supplies from nearby areas where the drugs were available. The Dte General of Health Services made emergency procurement through the assistance of WHO and other international agencies.

Examination of stocks for dapsone, clofazimin and rifampicin at the state head-quarters revealed that while dapsone was grossly over-stocked by almost all states, clofazimin and rifampicin were hardly adequate to last for 45 days as calculated on the basis of annual requirements. Maharashtra had 375.6 lakh tablets of dapsone in stock against the annual requirement of 14.2 lakh tablets. No information on drug stocks was available in 4 of the 24 states/UTs. Likewise, among the 71 districts, there was no stock of rifampicin and clofazimin in 12 while in the remaining the drugs were grossly under stocked except in 10 of the districts.

(e) Transport

The NLEP envisaged a vehicle exclusively for the programme use at the leprosy control units. The most important vehicle dependant activity at this level was drug delivery to the patients at fixed points in a pre-determined circuit. An inefficient transport system prevailed in nearly all the states including Assam, Bihar, Gujrat, Himachal pradesh, Jammu & Kashmir, Karnataka, Manipur, Orissa and Rajasthan. This was so because of lack of maintenance of vehicles or replacement of condemned ones. Difficulty in getting vehicles was experienced in several districts in Karnataka. In Dhenkanal and Mayurbhnaj districts 4 of the

vehicles had been off the road for long time and so also in Manipur, where only 4 of the 9 sanctioned vehicles were road-worthy. Rajasthan had not only given a single vehicle to be shared amongst the SLO, DLO and the medical officer, but also restricted touring to certain days of the week. The civil surgeon of Rohtas district took the transport with him on transfer. Thus, lack of mobility of concerned officers affected programme monitoring, supervision and sometimes even drug distribution.

(f) Sample survey and assessment units (SSAUs)

The SSAUs were formed mainly to assess the quality of data generated by the district leprosy services by validating the data arrived at by the NLEP staff. These units also laid down base-line epidemiological indicators after conducting sample surveys. They assisted in evaluating the effectiveness of treatment including MDT at periodic intervals by recomputing the various operational and epidemiological indicators. In those areas where the NLEP set up was not geared for estimating the magnitude of leprosy in terms of its prevalence, the SSAUs provided such information.

There were 41 SSAUs in the country of which 10 were included in evaluation. They possessed only 72% of the sanctioned staff of which only 65% had undergone orientation training. Only 1 out of the 5 SSAUs sanctioned for Madhya pradesh was functioning while the unit stationed in Punjab functioned beyond the given guidelines. It was engaged in survey on a selective basis. There were 3 SSAUs in the state of Gujrat of which only 1 was functional. All the units were understaffed particularly with regard to PMWs. Three SSAUs were visited in Bihar, only 1 had adequate staff strength.

The performance of the SSAUs with regard to the population surveyed showed that 92 districts with the total population of 684.6 lakhs were under their jurisdiction. Twenty five of the districts were covered in the current year. The population to be enumerated was 4,06,715; of which 80% was actually assessed. In a sample population, the NLEP staff identified 310 leprosy patients while SSAU discovered more than 4 times as many, numbering 1257 cases. It is highly unlikely that the programme workers missed such a large number of cases. Obviously, the SSAU grossly over-diagnosed. Several observers were struck by the fact that disease diagnosis made by the SSAU staff in general was on the higher side.

In the current year, of the 475 patients for surveillance by the SSAUs, only 232 were examined. Cases detected as relapsed numbered only 20 in a year. Such inept performance may be due to the fact that many of SSAUs were unclear about their role in the NLEP. Large areas in the country awaited attention of the assessment units for survey and confirming the changing epidemiological indices observed

in several districts under the impact of MDT. No information was available on true disease prevalence in Kerala as the state did not have a SSAU. Survey for leprosy was carried out in J&K a long time ago in 1965 by Dharmendra. Since then, there was no information on disease prevalence in that state. No survey had been carried out in Chandigarh and several districts of Assam. Now that plans are afoot to extend MDT coverage to the entire country, it became necessary to organize surveys to bring out true picture of leprosy in hitherto uncovered areas.

12. Expenditure

Utilization of development budget formed an important indicator of any programme efficiency. While the utilization of total budget provision was more than 90% in as many as 14 states, it was not so in the case of another 5. No information was available in respect of 6 states. What was really disconcerting was the non-utilization of plan provision. Bihar surrendered the entire amount of Rs. 107 lakhs provided in the year under evaluation. Likewise, the utilization of plan provision was about 50% only of the outlay in the states of Andhra pradesh, Kerala, Maharashtra, Rajasthan and Tripura. Appraisal of the state expenditure for the current financial year revealed that several of the states incurred expenditure in excess of plan provision for development; the excess contribution of state varying from 8.0% in Madhya pradesh to 15.0% in Karnataka, 45% in Tamilnadu and 195% in Assam. The fact indicated a great committment on the part of the state governments to give a fillip to leprosy eradication.

13. Voluntary Organisations

Administratively, the voluntary organizations were not a part of NLEP. However, ever since the meeting to co-ordinate the activities of these organizations by the Government of India n 1986,. efforts were made to draw the mass base of voluntary committment to leprosy into the technical ambit of the NLEP; by concentrating on mutually agreed activities for leprosy control.

Twenty nine voluntary organizations were seen. By and large, their activities converged on NLEP goals. They maintained 1,333 beds amongst them. All but one concentrated on case detection and treatment activities. The remaining one had rehabilitation work as its main focus.

They were staffed by trained personnel. In the total staff strength of 683 posts, only 4 were vacant. Likewise, 85% of them had received training.

As on 1.4.91, 55,331 patients of leprosy were registered under them, of which 29% were multibacillary and 8% had deformities. However, during the current year 10,490

new cases were detected and 94% of them were put under treatment. The treatment regimen followed by them for dapsone monotherapy as well as for MDT were those recommended by NLEP.

In the 2200 multibacillary patients identified in the current year, 80% showed smear positivity.

Twenty of the organizations undertook health education activities with members of the community being the main target groups. None of them was engaged in the training of leprosy personnel. The purpose of the visit was not so much to assess the activities of these organizations as to determine the participative nature of their functions in promoting NLEP activities. All save 4 of the VOs, shared their experience and information with the district health authorities in the form of regular reporting to the district health authorities.

The total amount of money spent by these bodies during 1990-91 was of the order of Rupees 5.0 crores.

The quality of service rendered by these bodies varied from state to state. In general, they rendered commendable service to the society. Some of them were however, beset with administrative problems. The Gandhi Kusht Nivaran Sevashram in Siwan did not receive the grants and the workers were on strike posing a threat to MDT programme in these districts.

Mother Teresa Leprosy Charity Home in Khasi Hills rendered valuable services to the neighboring states. It maintained a 95 bed leprosy ward besides providing out-door services.

V

CONCLUSIONS AND RECOMMENDATIONS

1. Commendable as the new case detection, MDT coverage and release of treated cases were, these activities needed to be strengthened in general and particularly, in states whose performance was not so good in this regard. Case detection should be activated through mass surveys, school surveys and house to house searches. Frontline workers should be encouraged to make greater efforts for retrieval of drug defaulters.
2. Detailed epidemiologic studies should be initiated in districts completing 5 years of MDT implementation, where the prevalence rate markedly declined and yet the proportion of child cases among the new cases showed an increase and there was no appreciable decline in the new case detection rates.

3. Monitoring of multi-drug therapy be augmented to detect drug resistance and post RFT surveillance strengthened.

4. Untrained staff in sufficient numbers existed within the programme at all levels. Time bound, phased leprosy training should be arranged for all categories of untrained staff. DLOs and MOs must be trained both in the management of the programme and the clinical aspects of leprosy to improve guidance and supervision of the field workers.

5. The training centers were grossly under utilized. The training capacity should be fully consumed and extended to look after the needs of neighboring states without such centers.

6. An extensive data was collected through the net-work of information reporting system. Not much use was made of it for improving the programme performance. Basic workshops for all health workers in data collection , compilation , analysis and usage should be organized to remove this weakness. The supervisory and paramedical staff be given orientation training in programme awareness creation amongst the public.

7. The programme suffered from significant number of vacancies at each level. These should be filled at the earliest possible. Particular attention need be paid to the posts of physiotherapist, laboratory technicians and health educators. States like West Bengal may be requested to create the posts of health educators and physiotherapists that were almost non-existent.

8. Bacteriological surveillance continued to be a weak link in the programme. The laboratory services must be improved by :
   (a) immediately filling up the existing vacancies;
   (b) expeditious training of the untrained laboratory technicians by organizing crash courses in skin smear preparation and reading;
   (c) provision of good workable microscopes; and
   (d) creation of new posts of smear technicians in keeping with the work load.

   It is for consideration if the work load of existing laboratory technicians be reduced by limiting the skin smear examination only to the multibacillary cases.

9. Regular and adequate supply of anti-leprosy drugs is a pre-requisite for implementation of MDT. Drug shortage, particularly of clofazimine and rifampicin, affected several of the districts and units. Buffer stocks of these drugs at the state headquarters to last at least for 3 months should be ensured. Drug requirements at all state and lower levels should be preplanned and periodically reviewed.

10. The state leprosy officers should be at least of the rank of a state joint director, must to exposed to leprosy work, and must exercise administrative and financial independence. Frequent transfers of the state leprosy officer, the district leprosy officer and medical officers should be avoided, particularly of those who were trained and possessed experience in leprosy.

11. The replacement of condemned vehicles should be an automatic and expeditious process. Mobility of all the staff should be assured by providing vehicles and adequate funds for POL. Imposing governmental restriction on touring adversely affected supervision. States doing so, may be requested to waive such restrictions.

12. Working of temporary hospitalization units must be radically activated. Their possession of full complement of trained staff must be assured to promote disability prevention by bringing them under the administrative control of the SLO/DLO, as also their utilization for the purpose these were created for.

13. The SSAUs should be looked into both in respect to their staffing and workload. With rapidly advancing MDT coverage in the country, true disease prevalence should be worked out for states that were attended to decades ago. So called low endemic areas should be focused on in a phased manner.

14. Under the impact of MDT as a dramatic decline occurred in case load, continued emphasis to the endemic districts left the non-endemic ones in relative neglect. Extension of MDT to these areas should be expeditiously considered.

15. Integration of leprosy services with primary health care presented certain difficulties as seen in Rajasthan and Himachal Pradesh, while the extension of modified multi-drug treatment scheme was beset with other local problems. These should be carefully considered before pushing forward these schemes.

16. Growing awareness of the programme in the community and the sharp rise in the rate of voluntary reporting were encouraging. Efforts at health education, however, should be further augmented particularly, with greater emphasis on imparting knowledge of leprosy to the people.

National Health Programme Series 6

NATIONAL LEPROSY ERADICATION PROGRAMME

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NATIONAL HEALTH PROGRAMME SERIES 6

NATIONAL LEPROSY ERADICATION PROGRAMME

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FOREWORD

One of the cardinal factors for achieving Health for All by 2000 A.D. is the ability of the individual and the organisation to recognise and respond to changes in advancing technology for health maintenance and promotion, new pattern of disease, disability, etc. new social policies, expectations and programmes for better health services. Towards this end, the education of the people concerning prevailing health problems and methods of preventing and controlling them is the first requisite of Primary Health Care. This is more so in the case of public welfare personnel and professionals through whom the knowledge and skills should percolate to the grassroot level.

In adhering to the above perspective, the National Institute of Health and Family Welfare conducts nearly fifty training courses/workshops annually towards requirements of a system of continuing education for health administrators of States and Districts, teachers of medical college, and also the members of Indian Administrative Service. However, the problem of updating the knowledge and skills of these personnel, already on the job, still remains. It has proved arduous to have them re-trained at institutions. The snail-like pace of implementation reflects in many instances the fact that this is an area where most professionals feel unprepared. It is, therefore, essential to initiate a programme to get relevant information out to individual participant. As such, the development of self-learning resource materials to keep abreast of scientific advances in research as well as in programme strategies is an enviable task which the NIHFW has undertaken with large-scale efforts.

These resource material present an assiduous expatiation of various National Health Programmes and Schemes currently in operation in the health services system. Each of these expatiates the genesis, strategy, current status, and the outcome of the evaluation of individual programme. Thus, the primary aim of this ***Series*** would be to share and utilise the available resources to update the knowledge and skills of programme personnel at their own place.

I fervently hope that this publication will provide orientation on the use of such self-learning materials to learners/participants. I also wish to asseverate that these resource materials will be updated periodically and as such, I am sure, they should be a valuable aid in overcoming the lag.

Much of the positive value in this ***Series*** originated with one or another of our associates. sincerely thank these Programme Officers who had so kindly undertaken the onerous task of compilation and completion of these documents.

New Delhi
December, 1988

J.P. Gupta
Director

INTRODUCTION

Much has been said and written about leprosy. However, many misconceptions and superstitions still prevail and shroud the disease in mystery. Leprosy is still commonly considered in certain parts of the country to be a curse of God or due to the visitation of an evil spirit. Social ostracism has been the most prevalent abuse of the affected.

The disease has been known for many centuries and reference to it is found in ancient Hindu scriptures. Until a few decades ago, the disease was one of neglect; the affected were interned in leprosariums mainly managed by charitable trusts and voluntary organisations. With the establishment of the Indian Council of the British Empire Leprosy Relief Association in 1925 (renamed as Hind Kusht Nivaran Sangh in 1947), the foundations were laid for the beginning of organised leprosy work in India. A Committee appointed by the Government of India in 1941 reviewed the extent of the leprosy problem in the country and made specific recommendations for anti-leprosy work. This was followed by another Expert Committee in 1954 that gave rise to concrete plans for the control of leprosy in India, including legislation.

The middle of the present century witnessed certain breakthroughs in the knowledge regarding causation, spread and treatment of leprosy. Organised efforts, supported by the national government, were launched in India to cure the affected, to contain further spread of the disease and impart education to the people about it. The present paper traces the development of anti-leprosy work in India leading to the National Leprosy Eradication Programme (NLEP) announced in 1983, including its achievements upto December, 1987, the imbalances of such efforts, the barriers in their promotion and the measures that may be integrated into future plans to achieve the goal of eradication of leprosy in the country by the year 2000 A.D.

CASE LOAD AND ITS DISTRIBUTION

World Scene

About 70 countries are reported to be endemic for leprosy with an estimated 11 million cases in the world. In the African region of WHO, 45 countries are endemic with a registered case load of 1.5 million. The problem has yet to be delimited to get accurate estimates in most countries of Africa. The Western Pacific region has about 2 million cases with China, Vietnam, the Philippines, Korea contributing about one-fourth of the cases. Of the countries in South and Central America, the largest number of cases appear to occur in Argentina, Brazil, Colombia, Mexico and Paraguay. The prevalence rates are lower than in endemic countries in Asia. In the South East Asia region, Burma has an estimated 7 lakh cases, Indonesia 2.5 lakhs, Bangladesh 1.5 lakhs, Thailand 1.4 lakhs, Nepal 1 lakh as against 40 lakh cases in India. Thus, one out of every third leprosy case in the world is in India.

Of the 11 million leprosy cases in the world as estimated by the WHO, about 5 million were registered in 1986-87; 3.8 million of them were from the South Asia region and 3.3 million were contributed by India alone. The African region has about 6 lakh cases, the American region 3.3 lakhs and the Western Pacific region 2.4 million registered cases.

About 1.3 million leprosy cases were under MDT at the end of 1987 in the world and about 1.1 million of them were in India.

Problem in India

A leprosy survey was included for the first time in India as a part of British Imperial Census in the year 1871-72. Later, its extent was reviewed in the country by the British Leprosy Commission in 1890-91. The prevalence rate of leprosy in India during the period prior to 1950 was essentially obtained as part of decennial population censuses. According to the census in 1931, there were about 160 thousand cases giving a prevalence rate of 0.5 per 1000 population. This would, however, be an under-statement becuase of several reasons, namely:

i. it included the cases with advanced forms of the disease only;

ii. all cases had not been reported because of the social stigma attached to the disease;

iii. many cases (early and with minor symptoms) were not recognised;

iv. errors in coverage of population.

Similar estimates available based on successive censuses may be seen in Table 1.

TABLE 1
PREVALENCE OF LEPROSY IN INDIA

Year	Population (million)	Estimated No. of leprosy patients (,000)	Prevalence rate (per 1000 population)
1871	198.291	108.81	0.55
1881	216.679	128.09	0.59
1891	274.334	126.24	0.46
1901	294.361	97.36	0.33
1911	315.156	109.09	0.35
1921	318.942	102.51	0.32
1931	324.753	159.80	0.49
1951	360.958	1,374.01	3.81
1961	439.118	2,561.60	5.83
1971	547.958	3,200.90	5.84
1981	685.185	3.919.337	5.72

Present estimates indicate that 20 to 25 per cent of all cases occur in children; nearly one-fourth are infectious and 15 to 20 per cent suffer from disabilities.

INTER-STATE VARIATIONS

While the disease existed all over the country, the inter-State variations in the prevalence rates and the percentage of population at risk were quite substantial.

The disease is widespread throughout the country. The current Statewise leprosy profile in the country is given in Table 2.

The subsequent reviews showed a slightly different pattern of endemicity. According to the 1987 review, there were States/UTs namely Pondicherry, Lakshadweep and Tamil Nadu with a registered prevalence of above 10 per 1000 population as against 5 in this category in 1981. The prevalence rates were between 5 and 10 in Andhra Pradesh, Bihar, Maharashtra, Orissa and West Bengal.

According to current estimates, about 430 million people were estimated to be at risk due to leprosy in areas with a prevalence rate of 5 and above/1000. The population at risk is uneven from State to State and even within the States.

Data collected from the States/Union Territories on the leprosy prevalence rates in each of the districts based on the latest information 1987 show that 196 districts out of 435 have a prevalence rate of 5 and above per 1000 population. This status was 201 against 412 districts in 1985.

EPIDEMIOLOGY

Leprosy occurs in all ages but new case occurrence is very low in infants and the very old. Prevalence of the disease is higher among adults than among children.

The disease affects both sexes with a preponderance in males. Incomplete detection of cases in females does not explain the difference.

The occurrence of high prevalence with a low proportion of lepromatous cases in some countries while in some others, low prevalence with a high proportion of lepromatous cases, suggests the influence of host factors.

Leprosy occurs more frequently in some families. Exposure to infection plays a more important role than hereditary predisposition.

The roles of climate, overcrowding in the house, nutrition, socio-economic status, literacy, etc. in the causation of disease have not been clearly established although the prevalence rates are high among groups with poor nutrition, overcrowding and low income.

TABLE 2

STATE-WISE LEPROSY PROFILE AND THE PROGRESS OF NLEP IN INDIA
DECEMBER, 1987

S. No.	Name of State	Population 1981 in lakhs	Estimated prev. Rate	Regd. Prev. prev.	No. of Distts. with PR <1	1-5	5+	Total	Distts. under MDT No.	Population	Cases	Cases on record	Cases under treatment	Cases discharged	Cases under MDT
1.	Andhra Pradesh	535.5	11.8	8.6	-	1	22	23	10	251.54	358897	461598	424159	723172	78998
2.	Arunachal Pradesh	6.3	3.6	2.3	-	6	4	10	-	-	-	1466	1466	687	75
3.	Assam	199.0	1.5	0.9	3	13	1	17	Nil	-	-	17577	17577	8545	3861
4.	Bihar	699.0	5.4	6.2	-	15	16	31	1	10.80	15760	435337	395610	168960	12977
5.	Goa	10.9	5.0	1.9	-	3	-	3	-	-	-	2082	2082	3090	1639
6.	Gujarat	341.0	2.9	1.9	12	2	5	19	3	47.47	32703	71201	68216	54887	22106
7.	Haryana	129.2	0.08	0.1	12	-	-	12	1	13.41	206	1086	1086	212	206
8.	Himachal Pradesh	42.8	1.6	1.1	6	6	-	12	1	3.03	NA	4751	4751	1878	NA
9.	J & K	27.0	2.2	1.2	9	5	-	14	-	-	-	5412	5412	1919	Nil
10.	Karnataka	371.4	6.0	3.9	4	10	6	20	2	59.25	31184	144718	116349	61302	23601
11.	Kerala	254.5	5.8	3.0	-	4	10	14	1	18.95	10042	76041	67338	49948	4055
12.	Madhya Pradesh	521.8	2.3	3.9	-	23	22	45	2	30.57	20727	203496	199478	76838	4746
13.	Maharashtra	627.8	6.2	5.5	-	11	19	30	9	132.44	171178	342572	324028	322074	38482
14.	Manipur	14.2	4.5	3.8	-	5	3	8	-	-	-	5402	3350	2408	153
15.	Meghalaya	13.4	4.6	1.2	3	2	-	5	-	-	-	1573	1573	1043	Nil
16.	Mizoram	4.9	1.0	1.3	2	1	-	3	1	3.40	246	631	631	232	246
17.	Nagaland	7.8	3.9	2.3	4	2	1	7	1	0.79	1700	1767	1767	550	143
18.	Orissa	263.7	12.1	7.9	-	-	13	13	3	101.79	149677	208229	202901	138284	60585
19.	Punjab	167.9	0.1	0.2	12	-	-	12	-	-	-	3183	3124	2458	361
20.	Rajasthan	342.0	1.6	0.5	8	19	-	27	1	17.71	6357	15648	14140	3679	6357
21.	Sikkim	3.2	7.8	1.1	-	-	4	4	-	-	-	338	338	98	237
22.	Tamil Nadu	484.1	12.9	11.3	-	-	20	20	10	235.13	404109	545129	451613	653970	58384
23.	Tripura	20.5	4.9	2.7	-	3	0	3	1	9.76	NA	5617	5617	2617	-
24.	Uttar Pradesh	1108.6	3.7	4.3	5	21	30	56	3	64.46	48766	479452	443527	206121	32092
25.	West Bengal	545.8	6.9	5.2	-	2	15	17	2	44.13	88793	284766	110321	74255	33100
26.	Andaman & Nicobar	1.9	4.9	4.9	-	1	1	2	-	-	-	940	940	1066	86
27.	Chandigarh	4.5	NA	1.3	-	1	-	1	-	-	-	595	595	24	555
28.	D&N Haveli	1.0	1.0	1.1	-	1	-	1	-	-	-	114	99	NA	Nil
29.	Delhi	62.2	0.4	1.6	-	1	-	1	-	-	-	9936	8752	NA	8752
30.	Lakshadweep	0.4	25.0	10.1	-	-	1	1	1	0.40	404	404	404	169	404
31.	Pondicherry	6.0	15.0	11.7	-	1	3	4	-	-	-	7008	5350	4306	336
		6818.3	5.7	4.9	80	159	96	435	53	1045.03	1340749	3338069	2882594	2582252	392537

The portal of entry of the bacilli is through the respiratory route and the skin. Similarly, the bacilli are discharged from the patient's nose, throat and skin.

The incubation period generally ranges between 3 and 5 years although it has been reported rarely as short as a few weeks/months or as long as 25 years.

Twenty to 25 per cent of the cases in the country are multi-bacillary (MB) and the rest are paucibacillary (PB). The risk of infection among family contacts of a MB case is eight times more than those with no leprosy case in their family and two times more than those with a PB case in their family.

CLASSIFICATION

The classification of leprosy followed under the NLEP with equivalents of different classifications is as follows:

	Other Classification	Current Classification	
		Multi-bacillary	Paucibacillary
1.	International (Madrid 1955)	i. Lepromatous ii. Borderline iii. Smear positive indeterminate, tuberculoid and Borderline tuberculoid	i. Tuberculoid ii. Indeterminate
2.	Ridley and Jopling	i. BB ii. BL iii. LL	i. I ii. TT iii. BT
3.	Indian	i. L ii. N L	i. T ii. MA iii. P under N iv. Early indeterminate under N L
4.	Indian Association of Leprologists (1981 Census)	i. Lepromatous ii. Borderline Lepromatous	i. Indeterminate ii. Tuberculoid iii. Pure Neuritic iv. Borderline Tuberculoid

EVOLUTION OF THE PROGRAMME

Leprosy Control Before 1955

Prior to the launching of the National Leprosy Control Programme in 1955, though anti-leprosy activities were available in the country, they were primarily concerned with the treatment of patients, and were organised by charitable missions and non-governmental agencies.

The physical facilities available were far from satisfactory. There were 152 institutions with in-patient facility for admitting and treating leprosy patients with a total bed strength of 19,600.

The inter-State distribution of beds was substantially uneven, the largest number being provided by the then Madras State (1:1261), followed by Manipur (1:3656) and Himachal Pradesh (1:4675). When contrasted with the estimated number of cases, the picture was really dismal in most States, with Uttar Pradesh being at the bottom, with 1 bed for 40,435 estimated cases.

In addition to 152 institutions with provision for in-patient care, there were 1,203 clinics in the country, providing out-patient services for leprosy patients. It was estimated that, on an average, there was one clinic per 300 thousand population, which again varied greatly from State to State. This, however, was quite understandable since most of anti-leprosy activities were being undertaken by several independent agencies such as voluntary organisations, religious institutions and charitable trusts without any plan and coordination to provide services on a rational basis. Lack of any organised efforts triggered off the governmental action to control the disease through the establishment of the National Leprosy Control Programme in 1955, based on the recommendations of an Expert Committee.

Current Status of National Leprosy Eradication Programme

The NLCP was launched in 1955, the last year of the First Five Year Plan, with the main objective of controlling leprosy through domiciliary sulphone treatment. It started as a Centrally Aided Scheme with its focus on rural areas of high and moderate endemicity. In the low endemic States, the expectation was to provide the leprosy services through the existing infrastructural facilities meant for general health services. The scheme was converted into a Centrally Sponsored Programme in 1969-70 to give impetus to control work.

OBJECTIVES

The programme did not have a clearly defined policy or operational objectives for nearly two decades. The Plan documents (1951, 1956, 1961 and 1969-74) only stated the problem and described the inputs that would be made available to strengthen the programme. In other words, the programme has all along been input-oriented and not performance-oriented. This was necessitated because of several factors:

i. lack of primary prevention (vaccine) and non-culturability of leprosy bacilli;

ii. non-availability of potent drugs for quick and complete care;

iii. isolation of 100 per cent cases was not feasible as benefits were not commensurate with the costs involved;

iv. the population was not fully co-operative due to the social-stigma attached to the disease; and

v. legislation on leprosy with its negative and un-scientific approach.

It was only from 1976 that the programme was made performance-oriented. Each of the States was given certain targets by the Government of India in respect of (i) new cases to be detected and brought under treatment; and (ii) number of patients to be discharged as disease-arrested or cured during each year. The targets, however, were based on certain assumptions (Appendix I).

STRATEGY

The strategy of the programme was to control the disease through reduction in the quantum of infection in the population, reduction of infective sources and breaking the chain of disease transmission. Four basic activities were envisaged, namely:

i. survey and case detection;

ii. registration of cases for treatment;

iii. provision of continuous treatment with sulphones to all cases, as close to their homes as possible; and

iv. education of the patients, their families, and the community about leprosy.

The NLCP was launched in the rural areas since 80 per cent of the population lived in the villages and a large percentage of cases was expected there. It was further considered that leprosy being a disease of rural incidence and urban prevalence, control in rural areas would automatically reduce the migration of cases. However, several indigenous foci have been observed in urban areas. Hence, during the Fifth Five Year Plan, it was extended to urban areas as well. It was stipulated that by detecting all cases and bringing at least 90 per cent of them under continuous treatment with sulphones, it would be possible to bring down the load of infection by about 80 per cent, thereby making the disease control effective.

While there has been a substantial expansion of the control activities and good results have been obtained in selected centres, the impact of the programme on the country as a whole has not been as expected. As mentioned earlier, large variations still exist in the prevalence of the disease,

not only from State to State but also from district to district in the same State. For example, in Tamil Nadu, the range of variation is from 5.0 to 28.7 per 1000, and in West Bengal from 4.0 to 25.0 per 1000. This unevenness called for an effective strategy for disease control in high endemicity districts on a priority basis.

Recently, with the discovery of a number of highly effective bactericidal drugs and better understanding of the disease, a radical change in the approach became necessary. Substantial reduction in the disease within a specified period of time appeared possible. In the meantime, there also developed in the country a new political will for controlling leprosy.

The late Prime Minister of India, Smt. Indira Gandhi, in her address to the World Health Assembly in May, 1981, made an appeal to all the developed countries, to help in leprosy eradication. While addressing a joint meeting of the Cabinet Committee on Science and Technology and Science Advisory Committee to the Cabinet in May, 1981, she again asked the Indian scientists to develop a leprosy eradication strategy. In pursuance of this determination, the Ministry of Health and Family Welfare constituted a Working Group to devise a new strategy and action plan for the control and ultimate eradication of leprosy. Dr. M.S. Swaminathan, the then Member, Planning Commission, was the Chairman and eminent scientists, leprologists and social scientists were the Members of this Committee.

The recommendations of the 'Group' brought about certain changes in programme administration and strategy, namely:

- the NLCP was changed into a time-bound eradication programme (NLEP) with the specific goal of arrest of disease activity in all leprosy cases by the turn of the century;
- the existing single drug therapy by sulphone was supplemented by one or more bactericidal drugs for treatment of the disease in the form of a campaign with a view to achieve its effective control;
- efforts were to be made to obtain self-sufficiency in the requirement of anti-leprosy drugs;
- measures were initiated to attract and retain medical officers in leprosy control services;
- the activities of voluntary organisations in leprosy control are recognised and supported;
- the Lepers Act 1898 has been repealed;
- mass education campaign has been intensified;
- community based rehabilitation of disabled leprosy patients is planned to be given priority;

- screening of pre-school children and youth is emphasised for detection of early leprosy;
- the National Leprosy Eradication Commission under the chairmanship of the Union Minister of Health and Family Welfare for programme policy guidance, and the National Leprosy Eradication Board under the chairmanship of the Union Health Secretary for monitoring the activities of the programme have been constituted and are in operation.

Organisational Structure

A five-tier organisational structure was created over the years as part of the NLCP/NLEP. The present basic elements of the structure are given in an organisational chart (Fig. 1).

The National Leprosy Eradication Commission (NLEC) functions as the policy making body for the guidance and surveillance of the programme. It is the responsibility of the National Leprosy Eradication Board (NLEB) to implement the plan and policies as laid down by the NLEC. An officer of the rank of Deputy Director General of Health Services is the Director of the programme and is basically responsible for planning, programming, organisation and implementation as per the policy decision of the NLEC and under the direction of the NLEB. The Programme Director is assisted by the technical officers of the rank of ADG and DADGs in planning, guiding and monitoring the programme and by the Central Leprosy Teaching and Research Institute, Chengalpattu, and three Regional Leprosy Training and Research Institutes at Aska (Orissa), Raipur (M.P.), and Gouripur (West Bengal), for assisting in manpower development and operational research.

The Additional/Joint Deputy Director of Health Services at the State level is the State Leprosy Officer. He performs the same functions at the State level as the DDG (Leprosy) does at the Centre.

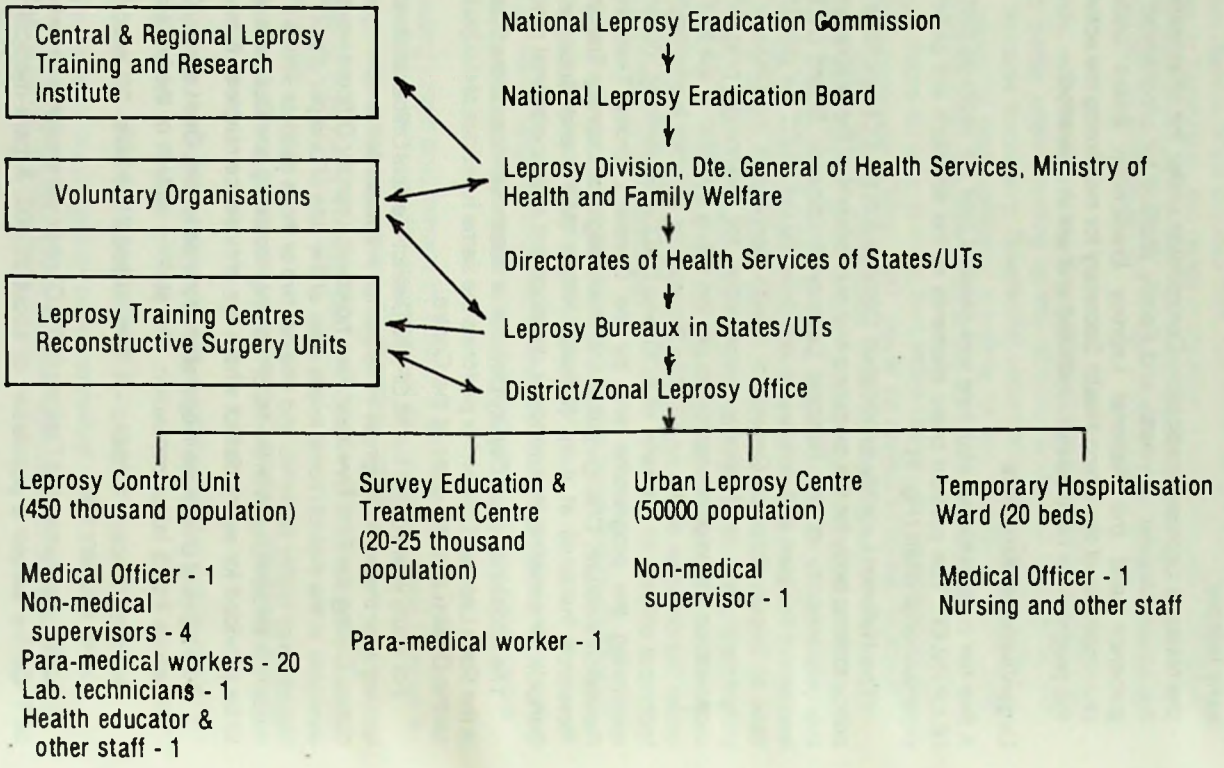
For many years under the NLCP, the District Medical Officer of Health was looking after the work of leprosy in his district, in addition to his numerous other duties. During the Fifth Five Year Plan, however, Leprosy Officers were made available at the district/zonal levels also, at the rate of one per district where leprosy was highly endemic and one per two or three districts where it was of moderate endemicity. With the NLEP coming into being, one DLO was planned to be provided for every district where the prevalence rate was 5 per 1000.

Two types of units were in operation at the periphery. One Leprosy Control Unit serves 4 to 5 lakhs population. The staffing pattern of the LCU is:

Medical Officer - 1, NMAs - 4, Para-Medical Workers - 20, in addition to other ancillary staff.

Survey, Education and Training (SET) Centres were established and each SET Centre serves a population of about 25,000. A para-medical worker

FIG. 1: ORGANISATIONAL CHART OF NLEP



(PMW) or a non-medical assistant (NMA) is given for each SET Centre and is attached to a PHC located in the area.

The programme was extended to urban areas during the Fifth Five Year Plan period. Urban Leprosy Centres (ULCs) were created at the rate of one per 50,000 to 70,000 population. Each ULC was manned by an NMA who functions under the supervision and guidance of a medical officer in-charge of the dispensary/hospital to which the ULC was attached.

In addition, facilities for hospitalisation of those needing special care were planned. Hospitals with facilities for reconstructive or corrective surgery were developed.

In order to facilitate understanding of the programme, its components, activities and responsibilities equally well by all concerned and to ensure that the peripheral workers perform their jobs in a uniform and comprehensive manner, several Operational Guides were developed during the 1980s and disseminated.

Infrastructure

After its introduction in 1955, as the NLCP progressed, a number of infrastructural facilities were developed during the successive Five Year Plans. The physical infrastructure in operation under the programme at the end of 1987 includes 601 Leprosy Control Units, 919 Urban Leprosy Centres, 6239 SET Centres, 215 district leprosy office units, 294 temporary hospitalisation wards, 45 leprosy training centres and 22 sample-survey-cum-assessment units. The organisational chart of the NLEP is given in Fig. 1 referred to earlier.

The salient features of the infrastructure development are summarised below:

- Creation of LCU started in the very first year of the programme.
- Establishment of SET Centres commenced during the Second Plan.
- Other facilities, especially urban leprosy centres and temporary hospitalisation wards, started during Fifth Plan period.
- During the Sixth Plan period, with the change in strategy and provision of additional funds, the achievement of the targets has increased.
- Inclusion of MDT in the programme called for an augmentation in the infrastructural facilities to be provided in a phased manner. It is envisaged that by the end of 1995 in all the 196 districts with a prevalence rate of over 5 per 1000, these facilities will be established.

It can be said that the programme acquired a major thrust with all-round development of infrastructural facilities to meet the varying needs of patients

during the Fifth Plan period and further significant impetus during 1980-88 following the introduction of MDT as a programme component.

Population Coverage

The total population covered upto 1966 was 54,724 million constituting 14.7 per cent of the endemic population of the country. About 16.3 per cent of additional population was covered during the Fourth Five Year Plan and another 35.99 per cent was provided for during 1974-77. The total population covered upto the end of 1985 was 439 million and 470 million by the end of 1987.

The State-wise estimated population, leprosy cases, leprosy prevalence rates, cases on record, cases under treatment and cases discharged as cured upto December, 1987 are given in Table 2. Year-wise detection, treatment and discharge of leprosy cases between 1980 and 1985 under the NLEP are given below in Table 3.

TABLE 3

NO. OF CASES DETECTED, TREATED AND DISCHARGED IN 1980-1988
(CASES IN LAKHS)

	No. cases detected	No. treated	No. discharged
1980-81	3.01	2.90	1.81
1981-82	3.68	3.47	2.59
1982-83	5.13	4.86	2.69
1983-84	4.82	4.56	2.69
1984-85	4.06	4.34	2.18
1985-86	4.08	4.60	4.45
1986-87	5.07	4.90	5.07
1987-88	4.49	4.33	5.03

A total 2.9 million cases have been discharged due to cure of the disease from the inception of the programme till the end of March, 1988.

Multi-drug Therapy (MDT)

Because of the problem of drug-resistance of bacilli towards Dapsone, the WHO Study Group on Chemotherapy of Leprosy in 1981 recommended the use of combined chemotherapeutic regimens based on sound microbiological principles for the treatment of all multi-bacillary and pauci-bacillary patients. The Working Committee report of 1982 mentioned earlier had emphasised the introduction of multi-drug treatment of leprosy cases in the country in a phased manner as one of the important strategies of the eradication programme.

Following a policy decision by the Government of India, a programme of combined therapeutic regimen (MDT) was launched in 1982 to replace Dapsone monotherapy for leprosy control. MDT was introduced in 15 endemic districts with the financial assistance of the Swedish International Development Agency through WHO in 12 districts and through UNICEF in 3 districts, between 1982 and 1985. Subsequently, 58 endemic districts were brought under MDT. Thus, 73 out of 196 endemic districts with over 50 per cent of the case load in the contry had been brought under MDT coverage by March, 1988.

Intensive 14 daily doses, and subsequently, monthly doses are given under the direct supervision of the Medical Officer. Cases detected on any day of intensive treatment are given supervised doses only for the remaining days of the 14-day course followed by monthly supervised and daily unsupervised treatment for a minimum of 24 months or till smear negativity, whichever is later. MB cases detected after administration of 14 intensive daily doses receive only monthly supervised and daily unsupervised doses for at least 24 months or till smear negativity.

The multi-drug treatment (MDT) regimen followed under the programme is as follows:

	MULTI-BACILLARY (MB) CASES		
Intensive for 14 days	Rifampicin	600 mg daily	Supervised
	Clofazimine	100 mg daily	Supervised
	Dapsone	100 mg daily	Supervised
	Rifampicin	600 mg once a month	Supervised
Continuation phase for a minimum of 2 years	Clofazimine	300 mg once a month	Superised
		50 mg daily	Unsupervised
	Dapsone	100 mg daily	Unsupervised
	PAUCI-BACILLARY (PB) CASES		
Continuation phase for a minimum of 6 months	Rifampicin	600 mg once a month	Supervised
	Dapsone	100 mg daily	Unsupervised

MDT was found to be safe and acceptable to the patients, and effective. In

the five endemic districts under MDT, the prevalence rate decreased by over 85 per cent after 5 years and there is a decline in the new case detection rates after 4 years of MDT. The deformity rates in new cases also greatly declined after 3 years of MDT. The relapse rate was low at 0.9 per 1000 MDT cases (1.2 for MB and 0.8 for PB cases).

MDT was also introduced in 5 low endemic districts (prevalence rate 5 per 1000) involving the general health care staff on an experimental basis during 1986-87. In these districts, the patients collect their drugs at the nearest primary health centre from the Medical Officer. Based on the experience gained, MDT will be extended to all the other low endemic districts in a phased manner.

In every district under Dapsone monotherapy, patients who have not improved clinically and/or bacteriologically after 5 years of Dapsone treatment are identified as Dapsone refractory cases and are put under MDT with the help of available staff. This step is expected to arrest the disease activity in these problem cases and prevent the spread of resistant bacilli.

Rehabilitation

Rehabilitation of leprosy patients is the joint responsibility of the Ministry of Health and Family Welfare and the Social Welfare Ministry. It includes physical, vocational and social rehabilitation. The physical rehabilitation rests heavily on medical personnel and involves the following activities: care of ulcers, correction of deformities, physiotherapy, proper health education, etc. Physiotherapy is useful for functional restoration. Under the NLEP, there are 13 Leprosy Rehabilitation and Promotion Units, 75 Reconstructive Surgery Units, and 294 Temporary Hospitalisation Wards to promote rehabilitation of deformed patients. The voluntary organisations are mainly providing the rehabilitation services in the country.

Health Education

The problem of leprosy is a complex one and has serious social overtones. A change about the image of leprosy in the minds of the people is as important as the treatment of diseased persons. For this, the active participation of the society and the patients is important. The people have to be educated about scientific facts of the causation and complete curability of leprosy and the prevalent prejudices and misconceptions have to be dispelled. Every worker under the NLEP is expected to be a health educator. However, inspite of the educational component incorporated in the methodology of leprosy control since the inception of the NLCP, the necessary messages have not reached the people to the desired extent. The financial outlays have been substantially enhanced under the NLEP towards health education from 1984-85 onwards.

Some voluntary organisations have been playing an important role in the dissemination of correct knowledge on the disease. The Gandhi Memorial

Leprosy Foundation, Wardha, has recently developed a master plan for mass awareness, health education and community participation by constituting a Task Force and the Health Education Plan. The Hind Kusht Nivaran Sangh continues to develop health education material for the use of medical and para-medical personnel and also the community, and to disseminate knowledge about leprosy.

Voluntary and International Agencies

A large number of organisations have been involved in various activities pertaining to the control of leprosy in India. While some of them are engaged in training, education and research, others are engaged, in addition, in case detection, treatment, rehabilitation and control work. A large number are voluntary, while some are governmental organisations and some others are international agencies.

Voluntary Organisations (VOs)

These organisations had been playing a pioneering role in anti-leprosy work in India. The first known leper asylum was established in Calcutta early in the 19th century followed by another in Varanasi.

Mission to Lepers, (now known as the Leprosy Mission) started in 1875, at Chamba (Punjab), has been by far, the biggest single agency, undertaking leprosy work. To evolve a mechanism for coordinating the activities of the voluntary bodies engaged in leprosy control activities among themselves and with the NLEP, annual meetings with representatives of voluntary organisations are organised by the Ministry of Health and Family Welfare, Government of India. Their number was about 150 in the country. Some of the prominent voluntary organisations in the field are:

- Hind Kusht Nivaran Sangh, New Delhi
- Gandhi Memorial Leprosy Foundation, Wardha
- Bharat Sevashram Sangh, Jamshedpur, Bihar
- Kashi Kusht Seva Sangh, Varanasi, U.P.
- Tapovan, Amravati, Maharashtra
- Hindu Mission, Madras, Tamil Nadu

International voluntary organisations are the pioneers in leprosy control work in India. They continue to play a major role in NLEP activities. The Leprosy Mission, German Leprosy Relief Association, Emmaus Swiss, Damien Foundation and Italian Leprosy Association are some organisations which have extensive field centres and are involved in different aspects of control/training/service of leprosy patients.

The contribution of voluntary organisations with regard to SET activities,

provision of hospital beds, vocational or medical rehabilitation, etc., as provided by 106 of them in 1987, is summarised as under:

About 6.0 crore population is covered under SET activities, about 8.0 lakh cases have been detected and about 6.5 lakhs are reported to be under treatment. About 3.0 lakh cases have been discharged, 16000 hospital beds are available for leprosy patients with 115 VOs. About 20,000 patients are undergoing vocational rehabilitation. A total 2941 medical and 8900 para-medical staff have been trained in leprosy control activities by 13 leprosy training centres of voluntary organisations. The annual budget of the voluntary organisations during 1987 was around Rs.32 crores. The Government of India provides grants to voluntary organisations involved in survey, education and treatment activities to partially meet the costs. Currently, about Rs.75 lakhs are given to eligible voluntary organisations.

Voluntary organisations are also running a number of leprosy homes, hospitals and vocational training institutes for rehabilitation of leprosy patients. Voluntary institutes are also playing a major role in vocational and social rehabilitation of deformed leprosy patients. Anandvan of Warora, running under the dynamic leadership of Baba Amte and Tapovan at Amravati in Maharashtra, established by the late Dr. S.G. Patwardhan, are shining examples of such rehabilitation centres. Considering that the majority of disabled leprosy patients are in rural areas, high investment-oriented rehabilitation centres like Anandvan, Tapovan, etc. may not be able to meet the demands. It is propsoed to encourage community based rehabilitation to help these rural disabled patients for restoration of lost functions and to impart appropriate skills based on the preference of individuals and feasibility, to make them physically and economically self-reliant.

International and Bilateral Agencies

Several international agencies such as WHO, UNDP, World Bank, SIDA, DANIDA, UNICEF, etc., are assisting the country in leprosy control. The most signficant role has been played by the World Health Organisation in evolving a global programme for leprosy control and providing technical guidance in formulating newer strategies from time to time.

WHO's special Programme for Research and Training in Tropical Disease covers leprosy and focusses on certain significant areas of research, which include:

1. development of better diagnostic tests;
2. determination of the prevalence of resistance to Dapsone;
3. development of improved methods of treatment including MDT; and
4. development of new drugs.

The Damion Foundation and Italian Leprosy Association have been

supplying the anti-leprosy drugs required under the programme. As mentioned earlier, SIDA is providing financial assistance for introduction of MDT in 18 endemic districts and UNICEF/Leprosy Mission in 3 districts.

Training of Personnel

Forty-five leprosy training centres were established during the successive Five Year Plans. Thirty-eight of them are located in the seven major States, namely, Andhra Pradesh (7), Bihar (3), Karnataka (4), Maharashtra (8), Tamil Nadu (8), Uttar Pradesh (4) and West Bengal (4). Institutional data available on the number of personnel of different categories trained and their annual training capacity will provide some insight into the performance of these institutions.

There are, at present, about 19,000 para-medical staff (PMW) in position, of whom about 5000 are untrained. Taking into account the vacancies arising due to manpower addition and transfers, it is estimated that, on an average, 1700 new and/or untrained workers would require to be trained annually in the coming years. The existing training capacity is adequate to fulfil this task. Over 20,000 para-medicals and 5,000 medical officers have been trained so far.

It is estimated that at any point of time, 1,500 doctors would be working full time on leprosy. Taking into account transfer of doctors from leprosy service, and their addition, about 250 doctors would require to be trained annually, and facilities for the same are available.

Involvement of the Primary Health Care (PHC) System

The NLEP continues to be a vertical programme in all 196 endemic districts. However, after 8-9 years of MDT, when the prevalence rates come down in these districts to less than 1 per 1000 population, the primary health care staff would take over the responsibilities of the NLEP with the help of a small number of leprosy staff. Steps have also been initiated to actively involve the PHC staff in low endemic districts (prevalence rate 5 per 1000) for improving the quality of NLEP activities in these districts.

Expenditure

At what cost were the foregoing infrastructural facilities for providing leprosy services established? The question, though apparently simple, is difficult to answer. Analysis of available data may throw some light on this question.

The NLEP had been a Centrally Aided Programme upto 1968-69 when it was developed, managed and financed by State Governments with assistance from the Government of India. However, during the Fourth Plan period commencing from 1969-70, the programme was fully supported by the Government of India as a Centrally Sponsored Programme and the total expenditure on it was to be chargeable to the Government of India but implemented by State Governments according to the guidelines of the Centre.

The year-wise/plan-wise expenditure of the Government of India under the NLCP/NLEP is as follows:

EXPENDITURE OF NLCP DURING SUCCESSIVE FIVE YEAR PLAN PERIODS

Plan period/years	Expenditure (Rs. in million)
1955-56	3.50
1956-61	52.90
1961-66	42.50
1966-69	6.30
1969-74	28.60
1974-79	202.30
1979-80	23.20
1980-85	412.00
1985-86	139.20
1986-87	153.90
1987-88	185.60

The expenditure on the NLCP suddenly increased during the Fifth Plan period when a large number of institutions came into being. This constituted more than 50 per cent of the total estimated expenditure on the NLCP. The expenditure during the Sixth Plan doubled that of the Fifth Plan, and the Seventh Plan expenditure will nearly double that of the Sixth Plan.

It may be mentioned that the expenditure currently incurred by the State Governments will be double of the Government of India's expenditure.

FINDINGS OF INDEPENDENT EVALUATION

The programme has been subjected to annual independent evaluation jointly by the Government of India and WHO since 1986, the first one in February, 1986, the second in April, 1987. Nine teams were formed with an experienced public work administrator and an epidemiologist from within the country representing the Government of India and a leprologist from outside the country representing WHO as members in each team.

The 1986 evaluation covered 15 States, 18 districts, 29 Leprosy Control Units/Urban Leprosy Centres, 42 villages and interviewed 72 para-medical staff, 182 patients and 134 community members. The 1987 evaluation focussed on in-depth examination of 5 districts which had been under MDT for

more than 5 years besides reviewing other components of the NLEP. The teams visited 15 States, 28 districts, 47 Leprosy Control Units/Urban Leprosy Centres and 103 villages, and interviewed 30 district leprosy officers, over 125 para-medical staff, 382 patients and 418 community members during the April, 1987 evaluation.

The conclusions and recommendations of the February, 1986, and April, 1987, joint independent evaluations are in Statements I and II respectively.

CONSTRAINTS

The programme has ben examined critically several times since its inception in 1955 and the limitations have been brought out by the examination reports.

It is a matter of satisfaction that both the Central and State Governments have been aware of the weaknesses affecting the programmes. A system of annual independent evaluation and continuous monitoring of the programmes has been established during the Seventh Plan period. The services of 13 full-time NLEP consultants with long and rich experience in the management of health programmes have been made available and each was assigned one or more States depending on the level of endemicity, population and geographic contiguity. These consultants guide the programme functionaries at State, district and peripheral levels and validate the reported NLEP data. Higher priority was given during Seventh Plan period for creation of sample survey-cum-assessment units in the States so that the reported data under the NLEP is validated independent of the set-up at district and lower levels. The constraints in the programme are listed below:

1. lack of motivation of workers and poor enthusiasm by senior Government officials;
2. lack of interest and support by medical men for leprosy work;
3. full complement of staff sanctioned has not been in position;
4. frequent transfers of medical officers and other field staff;
5. large number of untrained medical officers and para-medicals working for the programme;
6. lack of desired emphasis and priority to health education;
7. lack of rehabilitation facilities for the cured/deformed patients;
8. inadequate training in leprosy of undergraduate medical students, laboratory technicians, NMAs and PMWs;
9. delays in release of funds due to administrative bottlenecks;
10. non-utilisation of funds made available to the States;
11. inadequacy of vehicles and their disrepair and poor maintenance;

12. low priority to leprosy control by some States;
13. lack of operational research in leprosy to solve problems arising in the field;
14. lack of an effective monitoring system at different levels.

RESEARCH FINDINGS

Newer anti-leprosy drugs which are more effective and easy to administer have been developed/identified recently and field studies to assess their safety, acceptable dosages and regimens are yet to be initiated in different endemic areas of the world.

A vaccine against leprosy-one developed by WHO with killed ***M. leprae*** from arnadillos and two indigenously developed vaccines (ICRC bacillus and ***M.W***) from cultivable mycobaceteria are under different stages of trial. The relative efficacy of these vaccines will not be available for the next 6 to 7 years for using them as tools for immunotherapy/immunoprophylaxis against leprosy under the field programmes.

None of the available diagnostic techniques developed/described could as yet replace or improve the traditional skin smear examination and the clinical assessment of patients for diagnosis of leprosy.

The Indian Council of Medical Research is according high priority for leprosy research.

FUTURE PROSPECTS

The recent years have witnessed an increase in activities on various facets of the NLEP. For the first time, during the year 1987-88, the number of leprosy cases cured was higher than those detected and this trend is expected to increase consistently to achieve the goal set for the programme. The proposed annual targets for case detection and cure and the number of cases at the end of each year upto the year 2000 have been worked out to achieve the goal of arrest of disease activity in leprosy cases in the country, subject to the availability of adequate resources to create additional infrastructure and to extend MDT to all the districts in the country in a phased manner. Improved tools to prevent and control leprosy, if made available, would hasten the achievement.

With the early detection of leprosy cases and their complete cure, it is expected that the deformities will be prevented, thereby, further reducing the stigma attached to the disease.

SUMMARY

Leprosy is a major health as well as social problem in India. About 4.0 million leprosy cases are estimated to be present in India, one-fifth of whom are

infectious. Twenty to twenty five per cent of the cases in the country are among children while another 15 to 20 per cent have deformities. Cases have been reported from all over the country. However, the States of Tamil Nadu, Andhra Pradesh, Orissa, West Bengal, Nagaland, Bihar, Karnataka, Maharashtra, Meghalaya, Manipur, Sikkim, Tripura and the Union Territories of Pondicherry, Lakshadweep, Andaman and Nicobar Islands, Goa, Daman and Diu have prevalence rates of 5 and more per 1000 population in order to endemicity with 88 per cent of the cases resident in these States/Union Territories. Of the 435 districts, the prevalence rate exceeds 5 per 1000 population in 196 districts.

The National Leprosy Control Programme was in operation as a vertical programme since 1955 but it was only after 1982 that it received high priority from the Government of India. The National Leprosy Control Programme (NLCP) was redesignated as the National Leprosy Eradication Programme (NLEP) in 1983 with the goal of arrest of the disease in all known leprosy patients by the turn of the century. The programme has received 100 per cent financial support from the Central Government in all States/Union Territories in the Sixth and Seventh Five Year Plan periods (1980-90). The programme has been included in the 20-Point Programme of the Government since 1980.

The strategies formulated for achieving the above objectives are:

i. early detection and regular treatment of cases;

ii. multi-drug treatment (combination of drugs) to all the patients in place of administration of the single drug Dapsone;

iii. education of patients, their families and the community about leprosy and its curability;

iv. rehabilitation of cured patients with a view to make them economically self-reliant and socially acceptable.

By the end of 1987, there were 601 Leprosy Control Units, 919 Urban Leprosy Centres, 215 District Leprosy Units, 6239 SET Centres, 45 Leprosy Training Centres, 294 Temporary Hospitalisation Wards, etc., and 22 Sample Survey-cum-Assessment Units.

At the end of 1987, 3.30 million leprosy cases were on record and 3.04 million had been brought under treatment; 2.6 million cases had been discharged as cured/migrated/dead since the inception of the programme. During 1987-88, the number of cases discharged after cure exceeded the cases detected for the first time in the history of the NLEP.

In India, voluntary organisations (VOs) have played a pioneering role all through the history of leprosy control in the country. Since 1951, there occurred an extensive expansion in voluntary services for leprosy patients all over the country. Presently, about 150 VOs are actively engaged in leprosy relief services and information on their activities is available with the Government from 106 of them.

In recognition of the great potential of voluntary institutions in leprosy control, the Government of India has evolved a mechanism for annual meetings with them with a view to establish communication, to exchange information, to understand the nature of their work and to support and recognise their contribution.

The voluntary organisations currently contribute to the treatment of one-fourth of the leprosy cases on record in the country and the rehabilitation services to the disabled are provided primarily by the voluntary organisations.

Seventy-five Reconstructive Surgery Units and 13 Leprosy Rehabilitation and Promotion Units (LRPUs) are functioning under the NLEP to cater to the medical and vocational needs of disabled patients. The LRPUs aim at providing vocational rehabilitation besides facilities for surgical correction of deformed/disabled leprosy patients. The Social Welfare Ministry has plans to develop a pattern for providing grants-in-aid to voluntary organisations involved in vocational rehabilitation services.

The Lepers Act, 1898, has been repealed by the Government of India in respect of Union Territories without legislatures. The States of Maharashtra, Madhya Pradesh, Orissa, Kerala, Tamil Nadu, Tripura, West Bengal, Arunachal Pradesh, Uttar Pradesh and Mizoram have also repealed the Act. The Act is not applicable in Sikkim, Goa, Pondicherry and Rajasthan. Other States are expected to do so shortly.

High priority has been given to health education of patients, their families and the community since the inception of the programme, in view of the stigma attached to the disease. However, the inputs have increased substantially in recent years and all the available media and methods are employed to disseminate correct messages. Currently, about 95 per cent of the patients under treatment live with their families. However, treatment regularity among patients on Dapsone therapy has to be improved further through intensive education both before and during the treatment phase. The modern media of communication with the extension of network are to be involved to a greater extent in bringing about awareness.

Periodic reports received at different echelons are monitored. The reports have to be regular, timely and comprehensive. Field visits by supervisory staff are made to validate the accuracy of reported data.

In February, 1986, for the first time, the programme was subjected to an independent evaluation jointly undertaken by the Government of India and the World Health Organisation. Eighteen districts in 15 States were visited. The programme activities were considered very satisfactory at aggregate level. The programme was again evaluated in April, 1987, when 15 States and 28 districts were visited by the teams. The performance has been found to be highly satisfactory. Some constraints in the implementation of the programme at the grassroot level were identified and efforts to remvoe these constraints

are under way. The indepth evaluation of activities in districts under MDT for five years validated the reported encouraging results — MDT was found to be safe, acceptable and effective.

Forty-five Leprosy Training Centres established during successive Five Year Plan periods are functioning throughout the country to cater to the manpower development; 14 of these are with voluntary organisations. So far, over 20,000 para-medicals and over 5,000 medical officers have been trained.

During the Sixth Plan period (1980-85), about Rs.40.00 crores were spent by the Government of India and Rs.75.00 crores have been provided for the Seventh Plan period (1985-90) for the NLEP. An amount of Rs.13.90 crores was spent during 1985-86 and Rs.15.28 crores during the year 1986-87. During 1987-88, the expenditure has been over Rs.18.00 crores. States/Union Territories spend under non-plan, double this expenditure towards the cost of infrastructure created during earlier Plan periods. About Rs.75.00 lakhs were given additionally as grants-in-aid during 1986-87 to VOs involved in SET activities.

The Government of India has recognised the advantages of Multi-Drug Treatment (MDT) of leprosy cases over traditional Dapsone mono-therapy. The regimens recommended by WHO have been adapted to meet the operational and administrative requirements of the programme.

Before a leprosy endemic district is brought under MDT, it is ensured to have adequate infrastructure covering the total population, trained personnel, prior detection of at least 80 per cent of the estimated cases and creation of a district leprosy society to operate the additional funds provided by the Government of India to MDT districts. In view of the pre-requisites and the large quantity of anti-leprosy drugs and funds required for MDT coverage of all the cases in the country, MDT is introduced in a phased manner. Seventy-three leprosy endemic districts are currently under MDT, 1.9 million leprosy cases are present in these 73 districts.

The benefit of MDT activities is evident in the first 5 districts, namely, Wardha (Maharashtra), Purulia (West Bengal), Ganjam (Orissa), Srikakulam and Vizianagaram (Andhra Pradesh), which have completed an intensive treatment period of five years.

The efficacy of treatment regimens was uniformly favourable as ascertained during the evaluation. Drug side-effects were observed in about 4.0 per cent of MB and in less than 1.0 per cent of PB cases. None of the drug reactions proved fatal nor did any patient require hospitalisation for more than one month. In all these 5 districts, there has been a fall in the prevalence rates by over 80 per cent. The deformity rates declined markedly in the new cases detected in all the 5 districts compared to the earlier years. The annual new case detection also showed a decline during the 5th year after MDT. The relapse rate was very low with 0.9 per 1000 cases, 1.2 for MB cases and 0.8 for PB cases.

Plans have been made to achieve the goal of arrest of disease activity in all leprosy cases in the country by the year 2000 AD by working out annual targets for case detection, treatment and cure. These plans are operated subject to the provision of resources.

ASSUMPTIONS FOR STATE-WISE TARGETS

The following facts have been kept in mind in fixing the State-wise targets — 1976-77, NLCP.

1. For high endemic States/Union Territories namely, Andhra Pradesh, Bihar, Maharashtra, Nagaland, Orissa, Tamil Nadu, West Bengal and Pondicherry, the prevalence rate of leprosy in Leprosy Control Unit area and SET Centre area is taken, on an average, as 1.5 per cent and 0.7 per cent respectively. For other States/Union Territories, these figures are 1.0 per cent and 0.4 per cent respectively.

2. Targets are based on the number of sanctioned staff with the units/centres.

3. It is presumed that a PMW surveys a minimum population of about 5,000 in a year.

4. For the units/centres established up to the Fourth Plan, calculation has been made on the fact that about 15 per cent of the estimated number of cases in their respective areas should additionally be brought under treatment during 1976-77, because, including new cases and the undetected cases, the total number per year will sometimes exceed 20 per cent of the estimated cases of an area.

5. For the units/centres established or due to be established during 1976-77, during the Fifth Plan, calculation has been made on the fact that about 20-30 per cent of the estimated cases in their respective areas should be brought under treatment during 1976-77.

6. It is assumed that units/centres of 1976-77 will be working for about 3-4 months during the year.

7. About 15 per cent of the total cases that were brought and remained under treatment till the end of the previous year *i.e.* 1975-76, should be made bacteriologically negative and disease-arrested or cured during 1976-77 by treatment.

Source:

Government of India, Ministry of Health and Family Planning (Department of Health) — A communication issued to States vide their T. 11023/11/75-MTP (C&CD) dated 7.6.1976, under the National Leprosy Control Programme — Targets for the year 1976-77.

STATEMENT I

RECOMMENDATIONS OF INDEPENDENT EVALUATION OF NLEP FEBRUARY, 1986

1. Case detection in leprosy should be improved by:

   a. encouraging self-reporting through health education;

   b. strengthening surveys in urban areas;

   c. inclusion of survey as an essential activity in ULCs maintained under medical colleges; and

   d. adoption of rapid survey method for case detection.

2. While the prevalence rate for leprosy was in consonance with the number of estimated cases in most of the States, it was underestimated specially in Madhya Pradesh and Uttar Pradesh. This should be re-assessed.

3. All vacancies at different levels should be filled up expeditiously by trained personnel. The untrained staff in position at various levels should be quickly trained without dislocation of work. Only trained PMWs should be appointed and the practice of their recruitment in anticipation of future training must be discontinued.

4. The State Leprosy Control Officer should be at least of the status of a Joint Director, who has experience in leprosy work or of management of other health programmes with orientation training in leprosy. The District Leprosy Officer should be provided with sufficient office space and given adequate financial and administrative powers. His status should be at par with that of DHO/DMO/CMO.

5. Optimal utilisation of training capacity of the Training Centres requires to be ensured, the vacant posts of trainers filled and adequate educational material provided to them. Short-term reorientation courses on specific operational activities may be developed for para-medical workers.

6. RSUs created under the programme should be reactivated. Training facilities for specialisation in Reconstructive Surgery in leprosy should be augmented and stipends made available for trainees.

7. The disbursement of stipends to trainees should be as prescribed - in full, regular and timely. The financial allocations made on this account should be used only for this purpose and be fully utilised.

8. Laboratory services must be strengthened by:

   a. expeditious filling of sanctioned posts of laboratory technicians;

   b. revising the population and laboratory technician ratio realistically so

that there are at least 2 technicians for every 4 to 5 lakhs population;

c. recruiting in the place of laboratory technicians, workers trained as Smear Technicians having undergone a 3-month training course in smear examination;

d. provision of good microscopes and standard re-agents; and

e. introducing quality control through smear cross-check at the referral laboratories in the region.

9. Since the Modified Control Units are functionally identical with Leprosy Control Units, the disparity in the staffing pattern of the two should be removed by providing additional staff to the former.

10. The full utilisation of temporary hospitalisation wards must be ensured by bringing them under the administrative control of the SLO/DLO, thus establishing a link between the field and the specialised services.

11. The Urban Leprosy Centres should be fully integrated with the control programme and placed under the charge of the DLO.

12. The stock inventory of anti-leprosy drugs should be realistic. Requirement of drugs at the State and lower levels should be pre-planned, periodically reviewed to avoid shortage as well as ensure timely utilisation, specially of short shelf-life drugs.

13. Supervision at all levels and particularly in the field, needs strengthening to ensure regularity of treatment, accuracy of diagnosis and reliability of data. While timely submission of reports is necessary it is even more important to review them carefully and provide feedback on them.

14. The number of SSAUs established as independent monitoring structures in the programme should be increased to provide for wider coverage and improving validation of data.

15. The discharge of inactive cases needs to be accelerated. The existing criteria employed for assigning targets for case discharge do not possess reliable scientific validity. A Committee of experts may be appointed to go into the whole question of target allocation to States.

16. While the MDT programme has made a satisfactory take off, it must be ensured that it operates only as a vertical scheme. Only such new districts should be identified for introducing MDT that totally satisfy the prescribed pre-requisites. Identification of multi-bacillary, Dapsone refractory cases for providing them with MDT coverage is a timely step in the right direction. This should be closely monitored until its outcome is assessed.

17. In States like Himachal Pradesh, where the proportion of multi-bacillary patients is reported to be high, this should also be included, after due verification, as a criterion besides the prevalence rate for selecting a district for MDT.

18. There exists wide awareness in the community regarding leprosy. This should be fully exploited by strengthening the community's perception of the disease correctly through dissemination of appropriate messages, provision of educational material and imaginative use of media.

19. Display of charts, maps, histograms, tables, etc. on leprosy epidemiology and programme performance should be encouraged at all levels. The Programme Officer at the Headquarters may issue necessary advice in this regard.

20. The replacement of condemned vehicles should be an automatic and expeditious process. Necessary administrative steps be initiated in this direction.

21. The manual on guidelines for case detection, treatment, follow-up and reporting is a satisfactory, comprehensive and useful document. Its dissemination may be carried out widely. The manual may be translated into regional languages for use by the PMWs.

22. The existing co-ordination between the voluntary organisations and the programme personnel at various levels is praiseworthy. It may be ensured that grant-in-aid to these organisations is released timely by the Government of India.

23. While part-time leprosy specialists may continue to assist in making reliable diagnosis and classification of leprosy cases, there is need for full-time consultants, each made responsible for one or more States in respect of monitoring Dapsone monotherapy as well as MDT.

24. Having acquired experience of an independent evaluation of the programme and the establishment of baseline data, the NLEP should provide for this exercise each year.

25. Necessary steps should be initiated to meet the requirements of staff training, health education and programme monitoring in leprosy low endemic States.

STATEMENT II

CONCLUSIONS AND RECOMMENDATIONS OF INDEPENDENT EVALUATION OF NLEP — APRIL, 1987

1. The case detection in leprosy should be further improved by:

   a. greater efforts on the part of supervisory staff at all levels to unearth missed cases;

   b. strengthening contact and school surveys;

   c. greater emphasis on active case detection in urban areas with support from the medical profession; and

   d. involvement of NMAs in case detection as in Karnataka State, wherever possible.

2. While almost all the States over-reached the target of case detection and treatment, the discharge after treatment called for improvement in some States. A proportion of cases required to be removed from the records on account of death, migration or arrest of the disease.

3. The allotment of targets needed to be made more realistic; better and sensitive indicators of performance should be adopted.

4. Greater attention must be paid to retrieval of treatment defaulters, specially in areas under Dapsone monotherapy.

5. Data collection and reporting on relapse, reactions and Dapsone refractory cases was poor and should receive much greater importance.

6. Untrained staff at all levels in sufficient numbers existed within the programme. They should be expeditiously trained. The availability of trained manpower for the programme can be augmented by:

   a. improving the existing training capacity utilisation of the training centres;

   b. developing short-term 'Refresher Training' both for medical and non-medical workers; and

   c. stopping transfer of trained personnel working under the NLEP at least for a period of 5 years after they are trained.

7. The available training capacity at the national level for all categories of personnel and the training requirements in the country should be examined and mechanism evolved to ensure utilisation of surplus capacity.

8. In view of the workload, a definite staffing pattern existed for all types of organisational structures under the NLEP. It was a sad commentry that

vacancies in large numbers existed against sanctioned posts for all staff categories in many of the States. These need to be filled at the earliest.

9. The laboratory services continued to be neglected. In view of the key role these services played in the success of MDT, it is recommended that:

a. vacancies in lab/smear technicians should be filled up, and the additional post of laboratory technicians be sanctioned on top priority;

b. crash training courses for existing untrained technicians should be organised;

c. the quality of microscopes and reagents should be standardised;

d. an extra microscope should be made available to each laboratory to ensure uninterrupted work in the event of breakdown; and

e. quality control must be improved through constant cross-checking.

10. To strengthen planning, execution and monitoring of programme activities in the high endemic States, there is need for creating an additional post of a Deputy/Asstt. Director to assist the State leprosy office likewise, the performance in a district depends on the status and leadership provided by the district level officer; the status of District Leprosy Officer should conform to that of a District Health Officer/Chief Medical Officer/District Medical Officer of Health with commensurate powers.

11. The tendency to compile data only for onward transmission under the information system needs to be discouraged. Instead,it should be critically analysed to improve performance. The performance assessment should be backed up by complete and meaningful feedback. Suitable incentives may be introduced, as in the State of Maharashtra, for good work.

12. The inadequacy of existing supportive supervision and guidance should be replaced by effective managerial support to all functional levels.

13. To strengthen rehabilitation of the handicapped, the RSUs should be made fully operational and supported, where necessary, by the NLEP.

14. In view of the favourable impact discernible in the MDT districts, its expansion to other areas should be continued after due prior preparation. The practice of dispensing MDT without prior characterisation of patients, as observed in some Dapsone monotherapy districts in Karnataka State must be discontinued.

16. The impact of health education as evinced by greater disease awareness and increased self-reporting within the community must be further augmented to cover pockets of urban areas still suffering from prejudice. There should be greater emphasis on imparting knowledge on leprosy to these people.

17. There is need for an independent organisation outside the programme for continuous monitoring and establishing epidemiological indices. It is recommended that the existing SSAUs may be increased and new SSAUs provided where necessary to discharge these functions. Appointment of full-time NLEP consultants will also fortify this function.

NATIONAL INSTITUTE OF HEALTH AND FAMILY WELFARE (NIHFW) came into existence on 9th March, 1977, after the Government of India, realising the commonality of objectives of the two former institutions - National Institute of Health Administration and Education (NIHAE) and National Institute of Family Planning (NIFP) - and in pursuance of its policy to integrate health and family planning services, decided to merge these two institutions into an Apex Technical Institution.

As an Apex Technical Institute of its own kind in the country, the NIHFW has been actively engaged in the promotion of health and family welfare programmes through education, training, research, evaluation and advisory-consultancy and other specialised services.

In order to achieve these objectives, the NIHFW, apart from its regular M.D. Courses in Community Health Administration, also conducts 30-35 in-service training courses/workshops and seminars every year, which are attended by a variety of personnel ranging from high-ranking policy making officials and key trainers to the grassroot level workers.

Other activities of cardinal importance are research and evaluation in the field of health and family welfare. NIHFW conducts various research and evaluation studies at its own or in collaboration with other national and international agencies. The results of these studies are fed to the programme planners, administrators and managers.

NIHFW also provides advisory and consultancy services to the Ministry of Health and Family Welfare, to the States, voluntary organisations and international agencies in matters related to health and family welfare.

The Institute provides specialised services as a part of its education, training and research activities. These include clinical services, documentation, publication, audio-visual services and data processing services.

NATIONAL LEPROSY ERADICATION PROGRAMME

OPERATIONAL GUIDELINES ON CASE DETECTION, TREATMENT, FOLLOW UP AND REPORTING FORMS 1992

LEPROSY DIVISION
DIRECTORATE GENERAL OF HEALTH SERVICES
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LEPROSY DIVISION
DIRECTORATE GENERAL OF HEALTH SERVICES
MINISTRY OF HEALTH & FAMILY WELFARE
NIRMAN BHAWAN, NEW DELHI-110011

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FOREWORD

Leprosy is one of the oldest disease in the world, probably it is as old as mankind. There is perhaps no disease which, even today, has more myths and misconceptions, than leprosy. And it is ignorance and wrong attitude of people which cause many to shy away from treatment, bringing themselves even further psychological and physical suffering instead of consulting doctors early for a cure.

Leprosy continues to be a major public health problem in India. Leprosy cases are reported from all over the country. However, the prevalence of the disease is not evenly distributed. It varies from State to State as also from district to district. National Leprosy Control Programme has been in operation since 1955. It was redesignated as National Leprosy Eradication Programme (NLEP) in 1982-83. Under the Programme Multi Drug Treatment is extended to all leprosy cases to ensure their early and complete cure. Broad field of leprosy control encompasses wide variety of activities such as to develop a suitable and effective system of NLEP that reach the population, detect cases in early stages of the disease, ensure regular treatment with MDT and organise health education and rehabilitation services, etc.

Guidelines on leprosy case detection, treatment, follow up and reporting were developed in the form of a booklet in 1987 for doctors, medical students and leprosy workers. The present edition required rewriting to the extent of becoming effectively a new publication as a result of rapid progress in understanding leprosy. In a work like this, which attempts, in a small encompass, to cover the whole field of leprosy, it is difficult to maintain appropriate balance and focus. Viewed in this background, this booklet should prove to be indispensable for those actively involved in the programme planning and its implementation.

I am sure this book will be of immense help to the leprosy doctors, workers and other health personnel in the proper management of leprosy cases. I wish to take this opportunity to congratulate Deputy Director General, Health Services (Leprosy) and his team for their splendid effort in bringing about his edition.

(T.K. DAS)

ABBREVIATION

NLEP	National Leprosy Eradication Programme
VO	Voluntary Organisation
MB	Multibacillary
PB	Paucibacillary
BB	Mid Borderline
BL	Borderline Lepromatous
LL	Polar lepromatous
I	Indeterminate
TT	Polar Tuberculoid
BT	Borderline Tuberculoid
BI	Bacteriological Index
L	Lepromatous
N	Non-lepromatous
N?L	Borderline
T	Tuberculoid
MA	Maculo Anaesthetic
P	Pure Neuritic
MDT	Multidrug Therapy
MT	Mono Therapy
MIC	Minimum Inhibitory Concentration
MMDT	Modified Multidrug Therapy
RFT	Release From Treatment
RNA	Ribonucleic Acid
MO	Medical Officer
NMS	Non Medical Supervisor
PMW	Para Medical Worker
Lab.T	Laboratory Technician
DLO	District Leprosy Officer
ZLO	Zonal Leprosy Officer
SLO	State Leprosy Officer
LCU	Leprosy Control Unit
SET	Survey, Education and Treatment Centre
ULC	Urban Leprosy Centre
UT	Union Territory
M. leprae	Mycobacterium leprae

CONTENTS

1. INTRODUCTION

Leprosy is a chronic graulomatous infection of human beings caused by *Mycobacterium leprae* which attacks mostly superficial tissues, especially the skin and the peripheral nerves.

There are 10 million estimated cases of leprosy in the world. India ranks foremost amongst the countries saddled with this disease sharing nearly one fourth of the global leprosy load. The disease is present all over the country but it is not uniformly distributed. Its prevalence varies from state to state, district to district and within the district itself. The areas of high prevalence are found mainly in the south-eastern and central parts of the country, including the states of Tamil Nadu, Andhra Pradesh, Orissa, Bihar, Madhya Pradesh, Uttar Pradesh, Maharashtra and West Bengal. Between them, these eight states account for approximately 90% of the registered case load in the country.

About 15 to 20 percent of the leprosy sufferers are children below 14 years in age and an equal proportion of the patients suffer from deformities. The magnitude of the problem cannot be defined in terms of numbers alone. The age old social stigma attached to the disease leads to many a broken home and economic loss of production in farms, fields and factories.

2. NATIONAL LEPROSY ERADICATION PROGRAMME

The leprosy control programme has been in operation since 1955 but it was only in 1980 that the programme was accorded a high priority and redesignated as National Leprosy Eradication Programme. The approach to the control of leprosy is based on :

- provision multi-drug therapy to all patients;
- education of the patients, their families and communities about the disease and its curability; and
- physical social and economic rehabilitation of cured patients.

There are 455 districts in the country of which in 201, the leprosy prevalence rate exceeds 5 per thousand population (1985). Low endemic areas with prevalence rate below 1 per 1000 population are located in Haryana, Punjab, J & K, H.P. and Rajasthan.

3. MULTI-DRUG THERAPY (MDT)

The control strategy was so far based on dapsone monotherapy till 1982. Even as it was widely implemented in the country as a well organized programme and succeeded in decreasing the disease prevalence in several of the areas, a parallel decrease in disease incidence was not evident. Further, the problems of defaulting, drug resistance and bacterial persistence associated with dapsone monotherapy brought out its limitations as

a strategy for leprosy control. In 1982, the Government of India adopted the concept of treatment of leprosy cases with a combination of drugs to effectively shorten the treatment period and to break the chain of transmission of infection by regular and adequate treatment of all the cases. The drugs employed are dapsone, rifampicin and clofazimine. In 1983 MDT was started in 2 districts.

Under the programme the MDT scheme is being operated in three forms. In a vertical set up, MDT is provided by a separate, well-trained staff specifically meant for this purpose. Detailed guidelines for MDT operations have been provided in a printed form to the 201 districts with leprosy prevalence rate of 5 and above per 1000 people. MDT through a vertical set-up is being implemented in 135 districts. In districts with low endemicity, these services are provided by the existing primary health care staff. The third variant called the modified MDT scheme (MMDT) operates in the remaining 66 of the 201 districts with endemicity of 5 per 1000 or more. The MMDT differs from the regular vertical setup in the following important respects :

a. The district leprosy unit functions under the overall charge of the district leprosy officer.
b. Leprosy workers are provided to the district to the extent available. The MDT services are delivered through the primary health care set-up.
c. The medical officer of the primary health centre is the over all incharge of MDT operations.
d. Cash assistance is given to the patients for collecting drugs from the treatment points, and cash awards are provided to those completing treatment schedule in time. Cash assistance for detection/reporting of a new case is also provided.
e. The treatment points coincide with primary health centre, subcentre, community health centre and hospitals and dispensaries.

It is needless to say that the best drug combination will be doomed to failure unless the regularity of drug intake is maintained and the prescribed treatment schedule completed.

This manual gives instructions for the efficient and effective performance of principal activities related to the revised strategy. It does not aim at covering all aspects of the programme but gives practical guidelines for effective and efficient performance of key activities.

4. CASE DETECTION

The success of the leprosy control programme is dependent upon

early finding and management of cases. Leprosy is a disease with a long and uncertain incubation period. Very early signs and symptoms of the disease in many patients are not noticeable by patients nor in any way affect his life pattern. By the time the patient becomes aware of the manifestations and presents for advice, there may be a lag period of 2-3 years. Hence, potentially infectious cases may harbour a high quantum of bacilli in their body before the clinical disease becomes well evident. Early detection of disease can be promoted by health education and repeated and continuous examination of population.

Early detection of all types of patients is important but emphasis must be placed on patients discharging and transmitting infection with *M. leprae*. Bacteriological and epidemiological studies have clearly established the infectiousness of multibacillary patients. The frequency of disease is also highest among contacts of smear positive patients. Hence multibacillary patients should be the prime target of case detection.

The two principal approaches to case detection are :

- Passive case finding
- Active case finding

4.1 Passive Case Finding

Voluntary case reporting forms the main basis of passive case finding. In recent years there has been a significant increase in the proportion of self-reporting patients in the programme. Increasing self reporting indicates not only greater awareness of the disease but also a degree of confidence on the part of the community regarding the efficacy of available treatment and a reduction in social stigma. It should be encouraged by utilizing all available resources including the mass media. Several operational studies have shown that patients reporting voluntarily tend to be more regular for treatment compared to those detected by other methods. This fact alone is sufficient to justify concerted efforts on all fronts to intensify promotion of health education.

Contacts should be made with other medical institutions and social organizations within the district to encourage wide dissemination of information regarding the leprosy eradication programme.

4.2 Active Case Finding

Surveys constitute important operational activity for active case finding. Total population surveys should be intensified in all highly endemic areas. Efforts should be directed at obtaining at least a 90% coverage in all the villages. The districts should be covered within 3 years. In this connection, family surveys or surveys of selected groups of population, such as school children, industrial labourers etc., holding youth camps, skin camps

and enlisting the support of students under NSS and NCC may also help in case detection. Involvement of teachers, private practitioners, medical students and interns can also promote identification of early cases.

The surveys should be time bound and target oriented. Their progress should be monitored at periodic intervals. Contact surveys should be organized every year. While contacts of all patients should be examined annually, highest priority need to be accorded to contacts of multibacillary patients. Rapid survey of families and HE will yield good results.

In areas known for higher incidence of leprosy in children, school surveys should be carried out on priority with appropriate maintenance of records.

Case detection in urban areas present special problems. Case finding in these areas should focus on intensive health education with the use of mass media, such as news papers, radio and television. Contact surveys, school surveys and mass surveys in slums, tenements and industrial groups should be regularly undertaken.

5. DISEASE CLASSIFICATION

The manifestations of leprosy are many and variable. Its classification is based on clinical and histopathological findings and examination of skin smears. The two major polar types are lepromatous leprosy and tuberculoid leprosy. Classification within the borderline region is less precise. In addition, an early indeterminate form is seen which may develop into one of the three forms mentioned. However, for the purpose of eradication programme, leprosy patients are divided into multibacillary (MB) and paucibacillary (PB) types. The former is infectious while the later is not.

There are several classifications of leprosy in use. The equivalents of various types is presented in table - 1 below. It is recommended that the states/UTs follow the classification endorsed for the programme.

TABLE 1

Equivalents of Different Classifications of Leprosy

S. No.	Other Classification	Multibacillary		Current Classification Paucibacillary	
1.	International (Madrid 1953)	i	Lepromatous	i	Tuberculoid
		ii	Borderline lepromatous	ii	Indeterminate
		iii	Smear Positive Indet-erminate, tuberculoid and borderline tuberculoid	iii	Borderline tuberculoid
2.	Ridley and Jopling	i	BB.	i	I,
		ii	BL	ii	TT
		iii	LL	iii	BT.
3.	Indian	i	L	i	T

		ii N?L	ii MA
		iii P under N	
		iv Early indeterminate under N?L	
4.	Indian Association of Leprologists (1981) Consensus	i Lepromatous	i Indeterminate
		ii Borderline lepromatous	ii Tuberculoid
			iii Pureneuritic
			iv Borderline tuberculoid

6. CLINICAL EXAMINATION

The main objective of the clinical examination is to diagnose leprosy, identify the clinical type, and distinguish between paucibacillary and multibacillary patients. This will enable the field workers to decide on the proper treatment regimen, the duration of treatment as also the plan of surveillance.

The clinical examination should be undertaken systematically, preferably in day light by a medical officer or a senior paramedical worker. As for any other disease, it should include history taking and general examination of all systems. It is not the purpose of this booklet to document the manifold signs and symptoms of leprosy. Suffice it to say that the patients complaints should be checked for the presence of patches on the skin, anesthesia, sensations of the tingling and numbness, nerve enlargement, nodules anywhere over the body, shiny, oily skin, loss of sweating and presence of any ulcers. Complications such as fever, erythematous swellings, tenderness along the peripheral nerves and involvement of eye should be looked for. The clinical findings should be carefully noted in the performae prescribed in the programme for this purpose.

7. BACTERIOLOGICAL EXAMINATION

Bacteriological examination is an essential pre-requisite to classification and for commencing treatment. Subsequently, it is required during the surveillance period. It should be performed by a person trained for proper collection, staining and examination of the skin smear.

In stained skin smears, *M. laprae* can be seen lying singly, in clumps or in compact masses called globi. the *Ziehl-Neelsen* method of staining is recommended. In a properly stained skin smear the leprosy bacilli appear bright red and everything else takes the blue colour of the counter stain. The *M. leprae* retain the property of staining with carbol fuchsin even when dead. This may mislead the technician in concluding that the patient is not making progress on treatment. it is, therefore, important to distinguish between living and dead bacilli. The living bacilli appear as uniformly stained

rods while the dead bacilli take irregular staining or appear as granules (granular bacilli).

The bacteriological index (BI) should be reported on Ridley's scale which has a maximum reading of 6. The number of sites from where the smears are made should not be less than 3, out of which 2 sites should be from active lesions. The smears should be fixed and transported to the laboratory within a week.

8. OTHER LABORATORY INVESTIGATIONS

Facilities for additional laboratory investigations should be available. These include chemical and microscopic examination of urine, estimation of haemoglobin and performance of liver function tests. These investigations should be carried out wherever clinical examination indicates the need for these tests.

9. DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS

9.1 Diagnosis of leprosy is based on the following cardinal signs :

- skin lesion either hypopigmented/erythematous patch with or without infilteration;
- partial or complete loss of sensation;
- thickened nerves with or without tenderness/pain;
- demonstration of *M. leprae* in skin smear;

Presence of any two of these four cardinal signs will confirm diagnosis of leprosy.

9.2 A large number of neurological and dermatologic disorders may mimic leprosy. The scope of this publication does not permit any detailed discussions of these diseases. It may, however, be emphasised that the leprologists tend to over-diagnose leprosy (due to lack of knowledge of several of the skin and some neurological or general medical problems). Under the pressure of annual targets given to the states for detection of new cases, the problem of over diagnosis is further accentuated. It cannot be overemphasised that a combination of a chronic skin disease and peripheral nerve involvement should always lead to the consideration of leprosy. The skin lesions of leprosy, especially of paucibacillary disease, are characterized by hyposthesia, and peripheral nerve involvement can always be demonstrated. The peripheral neuropathy due to diabetes mellitus, collagen diseases or syringomyelia may be confused with leprosy, but skin involvement is not a feature of these diseases.

With the advent and successful implementation of MDT, there is a sharp fall in the prevalence rate of leprosy, though the incidence remains static. The peculiar phenomenon observed is that, most of the new cases

are with one or two lesions, Diagnosis of such cases is a problem when it occurs in children. Sometimes the cardianal criteria for diagnosis also may not hold good in such circumstances. Many dermatological diseases mimic leprosy and should be differentiated and if the diagnosis is still doubtful, should be kept under observation.

The skin lesions with following features should not be considered as leprosy:

1. Linear pale macular lesions with definite sharp margins since birth.
2. Hypopigmented, ill defined single or more patches over the face of children - look for other signs of avitaminosis.
3. Single or more round or oval hypopigmented patches with fine adherent scales having well defined margins over the cheeks of children -spontaneously heal with change of climate or respond well to topical steroids.
4. Hypopigmented or erythematous (red), slightly scaly or itchy, lesions seen on the seborrhic areas of the body viz : between the scapulae on the back, retroauricular or nasolabial fold - responds to topical steroids.
5. Severely itchy round lesions with marginal vasicles and central healing-responds well to antifungal agents.
6. Small round hypopigmented lesions on the neck or trunk with powdery scales, itches on sweating - respond well to antifungal agents or simple keratolytic (peeling) agents.
7. Round dry scaly plaques, usually symmetrical on the back of elbows or on the anterior aspect of knee joints. On removal of these silvery scales bleeding points can be visible.
8. Annular itchy plain skin lesions on plaques with papular or smooth nodular edges, usually in the hands of children.
9. Erythematous (red) round or oval itchy plaques with history of sudden onset - respond well to anti histamines.
10. Single round or oval mildly itchy lesions with (petaloid) fine scales on the margins, mainly seen on the trunk.
11. Butterfly lesions on the front of face or lesion of any shape on other parts of the face or sun exposed areas. These lesions are with raised margins, central atrophy or depigmentation and scaling.

10. DISEASE ACTIVITY STATUS

When patients receive only dapsone treatment, there is great reluctance in releasing them from control (RFC). Over the years, this has

resulted in substantially increasing the unproductive work load of the peripheral workers besides integrating prevalence rates. For efficient operation of the programme, a clear distinction must be made between the active case and those in whom the disease has become inactive. The later are of no immediate epidemiologic significance. Timely release of such patients from control is essential so that the manpower can be released for greater coverage.

A patient without any sign of clinical activity and with negative bacteriologic findings should be considered as an "inactive case". The signs of activity are :

- erythema and infiltration;
- extension or appearance of new skin lesions;
- extension of anaesthesia or paresis/paralysis or development of new anaesthetic areas;
- tenderness pain of nerves;
- presence of acid fast bacilli; and
- occurrence of reactions.

In the absence of these signs, the patient should be considered clinically inactive. In clinically inactive cases after dapsone monotherapy, regular treatment with dapsone should be continued for 1 year in paucibacillary patients and for 5 yrs in multibacillary cases before their release from control.

Because of the risk of relapse, the paucibacillary patients should be under yearly surveillance for several years after the treatment has been stopped.

In those districts where the treated patients have not yet been identified as inactive, the paucibacillary cases without any sign of clinical activity and with negative bacteriology, can be directly released from control provided.

- they have taken dapsone regularly for at least 3 years and
- the decision is taken by a medical officer or senior paramedical worker.

11. CHEMOTHERAPY

It has been estimated by Shepard that in a new untreated multibacillary patient, the bacterial population is 10^{12} organisms, 1/10th of which are alive ie 10^{11}. The principles of combined chemotherapy depend on the fact that if the bacterial population is rapidly reduced from 10^{11} to 10^{5} or less, the emergence of new resistant mutants can be minimized or stopped. The evidence based on the chemotherapy of tuberculosis shows that the more rapid the anti-bacterial effect, the less

likely are the persisters to emerge. If a drug has only bacteriostatic activity, the bacilli resume multiplication as soon as the serum level falls belowthe minimum inhibitory concentration (MIC). Compliance of treatment, therefore, becomes critical. When the drug has bactericidal activity, the compliance become less critical.

Objectives : The objectives of multi-drug treatment are :

- to sterilize the leprosy lesions in the shortest possible period of time so as to interrupt the transmission of infection;
- to prevent the emergence of resistant strains of *M. leprae*;
- to cure the patient, minimize the development of deformities and prevent treatment failures; and
- to prevent relapse.

The three drugs employed in the programme are dapsone, rifampicin and clofazimine.

Dapsone : Dapsone is cheap, effective and virtually without toxicity. At a dose of 100 mg daily it is weak bactericidal against *M. leprae* in man. Such a dose results in peak serum levels that exceed the minimum inhibitory concentration (MIC) of dapsone against leprosy bacilli by a factor of 500. This large therapeutic margin is exceptional and unique. At this dose the drug inhibits the multiplication of mutants of *M.leprae* with low or even moderate degrees of dapsone resistance. Dapsone has a long half life of about 24 hours.

Rifampicin : It is highly potent bactericidal drug and its rapid action in killing *M. leprae* is due to inhibition of ribonucleic acid (RNA) synthesis. It is effecitve against dapsone resistant bacilli.

Clofazmine: This is a red Riminophenazine dye which is bacteriostatic in action. It is virtually non-toxic when administered in doses not greater than 100 mg daily. However higher doses are used to manage type II reactions.

11.1 Treatment of Multibacillary Leprosy

The treatment of choice for multibacillary leprosy is by combined chemotherapy. Even though the MDT cover in the Indian programme has rapidly expanded ever since its commencement in 1983, however, due to financial constraints and other, it has not been possible for MDT to reach every district. Still, for sometime to come dapsone alone will continue to be the main stay in the treatment of leprosy in non-MDT districts.

11.1.1 Dapsone Monotherapy

Because of its safety and effectiveness, dapsone is pre-eminently suited for domiciliary treatment. Care should, however, be exercised to prevent the emergence of dapsone resistant strains of *M. leprae* by

- using the drug in full doses; and
- ensuring un-interrupted, daily treatment.

a. Regimen

Adults : Dapsone 100 mg daily self-administered.

Children : Dapsone is given in doses of 50 mg daily in children between 6 to 14 years in age. In the unlikely event ot the child with multibacillary disease being below 6 years, the dose should be further reduced to 25 mg daily.

b. Duration of Treatment

Treatment should be continued until the patient becomes clinically inactive and bacteriologically negative for which assessment should be carried out once every year. Compliance of drug intake should be regularly monitored by tablet counting and spot test of urine, wherever possible. Once inactivity is achieved, regular dapsone treatment is full dose should be carried out for a further period of 5 years. Thereafter, the patient should be kept under yearly surveillance, without treatment, to detect any relapse.

On this regimen, the majority of the patients become clinically inactive and bacteriologically negative within 5 to 6 years. If at the end of 7 years, this does not happen, the patient should be comprehensively reviewed clinically as well as bacteriologically by the medical officer and referred to the specialist for opinion. Such refractory responders are likely to be dapsone resistant and, therefore, need to be treated with combined therapy.

If at any time during the course of monotherapy, the patient shows evidence of clinical and bacteriological deterioration, it is likely that secondary dapsone resistance has supervened.

The reappearance of solid bacilli in the skin smears (MI) strongly suggests secondary dapsone resistance. These patients again need to be referred to the specialist for combined chemotherapy.

11.1.2 Multidrug Treatment

In the NLEP, combined chemotherapy with dapsone, refampicin and clofazimine is carried out in districts that are under the MDT and modified MDT programmes. In these districts all the leprosy patients both multibacillary and paucibacillary are to be subjected to the prescribed regimen of

treatment. In addition, multidrug treatment is resorted to in districts under dapsone monotherapy for certain categories of patients as described here under.

The criteria for selection of multibacillary patients in a MDT district are :

- all skins smear positive patients irrespective of their classification;
- all clinically active BB, BL and LL patients whether skin-smear positive or negative;
- all active BT cases with ten or more lesions including nerve and skin lesions, irrespective of their smear status;
- all skin smear positive relapse after dapsone monotherapy or MDT irrespective of the classification;
- multibacillary patients on dapsone monotherapy who have become bacteriologically negative within the last 24 months;
- paucibacillary patients on MDT, who at the end of 12 months of therapy shows new lesions or extension of old lesions.

In districts under dapsone monotherapy :

- multibacillary patients who do not show clinical inactivity and/or gross reduction of bacterial load after 5 years of regular dapsone monotherapy;
- paucibacillary patients who do not show clinical inactivity after 2 years of regular treatment with dapsone monotherapy;
- relapsed multibacillary or paucibacillary cases during or after dapsone monotherapy; and
- proved or even suspected patients of dapsone resistance - primary or secondary.

a. Regimen

All the registered cases will receive daily supervised treatment in the initial 14 days as follows :

Rifampicin	600 mg
Clofazimine	100 mg
Dapsone	100 mg

(This daily intensive therapy for 14 days should however be used only when separate instruction have been issued).

Patients appearing for the first time on any day of the intensive course will be given daily supervised doses only for the remaining days of the intensive 14 day course. Registered cases who missed the intensive course and new cases detected after the intensive phase of treatment is over, will receive only pulse treatment as prescribed in the continuation

phase. The supervised doses are meant to be ingested by the patient in the presence of the medical officer or the non-medical supervisor.

The supervised 14 day intensive phase of treatment is followed in the districts where the MDT programme functions under the vertical set-up. In the modified MDT districts, however, the 14 day intensive treatment course has been dispensed with. In these districts, all the registered patients start with pulse treatment in the continuation phase, as described below.

Continuation Phase : The treatment is given at least for a period of 2 years with the following drugs :

- Rifampicin : 600 mg, once a month supervised.
- Clofazimine : 300 mg, once in a month supervised and 50 mg daily self-administered.
- Dapsone : 100 mg daily, self-administered.

Note :

1. Adults less than 35 Kg in body weight should receive 450 mg rifampicin daily, during the intensive phase and thereafter once a month in the continuation phase.
2. The daily 50 mg clofazimine is recommended to be self-administered as it helps in patients compliance. If 100 mg capsules only are available, the drug should be taken on alternate days.

Children : In children, the doses are proportionately reduced. The recommended schedule for children in the age group 6-14 years is given in table-2.

TABLE- 2
Recommended dose for Children

Phase	*6 to 9 years*	*10 to 14 years*
Intensive for 14 days	Rifampicin 300 mgm daily Clofazimine 50 mgm daily Dapsone 25 mgm daily	Rifampicin 450 mgm daily Clofazimine 50 mgm daily Dapsone 50 mgm daily
Continuation for a minimum of 2 years	Rifampicin 300 mgm once monthly Clofazimine 100 mgm once monthly and 50 mgm twice weekly Dapsone 25 mgm daily	Rifampicin 450 mgm once monthly Clofazimine 150 mgm once monthly and 50 mgm on alternate days Dapsone 50 mgm daily

Duration of Treatment : The treatment should be continued for a minimum period of 24 months or until skin smear becomes negative, whichever is later. Smear negativity means absence of *M. leprae* in skin smears on 2 consecutive occasions at monthly interval, from at least 3 sites each time. If there is no favourable response in the disease activity after 3

years of treatment, the patient should be referred to the consultant leprologist. By favourable response is meant that either the signs and symptoms decline as evidence by flattening of raised lesions, subsidence of nodular lesions and neurites. There should be no extension of infiltration or anesthesia or a reduction in BI.

b. Regularity of Treatment

Adequate treatment implies that the patient has taken 24 monthly supervised doses of combined therapy in 36 months. A patient may be considered on regular treatment, if the combined therapy has been taken for at least two-thirds of the period at any interval of time. For example, if the patient has had 8 full months of combined treatment during the 12 month period, he or she can be considered to have received regular treatment.

The above multidrug treatment is designed for all categories of multibacillary patients, including

- freshly diagnosed untreated cases;
- patients not responding satisfactorily to previous dapsone monotherapy;
- dapsone resistant patients; and
- patients who have relapsed while on dapsone monotherapy or after its cessation.

11.2 Treatment of Paucibacillary Leprosy

11.2.1 Dapsone Monotherapy

Regimen :

Adults : Dapsone 100 mg daily self-administered

Children: The dose should be proportionately reduced to 50 mg daily for children in the age group of 6-14 years. In children 5 years old or less in age, dapsone should be given in a dose of 25 mg daily.

Duration of Treatment : The treatment should be continued till the patient is declared "inactive". Once inactivity is achieved, treatment should be continued for 1 year before the patient is release from control (RFC). Surveillance is not required, but the patient should be advised to report to the clinic if symptoms recur or lesions develop.

The vast majority of patients will become clinicaily inactive within 3 years and no purpose is served in treating these patients beyond 3 years. If inactivity is not achieved within this period, these patients should be carefully reassessed by medical officer to ensure that the diagnosis and classification are correct. This refractory response is presumptive evidence of primary resistance and these patients may need combined chemotherapy. They shoud be referred to the consultant leprologist.

11.2.2 Multidrug Treatment of Paucibacillary Patients

Paucibacillary multidrug regimen is required for Indeterminate, TT and BT cases as well as for pure neuritic patients, provided they are smear negative.

Regimen :

Adults : Rifampicin is given once a month in a dose 600 mg under supervision and dapsone 100 mg daily, self-administered For adults below 35 Kg in weight the dose of rifampicin should be 450 mg once monthly and dapsone 50 mg daily.

Children : The dose should be proportionately reduced as shown in table - 3.

TABLE- 3
Dose for Children with Paucibacillary Leprosy

Drugs	*0-5 years*	*6-14 years*
Dapsone daily	25 mgm	50 mgm
Rifampicin monthly	300 mgm	450 mgm

Duration of Treatment : Treatment should be continued till 6 of the monthly doses have been administered. If the treatment is interrupted for some reasons, the regimen should be recommended from where it was left off to complete the full course, provided that 6 monthly doses are given within a period of 9 months. Clinical and bacteriological assessment must be under-taken by a medical officer or a non-medical supervisor. Treatment can then be terminated if :

- there is no extension of existing lesions or appearance of new lesions; and
- there is no new nerve involvement or paresis/paralysis.

Before discharge, the patient should be informed that the reduction or disappearance of the lesions would occur gradually and that, if at any time, new lesions appear, he must report for advice immediately; also, that it was not necessary to seek treatment elsewhere.

It takes nearly 6 months for clinical inactivity to be achieved with chemotherapy. The purpose of the short term course is to render the patient free from viable bacilli and to initiate regression of the disease. Resolution of skin and nerve lesions takes place gradually, brought about by the high cell-mediated immunity. It should also be remembered that some lesions are only partially reversible or even irreversible and may, therefore, persist. Rarely, lesions of a trophic or degenerative nature may occur much later and should be ignored.

Occassionally on completion of adequate treatment (6 supervised doses of rifampicin), the lesion may not show regression This is liable to occur especially in patients who are smear negative and have multiple lesions, widely disseminated symmetrically or bilaterally. The diagnosis then, should be carefully reviewed by the medical officer after detailed clinical and bacteriological examination for any error in classification. If the classification was correct, the treatment should be continued with rifampicin and dapsone in the same doses for a further period of 6 months. If the disease was wrongly classified, the treatment should be changed to that recommended for multibacillary disease.

11.2.3 Regularity of Treatment

For paucibacillary patients, adequate treatment implies intake of 6 doses of combined therapy at monthly interval within a period of 9 months. Such patients when taken off the drugs will be said to have 'completed treatment'.

Type of patients : The proposed regimen is designed for the treatment of all categories of paucibacillary patients including :

- newly diagnosed and previously untreated patients;
  primary dapsone resistant patients; and
  dapsone treated paucibacillary patients who relapse.

12. ASSESSMENT AND SURVEILLANCE

At periodic monthly contacts for supervised administration of drugs, the MO/NMS should

- elicit information regarding any side effect of drugs;
- monitor occurrence of adverse reactions; and
- take appropriate action such as,referral if required

Periodic clinical and bacteriological examination of the patients are required during and after treatment.

Clinical : Clinical assessment should be undertaken by a MO/NMS, at the end of the month following the administration of the sixth supervised dose of rifampicin in paucibacillary patients to decide on termination of treatment. For multibacillary patients, clinical review should be carried out annually for a minimum period of 2 years or until smear negativity is attained, whichever is later. Patients who do not show the anticipated favourable response after 3 years of treatment should be referred to the consultant leprologist for comprehensive review.

Bacteriological : Skin smear examination is necessary before the commencement of MDT in multibacillary patients. Thereafter, it should be under-taken annually until the smear becomes negative. After the treat-

ment is discontinued, smear examinations should be repeated every year for 5 years during the surveillance period.

In paucibacillary patients, smear examination should be undertaken prior to the commencement of MDT and at the end of the prescribed course of treatment, before discharge only if the work load permits.

13. CASE HOLDING

Regularity of Treatment : The success of multidrug therapy programme depends no less on operational efficiency as on technical factors. Any interruption in the regular system of treatment, whether supervised or self-administered, will increase the risk of failure. It calls for the highest degree of patience, tact and tolerance in those responsible for seeing that the treatment is carried out. It means winning the confidence of the patient and his family. As long as the organizers of treatment services do not shoulder the responsibility of promoting regular drug intake, even the best of drug regimens will fail to induce therapeutic and epidemiological success they are capable of.

Regularity of attendance should be promoted by :

pre-clinic motivation drives; and

intensive health education, explaining to the patients, particularly, the development of deformities following incomplete or irregular treatment.

Scrupulous attention must be paid to the recording of clinic attendance. The treatment card should be carefully maintained. The dates when the patient has to attend should be recorded in advance on the treatment card or registered in accordance with the individual attendance schedule.

Monitoring drug intake : Irregularity in taking self-administered clofazimine and dapsone is more difficult to detect and may take several weeks before it becomes known. Regularity of drug intake should be promoted by:

- emphasising its importance on the patient at the very first visit and reinforcing this information at periodic intervals;
- dispensing the tablets and capsules in air tight plastic containers which makes counting much easier besides protecting the drug;
- intensive health education to the patient and his family members to generate family pressures, promoting regularity in drug intake; and
- spot testing of urine for detection of DDS.

It cannot be overstated that continuity, regularity and completion of chemotherapy are keys to the success of disease control.

14. DEFAULTER RETRIEVAL ACTION

Absentee follow up action may be by direct contact or indirectly through messages sent by post or delivered through friends and relatives. Needless to say that direct action, though more expensive and time consuming, is liable to be more effective.

It is easy to identify the causes of default than to remedy them. Treatment default has many of its roots outside the health system. They may be for loss of working time or other competing activities of daily life or social and cultural traditions. Many health professionals believe that health education is required to ensure patient compliance. Experience, however, does not support this view. Successive evaluations of NLEP have revealed that many a patient give no reason to explain absenteeism. Some are reluctant to accept the diagnosis in the absence of deformities. It is, however, that with the extension of MDT to larger areas, the beneficial effects of the treatment have built community faith regarding the cure of their disease. This has resulted both in increased self-reporting of patients and in greater regularity of treatment.

15. CRITERIA FOR DISCHARGE

Multibacillary Leprosy : A multibacillary patient who is clinically inactive and bacteriologically negative at the commencement of MDT, should continue treatment for 2 years (24, monthly supervised doses within 36 months). Thereafter, the treatment should be discontinued provided the patient continued to remain clinically inactive and bacteriologically negative at the end of this period.

Multibacillary, smear positive patients should be treated until they become clinically inactive and bacteriologically negative, or administration of 24 supervisory pulses maximum in 36 months, whichever is later. If after the treatment for more than 36 months, the BI remains the same, or increases, the patient should be assessed again clinically and bacteriologically for deciding the course of treatment.

Paucibacillary Leprosy : These patients should continue treatment till 6 supervised monthly doses have been administered. If the treatment was interrupted, the regimen should be recommenced where it was left off to complete 6 doses within 9 months. If the lesions show extension or new lesions appears at the end of the prescribed course of treatment, the same schedule must be continued for a further period of 6 months to complete 1 year, provided the classification is reviewed and found correct. Patients refractory after 1 year of treatment should be referred to the consultant leprologist for evaluation and advice.

Surveillance : Case released from treatment after MDT shall be on surveillance as follows :

- MB cases for 5 years with yearly clinical and bacteriological assessment;
- PB cases for 2 years with yearly clinical assessment.

16. RELAPSE

A patient released from treatment after completing and adequate course of multi-drug therapy, monotherapy but who subseqently develops new signs and symptoms of the disease either during the period of surveillance or thereafter, is considered to have 'relapsed'.

In paucibacillary patients, it is very often difficult to distinguish between relapse and type I reactions. Nevertheless, it is essential that the distinction is made correctly so that appropriate treatment can be given. The differences between the two are summarized in table-4.

TABLE- 4
Differences between TYPE I Reaction and Relapse

	Type I Reactions	*Relapse*
Time interval	Generally occurs during chemotherapy or within 6 months of stopping treatment	Occurs only when chemotherapy has been discontinued after an interval of at least 6 months.
Onset	Abrupt and sudden	Slow & insidious
Old lesions	Existing lesions become erythematous and considerably swollen and edematous.	Only the margin of the lesion may show erythema and infiltration.
New lesions	Several new lesions appear.	New lesions are minimal.
Ulceration	Lesions usually ulcerate	Ulceration does not occur.
Nerve involvement	Multiple nerve involvement common, painful and tender.	Nerve involvement may occur only in a single nerve, no pain or tenderness.
General condition	Fever, joint pains, malaise	Not affected
Response to treatment	Rapid may occur	Slow

16.1 Precautions and Side-effects of Drugs

16.1.1 Dapsone

The Contra indications for the induction of dapsone therapy are :

- the presence of anaemia, a haemoglobin value of less than 8.0 g%;
- debilitating illnesses;
- evidence of renal or hepatic damage;
- hypersensitivity to dapsone.

There is no other contra indication to the use of dapsone. In patients with anaemia, it should be corrected with haematinics before commencing treatment.

Side-effects

1. *Anaemia* : The drug is known to cause haemolysis in the early part of treatment. This is generally self-limiting. Rarely, however, acute haemolysis may be precipitated by dapsone.

2. *Hepatitis* : Genuine cases of dapsone hepatitis have been documented. Detection of hepatitis during dapsone therapy calls for its cessation.
Specific treatment can be restored once the icterus has cleared.

3. *Allergic dermatitis.*
4. *Hypermelanosis* or fixed drug eruption.
5. *Psychosis* : It is reversible once the drug is withdrawn.

16.1.2. Rifampicin

It is available in the form of capsules. The drug should be given on empty stomach to exert its therapeutic effect. The drug should not be given if the patient has hepatic or renal dysfunction.

Side-effects

a. Flushing or pruritis with or without rash often on the face and scalp. There may be redness and watering of the eyes.
b. Abdominal pain and nausea sometimes accompanied by vomiting and diarrhea.
c. Fever, chills, malaise, headache and bone and joint pains.
d. Rarely shortness of breath may occur.
e. Purpura, acute hemolytic anaemia, shock and renal failure are also rare.
f. Elevated serum transaminase levels with risk of hepatitis.

The first few symptoms occur within 2-3 hours of the first dose. Flushing and pruritis may occur during the first month, nausea and vomiting during the first 6 months and breathlessness between the 3rd and the 6th months of the treatment.

Half the patients with adverse reactions require no modification of the regimen since the symptoms are mild and self-limiting. Symptomatic treatment should be given where the reactions trouble the patients and persist. In patients with respiratory syndrome, caution is necessary and

such patient may require hospitalization. If shock is followed by renal failure, rifampicin should not be given again. This is true of haemolytic anaemia as well. Likewise, if purpura occurs, the drug should be stopped. Whenever the reaction persists and bother the patient, the dose should be reduced to 450 mg. If no improvement occurs, rifampicin may be discontinued.

It should be remembered that the effectiveness of steroid is reduced if given to a patient receiving daily rifampicin. Similarly, the effectiveness of oral contraceptives is impaired.

16.1.3. Clofazimine

Clofazimine is well tolerated and virtually non-toxic in the doses used. The following side-effects are described :

a. *Skin* : Reversible dose related reddish to brown black discolouration, especially on the exposed parts of the body, Discolouration of sweat, tears, hair, sputum, urine and faeces may occur during the administration of the drug. General dryness of the skin (xeroderma), ichthyosis and pruritis can be troublesome side-effects. Photo-toxicity, acneform eruptions and non-specific skin rashes have also been reported.

b. *Gastro-intestinal* : Symptoms reported include nausea, vomiting, abdominal pain, intermittent loose stools, diarrhoea anorexia and weight loss. There are two separate entities :

i) An early syndrome commencing within a few days of the treatment, possibly related to the direct irritating effect of the drug. The symptoms subside when the dose is reduced.

ii) A late syndrome observed after some months of high dose therapy with persistent diarrhoea loss of weight and abdominal pain. The syndrome is associated with deposition of clofazimine crystals in the tissues, usually in the sub-mucosae of the small intestine and the mesenteric lymph nodes.

iii) *Eyes* : But for conjunctival pigmentation that does not affect acuity of vision, no other ocular side effects have been reported.

18. REPORTS

The progress of the activities under the programme is reported monthly, quarterly and annually.

The year starts on 1st of April and ends by 31st March. Accordingly the quarterly and monthly reports are also to be submitted. Completeness, accuracy and regularity in the submission of reports are important. The monthly and annual reporting forms are given in Annexure I and Annexure II. For quarterly report, replace the annual in the Annexure II with the quarter

ending June, September, December and March as applicable. Monthly reports should be submitted by Leprosy Control Unit and other existing setup under NLEP to the District Leprosy Unit/Zonal Leprosy Office by the 10th of succeeding month. The DLO/ZLO will compile the report for the district and send it to the state by the 20th of the succeeding month. In the districts where DLO/ZLO are not available, the State Leprosy Officer would give suitable instructions as to who shall compile report from those districts. The State/Union Territory Leprosy Officer (SLO) would send a compiled report for the month to the Leprosy Division, Directorate General of Health Services, Nirman Bhavan, New Delhi by the 28th of the succeeding month. The quarterly reports also may be timed as above. The annual report for the year from 1st April of the preceding year to 31st March of the current year should be compiled by the LCUs/SETs etc. functioning under NLEP in the districts to the DLO/ZLO by the 20th of April of the current year. The DLO/ZLO would compile the report from the different components and submit it to the SLO by 30th April. The SLO would send the consolidated annual reports for the year to the Leprosy Division of the Directorate General of Health Services so as to reach on or before 10th May of the year.

ANNEXURE I

NATIONAL LEPROSY ERADICATION PROGRAMME
MONTHLY REPORTING FORM*

		MB**	PB***	Total
1.	Name of the state			
2.	Period under report since beginning of 1st April of new financial year.			
3.	Total no of districts			
	i) Districts under regular MDT			
	ii) Districts under regular MMDT			
	iii) Districts under low endemic MDT			
	iv) Districts under Monotherapy			
	v) Total districts			
4.	No. of cases on record at the beginning of the year i.e. 1st April.			
5.	No. of cases under treatment on 1st April			
	i) Under MDT			
	ii) Under monotherapy			
	iii) Total Patients under treatment by all means			
6.	No. of new cases detected between 1st April and period under report			
7.	No. of new cases brought under treatment between 1st April and period under report			
	a. New patients under MDT			
	b. New patients under monotherapy			
	c. Total			
8.	No. of cases deleted from records (discharge by all means including release from treatment)			
9.	No. of child cases below 14 years among new cases detected between 1st April and period under report			
10.	No. of new cases with deformity (grade II and more) among cases detected in the current year			
11.	Balance No. of active cases on record on 31.3.92			
12.	Balance No. of leprosy cases remained under antileprotic treatment as on 31.3.92			
	- Monotherapy			
	- MDT			

* Form for use at state level ** MB - Stands for Multibacillary

*** PB - Stands for Paucibacillary

ANNEXURE II

ANNUAL REPORTING FORM
NATIONAL LEPROSY ERADICATION PROGRAMME

State/UT
Year :

PART-A

		Urban	Rural	Total
1.	Estimated total population for the year			
2.	Population covered under NLEP during the year.			
3.	Population examined during the year.			
		MB	PB	Total
4.	Number of new cases detected during the year. i. By surveys ii. By other methods			
5.	Number of child cases (0-14 yrs) newly registered during the year.			
6.	Total number of patients registered at the end of previous year.			
7.	Total number of registered in-patients at the end of the reporting year.			
9.	Bacteriological status of total registered patients at the end of the reporting year.			
9.1.	Number of patients bacteriologically positive.			
9.2.	Number of patients bacteriologically negative.			
9.3.	Number of patients with bacteriological status unknown.			
10.	Treatment administered to the cases registered during the year.			
10.1.	Number of patients who received dapsone monotherapy			
10.2.	Number of patients who received multidrug therapy.			
11.	Number of patients under surveillance after completion of treatment.			
12.	Number of patients registered relapses during the year.			
13.	Regularity of treatment			

	MT	MDT	Total
13.1. Number of patients taking regular treatment (more than 9 months) in a year.			
13.2. Number of patients not taking regular treatment (less than 9 months).			
13.3. Number of unknown.			
14. Number of patients released from treatment.			

	MB	PB	Total
15. Number of patient referred for surgical procedures like			
15.1. Reconstruction surgery.			
15.2. Eye complications.			
15.3. Amputation.			
16. Number of cases provided with			
Foot wear.			
Artificial limbs.			
Crutches.			

PART-B (LOGISTICS)

Infrastructure	*No. at the beginning of year*	*Current Year*		*No. at the end of the year*
		Target	*Achievement*	
1. **Establishment**				
a. L.C.U.				
b. U.L.C.				
c. S.E.T. Centres				
d. T.H. Ws/No. of Beds.				
e. Rec. Surg. Unit.				
f. L.R.P.Us.				
g. Other (Specify)				
h. No. of Leprosy beds.				
i. No. of Voluntary Orgns. working in leprosy.				

2. **Vehicles Positions**
Total Number ..... No. in working condition .....

3. **Staff Position**

Category	*No. sanctioned*	*No. in position*	*No. Trained*

1. S.L.O.
2. Z.L.O./D.L.Os.
3. M.Os.
4. N.M.S.
5. Health Educators
6. Physiotherapists
7. Statistical Asstt.
8. PMW/NMA/LI, etc.
9. Lab. Technician.
10. Dispensers.
11. Clerical Staff.
12. Drivers.
13. Group D.
14. Others

4. **Stock Position of Drugs :**

Drugs		*Quantity at the beginning of the year*	*Quantity consumed during the year*	*Quantity required for next year*
Dapsone	100 mgm			
	50 mgm			
Rifampicin	300 mgm			
	150 mgm			
Clofazimine	100 mgm			
	50 mgm			

5. **Microscope facilities :**
   No. of Microscopes ..... No. in working condition .....
6. **Building position.**

Building constructed/acquired

Specify

Signature of the Reporting Officer

Name

Date :

Designation

Place :

Postal Address

NATIONAL LEPROSY ERADICATION PROGRAMME

STATUS REPORT 1992

LEPROSY DIVISION
DIRECTORATE GENERAL OF HEALTH SERVICES
MINISTRY OF HEALTH AND FAMILY WELFARE
NIRMAN BHAWAN, NEW DELHI

NATIONAL LEPROSY ERADICATION PROGRAMME

STATUS REPORT
1992

LEPROSY DIVISION
DIRECTOR GENERAL OF HEALTH SERVICES
MINISTRY OF HEALTH & FAMILY WELFARE
NIRMAN BHAWAN, NEW DELHI - 110011.

FOREWORD

The Indian Programme for leprosy control is the largest of its kind in the world. It is time-bound and target oriented, aiming at disease elimination by the end of the century.

Leprosy continues to engage urgent attention of health planners in this country. There is need for making available comprehensive data on the National Leprosy Eradication Programme for all those interested in leprosy control. This status report traces the evolution of organised leprosy control in India, the factors behind the disease which constrain an effective programme; the programme (NLCP/NLEP) its growth, performance, imbalances and measures to strengthen the same. An attempt has been made to provide an understanding of the problems and perspectives of leprosy control work in India.

We are grateful to World Health Organisation for providing the services of Dr. Sharad Kumar for assistance in preparing this document.

(Dr. A.K. Mukherjee)

ABBREVIATION

NLEP	National Leprosy Eradication Programme
VO	Voluntary Organisation
MB	Multibacillary
PB	Paucibacillary
MDT	Multidrug Therapy
MT	Mono Therapy
MMDT	Modified Multidrug Therapy
RFT	Release From Treatment
MO	Medical Officer
NMS	Non Medical Supervisor
PMW	Para Medical Worker
Lab. T	Laboratory Technician
DLO	District Leprosy Officer
ZLO	Zonal Leprosy Officer
SLO	State Leprosy Officer
LCU	Leprosy Control Unit
SET	Survey, Education and Treatment Centre
ULC	Urban Leprosy Centre
UT	Union Territory
ZLO	Zonal Leprosy Officer
CHC	Community Health Centre
PHC	Primary Health Centre
HE	Health Educator
PT	Physiotherapist
AM	Adult Male
AF	Adult Female
CM	Child Male
CF	Child Female
IEC	Information, Education & Communication
DDP	Drug Delivery Point
MCR	Micro Cellular Rubber
RFC	Release From Control
CMO	Chief Medical Officer
POL	Petrol, Oil & Lubricants
OTC	Orientation Training Camp
HA	Health Assistant
NGO	Non Government Organisation
GOI	Government of India
Ut	Unit
Dt or Distt.	District
Q & A	Question & Answers

CONTENTS

1. INTRODUCTION

Leprosy is a disease of great antiquity; its origin and early spread is largely a matter of surmise. Possibly it originated in Africa and spread very early to India and from there to China. There is no doubt that in Africa, India and China, the disease has been prevalent for many centuries. There are Biblical references to leprosy. Reference to leprosy is found in the ancient medical writings of India. The most ancient are those of Charaka, Sushruta and Vaghbata.

Leprosy is unique in many respects. It has the maximum social stigma attached to it. A common belief is that leprosy is due to sins committed. There is also a belief that leprosy is hereditary and incurable. There are many misconceptions about this disease. These combined with the high deformity and very low mortality rates in leprosy patients have led to the development of social aversion and ostracism against leprosy patients.

It is now accepted that leprosy is completely curable at any stage, that it is only an infection, that it is least communicable and the deformities that arise in leprosy patients can be completely prevented by early detection and treatment.

Until a few decades ago, the disease was one of neglect; the affected were interned in leprasoriums mainly managed by charitable trusts and voluntary organisations. The establishment of the Indian council of the British Empire Leprosy Relief Association in 1925 (Renamed as Hind Kusht Nivaran Sangh in 1947), laid the foundation of organised leprosy work in India. A committee appointed by Government of India in 1941 reviewed the extent of leprosy problem in the country and made specific recommendations for initiating anti-leprosy measures. This was followed by another expert committee in 1954 that gave rise to concrete plans for leprosy control in India including legislations.

The middle of the present century witnessed a breakthrough in the knowledge regarding the causation, spread and treatment of leprosy. Organised efforts, supported by national government, were launched in India to cure the affected and contain its further spread and impart education to the people on the disease. The present book-let traces the development of this anti-leprosy work, leading to national leprosy eradication programme (NLEP) announced in 1983, with the avowed goal of its eradication by the year 2000 AD.

2. CASE LOAD

Leprosy survey was included for the first time in India as a part of British Imperial Census in the year 1871-72. Later, it was extended in the country in 1890-91. The prevalence rate of leprosy in India during the period prior to 1950 was essentially obtained as a part of decennial population

census. According to the subsequent census in 1931, about 136 thousand cases were there, giving a prevalence rate of 0.49 per 1000 population[1].

This was, however, a gross underestimate because of several reasons, namely :

- it included cases with severe forms of the disease only;
- all cases might not have been reported because of social stigma attached to the disease;
- latent cases and those with minor symptoms were not recognized; and
- errors in coverage of population.

Similar estimates based on successive censuses may be seen in Table - 1.

As a result of the surveys carried out in different parts of the country during nineteen twenties and thirties and by multiplying the detected number of cases by a certain factor, it was estimated that the number of cases in the country would be 10 lakhs. Since the anti-leprosy work in the country intensified in the post independence years after 1948, and particularly after the initiation of the national leprosy control programme in 1955 by Government of India, the number of cases of leprosy rose from 10 lakhs to 20 lakhs to 25 lakhs and in 1981 it stood at 39 lakhs.

The progressive increase in the estimated number of cases may give rise to the erroneous idea that leprosy was on an increase

TABLE-1
Prevalence of Leprosy in India

S. No.	Year	Population (millions)	Estimated number of leprosy patients ('000)	Prevalence rate (per 1000 population)
1.	1871	198.291	108.81	0.55
2.	1881	216.679	128.09	0.59
3.	1891	274.334	126.24	0.46
4.	1901	294.361	97.36	0.33
5.	1911	315.156	109.09	0.35
6.	1921	318.942	102.51	0.32
7.	1931	324.753	159.80	0.49
8.	1951	360.958	1374.01	3.81
9.	1961	439.118	2561.60	5.83
10.	1971	574.958	3200.90	5.84
11.	1981	685.185	3919.337	5.72
12.	1991	847.421	2764.00	3.26

Source : For data prior to 1971 Mohammed Ali, P. (1963) Facts and Figures about Leprosy in India.

1. Government of India, Ministry of Health (1955) Report of Committee for Control of Leprosy, Govt. of India Press Calcutta.

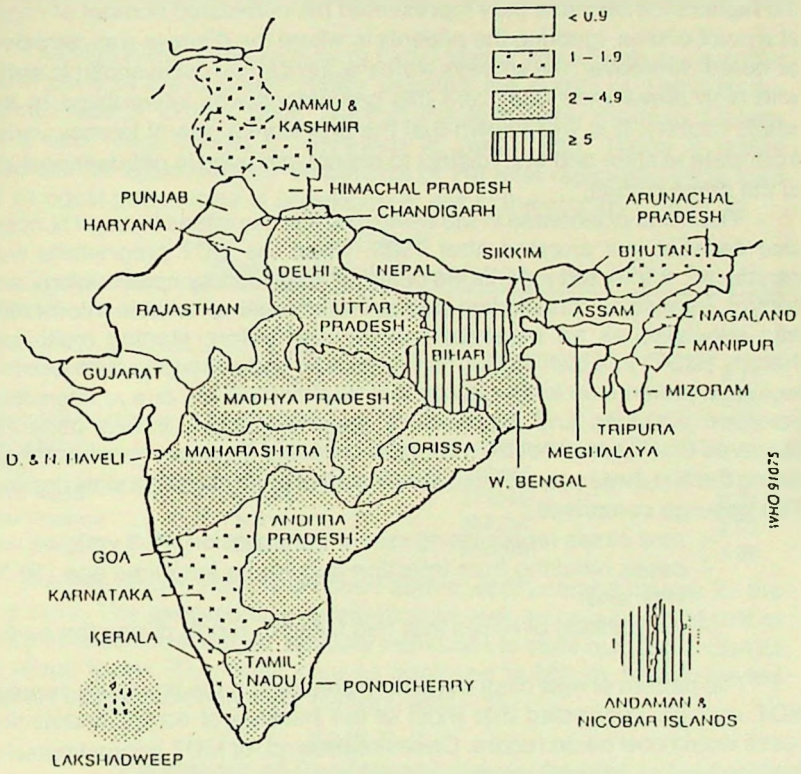

Figure 1 : Prevalence of Registered Leprosy Cases, June 1990

in the country. This was, however, not so. In some areas where systematic surveys were carried out on a long term basis, there was no evidence of any increase in the disease. Apart from increase in population, the other reason for rise in the number of estimated cases was intensification of case finding programme. Increased voluntary reporting consequent upon the availablility of potent drugs also served to increase the known number of cases.

On the other hand, it would appear that the estimated figures were on the higher side because they represented the cumulated number of cases at a point of time, ignoring the patients in whom the disease was 'arrested' or 'cured'. Moreover, the surveys were usually carried out in endemic areas with high prevalence rates and this prevalence was interpolated to the whole country. It is well-known that the prevalence rate of leprosy varies from state to state and from district to district and even in different pockets of the same district.

The trend of increase in the estimated leprosy cases through successive decades got arrested after 1983, when the MDT programme was introduced. It affected a profound change in the leprosy epidemiology and control. Intensified casefinding and establishment of reliable information was stipulated as an essential pre-requisite before starting multi-drug therapy (MDT) in a district. Further, it resulted in discharging from existing registers, patients no longer in need of treatment. Both, due to intensified detection activities and the curative appeal of MDT, it was generally observed that the number of 'new case' detected increased phenomenally during the first three years before leveling off or even starting a slow decline. This upsurge comprised.

- new cases representing recent transmission, (1-3 yrs);
- cases resulting from infection acquired a long time ago (10-30 yrs); and
- the backlog of cases that had failed to report during the earlier years.

The pattern of new case detection rates during the first three years of MDT strongly suggested that most of the backlog of earlier undetected cases would now be on record. Cases registered for MDT approximated to the true load of leprosy cases needing treatment.

The estimated case load for the country in June 1990 was around 27,64,000 giving a prevalence rate of 3.26 per 1000 population against the registered cases numbering 23,70,687. Present estimates indicated that 15 to 20 per cent of the leprosy cases were in children below 14 years, 6 to 12 percent suffered from deformities and about one-fifth of the cases were infectious.

Inter-State Variations

Variations in the prevalence of leprosy in the different states of India

are shown in the map at figure 1. It would be seen from the map that although the disease was found throughout the country, it was not equally distributed in the sub-continent. There was a wide variation in the prevalence, even in low endemicity areas there existed pockets of high prevalance. However, a definite pattern could be established demarcating high (prevalence rate of more than 5), moderate (2 to 5) and low (<2) endemicity areas.

The high endemicity areas were found mainly in the south eastern and central parts of the country. These included the states of Tamil Nadu, Andhra Pradesh, Orissa, Bihar, Madhya Pradesh, Uttar Pradesh, Maharashtra and West Bengal as reviewed in June 1990. These 8 states accounted for approximately 90 percent of the total registered case load and an equal percentage of population at risk in the country (Table 2).

TABLE- 2
States of High Prevalence

State/UT	*Population* 1990	*Cases on record* June 1990	*Prevalence* rate per 1000
Andhra Pradesh	64311	283866	4.41
Bihar	83946	465553	5.55
Madhya Pradesh	65096	203250	3.12
Maharashtra	78773	181459	2.30
Orissa	31669	182487	5.76
Tamil Nadu	58138	378444	6.51
Uttar Pradesh	138410	367234	2.65
West Bengal	65548	287296	4.39

The Prevalence rates mentioned above were average figures for the entire state. The geographical distribution as well as population at risk of leprosy differed substantially, not only from state to state but also at district and village levels. The latest data as compiled in March 1991 provided complete information on all the states (Table - 3).

TABLE- 3
Prevalence of Registered Leprosy Cases
by State - March 1991

S. No.	*State/UT*	*Population 1991 (lakhs)*	*Cases on record March 1991*	*Prevalence rate per 1000*
1.	Andhra Pradesh	663.00	203521	3.07(11.8)
2.	Arunachal Pradesh	8.58	1305	1.52(3.6)
3.	Assam	222.94	18215	0.81(1.5)
4.	Bihar	863.38	451357	5.22(5.4)
5.	Goa	11.68	1228	1.05(5.0)
6.	Gujarat	411.74	22316	0.54(2.9)

7.	Haryana	163.17	680	0.04(0.08)
8.	Himachal Pradesh	51.11	3956	0.77(1.6)
9.	Jammu & Kashmir	77.18	3720	1.22(2.2)
10.	Karnataka	448.17	72071	1.60(6.0)
11.	Kerala	290.11	53932	1.85 (5.8)
12.	Madhya Pradesh	661.35	279286	4.22(2.3)
13.	Maharashtra	787.16	147866	1.96(6.2)
14.	Manipur	18.26	1369	0.74(4.5)
15.	Meghalaya	17.61	1552	1.20(4.6)
16.	Mizoram	6.86	363	0.52(1.0)
17.	Nagaland	12.15	2026	1.66(3.9)
18.	Orissa	315.12	153267	4.86(12.1)
19.	Punjab	201.90	550	0.02(0.1)
20.	Rajasthan	438.89	19911	0.45(1.6)
21.	Sikkim	4.03	109	0.27(7.8)
22.	Tamil Nadu	556.38	176027	3.16(12.9)
23.	Tripura	27.44	2193	0.80(4.9)
24.	Uttar Pradesh	1387.60	356285	2.56(3.7)
25.	West Bengal	679.82	203852	3.00(6.9)
26.	Andaman & Nicobar	2.77	1280	4.60(4.9)
27.	Chandigarh	6.40	2049	4.54(4.7)
28.	Dadar & Nagar Haveli	1.38	280	2.02(1.0)
29.	Daman & Diu	1.01	252	2.49(3.8)
30.	Delhi	93.70	1363	0.14(0.4)
31.	Lakshadweep	0.51	151	2.92(25.0)
32.	Pondicherry	7.89	1962	2.48(15.0)
	TOTAL	8439.30	2184299	2.5

NB : Figures in parenthesis give the estimated prevalence rate)

Of the 455 districts in the country, 201 were high endemic for leprosy with a prevalence of 5 or more per 1000 population. Another 77 districts had prevalence varying between 2 and 5 while the remaining 177 districts had prevalence below 2/1000. These districts were distributed among the 32 states and union territories of the country. The stratification of leprosy according to the districts may be seen in Table - 4. Nearly 450 million population lived in endemic areas. Districts with high and moderate prevalence of leprosy are shown state-wise in Table - 5 and Table - 6.

TABLE- 4

Stratification of Districts According to Prevalence Rate

S. No.	*Prevalence Rate*	*No. of Districts*	*Cases ('000)*
1.	Less than 2/1000	177	150
2.	Between 2 - 4.9/1000	77	400
3.	5 or 5+/1000	201	1500
	TOTAL	455	2050

TABLE - 5
List of High Endemic Districts with Prevalence Rate 5 to 5+/1000

S. No	Name of State/ UT	Under vertical MDT setup	Under modified MDT setup
1	2	3	4
1.	Andhra Pradesh	1. Ananthapur 2. Guntur 3. Rangareddy 4. Mohbubnagar 5. Niziamabad 6. Khammam 7. Sirkakulum 8. Vizianagram 9. Visakhapatnam 10. Chittor 11. East Godavari 12. Krishna 13. Warangal 14. Nalgonda 15. Cuddapah 16. West Godavari 17. Karim Nagar 18. Medak 19. Nellore 20. Kurnool 21. Prakasam 22. Adilabad 23. Hyderabad	
2.	Assam	1. Karbi Anglong	
3	Bihar	1. Deogarh 2. Singhbhum 3. Bhagalpur 4. Rohtas	1. Gaya 2. Hazaribagh 3. Girith 4. Ranchi 5. Dhanbad 6. Siwan 7. Patna 8. Aurangabad 9. Nawadah 10. Bhojpur 11. Purunia 12. Katihar 13. Muzaffarpur

1	2	3	4
			14. Sitamarhi
			15. Darbhanga
			16. West Champaran
			17. Santhal Pargana
4.	Gujarat	1. Dangs	
		2. Panchmahal	
		3. Surat	
		4. Bharuch	
		5. Baroda	
		6. Valsad	
5.	Karnataka	1. Belgaum	
		2. Dharwad	
		3. Bidar	
		4. Gulbarga	
		5. Raichur	
		6. Bijapur	
		7. Bellary	
		8. Mysore	
6.	Kerala	1. Alleppey	1. Kasargode
		2. Trichur	2. Ernakulam
		3. Trivandrum	3. Cannannore
		4. Quilon	4. Mallapuram
		5. Palghat	5. Kozikode
7.	Madhya Pradesh	1. Durg	1. Bhopal
		2. Rajnandgaon	2. Indore
		3. Bilaspur	3. Khadwa
		4. Bastar	4. Satna
		5. Raipur	5. Datia
		6. Bhind	6. Tikamgarh
		7. Gwalior	7. Chhattarpur
		8. Rewa	8. Jabalpur
		9. Ujjain	9. Bolaghat
		10. Raigarh	10. Shahdol
		11. Sagar	11. Surguja
8.	Manipur		1. Tamemglung
			2. Chandel
9.	Maharashtra	1. Wardha	
		2. Amaravati	
		3. Chandrapur	
		4. Nanded	
		5. Osmanabad	
		6. Yuvatmal	
		7. Latur	
		8. Gadchirori	
		9. Bhandara	

1	2	3	4
		10. Nagpur	
		11. Thane	
		12. Sholapur	
		13. Satara	
		14. Parbhani	
		15. Raigad	
		16. Akola	
		17. Buldhana	
		18. Beed	
		19. Bombay	
10.	Nagaland	1. Mon	
11.	Orissa	1. Ganjam	1. Kalahandi
		2. Puri	2. Keonjhar
		3. Cuttack	
		4. Dhenkanal	
		5. Mayurbhani	
		6. Balasore	
		7. Sambalpur	
		8. Balangir	
		9. Koraput	
		10. Phulbani	
		11. Sundergarh	
12.	Sikkim	1. East District	
		2. South District	
13.	Tamil Nadu	1. North Arcot	
		2. Anna Chengi	
		3. Salem	
		4. Pasumpon PTT (PMR Shivranga)	
		5. Kamarajar	
		6. Ramanathpuram	
		7. Dharmapuri	
		8. Thanjavur	
		9. Periyar	
		10. Anna Duidigul	
		11. Madurai	
		12. South Arcot	
		13. Puddukkotai	
		14. Tiruchirapalli	
		15. Neilai Kottabomman	
		16. VO Chidambaranar	
		17. Coimbotore	
		18. Nilgiris	
		19. Kanyakumari	
		20. Madras	

1	2	3	4
14.	Uttar Pradesh	1. Varanasi	1. Gorakhpur
		2. Barabanki	2. Lucknow
		3. Dehradun	3. Unnao
		4. Faizabad	4. Rampur
		5. Sitapur	5. Badaun
		6. Kheri	6. Shahjahanpur
		7. Kanpur(urban)	7. Etawah
		8. Kanpur Dehat	8. Fatehpur
		9. Uttarkashi	9. Banda
		10. Pilibhit	10. Hamirpur
		11. Baharaich	11. Jalaun
		12. Deoria	12. Basti
		13. Hardoi	13. Gonda
		14. Raebarely	14. Bareilly
		15. Azamarh	
		16. Ballia	
		17. Ghazipur	
		18. Mirzapur	
15.	West Bengal	1. Purulia	1. Cooch Bihar
		2. Bankura	2. Howrah
		3. Bardhaman	3. Hooghly
		4. Midanapur	4. Jalpaiguri
		5. Birbhum	5. Malda
			6. 24 Parganas (S)
			7. Nadia
			8. 24 Parganas (N)
			9. West Dinajpur
			10. Murshidabad
16.	Andaman & Nicobar	1. Andaman	
17.	Lakshadweep	1. Lakshadweep	
18.	Pondicherry	1. Pondicherry	
		2. Karaikal	
		3. Yanam	

TABLE- 6

Moderately Endemic 77 Districts (PR - 2 - 5/'000)

S.No.	District	State	Population 1981 (Lakhs)	Estd. PR/ 1000 (81)
1.	Gaya	Bihar	21.38	4.8
2.	Hazaribagh	Bihar	21.95	4.5
3.	Giridih	Bihar	17.30	4.4
4.	Ranchi	Bihar	30.59	3.1
5.	Monghyr	Bihar	33.14	3.6
6.	Begusarai	Bihar	14.56	4.7

7.	East Champaran	Bihar	24.27	3.1
8.	Madhubani	Bihar	23.24	4.8
9.	Samastipur	Bihar	21.16	4.3
10.	Nalanda	Bihar	16.38	2.9
11.	Palamu	Bihar	19.16	2.6
12.	Saharsa	Bihar	29.52	2.2
13.	Saran	Bihar	20.74	2.3
14.	Gopalganj	Bihar	13.61	2.8
15.	Daman	Daman & Diu	0.48	4.1
16.	Bangalore(U)	Karnataka	34.92	3.1
17.	Kolar	Karnataka	19.05	3.7
18.	Mandya	Karnataka	14.18	3.8
19.	D. Kannada	Karnataka	23.36	2.8
20.	Pathanamthita	Kerala	10.76	3.3
21.	Kottayam	Kerala	16.97	3.3
22.	Idukki	Kerala	9.71	3.3
23.	Wynad	Kerala	0.55	3.0
24.	Hoshangabad	Madhya Pradesh	10.03	3.6
25.	Ratlam	Madhya Pradesh	7.82	4.6
26.	Dhar	Madhya Pradesh	10.57.	3.8
27.	Jhabua	Madhya Pradesh	7.95.	3.2
28.	Barwani	Madhya Pradesh	16.30	4.0
29.	Guna	Madhya Pradesh	10.01	3.2
30.	Damoh	Madhya Pradesh	7.21	4.3
31.	Chhindwara	Madhya Pradesh	12.33	4.3
32.	Mandla	Madhya Pradesh	10.37	3.8
33.	Sidhi	Madhya Pradesh	9.90	4.2
34.	Betul	Madhya Pradesh	9.25	2.7
35.	Rajgarh	Madhya Pradesh	8.01	2.7
36.	Dewas	Madhya Pradesh	7.95	2.3
37.	Shajapur	Madhya Pradesh	8.40	2.3
38.	Shivpuri	Madhya Pradesh	8.65	2.7
39.	Morena	Madhya Pradesh	13.03	2.0
40.	Seoni	Madhya Pradesh	8.09	2.1
41.	Panna	Madhya Pradesh	5.39	2.9
42.	Narsingpur	Madhya Pradesh	6.50	2.1
43.	Jalna	Maharashtra	11.85	3.4
44.	Jalgaon	Maharashtra	20.04	4.1
45.	Kohlapur	Maharashtra	28.18	3.4
46.	Sangli	Maharashtra	20.59	4.0
47.	Ratnagiri	Maharashtra	14.54	2.2
48.	Dhule	Maharashtra	23.53	2.6
49.	Ahmad Nagar	Maharashtra	30.51	2.8
50.	Pune	Maharashtra	49.49	2.2
51.	Aurangabad	Maharashtra	18.23	2.8
52.	Farrukhabad	Uttar Pradesh	20.02	3.8
53.	Jhansi	Uttar Pradesh	11.33	3.2
54.	Pratapgarh	Uttar Pradesh	18.07	3.3

55.	Sultanpur	Uttar Pradesh	20.38	3.6
56.	Chamoli	Uttar Pradesh	3.64	3.2
57.	Nanital	Uttar Pradesh	11.23	3.2
58.	Moradabad	Uttar Pradesh	31.51	4.2
59.	Jaunpur	Uttar Pradesh	25.27	4.1
60.	Aligarh	Uttar Pradesh	25.65	2.1
61.	Allahabad	Uttar Pradesh	37.81	2.7
62.	Lalitpur	Uttar Pradesh	5.87	2.6
63.	Tehri Garwal	Uttar Pradesh	4.99	2.9
64.	Pithoragarh	Uttar Pradesh	4.80	2.7
65.	Calcutta	West Bengal	42.56	4.0
66.	Darjeeling	West Bengal	11.49	4.0
67.	Chamba	Himachal Pradesh	3.11	2.7
68.	Shimla	Himachal Pradesh	5.10	2.0
69.	Sirmur	Himachal Pradesh	3.06	2.6
70.	Ajmer	Rajasthan	14.40	2.5
71.	Bharatpur	Rajasthan	12.99	2.6
72.	Ganga Nagar	Rajasthan	20.29	2.6
73.	Jaipur	Rajasthan	34.20	2.0
74.	Jodhpur	Rajasthan	16.67	2.0
75.	S. Madhopur	Rajasthan	15.35	2.7
76.	Sirohi	Rajasthan	5.42	2.2
77.	Udaipur	Rajasthan	3.56	2.4

4. LEPROSY CONTROL BEFORE 1955

Prior to the beginning of national leprosy eradication programme in 1955, anti-leprosy activities were wide spread in the country. However, these measures were primarily concerned with the treatment of patients, and organised by charitable missions and non-governmental agencies.

The physical facilities available were far from satisfactory. There were 152 institutions with in-patient provision for admitting and treating patients with a total bed strength of 19600. In other words, there were 142.6 beds per 1000 estimated cases.

The inter-state availability of beds was grossly uneven, the largest number being provided by then Madras state (1 : 1260), followed by Manipur (1 : 3666) and Himachal Pradesh (1 : 4675). When viewed against the estimated number of cases, the picture was really dismal in most of the states, Uttar Pradesh being at the bottom with 1 bed for 40,435 estimated cases.

In addition to 152 institutions with in patient care provision, 1203 clinics in the country operated out-patient services for leprosy patients. It is estimated that on an average, there was one clinic per 300 thousand population, which again varied greatly from state to state. This, however, was understandable since most of anti-leprosy activities were being undertaken by several independent agencies such as voluntary organisations,

religious institutions and charitable trusts, without any plan and co-ordination to provide services on a rational basis. Lack of any organised effort led to the governmental action to control the disease through the establishment of national leprosy control programme based on the recommendation of an expert committee[1].

5. NATIONAL LEPROSY CONTROL/ERADICATION PROGRAMME

The NLEP was launched in 1955, the last year of the first five year plan, with the main objective of controlling leprosy through domiciliary treatment with sulphone. It started as a centrally aided scheme with its focus on the rural areas of high and moderate endemicity. In the low endemic states the expectation was to provide leprosy services through the existing infrastructural facilities meant for general health services. To give impetus to control work, the scheme was converted into a centrally sponsored programme in 1969-70, with total expenditure on it being chargeable to the central government.

i) Objectives

To begin with the programme did not have a clearly defined policy or operational objectives for nearly two decades. The plan documents (1951, 1956, 1961 and 1969-70) only stated the problem and described the inputs that would be made available to strengthen the programme. This meant that the programme was all along input oriented and not performance oriented. This was necessitated because of several factors.

a. lack of primary prevention (vaccination) against the disease;
b. non-availability of potent drugs for early and complete cure;
c. isolation of all patients was not feasible as the benefits were not commensurate with costs involved;
d. lack of community cooperation due to social stigma attached to the disease; and
e. the existing legislation on leprosy were negative and had unscientific approach.

It was only in 1976 that the programme was made performance oriented[2]. Each of the states was given certain targets by the Government of India in respect of :

a. new cases to be detected and brought under treatment and
b. number of patients to be discharged as disease arrested or cured during each year. The targets, however, were based on certain assumptions (Appendix 1).

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1 Government of India, Ministry of Health (1955), Report of the Committee for the Control Leprosy, Government of India Press, Calcutta.

2 Government of India (1976), Ministry of Health & Family Planning, Report of the Central Councils of Health & Family Planning, 15-17, April 1976.

NLEP focused on the rural areas since 80.0 percent of the population lived there and even a larger percentage of cases were expected there. It was further considered that leprosy being a disease of rural incidence and urban prevalence, its control in the rural areas will automatically reduce the migration of cases. However, several indigenous foci were observed in urban areas. Hence, during the fifth five year plan, the programme was extended to the urban areas as well. It was envisaged that by detecting all cases and bringing at least 90 percent of them under continuous treatment with sulphones, it would be possible to bring down the load of infection by 80 percent and there by making disease control effective.

While there was considerable expansion of the control activities and good results were obtained in selected centres, the impact of the programme on the country as a whole was far below expectations. Even with well-organised and effectively implemented programme based on dapsone monotherapy, although substantial decline was achieved in the prevalence of the disease, it was not possible to demonstrate a parallel decline in its incidence, which was *sine qua non* arresting for disease transmission in the country.

The monotherapy strategy further suffered from both operational and technical limitations. It relied mainly on long-continued, self administered dapsone. The treatment remained meagre, rudimentary and restrictive, relying solely on pill distribution to the maximum number of patients possible. The emphasis, thus, was on quantitive rather than qualitative cure. Besides, resistance to dapsone was emerging as a serious phenomenon to contend with.

Large geographic variations in the same state still existed in the prevalence of the disease. For example, in Tamil Nadu, the range of variation was from 5.0 to 28.7 per thousand and in West Bengal from 4.0 to 25.0 per thousand. All these factors called for an effective strategy for leprosy control in the high endemicity districts on a priority basis.

With the availability of a number of highly effective bactericidal drugs and better understanding of the disease, a radical change in the approach to arrest the disease within a specified period of time appeared possible. Simultaneously, there also developed in the country a new political will to control leprosy.

The Prime Minister of India in her address to the World Health Assembly in May, 1981, made an appeal to all the developed countries to help in leprosy eradication. While addressing a joint meeting of the Cabinet Committee on Science and Technology and Science Advisory Committee to the cabinet in May, 1981, the Prime Minister again asked the Indian scientists to develop a leprosy eradication strategy. The Ministry of Health

and Family Welfare constituted a working group to devise a new strategy and action plan for the control and ultimate eradication of leprosy. Dr. M.S. Swaminathan, member, Planning Commission, was the chairman and eminent scientists, leprologists and social scientists were the members of the committee.

The recommendations of this group[1] brought about changes in the programme administration and strategy namely.

- NLCP was changed into a time bound programme with the specific goal of arresting the disease activity in all leprosy cases by the turn of the century;
- the existing sulphone monotherapy was supplemented with one or more bactericidal drugs for treatment of the disease in the form of a campaign with a view to achieve its effective control;
- efforts were to be made to obtain self-sufficiency in the requirement of anti-leprosy drugs;
- measures were initiated to attract and retain medical officers in leprosy control services;
- activities of voluntary organisations in leprosy control were reorganised and supported;
- the process of repealing leprosy act of 1898 to be expedited;
- community based rehabilitation of disabled leprosy patients was planned on a priority basis;
- screening of pre-school children and youth emphasized for early detection of disease;
- setting up National Leprosy Eradication Commission (NLEC) under the chairmahship of Union Minister of Health and Family Welfare for programme policy guidance and National Leprosy Eradication Board (NLEB) under the chairmanship of Union Health Secretary for monitoring the activities of the programme.

ii Strategy

The strategy of the programme was to control the disease through reduction in the quantum of infection in the population, reduction of infective sources and breaking the chain of disease transmission. Four basic activities were envisaged namely.

early detection and regular treatment of patients,

- providing multi-drug therapy (MDT) to all the patients on domiciallary basis; and
- education of the patients, their families and the community

1 Government of India (1982). Ministry of Health & Family Welfare. Report of the Working Group on the Eradication of Leprosy. Publication & Information Directorate (CSIR) Hillside Road, New Delhi.

members in general on leprosy and its curability; and
- social and economic rehabilitation of the patients.

The objectives of MDT were :

- to sterilize the leprosy lesions in the shortest possible period of time so as to Interrput the transmission of infection;
- to prevent the emergence of resistant strains of *M. leprae;*
- to cure the patient, minimize the development of deformities and prevent treatment failures; and
- to prevent relapse.

The bactericidal drugs recommended in the programme were dapsone, rifampicin, and clofazimine in the following doses (Table-7)

An intensive course of 14 daily doses and subsequently monthly doses were given under the direct supervision of the medical officer. Cases detected on any day of intensive treatment were given supervised doses only for the remaining days of the 14 day course, followed by monthly supervised and daily unsupervised treatment for a minimum of 24 months. Multibacillary (MB) cases detected after administration of 14 intensive daily doses received only monthly supervised and daily unsupervised doses for at least 24 months.

Until 1984, rifampicin was being administered to MB patients on two consecutive days every month, one supervised and other unsupervised. Since January 1985, however, the administration of second unsupervised doses of rifampicin was discontinued. Likewise, in Paucibacillary (PB) cases, initially three supervised daily doses of rifampicin and dapsone were given until 1984. From January 1985, only single monthly dose of rifampicin was given under supervision for a mininum of six months.

The supervised14 days intensive phase of treatment was followed in the districts where the MDT programme functioned as a vertical set-up. In the modified MDT districts the 14 days intensive, supervised treatment was dispensed with. In these districts all the registered patients started with pulse treatment in the continuation phase.

iii) Organisational Structure

A five tier organisational structure was created over the years as a part of NLCP/NLEP. The present basic elements of the structure are given in an organisational chart (fig. 2).

National Leprosy Eradication Commission functions as the policy making body for the guidance and surveillance of the programme. It is the responsibility of the National Leprosy Eradication Board (NLEB) to implement the plan and policies as laid down by the NLEC. An officer of the rank of a deputy director general of health services is the director of the programme. He is basically responsible for planning, programming, organ-

TABLE- 7

Multidrug Therapy Regimen in Leprosy

Period	*Drugs*	*Age Group*			*Remarks*
		6-9 yrs	*10-14 yrs*	*15yrs*	
MB Cases					
Intensive for 14 days	Rifampicin	300mg	450mg	600mg	Supervised
	Clofazimine	50mg	50mg	100mg	Supervised
	Dapsone	25mg	50mg	100mg	Supervised
Continuation phase for a minimum of two years	Rifampicin	300mg *	450mg *	600mg *	Supervised
	Clofazimine	100mg *	150mg *	300mg *	Supervised
		50mg **	50mg [2]	50mg [1] 100 mg [2]	Unsupervised
	Dapsone	25mg [1]	50mg [1]	100mg [1]	Unsupervised
PB Cases					
Continuation phase for a minimum of 6 months	Rifampicin	300mg *	450mg *	600mg *	Supervised
	Dapsone	25mg [1]	50mg [1]	100mg [1]	Unsupervised

* Once in a month
** Twice a week
1 Daily
2 Alternate days

MB - Multibacillary
PB - Paucibacillary

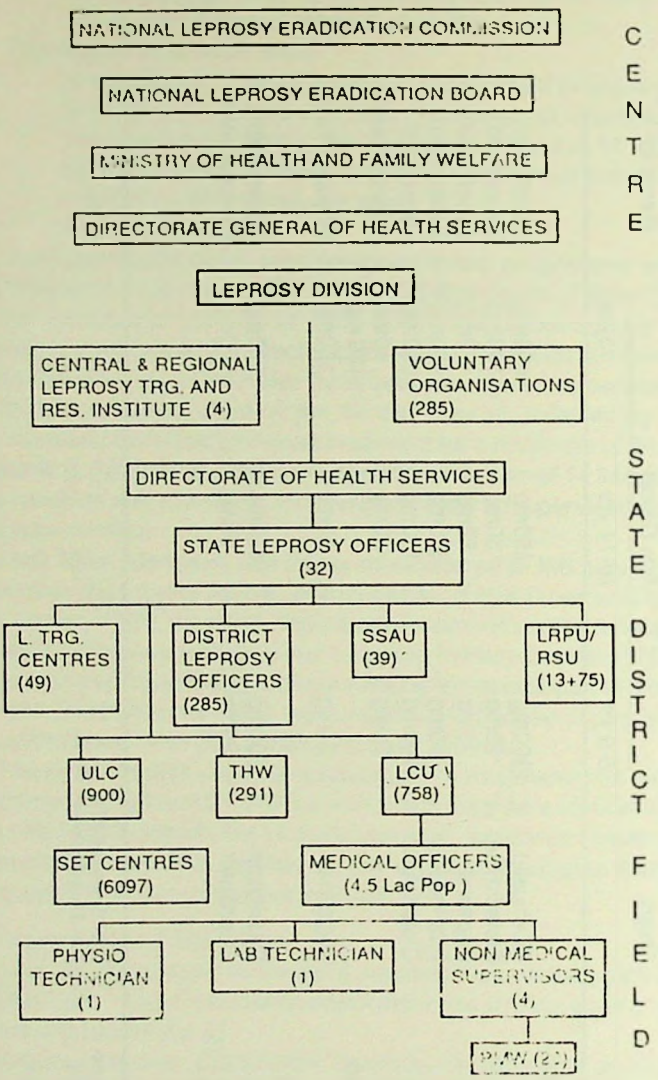

Figure 2 : Organisation Structure of NLEP at the Centre, State and District Levels

isation and implementation as per the policy decisions of NLEC and under the direction of NLEB. The programme director is assisted by technical officers of the rank of assistant director general (ADG) and deputy assistant director general (DADG) of health services.

Additional/joint/deputy director of health services at the state level is the state leprosy officer (SLO). He performs the same functions at the state level as DDG (leprosy) does at the centre.

For many years under NLCP, the district medical officer of health looked after the leprosy work in his district, in addition to his many other duties. During the fifth five year plan, however, leprosy officers were made available at the district/zonal levels also at the rate of one per district where the disease was of moderate endemicity. With NLEP coming into being, one DLO was planned to be provided for every district where the prevalence rate was 5 per thousand or more.

Two types of units were in operation at the periphery. In areas of high endemicity, a subsidiary centre was created, one for every 80,000 population. After initial experimentation, however, the subsidiary centre was renamed as leprosy control unit (LCU) during the third five year plan and was given a population of 150 thousands. With the introduction of effective control in the fourth plan period, districts with prevalence of 5 or more per thousand were provided with LCU at the rate of one per 4 - 5 lakh population. The present staffing pattern of LCU besides ancillary staff is :

Medical officer	1
Non-medical supervisors (NMS)	4
Paramedical workers (PMW)	20

In areas of moderate endemicity, the survey, education and treatment (SET) centres were established commencing with the second five year plan. In 1982, these were extended also to areas with endemicity of less than 5 per thousand. A SET centre was to serve a population of 25,000. A PMW or a non-medical assistant was given for each centre. The SET centre was attached to a Primary Health Centre (PHC) or a dispensary or a hospital located in the area. The PMW worked under the supervision of a NMS who was made available one for every five PMWs. SET centres were established also in known moderately endemic areas in highly endemic districts.

When the programme was extended to urban areas during the fifth plan period, urban leprosy centres (ULC) came into existence, one for every 50,000 population. Each ULC was manned by a PMW who functioned under the supervision and guidance of a medical officer in charge of the dispensary/hospital to which the ULC was attached.

In addition, facilities for those who needed hospitalization were

planned. These were supplemented by a limited number of reconstructive surgery units.

a. MDT Under Vertical Setup

Over the years, a separate cadre of health workers were trained to provide anti-leprosy services. In 1983 MDT was started in two districts. To ensure the satisfactory implementation of Multi-drug treatment in the district both with regard to its quality and coverage, certain pre-requisites were laid down before the district was selected. These included :

- the selection of districts was confined to those having prevalence rate of 5 or more per 1000 in the year immediately preceding the sanction of MDT;
- the districts selected should have been covered by LCUs, ULCs and SET centres and there was to be no unsurveyed virgin population;
- the districts was to have a full-time functioning DLO supported by other recommended staff;
- the district should have adequate referral facilities for attending complications; and
- the district was to have detected at least 80 percent of the estimated cases, evolved a system of regular treatment and also possessed a laboratory attached to each unit.

High endemic districts with leprosy prevalence of 5 or more per 1000 numbered 201 (Table - 5). MDT was extended to these districts in a phased manner. By 1991, 135 of the districts were covered. Presently, these districts were at various stages of MDT implementation and provided MDT umbrella to 75 percent of all the recorded cases, numbering 1.5 to 1.6 million.

b. Modified MDT Setup

Besides 135 of the 201 endemic districts where MDT operated, there still remained 66 districts where leprosy services were provided by the existing health services. These districts did not possess the requisite infrastructure for establishing the vertical MDT setup. At the same time it was necessary to extend the benefit of multidrug treatment to nearly 0.6 to 0.7 million patients in these districts. The Government of India, in 1990 developed the modified multidrug therapy approach.

The modified approach differed from the vertical programme essentially in the following respects :

- district leprosy unit functioned under the overall charge of the district medical officer;
- the leprosy services were delivered through the primary health

care staff supplemented by leprosy workers to the extent available in the district;

- the medical officer of the PHC was to be the overall incharge of MDT operations in the area;
- the treatment points were to coincide with the PHC, the subsidiary health centre, the dispensaries and hospitals; and
- Cash assistance was envisaged to leprosy patients for collecting drugs from the treatment points with further incentive to those completing treatment.

The organisational chart for modified MDT at the state level and below may be seen in figure 3.

In order to facilitate understanding of the programme, its components, activities and responsibilities equally well by all concerned and to ensure that the peripheral workers performed their jobs in an uniform and comprehensive manner, an operational guide[1] was developed earlier. After MDT was introduced into the programme, 2 other manuals detailing guidelines on case detection, classification, treatment. Follow up and reporting in MDT districts[2] and for modified MDT scheme[3] were brought out in 1985 respectively.

iv. Infrastructure

As the NLCP progressed after its establishment in 1955, the number of infrastructural facilities developing during the successive five year plans are presented in Table - 8.

The physical infrastructural components as on 1/4/1991 by state and union territories are given in Table - 9. Certain salient features of the infrastructure development were as follows :

- Creation of LCU started in the very first year of the programme, though the achievement of the target was only 77.5 percent during the first plan. It recorded a growth of 103 percent during the second plan. During the succeeding plans the achievements were short of the targets, each between 87.5 and 95.3 percent. In the seventh plan, however, the achievement exceeded the target by 12.4 percent.
- SET centres whose establishment commenced during the 2nd

1. Government of India, Ministry of Health, Family Planning & Urban Development (1969). Guide and Operational Guidelines for Assessment of Leprosy Work in India, Government of India Press, Faridabad.
2. Government of India, DGHS (1985) Leprosy, Guidelines for Case Detection, Treatment, Followup and Reporting - Ashok Printers, Delhi.
3. Government of India, DGHS (1990). Guidelines for Modified MDT Scheme in Selected Districts - TPS, New Delhi.

TABLE- 8
Establishment of Infrastructure by Plan Period

Type of	*Plan Period*									*Total*
	I	*II*	*III*	*Ann-ual*	*IV*	*V*	*Ann-ual*	*VI*	*VII*	
	51-56	*56-61*	*61-66*	*66-69*	*69-74*	*74-79*	*79-80*	*80-85*	*85-90*	
Leprosy Control Unit	31	103	46	1	70	126	0	26	355	758
SET Centres	4	194	564	379	363	462	0	861	0	6985
Urban Leprosy Centre	0	0	0	0	53	411	0	197	241	902
Temporary Hospital Ward	0	0	0	0	0	166	0	87	38	291
Reconst Surgery Units	0	0	0	0	0	68	0	7	0	75
District Leprosy Units	0	0	0	0	0	97	0	93	87	277
SSAU/ESU	0	0	0	0	0	0	0	17	24	41
Leprosy Training Centres	10	0	10	0	1	19	0	3	6	49

TABLE- 9
Physical Infrastructure under NLEP by States
as on March 1991

S. No.	State/UT	LCU	ULC	SET	DLO	THW	SSAU	VO
1.	Andhra Pradesh	94	91	164	31	50	3	45
2.	Arunachal Pradesh	2	0	31	0	1	0	3
3.	Assam	9	16	250	6	5	1	6
4.	Bihar	85	69	1044	21	29	4	18
5.	Goa	1	2	31	1	1	0	0
6.	Gujarat	21	21	369	7	9	2	17
7.	Haryana	0	3	2	0	0	1	1
8.	Himachal Pradesh	6	1	15	5	1	1	1
9.	Jammu & Kashmir	8	2	37	0	2	0	1
10.	Karnataka	41	48	673	20	22	3	22
11.	Kerala	20	15	254	8	5	3	11
12.	Madhya Pradesh	54	72	530	23	14	5	7
13.	Maharashtra	42	258	970	24	23	1	27
14.	Manipur	4	1	17	4	1	0	2
15.	Meghalaya	2	1	16	0	2	0	1
16.	Mizoram	2	1	7	2	1	1	0
17.	Nagaland	2	2	30	3	2	0	0
18.	Orissa	55	16	140	10	11	1	17

S. No.	State/UT	LCU	ULC	SET	DLO	THW	SSAU	VO
19.	Punjab	2	16	0	1	1	1	1
20.	Rajasthan	5	5	8	4	4	0	7
21.	Sikkim	2	6	13	1	1	0	1
22.	Tamil Nadu	102	82	26	22	52	7	31
23.	Tripura	3	4	20	1	1	1	1
24.	Uttar Pradesh	122	60	1023	65	17	1	48
25.	West Bengal	73	71	395	15	30	4	14
26.	A & N Islands	0	3	10	1	1	1	0
27.	Chandigarh	0	0	0	0	0	0	1
28.	D & N Haveli	0	0	0	0	0	0	0
29.	Daman & Diu	0	0	0	0	0	0	0
30.	Delhi	0	3	0	0	1	0	3
31.	Lakshadweep	0	0	0	0	0	0	0
32.	Pondicherry	1	3	24	2	1	0	1
	Total	758	902	6099	277	291	41	287

STATE	DIRECTOR OF HEALTH SERVICES assisted by STATE LEVEL OFFICER
DISTRICT	CHIEF MEDICAL OFFICER assisted by DISTRICT LEPROSY OFFICER
1,00,000 POP.	COMMUNITY HEALTH CENTRE assisted by LEPROSY NON MEDICAL SUPERVISOR
30,000 POP.	PRIMARY HEALTH CENTRE assisted by PARA MEDICAL WORKER
25,000 POP.	MULTI PURPOSE HEALTH ASSISTANT (MALE) assisted by HEALTH ASSISTANT (FEMALE)
5,000 POP.	MULTI PURPOSE WORKER (MALE) assisted by MULTI PURPOSE WORKER (FEMALE)
1,000	COMMUNITY HEALTH GUIDE/WORKER

Figure 3 : Organisational Structure for Modified MDT Setup at the State Level and Below.

plan recorded shortfalls in target achievement during each of the plan periods though their number increased with each successive plan. In the 7th plan a number of SET centres were converted into modified LCUs.

- Other facilities which started during the 5th plan period showed varying degrees of success in the establishment of targets ranging between 68.0 percent for reconstructive surgery units to 87.0 percent for upgradation of subsidiary centres into LCUs.
- During the 6th plan period, with the change in strategy and provision of additional funds, the achievement of all targets shot up from 17.3 percent to 400 percent except for reconstructive surgery units.

Inclusion of MDT in the programme called for an augmentation in the infrastructural facilities to be met with in a phased manner. It was envisaged that by the end of 1990, in all the 201 districts with prevalence rate of over 5 per 1000, these facilities will be established. By the end of the 7th plan, there was a further augmentation in the establishment of all facilities.

starting with a 14 percent increase in leprosy training centres to 36.4 in ULCs and 88.0 percent in LCUs.

It can be said that only after the 4th plan period did the programme acquire a significant thrust with allround development in infrastructural facilities to meet the patient needs. It received a further major filling following the introduction of MDT as a programme component in 1983.

V). Population Coverage

The population coverage by infrastructural facilities since the start of NLCP is given in Table - 10.

The total population covered upto 1966 was 54.724 million, constituting 14.7 percent of the endemic population of the country. About 16.3 percent additional population was covered in the 4th five year plan, 35.99 percent during 1974-77 and 64.2 percent by the end of 1985. Currently, (March 1991) the infrastructural facilities extend to 568.5 million representing 67.4 percent of the endemic population.

TABLE- 10

Population Covered and Cases Detected Since the Inception of NLCP by Plan Periods (Figures in Lakhs)

Plan	*Period*	*Cumulative Population Covered*	*Cases Detected*
I	1951-56	20.00	0.17
II	1956-61	147.00	0.95
III	1961-66	572.00	4.56
	Annual Plan (1966-69)	818.00	2.10
IV	1969-74	1467.00	4.56
V	1974-79	3548.00	10.90
	Annual Plan (1979-80)	3618.00	2.60
VI	1980-85	4399.00	21.44
VII	1985-90	5685.00	29.12

Marked variations did exist amongst different states and union territories in the percent endemic population provided with infrastructural facilities. However, highly endemic states with large patient load were accorded complete coverage. The extent of endemic population extended the protection by March 1991 in 8 of the states that accounted for approximately 90 percent of the total registered case load in the country is shown in Table - 11.

TABLE - 11
Endemic Population Provided Cover in
Certain Selected States

State/UT	*Population, 1991 (Lakhs)*	*Percent Population Provided Cover*
Andhra Pradesh	663.00	10.0
Bihar	863.38	48.6
Madhya Pradesh	661.35	59.3
Maharashtra	787.16	79.0
Orissa	201.90	100.0
Tamil Nadu	556.38	100.0
Uttar Pradesh	1387.60	55.0
West Bengal	679.82	86.2

But for Bihar, Madhya Pradesh and Uttar Pradesh, 80.0 Percent or more of the population had been covered.

vi. Case Detection and Treatment

The number of leprosy cases on record and those brought under treatment in successive plan periods since the beginning of NLCP in 1955 is shown in fig. 4.

The number of cases on record in the country progressively increased through the years-from 1.12 lakhs during the II plan to 32.46 lakhs between 1980-85. This was to be expected with increasing coverage of population and establishment of more and more infrastructural facilities. The number of recorded cases that was 20.4 lakh in March 1991, showed a decline for the first time in years. This was, no doubt, due to incorporation of MDT in the programme. By 1991, the MDT had reached all the 201 districts with endemicity of 5 per thousand or more. The introduction of MDT entailed large scale elimination of cases at initial screening (Table-12), resulting in a precipitous fall in the number of cases on record. This was supplemented by actual decrease in the number of cases in areas where MDT had been in operation for more than 3 years.

The performance during the present decade showed that on an average 0.4 to 0.5 million new cases were being detected annually. The number of cases discharged as cured progressively increased every year (Fig-5). At the end of March 1991, 2.0 million leprosy cases were on record, of which a proportion were on treatment. Over 5.0 million patients had been discharged as disease cured/migrated/dead since the inception of the programme.

Case detection, treatment and discharge by states/union territories for 1990-91 is presented in Table-13. Performance in this regard was being measured by the programme on the basis of two indices, namely

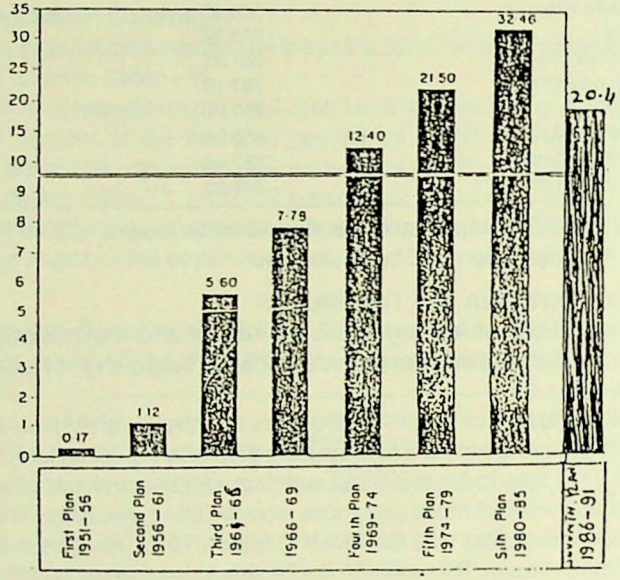

Figure 4 :Number of Cases on Record and Under Treatment since Programme Inception

percent of the allotted cases detected annually, and

per cent of the detected cases treated in the same period.

It would be seen that most of the states and union territories, not only met their targets but exceeded them by 9.0 to 192.0 per cent of the allotted number, the exceptions being Himachal Pradesh, Madhya Pradesh, the eastern states of Meghalaya, Mizoram and Nagaland, Sikkim, West Bengal and union territories of Delhi and Pondicherry. Even these states detected 80 per cent or more of the allotted cases save for Nagaland and Sikkim. Since nearly all the detected cases were brought under treatment, the number of treated cases also overshot the allotted targets.

TABLE12

Total Number of Leprosy Cases on Record, Under Treatment and Discharged by States as on March 1991.

S.No.	State/U.T.	Cases on record	Cases under treatment	Cases discharged
1.	Andhra Pradesh	214235	214235	1190031
2.	Arunachal Pradesh	1301	1301	813
3.	Assam	18766	18446	13179
4.	Bihar	462710	418689	264080
5.	Goa	1245	1245	3917
6.	Gujarat	24901	24864	128230
7.	Haryana	1282	1282	918
8.	Himachal Pradesh	3957	3957	3299
9.	J & K	6356	5456	1873
10.	Karnataka	39470	39470	263859
11.	Kerala	65817	53544	79209
12.	Madhya Pradesh	159850	124598	188864
13.	Maharashtra	166619	166619	839561
14.	Manipur	1365	1365	4667
15.	Meghalaya	1394	1394	1199
16.	Mizoram	201	193	680
17.	Nagaland	2030	2030	583
18.	Orissa	157621	156966	330106
19.	Punjab	3291	2991	4651
20.	Rajasthan	15549	13961	8026
21	Sikkim	225	225	248
22.	Tamil Nadu	207116	202897	1171891
23.	Tripura	2706	2706	2446
24.	Uttar Pradesh	361568	316939	368712
25.	West Bengal	114349	92974	529566
26.	A & N Island	1347	1347	1243
27.	Chandigarh	936	878	13
28.	D & N Haveli	383	368	64
29.	Daman & Diu	192	192	96

30. Delhi	4232	3945	1097
31. Lakshadweep	159	159	443
32. Pondicherry	1963	1963	12320
Total	2043136	1877199	5415884

If treatment of all the cases was inescapable in the interest of programme efficiency, it was even more important that they complete treatment. Against 4.81 lakh new cases detected during the 1990-91 those discharged numbered 9.84 lakhs. The latter included besides those who completed treatment, cases in the backlog and others who migrated or died.

Some of the reasons why achievement exceeded the targets may be found in a massive increase in NLEP infrastructure simultaneous with the extension of MDT and adoption of rapid methods of screening leading to increasing case detection.

Drug defaulting was the bane of many a leprosy control programmes. The NLEP, however, maintained a high rate of treatment regularity. The proportion of MB patients taking regular treatment was 88.6 per cent, while 73.0 per cent of the paucibacillary were regularly taking drugs, with an overall treatment compliance of 75.0 per cent in all the patients[1].

vii) Progress of Multidrug Therapy (MDT)

a. Leprosy Profile

Currently 201 districts with leprosy prevalence of 5 or more per 1000 population were under MDT (Table-5). These included 137 districts where the MDT operated under the vertical setup, while in the remaining 64, modified MDT was introduced in 1991. These districts were in various stages of MDT implementation. In addition, in 45 low endemicity districts, MDT was being given with the help of existing health services. The Total population under cover of combined therapy was 568.5 million.

At the end of March 1991, nearly 75.0 per cent of the recorded leprosy cases *i.e.* 1.5 to 1.6 million were receiving multidrug treatment. Over a million cases had been discharged since 1985 as disease cured.

The disease profile in 100 of the MDT districts for which complete data was available is shown in Table-14.

It showed that MDT had been in progress for 5 or more years in 17 of the districts; in 19 it had operated for 4 years, in 52 for 2 to 3 years while in the remaining 12 it was launched only in 1990. The case load in these districts at the commencement of MDT stood at 1.7 million. This number came down to 0.55 million at the end of December, 1991.

1. Ministry of Health, DGHS (1991), Fourth Independent Evaluation of National Leprosy Eradicaton Programme.

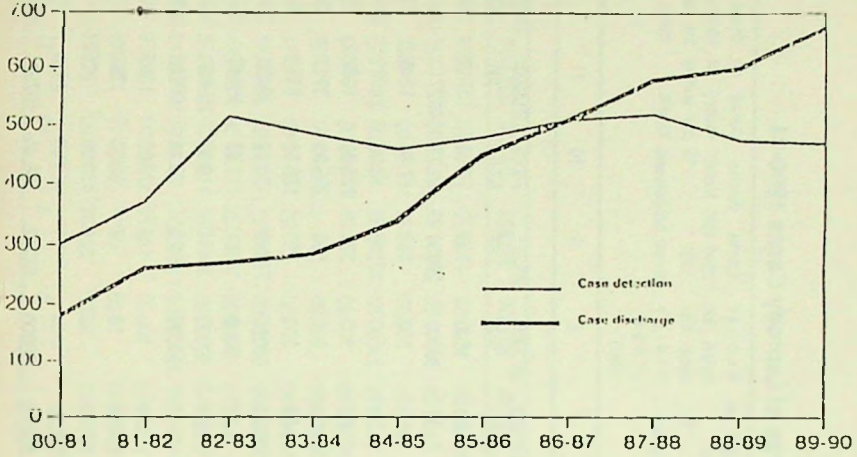

Figure 5 : Annual New Leprosy Case Detection and Discharge Performance, 1980-1990

TABLE 13

Case detection, Treatment and Discharge of Leprosy Cases 1990-91

State/ U.T.	Annual target for case detection & treatment (1990-1991)	New cases detected as on March 1991		Cases brought under treatment		Annual target for case discharge (1990 1991)	Cases discharged upto March 1991		Cases on record at the end of month	Cases under treatment at the end of month
		Number	% Achievement	Number	% Achievement		Number	% Achievement		
1 2	3	4	5	6	7	8	9	10	11	12
1. Andhra Pradesh	50000	85795	171.59	85795	100.00	200000	141351	70.68	214235	214234
2. Arunachal Pradesh	100	109	109.00	109	100.00	100	57	57.00	1301	1301
3. Assam	1500	1647	109.80	1647	100.00	1500	1185	79.00	18766	18448
4. Bihar	25000	26107	104.43	25404	97.31	30000	29934	99.78	462710	418685
5. Goa	200	505	252.50	505	100.0	500	937	187.40	1245	1245
6. Gujarat	8000	9721	121.51	9700	99.78	25000	13396	53.58	24901	24864
7. Haryana	100	263	263.00	263	100.00	100	325	325.00	1282	1282
8. Himachal Pradesh	200	169	84.50	169	100.00	200	530	265.00	3957	3957
9. J & K	200	265	132.50	265	100.00	200	253	126.50	6356	5454
10. Karnataka	18000	19786	109.92	19786	100.00	60000	76195	126.99	39470	39470
11. Kerala	6000	7318	121.97	6174	84.37	9000	10061	111.79	65817	53544
12. Madhya Pradesh	27000	26520	98.22	26520	100.00	30000	35491	118.30	159850	124590
13. Maharashtra	55000	89696	163.08	89696	100.00	190000	118323	62.28	166619	166619
14. Manipur	80	124	155.00	124	100.00	100	136	136.00	1365	1365
15. Meghalaya	50	39	78.00	39	100.00	50	46	92.00	1394	1394
16. Mizoram	50	42	84.00	42	100.00	50	224	448.00	201	190
17. Nagaland	100	34	34.00	34	100.00	100	11	11.00	2030	2030
18. Orissa	30000	47326	157.75	47326	100.00	50000	68202	136.40	157621	156960

1	2	3	4	5	6	7	8	9	10	11	12
19.	Punjab	200	550	275.00	550	100.00	200	736	368.00	3291	2990
20.	Rajasthan	800	1006	125.75	1006	100.00	800	2641	330.13	15549	13940
21.	Sikkim	80	20	25.00	20	100.00	50	125	250.00	225	225
22.	Tamil Nadu	75000	94794	126.39	90575	95.55	200000	249331	124.67	207116	202890
23.	Tripura	150	355	236.67	355	100.00	100	591	591.00	2706	2706
24.	Uttar Pradesh	45000	50963	113.25	49563	97.25	50000	42032	84.06	361568	31690
25.	West Bengal	25000	17134	68.54	17134	100.000	30000	190683	635.61	114349	92970
26.	A & N Islands	100	165	165.00	165	100.00	100	55	55.00	1347	1347
27.	Chandigarh	50	146	292.00	114	78.08	50	7	14.00	936	870
28.	D & N Haveli	50	105	210.00	105	100.00	50	64	128.00	383	383
29.	Daman & Diu	20	22	110.00	22	100.00	20	29	145.00	192	192
30.	Delhi	500	383	76.60	374	97.65	200	136	68.00	4232	3940
31.	Lakshadweep	50	54	108.00	54	100.00	50	88	176.00	159	159
32.	Pondicherry	500	473	94.60	473	100.00	2500	1655	66.20	1963	1963
	Total	369080	481636	130.50	474108	98.44	881020	984830	111.78	2043136	1877190

TABLE - 14
Leprosy Profile in 100 Selected MDT Districts

S.No.	Districts	Year of MDT commencement	No. of Cases At MDT commencement	No. of Cases Dec 91	Prevalence Rate At MDT commencement	Prevalence Rate Dec 91	Prevalence Rate % Fall	Childhood Rate Among New Cases	MB:PB Ratio in Net Cases Dec 1991	Disability Rate Among New Cases
1	2	3	4	5	6	7	8	9	10	11
1.	Anantapur	1989	27022	10260	10.60	3.22	78.2	30.88	17.48	0.70
2.	Guntur	1989	27196	9057	9.00	2.20	31.8	33.53	13.22	1.50
3.	Nellore	1989	27022	9410	13.40	4.67	65.3	26.19	23.22	2.55
4.	Karimnagar	1988	26910	7675	10.43	2.50	76.0	32.24	24.82	1.69
5.	Krishna	1987	28036	7532	9.20	2.04	77.8	33.69	17.50	3.72
6.	Cuddapah	1988	29069	5297	15.30	2.73	82.1	30.09	14.44	1.82
7.	Warangal	1987	38216	3389	21.70	1.60	92.6	24.68	27.65	1.90
8.	Chittoor	1987	32669	3767	8.80	1.15	82.9	28.56	17.16	2.57
9.	West Godavari	1987	191.38	4472	6.66	1.27	91.8	32.42	17.80	2.27
10.	Vishakhapatnam	1985	24155	2492	9.37	0.76	76.0	31.20	16.87	2.59
11.	Medak	1989	16268	4895	9.00	2.16	38.6	16.90	33.65	3.42
12.	Prakasam	1990	13626	10946	7.50	4.60	38.6	30.25	14.47	2.78
13.	East Godavari	1985	43945	9982	10.90	2.69	75.3	37.13	18.78	3.33
14.	Nizamabad	1990	8273	2761	5.30	1.76	66.7	17.13	38.45	0.29
15.	Nalgonda	1988	30456	5289	9.60	2.40	75.0	30.42	18.26	1.66
16.	Adilabad	1989	13718	8970	6.59	4.30	34.7	25.49	26.71	3.53
17.	Khammam	1988	11732	9393	6.65	5.30	20.3	30.69	24.61	2.85
18.	Kurnool	1990	36371	11566	15.00	4.80	68.0	26.30	15.08	1.51
19.	Srikakulam	1983	30740	2559	16.20	1.10	93.2	21.40	22.77	1.61
20.	Vizianagaram	1987	23643	2668	13.20	1.27	90.3	15.52	19.96	5.54

1	2	3	4	5	6	7	8	9	10	11
21.	Mahabubnagar	1989	20593	16784	6.70	4.90	26.8	13.39	28.52	12.14
22.	Karbi Anglong	1990	1901	1828	3.52	0.29	91.7	-	7.31	-
23.	Deogarh	1985	11069	1951	10.88	1.91	82.3	12.23	45.35	10.00
24.	Valsad	1987	11683	2718	6.90	1.53	77.8	29.47	31.74	3.79
25.	Dangs	1987	668	179	5.80	1.55	73.2	14.01	45.09	3.73
26.	Panchmahal	1988	11765	2765	5.17	1.19	76.9	13.39	34.93	6.48
27.	Surat	1989	6920	3675	6.20	1.47	76.2	23.09	40.04	6.80
28.	Bharuch	1989	6231	3503	4.76	2.70	43.2	54.58	37.40	6.46
29.	Vadodra	1984	11975	1459	4.68	0.57	87.8	12.96	31.15	4.44
30.	Gulbarga	1988	17357	3257	8.30	1.56	81.2	29.71	15.47	3.21
31.	Raichur	1988	17767	6103	8.96	3.40	65.8	27.34	23.86	4.95
32.	Bidar	1988	7390	1825	7.40	1.80	75.6	22.85	20.51	5.16
33.	Rajnand Gaon	1987	9683	2385	8.30	1.65	80.1	17.15	43.44	8.17
34.	Durg	1987	16155	4947	10.00	2.60	74.0	17.92	41.29	8.74
35.	Bilas pur	1989	14607	10256	6.60	3.47	47.4	10.69	31.80	4.07
36.	Bastar	1989	4253	1060	6.00	1.53	74.5	10.82	51.39	12.66
37.	Raigarh	1989	12162	9643	8.97	6.68	24.4	13.79	37.69	4.72
38.	Gadchiroli	1988	6817	1835	11.64	2.29	80.3	32.45	8.75	0.54
39.	Nanded	1987	20329	3490	11.63	1.98	82.9	31.92	5.46	0.34
40.	Osmanabad	1987	10965	1564	10.84	1.91	82.3	32.76	8.69	0.04
41.	Sholapur	1987	14712	4138	5.64	1.28	77.3	7.94	7.28	0.79
42.	Yuvatmal	1987	13506	3009	7.77	1.45	81.3	10.05	9.16	0.23
43.	Nagpur	1988	10825	2261	7.90	1.65	79.1	16.43	11.58	0.14
44.	Thane	1988	25704	6252	7.67	1.19	84.4	42.89	14.49	0.63
45.	Bhandara	1988	12920	3096	7.06	1.46	79.3	18.73	19.86	0.71
46.	Akola	1990	10631	3602	5.80	1.97	66.0	25.90	8.38	0.04
47.	Satara	1989	6139	3006	5.50	1.50	72.7	35.89	11.41	0.29
48.	Raigarh	1989	6114	3618	7.00	4.10	41.4	25.95	30.14	2.55
49.	Buldana	1989	7638	3178	5.06	1.68	66.7	29.88	13.59	0.45

1	2	3	4	5	6	7	8	9	10	11
50.	Beed	1990	7461	4521	6.25	3.20	48.8	17.35	11.94	1.11
51.	Parbhani	1989	9944	4150	7.10	2.22	68.7	23.59	10.70	0.26
52.	Amravati	1985	10487	2405	5.68	1.10	80.6	35.11	6.50	0.17
53.	Wardha	1981	8973	1578	9.30	1.70	81.7	26.52	10.16	0.23
54.	Chandrapur	1987	19737	3466	13.92	2.44	82.4	27.69	9.86	0.17
55.	Mon	1988	940	288	8.50	3.09	00.0	-	56.49	-
56.	Puri	1985	33227	7368	10.50	2.52	63.6	29.82	25.21	1.03
57.	Cuttack	1987	45897	11338	9.60	2.06	78.5	19.96	23.79	3.40
58.	Dhankenal	1988	13903	6706	12.70	5.72	54.9	21.50	36.97	1.30
59.	Mayurbhanj	1988	17791	6933	10.50	3.70	64.7	14.15	24.01	2.65
60.	Balasore	1989	21284	14090	8.10	6.25	22.8	25.86	34.86	6.50
61.	Sambalpur	1991	29231	19985	10.87	8.76	19.4	16.37	42.63	4.13
62.	Ganjam	1983	36704	4939	13.57	1.85	86.3	3.91	13.57	26.70
63.	Salem	1987	44497	7531	20.20	2.10	89.6	30.83	9.18	2.71
64.	Chengai Anna	1985	43701	10955	12.10	3.02	75.0	32.03	9.95	1.96
65.	Dharampuri	1988	10213	3512	12.45	1.76	85.0	28.37	16.86	3.33
66.	Madurai	1988	27614	10156	20.00	3.36	83.2	19.63	8.61	3.69
67.	Ramnathapuram	1988	6333	2549	6.20	2.25	63.7	20.20	13.75	1.13
68.	Periyar	1988	25249	8652	12.27	3.65	70.2	25.23	10.89	2.44
69.	QEM Dinndigul	1987	15366	3460	16.20	1.95	87.9	32.44	12.94	2.45
70.	Sinaganga PTT	1988	13938	5080	14.32	4.73	66.9	31.51	23.22	2.43
71.	Kamarajar	1988	14903	4305	10.80	2.77	74.3	31.88	13.70	4.88
72.	Thanjavur	1988	26696	7298	6.50	1.60	75.3	31.45	10.09	2.68
73.	Madras	1990	13193	4191	6.90	1.10	84.0	49.01	6.65	1.71
74.	South Arcot	1990	34787	22423	8.28	4.17	49.6	28.15	9.16	1.52
75.	North Arcot	1983	35213	3295	13.90	1.10	92.0	33.62	11.63	5.11
76.	Coimbotore	1989	15196	8263	8.90	2.68	69.8	36.24	8.71	1.40
77.	Varanasi	1985	14984	7013	6.40	1.90	70.3	18.66	42.96	10.04
78.	Barabanki	1987	10292	2772	6.30	1.39	77.9	7.39	34.97	5.92
79.	Faizabad	1989	7700	4334	5.00	1.82	63.6	6.42	53.34	8.04
80.	Uttar Kashi	1990	563	186	8.87	0.94	89.4	1.61	28.22	12.90
81.	Kanpur Dehat	1988	18056	5266	13.37	2.93	78.0	4.22	38.70	5.72

1	2	3	4	5	6	7	8	9	10	11
82.	Pilbhit	1990	11276	10766	11.58	10.67	7.8	13.05	16.94	9.98
83.	Mirzapur	1990	8156	4669	6.90	3.69	46.5	12.50	34.59	10.90
84.	Deoria	1989	9020	5249	6.10	3.48	42.9	8.08	36.43	5.78
85.	Sitapur	1990	17150	12504	8.00	5.34	33.2	3.93	22.89	2.68
86.	Bankura	1988	26304	6561	12.00	2.76	77.0	23.99	32.76	4.65
87.	Purulia	1982	27254	8830	33.75	4.17	87.6	17.60	21.83	6.87
88.	Lakshadweep	1986	406	73	10.50	1.43	86.3	32.35	6.33	-
89.	Pondicherry	1989	4210	1801	7.00	2.32	66.8	37.58	13.05	2.05
	Total		1702935	554217						

The incidence of the disease in children varied widely as did the MB ratio. The former ranged between 1.61 and 54.5 per cent of all the new cases with an average of 23.9 per cent, while 6.5 to 56.4 per cent of the cases were multibacillary. Deformity affected about 5.0 per cent of the patients. The unusually high childhood rate was due to detection of children in large numbers at the surveys that focused primarily on schools. At the aggregate level nearly 40.0 per cent of the all cases were detected through school surveys during 1990-91.

Independent evaluations carried out in 1987, 1989 and 1991 showed that MDT was very well accepted by the patients, the tolerance was good and the side effects minimal. The drug compliance was excellent as seen by high attendance rate. Over 80.0 per cent of the patients took treatment regularly and the relapse rate was less than 1.0 per cent, indicating that the treatment was effective. Voluntary reporting of patients in the MDT districts was 35.0 per cent on an average.

b. Bacteriological Examination

Examination of skin smears for bacilli was an essential pre-requisite of MDT programme. Such examination was carried out to supplement disease classification before starting treatment and later as a follow up measure. Currently the bacteriological services constituted a weak link in the MDT programme. On an average, 60.0 per cent of the patients were subjected to bacteriological examination. Between the two disease types, however, bacteriological cover was available to 72.5 per cent of the multibacillary cases against 47.6 per cent given to paucibacillary type.

c. Impact of MDT

The MDT programme profoundly changed the leprosy picture in the affected districts. The number of cases decreased by more than 67 per cent (from 1.7 to 0.55 million). Each one of the 100 districts registered a significant decline in the prevalence rate, ranging between 7.8 per cent observed in Pilibhit to 95.7 per cent of the rate at the commencement of MDT in Alleppey.

The effect of MDT on the epidemiological profile in 10 of the districts completing intensive phase of MDT operations is presented in Tables 15, 16, 17, 18. The epidemiological indices employed were :

- prevalence rate per 1000
- annual case detection rate per 1000
- proportion of MB cases among the new cases per 100
- childhood leprosy rate among new cases per 100
- deformity rate in new cases per 100

- relapse rate per 1000
- voluntary reporting rate per 100

Prevalence Rate : A dramatic decline in the prevalence rate characterized all the districts, the average fall being 71.6 per cent from its pre-MDT value. The maximum decrease of 89.2 per cent was witnessed in Vishakhapatnam while the least that occurred was 13.5 per cent in Balasore. Since the detection of new cases in the districts was through, the prevalence rate denoted the actual number of cases. There was no doubt that the case load in these districts declined simultaneously.

Annual Case Detection Rate : Like the prevalence rate, the annual case detection rate also decreased uniformly in all the districts. The average decline was 44.5 per cent.

MB Ratio in New Cases : The proportion of multibacillary cases increased in 7 of the 10 districts, while in the remaining 3 it showed an average decline of 11.0 per cent. As some of the paucibacillary cases resolved on their own, the duration of the disease in the PB cases was, on an average, shorter compared to MB cases. This accounted for the increase in the MB cases. The backlog of cases prevalent during the early stages of MDT also disproportionately increased the number of multibacillary cases.

Childhood Leprosy Rate : An increase in the proportion of children among the new cases was seen in all the districts compared to what it was at the commencement of MDT, the increase varying widely from 9.3 in Purulia to 285 per cent in Balasore.

TABLE-15

Prevalence & Annual Case Detection Rates in Selected Districts Completing Intensive MDT Phase

District	*Prev. rate*		*%*	*Annual Case Detection rate*		*%*
	Prev.	*Current.*	*Vari.*	*Prev.*	*Current*	*Vari.*
BALASORE	8.1	7.0	-13.5	0.8	0.6	-25.0
CHENGALMGR	12.8	3.3	-74.2	2.4	1.6	-33.3
DEOGARH+DUMKA	10.8	1.9	-82.4	2.3	1.7	-26.0
DHARWAD	6.2	1.0	-83.8	2.4	1.2	-50.0
DURG	9.0	2.7	-70.0	2.8	2.0	-28.5
MAYURBHANJ	11.4	4.5	-60.5	5.7	2.0	-64.9
PURI	10.5	2.0	-80.9	1.9	1.0	-47.3
PURULIA	33.7	4.4	-86.9	2.6	1.7	-34.6
VISHAKHAPATNAM	9.3	1.0	-89.2	4.9	1.0	-79.5
WEST GODAVARI	6.6	1.7	-74.2	2.7	1.2	-55.5

TABLE-16

MB Ratio & Childhood Leprosy Rate in Selected Districts Completing Intensive MDT Phase

District	MB ratio in new cases		% Vari.	Childhood %		% Vari.
	Prev.	Current		Prev.	Current	
BALASORE	35	33.0	-7.1	12.7	49.0	+285
CHENGAI MGR	32.8	27.6	-15.8	14.5	19.2	+32.4
DEOGARH+DUMKA	31.0	45.0	+48.4	16.0	12.0	-25.0
DHARWAD	27.8	25.6	-8.8	13.0	20.0	+53.8
DURG	29.0	38	+31.0	18.6	21.0	+12.9
MAYURBHANJ	32	50	+56.2	15.0	19.0	+26.6
PURI	19.0	23.0	+21.0	18.0	23.0	+27.7
PURULIA	29	31	+6.8	16.0	17.5	+9.3
VISHAKHAPATNAM	33.0	35.8	+8.4	14.2	31.0	+118.3
WEST GODAVARI	12	14	+16.6	15.6	38.0	+143.5

TABLE-17

Disability & Relapse Rates in New Leprosy Cases in Selected Districts Completing Intensive MDT Phase

District	MB ratio in new cases		% Vari.	Childhood %		% Vari.
	Prev.	Current		Prev.	Current	
BALASORE	12.2	NA	NA	0	0	NA
CHENGAI MGR	6.8	2.4	-64.7	0.8	0.7	-12.5
DEOGARH+DUMKA	15.4	10.1	-34.4	0.3	0.3	-
DHARWAD	2.0	1.4	-30.0	.02	.01	-50
DURG	11.6	8	-31.0	0.5	0.2	-60
MAYURBHANJ	NA	NA	NA	0	0	-
PURI	6.4	1.0	-84.3	0.2	0.18	-10
PURULIA	9.6	6.8	-29.1	1.6	1.4	-12.5
VISHAKHAPATNAM	3.4	2.0	-41.1	0	0	-
WEST GODAVARI	5.4	1	-81.4	0	0	-

TABLE-18

Voluntary Case Reporting Rate in Selected districts Completing intensive MDT Phase

Districts	Voluntary Reporting rate		Vari.
	Prev.	Current	
BALASORE	20	60	+40
CHENGAI MGR	23	36	+13
DEOGARH+DUMKA	26	35	+9
DHARWAD	46	53	+8
DURG	22	30	+8

MAYURBHANJ	15	25	+10
PURI	21	34	+13
PURULIA	19	27	+8
VISHAKHAPATNAM	33	27	-6
WEST GODAVARI	36	51	+15

Prev. = Before MDT
Vari. = Variation

Disability Rate: The disability rate also showed a decrease in 8 of the 10 districts; in the remaining two no information was available. The decline in the disability rate was difficult to explain. No doubt, it was partly due to the effect of MDT, as in these districts the MDT had been in progress for several years. On the other hand, it was also influenced by a large scale elimination of disabled patients during initial screening at the commencement of MDT.

Relapse Rate : The relapse rate showed a decrease in all the 5 districts for which information was available.

Voluntary Reporting Rate : An increase in self reporting varying from 8 to 40 per cent in different districts was in fact a measure of the confidence of people reposed in the effectiveness of MDT and an increasing awareness of the availability of cure against leprosy.

6. TRAINING OF PERSONNEL

NLEP maintained its own cadre of leprosy workers for the training of which 49 training centres were established during the successive five year plans. These leprosy training centres were spread over 12 states in the country (Table-19).

TABLE-19
Distribution of Leprosy Training Centres by States

S.No.	State	Number of leprosy Training centre
1	Andhra Pradesh	7
2	Assam	1
3	Bihar	4
4	Gujarat	1
5	Karnataka	4
6	Kerala	2
7	Madhya Pradesh	3
8	Maharashtra	7
9	Orissa	2
10	Tamil Nadu	8
11	Uttar Pradesh	5
12	West Bengal	5
	Total	49

Institutional data available on the number of personnel of different

categories trained and their annual training capacity will provide some insight into the performance of these institutions (Table-20)

TABLE-20
Number of Training Centres, Their Annual Training Capacity and the Number Trained by Category

S.No. Category	No. of Training Centres	Annual Training Capacity	No. Trained Till March 1992
1. Para-medical worker	39	2048	17265
2. Non-medical supervisors	9	111	2061
3. Lab. technician	8	130	1975
4. Physiotherapy technician	7	73	529
5. Health educator	2	20	401
6. Medical officer	11	274	3161

Only 11 of the 49 centres were engaged in the training of medical officers while those that trained non-medical supervisors, laboratory technicians and physiotherapists numbered nine, eight and seven. Only 2 of the institutions provided training in health education.

The above training capacity should be viewed in the background of current training needs as well as the anticipated requirements in the near future in the country. Amongst the existing personnel, over 5000 paramedical workers, 1000 non-medical supervisors, 739 doctors, 508 laboratory technicians were without training. In addition, 281 physiotherapists and 246 health educators were untrained (Table-21). The extension of MDT services to 77 moderately endemic districts having prevalence rates between 2 to 5 per 1000 population added its own training load.

In 1986-87, a WHO consultant appointed to recommend steps for NLEP staff development in view of the Switch over to the MDT programme, concluded that while the recruitment and training of para-medical workers

TABLE-21
Current Training Status of Personnel in the Programme

Personnel	Sanctioned Strength Training	Number Trained	Number Requiring Training
Medical officers	1403	664	739
Non-medical supervisors	4034	2137	1087
Para-medical workers	19327	14200	5127
Laboratory technicians	1383	875	508
Physio-therapists	641	360	281
Health educators	409	163	246

was on the whole satisfactory, the same could not be said of medical officers, non-medical supervisors, laboratory technicians, physiotherapists and health educators[1]. It was felt that top priority was required to be given to the training of over 800 medical officers, 2500 non-medical supervisors, 7000 para-medical workers and 1500 smear technicians.

In order to cater to this need either the existing institutions would be required to accelerate their activity or new training centres established. In this context, it must be noted that the current utilization of the training capacity of the existing institutions was only 36.0 per cent for medical officers and 39.0 per cent for non-medical supervisors.

7. VACANCY OF POSTS

The overall vacancy position by category of staff may be seen in Table-22. The sanctioned post for the programme varied from about 19500 to 27000 between 1985 and 1991 and about 15 to 25 per cent of them lay vacant at any point of time.

An analysis of the data showed that the worst affected states were Bihar, West Bengal, Karnataka and Madhya Pradesh. The most affected category was that of physiotherapists in which 35.0 per cent of the posts were unoccupied.

8. PERFORMANCE

The recorded evidence indicated that NLCP/NLEP performance during the last four decades of its existence was creditable. The programme came into being in 1955 and did not take off until the end of 3rd five year plan, that is for over 10 years of its birth. Several constraints-social, epidemiological, therapeutic and technical impeded its progress. It was only during the 5th plan period that the programme got activated. The programme received a further boost after inclusion of MDT as the main strategy for disease control as indicated by the investments made and infrastructural facilities created.

i) Disease Detection and Treatment

One of the most important activities of NLEP was that of surveying households and examination of family members in the endemic areas to detect cases. The performance in this respect could be assessed on the basis of

- per cent of endemic population surveyed ; and
- per cent of estimated cases detected

Population survey was a continuous on-going activity at the LCU and SET centres. It was expected that the total population examination would

1 Tranining for National Leprosy eradication Programme Needs-India, WHO Project, ICP LEP001, 31st August, 1987, New Delhi.

TABLE - 22*
Vacant Posts in NLEP

Category of Post	*1985*		*1987*		*1989*		*1991*	
	Sanctioned	*% Vacant*	*Sanctioned*	*% Vacant*	*Sanctioned*	*% Vacant*	*Sanctioned*	*% Vacant*
ZLO/DLO	NA	NA	234	17.9	238	14.7	271	27.6
MO	1069	18.9	1009	28.3	1076	14.6	1132	28.2
NMS	2754	15.6	3324	24.4	3654	17.1	4034	17.7
PMW	14212	11.7	17043	22.6	17683	18.9	19327	21.9
Lab. technician	553	32.4	813	39.7	1036	34.2	1383	30.8
Physiotherapist	746	39.5	556	48.4	616	50.0	641	35.5
HE			410	42.0	NA	NA	409	23.2
Total	19334	14.3	23239	24.6	24303	19.9	27152	22.5

* Source : Ministry of Health & Family Welfare, DGHS (1985, 1987, 1989, 1991), NLEP, 1st 2nd, 3rd and 4th independent evaluations.

be completed once in 5 years. Programme evaluation in 1991 showed that more than 87.0 per cent of the para-medical workers were engaged in survey, spending on an average 28 days in the field in the preceding 3 months. Average population examined by a para-medical workers in the last 3 months was 3280 in the 33 MDT districts.

The second indicator used for performance assessment was the per cent of estimated cases detected. There were 3.9527 million cases of leprosy in India, out of which 2.584 million (65.37%) had been detected by Dec. 1980. There was a remarkable increase in case detection during the 6th plan period accounting for 41.5 per cent of the total case detection till that time (21.44 lakhs out off 51.70 lakhs). The case detection shot up further in the 7th plan period numbering 29.12 lakhs (Table-10).

Another, perhaps even more important, NLEP activity was to bring the detected cases under treatment to eliminate the foci of infection. As on 31 March, 1991, there were 20,43,136 cases on record, of which 1877199 (91.9%) had been brought under treatment. A total of 5.41 million cases had been discharged as cured or eliminated due to death since the inception of the programme.

ii) Programme Monitoring

A well developed system of programme monitoring and reporting existed under the NLEP. It operated at all levels of administrative hierarchy. The data orginated at the peripheral level of the units and was reported to the district headquarters which, in turn, forwarded it for aggregation to the state. An efficient management of the programme depended on continuous monitoring and initiating remedial measures in time. For this reason, an elaborate system of data collection, recording and reporting was prescribed in the programme. Monthly, quarterly and yearly reports were envisaged. Certain MDT districts were required to send special report on their progress. Even the highest level of administrative control in the Government of India set a great store by regular programme monitoring. The Leprosy Commission, under the chairmanship of Health Minister met at least once a year to lay down policies, for the implementation of which the Leprosy Eradication Board met once in six months.

Despite such an elaborate system, the programme suffered set backs as many of the health workers did not have understanding of why the reports were required. Many of them did not receive training in filling up the forms, development of skills in interpreting data and using information for programme management. These inadequacies came to light during the 4th independent evaluation of NLEP in 1991. It was, however, to the credit of the programme that the data originating in the field was found to be reliable

and the reports from 90.0 per cent of peripheral units were sent regularly and in time.

Iii) Management

NLEP had considerable inputs that were vital to its functioning. A vast network of infrastructure existed under it. The programme presently monitored a cadre of 26788 technical persons. Centres were maintained to train manpower and facilities had been created in the form of temporary hospitalization units and reconstructive surgery units to provide specialized care. These called for considerable managerial skills for their optimal utilization. In addition, it was necessary to ensure continuous supply of adequate anti-leprosy drugs, equipment and transport at all levels.

The programme suffered for want of an optimal management. Nearly one-fourth of the sanctioned posts remained unutilized and were filled, the incumbents suffered for want of training. Half of the health educators had not received any training while more than one-third of the medical officers and non-medical supervisors were untrained.

Cadre management presented its own lacunae. the Swaminathan Commission recommended that the state leprosy officer being the chief coordinator and technical advisor to the state government on NLEP, his post should be held by a senior officer with adequate administrative experience, holding at least the rank of a deputy director of health services. He should remain in position for a minimum period of 10 years to enable him to take a long view of the problem. However, only 13 of the 24 SLOs interviewed during the 4th evaluation possessed earlier experience of work in leprosy. The average stay of the SLO at his post was only 1 year and 8 months.

9. EXPENDITURE

At what cost were the foregoing infrastructural facilities for providing leprosy services established. A simple question like this was difficult to answer. Analysis of the available data may throw some light on this question.

The NLEP had been a centrally aided programme upto 1968-69 when it was developed, managed and financed by the state governments with assistance from Government of India. However, during the 4th plan period commencing 1969-70, the programme was fully supported by Government of India as a centrally sponsored scheme and the total expenditure on it became chargeable to Government of India, while the programme was implemented by state governments according to the guidelines of the centre.

It would be seen from Tabel-23 that expenditure on NLCP suddenly

increased during the 5th plan period when a large number of institutions came into being. This constituted more than 50 per cent of the estimated expenditure of NLCP. The expenditure during the 6th plan doubled that of the 5th plan expenditure and that of the 7th plan was twice as much as in the 6th plan. Large infrastructural facilities were established during the 6th and 7th plan periods due to extension of multi-drug treatment programme to more and more districts in the country.

Utilization of development budget for 1990-91 by the states showed that while the utilization of total budget provision was more than 90.0 per cent in as many as 19 states/UTs, it was not so in the case of another 7. No information was available in respect of 6 states. Not all the states, however, utilized the non-revenue budget provision. Bihar surrendered the entire amount of Rs. 107 lakhs. Likewise, expenditure was about 50.0 per cent of the plan outlay in the states of Andhra Pradesh, Kerala, Maharashtra, Rajasthan and Tripura.

Table-23
Expenditure on NLCP/NLEP During Successive Five Year Plan Periods

Period	*Expenditure*	*Pattern of Assistance*
1st Plan (1955-56)	35.00	Centrally aided
2nd Plan (1956-61)	529.00	Centrally aided
3rd Plan (1961-66)	425.00	Centrally aided
Annual Plan (1966-69)	63.00	Centrally aided
4th Plan (1969-74)	286.00	100%
5th Plan (1974-79)	2023.00	50:50
Annual Plan (1979-80)	232.00	50:50
6th Plan (1980-85)	4004.43	100%
7th Plan (1985-90)	8582.00	100%
1990-91	2193.57	100%
1991-92	2280.00 (BE)	100%

10. HEALTH EDUCATION

Serious recognition of the fact that health education formed an effective means of promoting leprosy control programme was relatively recent. Age-long prejudice and ignorance in the society regarding the nature of the disease and the possibility of arresting and curing it came in the way of leprosy control. A change in the general prevailing attitude would immediately sharpen the cutting edge of our available weapons against leprosy.

With the acceptance of MDT as a sheet anchor for arresting the disease, it became all the more important to prepare the community on the

curative role of these drugs, the need for regular treatment for prolonged periods, assistance in default retrieval and social integration of the general patients.

Every worker under the NLEP was expected to be a health educator. Inspite of educational component incorporated in the methodology of leprosy control since the inception of NLEP, necessary messages failed to reach the people to the desired extent. Financial out-lays were simultaneously enhanced under NLEP towards health education from 1984-85.

Health education in the programme aimed at:

- creating awareness on the availability of free treatment;
- developing knowledge on the nature of leprosy, its amenability to cure, recognition of early signs of the disease and prevention of deformities;
- promoting social integration of the leprosy patients; and
- promoting community's commitment to the programme.

The impact of health education on the programme was gone into some detail by the 4th Independent Evaluation. It would be relevant to discuss some of its findings.

A high degree of programme awareness prevailed in the community. A great majority of the villagers (71.2% out of 425 interviewed) were aware of the leprosy workers visiting the villages. Nearly half of them knew the workers by name. As many as 65 per cent were familiar with the work the paramedical workers performed in the villages.

Nearly 60.0 per cent of the respondents believed that leprosy did not spread easily while more than 70.0 per cent knew that the disease was curable. A high proportion of them (67.0%) knew that a leprosy patient could be safely kept at home. The majority was knowledgeable on the non-hereditary nature of leprosy.

The general belief that the leprosy patients were shunned by one and all was not borne out by facts. More than 90.0 per cent of the 466 patients lived with their families and half of the patients were occupied in one vocation or the other.

It was obvious that the programme had percolated to the people. The general attitude of the community towards the disease was positive. The proportion of self-reporting cases had gone up substantially over the years. Among 466 patients interviewed, 255 (48.2%) had reported to the medical officer on their own.

Undoubtedly, wide variations existed from state to state in respect of health education component of the programme but the overall picture was quite satisfactory. It was in the states of Gujarat, Orissa and Maharashtra that the health education seemed to have made the maximum impact.

with extensive field centres comprehensively engaged in antileprosy activities. Thus, the resources of the several of the voluntary agencies were directed to converge on a single focus of leprosy eradication. It is for the programme managers now to ensure that these efforts became mutually supportive with a clear understanding and appreciation of each others role. It can be facilitated by forming a consortium or a similar structure to develop linkages between various agencies at the state and central levels for the purpose of imaginative utilization of all existing facilities.

b. International and Bilateral Agencies

Following the announcement of the Government of India to eradicate leprosy in a time bound manner, there was wide spread international interest in the national leprosy eradication programme. Several international agencies such as UNDP, World Bank, SIDA, DANIDA, WHO, UNICEF etc. were cooperating with the government in leprosy control. The most significant role had been played by WHO in evolving a global programme for leprosy control and providing technical guidance in formulating newer strategies from time to time.

WHO's special programme for research and training in tropical diseases covered leprosy and focused on certain significant areas of research such as:

- development of better diagnostic tests;
- determination of the prevalence of resistance to dapsone;
- development of improved methods of treatment including MDT; and
- development of vaccine and new drugs.

SIDA was assisting the NLEP since 1978. The first MDT projects in 2 districts viz Wardha and Purulia were launched with SIDA support. SIDA provided assistance to 15 endemic districts through WHO. These districts included Srikakulam, Vizianagaram, Ganjam, Deogarh, Varanasi, Purulia, Krishna, Chandrapur and Thanjavur. The first 10 districts had since gone into the maintenance phase. In addition, financial assistance for the services of 40 consultant leprologists was made available.

Implementation of MDT and promotion of health educaiton were the two main foci of assistance of most of the international agencies. These activities received assistance from DANIDA in 8 of the districts, by LEPRA in 6, by NORAD in 3 and by Italian Leprosy Association and Damien Foundation in 2 each.

13. TENTATIVE PLAN FOR LEPROSY ELIMINATION IN THE COUNTRY

The Government of India are committed to eradicate leprosy by the year 2000 AD. The strategy is to provide rapid universal MDT coverage in

all the endemic districts. The count down of affected cases and villages has already begun.

There are 450 districts in India; 201 are high endemic for leprosy with a prevalence to 5 or more per 1000 population. Another 77 districts have prevalence varying between 2 and 5. The remaining 177 districts have prevalence below 2/'000.

Presently the 201 districts have been brought under MDT. These districts have 85.0 per cent of the total cases in the country. However 66 of these districts have very recently been sanctioned MDT with a modified pattern of services. It is proposed to establish vertical MDT services to these districts by March 1993 with the assistance of World Bank.

Following an in-depth analysis of leprosy situation, 77 districts have been identified having leprosy prevalence of 2 to 5 per 1000 population. These districts are intended to be covered under modified MDT scheme in the proposed World Bank project.

MDT was very well accepted by the patients, the tolerance was good and side effects were minimal. The drug compliance as observed by attendance rate was high. There was marked reduction in the reactive episodes. MDT had improved the motivation among patient, staff and community. There was increased awareness and knowledge about leprosy in the community as reflected by more and more self reporting of new patients.

Annual performance of NLEP in the 6th and 7th plans, after MDT had been introduced as presented in Table-24 shows that for the first time in 1987, the number of cases discharged were 10 per cent more than the newly detected cases. The trend is noticeable in subsequent years as well. This has undoubtedly been possible due to larger and larger number of patients being brought under multi-drug therapy. The programme is, thus, moving in the right direction of control. It is expected that the absolute number of leprosy cases would come down to less than 1.0 per cent of the present case load in the next five years.

TABLE-24

Year	*No. of cases at the begining of the year*	*New cases*	*Discharges*		*No. of cases at the end the year*
			MDT	*Monotherapy death, other reasons*	
1991	2120	+450	-500	-300	1770
1992	1770	+420	-650	-250	1290
1993	1290	+400	-500	-200	990
1994	990	+370	-500	-100	760
1995	760	+320	-500	-50	530

1996	530	+280	-450	-30	330
1997	330	+240	-380	-20	170
1998	170	+220	-250	-20	120
1999	120	+150	-200	-10	60
2000	60	+120	-150	-10	20

The proposed annual targets for case detection and cure and number of cases at the end of each year upto the year 2000 as worked out by the Leprosy Division, Directorate General of Health Services in presented in Table-25.

14. ISSUES

The issues in leprosy should be examined in the context of incomplete scientific knowledge on many facets of the disease and the limitation of the available chemotherapy. Despite these limitaitions, there is evidence to suggest that the disease is on decline.

TABLE - 25
Targeted Achievements Under NLEP by Years

(Cases in Millions)

Year	*No of cases at the beginning of the year*	*New cases*	*Discharges Monotherapy death, other reasons*	*No. of Cases at the end of the year*
1991	2.043	+0.45	-0.75	1.743
1992	1.743	+0.43	-0.72	1.453
1993	1.453	+0.40	-0.68	1.173
1994	1.173	+0.37	-0.65	0.893
1995	0.839	+0.35	-0.62	0.623
1996	0.623	+0.30	-0.60	0.323
1997	0.323	+0.25	-0.48	0.093
1998	0.093	+0.23	-0.25	0.073
1999	0.073	+0.15	-0.20	0.023
2000	0.023	+0.10	-0.12	0.003
2001	0.003	+0.10	-0.103	0.000

On the basis of the work done over a period of 12 years, it was observed that the prevalence rate in an observed area fell from 2.16 to 1.1 per cent; the total infectiousness declined from 149 to 36 with an average reduction of 9.0 per cent per year, though the incidence of the disease apparently did not appreciably come down. Another study carried out by Gandhi Memorial Leprosy Foundation in Bobbilli area of Andhra Pradesh indicated that the number of new cases and the incidence rate per 1000 population decreased from 144 and 7.2 in 1964-65 to 34 and 1.63 respectively in 1972-73. In yet another area, the incidence declined from 3.11 per 1000 in 1957 to 1.50 per 1000 in 1972.

There is no doubt that there has been substantial progress in the control of leprosy in the country. The achievements of MDT so far have been impressive. The situation in districts which have completed more than 5 years of MDT seems to prove that elimination of leprosy from India is within sight. However, the successive evaluations of NLEP performed between 1986 to 1991 have drawn attention on certain issues affecting the programme. These are:

- lack of interest and support by medical men in general to work in leprosy;
- lack of motivation of workers and lack of enthusiasm in government officials;
- presence of untrained staff in sufficient numbers within the programme at all levels;
- the training centres remained under-utilized;
- indadequate training in leprosy of under-graduates, laborotary technicians and non-medical supervisors;
- full complement of staff sanctioned has not been in position;
- inadequate bacteriological surveillance and sub-standard quality of laboratory work;
- lack of desired emphasis on health education
- inadequate facilities of temporary hospitalization wards and sub-optimal utilization of the existing ones;
- lack of rehabilitaiton facilities;
- inadequacy of vehicles and disrepair and poor maintenance of available vehicles;
- inadequate coverage of entire population by SSAUs for long periods;
- lack of operational research in leprosy to solve problems arising in the field.

It would be seen that many of the limitations have been in respect of managerial inputs. However, recent years have witnessed heightened expression of activities on various facets, of NLEP. It is matter of satisfaction that the governments both central and states have been alive to these weaknesses in the programme. Administrative supervision has been strengthened to solve on the spot problems by appointing 45 consultant leprologists with SIDA assistance in selected districts. A system of monitoring has already been built into the programme to provide regular feed back for corrective measures. There is growing concern for the timely achievement of targets for disease control and the political will for elimination of the disease by the turn of the century remains unshaken. There has been substantial increase in financial outlays for NLEP.

It is envisaged that as the prevalence rate of leprosy declines to less than 1/1000 population, the leprosy services would be integrated into general health services. The paramedical workers would work under the supervision and guidance of medical officers of primary health centres. While at some stage the integration of the two will have to take place, the questions that arise at this stage are:

- will the general health services be able to maintain leprosy control in the face of competing priorities for family planning and other health programmes diseases; and
- do the general health services staff possess the necessary competence, knowledge and skills and above all the commitment for leprosy control.

NLEP remains largely a vertical programme. If the goal of disease control is achieved as planned, it would be a great success for the vertical programme. The success of small pox eradication in the country is an example of the operational efficiency of vertical disease control programme, unlike malaria that was integrated at crucial stages of its low prevalence.

There is a need for caution in integrating leprosy services with general health care services. The operation of modified MDT scheme in selected districts should be viewed as an experimental field trial towards integration. Its results should be carefully evaluated before embarking on dismanting the existing structure of NLEP.

FOLLOWING FACTS HAVE BEEN KEPT IN MIND IN FIXING THE STATEWISE TARGETS - 1976-77, NLCP

1. For high endemic States/UTs namely, Andhra Pradesh, Bihar, Maharashtra, Nagaland, Orissa, Tamilnadu, West Bengal and Pondicherry, the prevalence rate of leprosy in Leprosy Control Unit area and SET Centre area is taken, on an average, as 1.5 per cent and 0.7 per cent respectively. For other States/UTs, these figures are 1.0 per cent and 0.4 per cent respectively.
2. Targets are based on the number of sanctioned staff with the units/centres.
3. It is presumed that a PMW surveys a minimum population of about 5000 in a year.
4. For the units/centres established up to IV Plan, calculation has been made on the fact that about 15 per cent of the estimated number of cases in their respective areas should be brought under treatment in addition during 1976-77. Because including new cases and the undetected cases the total number per year will exceed 20 per cent of the estimated cases of an area for some times.
5. For the units/centres established or due to be established during 1976-77 during Fifth Plan, calculation has been made on the fact that about 20-30 per cent of the estimated cases in their respective areas should be brought under treatment during 1976-77.
6. It is assumed that units/centres of 1976-77 will be working for about 3-4 months during 1976-77.
7. About 15 per cent of the total cases brought and remained under treatment till the end of previous year *i.e.*, 1975-76 should be made bacteriological negative and disease-arrested or cured during 1976-77 by treatment.

Source :

Government of India, Ministry of Health and Family Planning (Department of Health)-A communication issued to States vide T. 11023/11/75-MTP (C & CD) dated 7.6.1976, under National Leprosy Control Programme-Targets for the year 1976-77.

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11. REHABILITATION

Rehabilitation of leprosy patients was the joint responsibility of Ministry of Health and Family Welfare as well as Social Welfare Ministry. It included physical, vocational and social rehabilitation. Physical rehabilitation depended heavily on the health ministry, involving as it did care of the ulcers, correction of deformities, physiotherapy and health education. However, the existing facilities for physical rehabilitation were far too meagre considering the programme needs. There existed 75 reconstructive surgery units and 13 leprosy rehabilitation promotion units (LRPUs) under the NLEP. The LRPUs aimed at providing vocational rehabilitation besides facilities for surgical correction of deformed/disabled patients.

Now that MDT was being implemented in 201 districts and the disease prevalence had substantially come down, rehabilitation and prevention of dehabilitation assumed great importance. Deformities were more commonly associated with long standing disease. MDT, which reduced the duration of treatment was expected to make a definite impact in reducing the occurrence of deformities. However, deformities would still occur due to reactionary episodes, such as neuritis. An accelerated programme of rehabilitation was, therefore, an immediate need of NLEP

It was understood that the World Bank had agreed to support a project of the Government of India to provide rehabilitation including prevention of dehabilitation in the 66 endemic districts showing leprosy prevalence of more than 5 per 1000 and in another 77 districts where the prevalence rate was between 2 and 5. The project was expected to cater to an estimated case load of 600000 in the former set of districts and to 900000 in the latter.

It was proposed to establish rehabilitation promotion and training units with the World Bank assistance at 15 places in the country as indicated below :

1. Kanpur	6. Patna	11. Midnapur
2. Puri	7. Bhopal	12. Vishakhapatnam
3. Chengalput	8. Trivendrum	13. Banglore
4. Baroda	9. Shimla	14. Thane
5. Guwahati	10. Jaipur	15. Hyderabad

12. VOLUNTARY AND INTERNATIONAL AGENCIES IN ANTI-LEPROSY WORK

A large number of organizations were involved in various activities pertaining to control of leprosy in India. While some of them were engaged in training, education and research, others were engaged, in addition, in case detection, treatment and rehabilitation to promote leprosy control. A large number of them were voluntary, some were governmental organisations and some others international agencies.

a. Voluntary Organisations

Voluntary organisations played a pioneering role throughout the history of leprosy control in the country. The first known leper asylum was established in Calcutta early in the 19th century followed by another in Varanasi. Mission to Lepers, started in 1875 at Chamba, was by far the biggest single agency engaged in leprosy work.

The earlier focus of these agencies was through out-patient's clinics in the country. With the introduction of dapsone for the treatment of leprosy, the focus changed from an individual patient to the entire population.

After 1951, there occurred an extensive expansion of voluntary services for leprosy all over the country. Presently, about 285 voluntary organisations were actively engaged in leprosy relief.

Some of the prominent organisations in the field were :

- Gandhi Memorial Leprosy Foundation, Wardha, Maharashtra
- Hind Kusht Nivaran Sangh, New Delhi
- Bharat Sevashram Sangh, Jamshedpur, Bihar
- Kashi Kusht Seva Sangh, Varanasi, Uttar Pradesh
- Anandvan, Warora, Maharashtra
- Tapovan, Amravati, Maharashtra
- Hindu Mission, Madras, Tamil Nadu

In addition to institutions establihsed by NLEP, a number of voluntary agencies contributing a great deal towards leprosy control were subsequently taken over by the government. Prominent among them were :

- Central JALMA Institute for Leprosy, Agra
- Belgium Leprosy Centre, Dharmapuri, Tamil Nadu
- The Danish Leprosy Mission, Aska, Orissa.

Recognizing the great potential of voluntary agencies, the DGHS evolved in 1985 a mechanism for annual meetings with them with a view to establish communication and exchange of information and also to understand the nature of their work.

The majority of these organisations were multi-functional in nature, rendering curative-rehabilitative services, besides organising the training of medical and health auxiliaries. With a bed strength of 14,409 in 1990 in 127 organisations, these institutions vocationally rehabilitated 35275 leprosy affected persons and nearly 20,000 suffers or were medically rehabilitated. About 5.0 crore population was covered under SET activities. Nearly a million cases were detected so far and 1,25,000 cases were discharged.

International voluntary agencies were the pioneers in leprosy relief work in India. They continued to play a major role in NLEP activities. The Leprosy Mission, German Leprosy Relief Association, Swiss Emusus, Damein Foundation and Italian Leprosy Association were organisations

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THE MOUSE FOOTPAD TEST—SENSITIVE TO SMALL PROPORTIONS OF DRUG-RESISTANT BACILLI IN A SAMPLE OF M. LEPRAE

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THE MOUSE FOOTPAD TEST—SENSITIVE TO SMALL PROPORTIONS OF DRUG-RESISTANT BACILLI IN A SAMPLE OF M. LEPRAE

J.G. ALMEIDA[1], P.S. JOSEPH[2], G. SARANGAPANI[3], AND C.J.G. CHACKO[4]

ABSTRACT : *In experiments at the Radda Barnen Research Laboratories of the SLR & TC Karigiri, the mouse footpad test was demonstrated to detect DDS-resistant* M.leprae *even if as few as 0.1% (1 in 1000) of the* M. leprae *tested were DDS-resistant. The mouse footpad test appears to be sensitive to minute proportions of drug-resistant bacilli in samples of* M. leprae *tested.*

The demonstration of drug-resistant *M. leprae* by the mouse footpad test (Pettit et al, 1964) is commonly interpreted to mean that a majority of the *M. leprae* in the sample tested are drug-resistant (Almeida et al 1983 ; Baquillon et al 1980, 1983 ; Pearson et al, 1980, 1981, Pettit et al 1964). Samples of *M. leprae* with only small proportions of drug-resistant *M. leprae* would presumably escape being labelled "drug-resistant" by the mouse footpad test. The objective of this study was to test directly whether the assumption is valid.

The study was carried out in the Radda Barnen Research Laboratories of the Schieffelin Leprosy Research and Training Centre, Karigiri, where a large mouse footpad laboratory has been in operation since 1970.

MATERIALS AND METHODS

Two separate populations of *M. leprae* labelled "R" and "S" respectively, were taken from mouse footpad culture. "R" was obtained from mice continuously fed DDS from the day of inoculation, at a concentration of 0.01% w/w DDS in mouse diet. "S" was obtained from mice fed on DDS, and had already been shown to be completely inhibited by 0.01% w/w DDS in mouse diet.

Each of the populations was processed for inoculation into mouse footpads by routine methods previously published (Rees, 1964). The

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separate suspension of "R" and "S" bacilli that resulted, were then mixed in five different proportions of "R" to "S" bacilli : 100%"R"+0%"S", 10%"R"+90%"S", 1%"R"+99%"S", 0.1%"R"+99.9%"S", and 0%"R"+100%"S". These will be referred to as 100%R, 10%R, 1%R, 0.1%R and 100%S respectively.

Each of the five was diluted to give 3.3×10^5 *M. leprae* per ml, and 0.03 ml was inoculated into each hind footpad of CBA mice. The mice were then maintained in two groups : One (control mice) fed normal mouse diet, and the other (treated mice) fed the same diet mixed with 0.01% w/w DDS from the day of inoculation. Samples of the diet were tested to ensure that the required concentration of DDS was achieved (Ellard, 1980). Mice treated with DDS in the diet will be referred to as "treated" mice and those on normal diet as "control" mice.

Foot by foot harvests were performed from "control" mice at 1 week after inoculation, and on both "treated" and "control" mice at 3rd and 4th months after inoculation. Footpads were processed by routine methods to detect *M. leprae* (Rees, 1964). "Positive" harvests are those in which *M. leprae* were found. No bacilli could be found in footpads yielding $<0.5 \times 10^4$ *M. leprae*.

RESULTS

Tables 1 and 2 show the results of harvests in control and treated mice respectively. The most remarkable finding is that the inoculum of 0.1%R yielded positive footpads in treated mice.

TABLE 1 : Mouse footpad harvest results from control mice

INOCULUM	NO. OF FOOTPADS (POSITIVE/HARVESTED) AT		
	1 WEEK	3RD MONTH	4TH MONTH
100%R	0/4	8/8	4/4
10%R	0/4	8/8	4/4
1%R	0/4	8/8	4/4
0.1%R	0/4	2/2	8/8
100%S	0/4	8/8	4/4

TABLE 2: Mouse footpad harvest results from treated mice

INOCULUM	NO. OF FOOTPADS (POSITIVE/HARVESTED) AT	
	3RD MONTH	4TH MONTH
100%R	8/8	4/4
10%R	2/8	4/4
1%R	0/8	4/4
0.1%R	ND*	10/12
100%S	0/8	0/4

* Not done

"R" bacilli were taken from mice continuously fed on 0.01% DDS mixed with the diet from the day of inoculation, and may be regarded as predominantly DDS-resistant. "S" bacilli were taken from mice fed on DDS, and are seen to be completely inhibited by 0.01% DDS in the mouse diet (Table 2). They may be regarded as predominantly DDS-sensitive. The inoculum "0.1%R" therefore contained as few as 1 resistant *M. leprae* in 1000. Yet harvest of treated mice in the 4th month after inoculation found 10 to 12 footpads positive.

There are several noteworthy features in the results. None of the control mice harvested 1 week after inoculation yielded a positive foodpad. At each harvest of control mice, the proportion of positives among harvested footpads was identical for inocula "100%R" and "100%S". None of the treated mice with inoculum "100%S" yielded a positive footpad at any harvest. Between the 3rd and 4th month harvests of treated mice, the proportion of positives among harvested footpads apparently increased. In the third month after inoculation, harvest of treated mice suggests that as the proportion of "R" bacilli in the inoculum decreased, the proportion of positives among harvested footpads also decreased.

DISCUSSION

In the light of the observations made, one must account for the demonstration of drug-resistant *M. leprae* from an inoculum containing as few as 1 resistant *M. leprae* in 1000 (0.1%). The mouse footpad test

appears sufficiently sensitive to demonstrate drug resistant *M. leprae* even when they form only 0.1% of the bacillary population. This minute proportion constitutes persuasive evidence of the sensitivity of the mouse footpad test to drug-resistant *M. leprae*. The point can probably be further emphasized by testing even smaller proportions of drug-resistant *M. leprae*.

A common practice in the diagnosis of drug-resistance by the mouse footpad test is to harvest treated mice from the sixth month after inoculation (Almeida et al 1983a, 1983b ; Baquillon et al, 1980, 1983 ; Pearson et al, 1980, Pearson et al, 1981 ; Pettit et al, 1964). If a positive footpad is found, the *M. leprae* are declared to be "drug-resistant". By these criteria, it is difficult to see how a strain of *M. leprae* with only 1 resistant bacillus in 1000 can escape being labelled "drug-resistant."

This report does not in any way detract from the intrinsic worth of the mouse footpad as a model for the experimental study of leprosy. It must be viewed rather as a sharpening of the valuable technique, that hopefully will help shed new light on some of the puzzling questions that remain in leprosy.

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ರೋಗವಾಹಕ ಸೊಳ್ಳೆಗಳಿಂದ ಹರಡುವ ಮಲೇರಿಯ, ಆನೇಕಾಲು ರೋಗ ಮೆದುಳು ಜ್ವರ ಡೆಂಗಿ ಜ್ವರ ಹಾಗೂ ಜೈವಿಕ ಪರಿಸರ ನಿಯಂತ್ರಣ ವಿಧಾನಗಳ ಬಗ್ಗೆ ಕಿರು ಹೊತ್ತಿಗೆ

ಪ್ರಕಟಣೆ :
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ಆರೋಗ್ಯ ಮತ್ತು ಕುಟುಂಬ ಕಲ್ಯಾಣ ಸೇವೆಗಳ ನಿರ್ದೇಶನಾಲಯ
ಆನಂದರಾವ್ ವೃತ್ತ, ಬೆಂಗಳೂರು-560 009.

ಮುನ್ನುಡಿ

ಮಲೇರಿಯ, ಆನೇಕಾಲು ರೋಗ, ಮೆದುಳುಜ್ವರ ಮತ್ತು ಡೆಂಗಿ ಜ್ವರ ರೋಗಗಳು ವಿವಿಧ ಜಾತಿಯ ರೋಗವಾಹಕ ಸೊಳ್ಳೆಗಳ ಕಡಿತದಿಂದ ಹರಡುತ್ತವೆ. ಮಲೇರಿಯ ಮತ್ತು ಆನೇಕಾಲು ರೋಗಗಳು ಪರೋಪಜೀವಿಗಳಿಂದ ಉಂಟಾಗುವುದು. ಮೆದುಳುಜ್ವರ ಹಾಗೂ ಡೆಂಗಿ ಜ್ವರ ರೋಗಗಳು ವೈರಾಣುಗಳಿಂದ ಉಂಟಾಗುತ್ತವೆ.

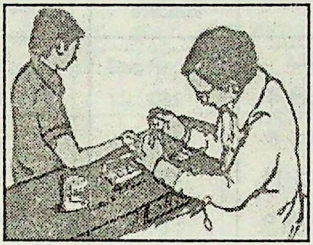
ಕರ್ನಾಟಕ ರಾಜ್ಯದಲ್ಲಿ ಈ ನಾಲ್ಕೂ ರೋಗಗಳು ವರದಿಯಾಗುತ್ತಿದ್ದು, ಇದರ ನಿಯಂತ್ರಣಕ್ಕಾಗಿ ಆರೋಗ್ಯ ಇಲಾಖೆಯು ಎಲ್ಲ ರೀತಿಯ ಕ್ರಮಗಳನ್ನು ಕೈಗೊಳ್ಳುತ್ತಿದೆ. ಆದರೂ ಸಹ ಈ ಕ್ರಮಗಳನ್ನು ಯಶಸ್ವಿಯಾಗಿ ಅನುಷ್ಠಾನಗೊಳಿಸಲು ಬೇಕಾದ ಜನತೆಯ ಸಹಕಾರವು ನಿರೀಕ್ಷಿತ ಮಟ್ಟದಲ್ಲಿ ಸಿಗದಿರುವುದು ವಿಷಾದಕರ. ಜನರಲ್ಲಿ ಈ ರೋಗಗಳ ಬಗ್ಗೆ ವೈಜ್ಞಾನಿಕವಾದ ಮಾಹಿತಿ ಮತ್ತು ತಿಳುವಳಿಕೆ ಇಲ್ಲದಿರುವುದೇ ಇದಕ್ಕೆ ಮುಖ್ಯ ಕಾರಣ.

ಆದುದರಿಂದ, ಸಾಮಾನ್ಯ ಜನರಿಗೆ, ಅದರಲ್ಲೂ ಗ್ರಾಮಾಂತರ ಪ್ರದೇಶಗಳಲ್ಲಿ ವಿವಿಧ ಪರಿಸರದಲ್ಲಿ ವಾಸಿಸುತ್ತಿರುವ ಜನ ಸಮುದಾಯಕ್ಕೆ ಈ ರೋಗಗಳ ಹರಡುವಿಕೆ, ಚಿಕಿತ್ಸೆ, ಹಾಗೂ ನಿಯಂತ್ರಣ ವಿಧಾನಗಳ ಬಗ್ಗೆ ಸಂಕ್ಷಿಪ್ತವಾಗಿ ತಿಳುವಳಿಕೆ ನೀಡುವುದೇ ಅಲ್ಲದೆ, ಈ ಸಾಂಕ್ರಾಮಿಕ ರೋಗಗಳನ್ನು ತಡೆಗಟ್ಟುವಲ್ಲಿ ಜನಸಾಮಾನ್ಯರ ಪಾತ್ರ ಮತ್ತು ಇಲಾಖೆಯ ಸಿಬ್ಬಂದಿಯೊಡನೆ ಯಾವ ರೀತಿ ಸಹಕರಿಸಬೇಕೆಂಬ ವಿಚಾರಗಳನ್ನು ಸಾರ್ವಜನಿಕ ಆರೋಗ್ಯ ಹಿತದೃಷ್ಟಿಯಿಂದ ಈ ಸಂಯುಕ್ತ ಕಿರುಹೊತ್ತಿಗೆಯಲ್ಲಿ ಪ್ರಕಟಿಸಲಾಗಿದೆ.

ಕರ್ನಾಟಕದ ಜನತೆಯು ಈ ಕಿರುಹೊತ್ತಿಗೆಯ ಸದುಪಯೋಗ ಪಡೆದುಕೊಂಡು, ಆರೋಗ್ಯ ಇಲಾಖೆಯ ಸಿಬ್ಬಂದಿಯೊಡನೆ ಮಲೇರಿಯ, ಆನೇಕಾಲುರೋಗ, ಮೆದುಳು ಜ್ವರ ಹಾಗೂ ಡೆಂಗಿ ಜ್ವರ ರೋಗ ನಿಯಂತ್ರಣಕ್ಕಾಗಿ ಸಂಪೂರ್ಣ ಸಹಕಾರ ನೀಡಿವಿರೆಂದು ಆಶಿಸುತ್ತೇನೆ.

ಡಾ|| ಜಿ.ವಿ. ನಾಗರಾಜ್
ನಿರ್ದೇಶಕರು
ಆರೋಗ್ಯ ಮತ್ತು ಕುಟುಂಬ ಕಲ್ಯಾಣ ಸೇವೆಗಳು
ಬೆಂಗಳೂರು - 9

ಸಾರ್ವಜನಿಕ ಆಸ್ಪತ್ರೆ, ಪ್ರಾಥಮಿಕ ಆರೋಗ್ಯ ಕೇಂದ್ರ, ಪ್ರಾಥಮಿಕ ಆರೋಗ್ಯ ಘಟಕಗಳು ಸ್ವಯಂಸೇವಕರಿಂದ ನಡೆಸಲಾಗುತ್ತಿರುವ ಜ್ವರ ಚಿಕಿತ್ಸಾಕೇಂದ್ರಗಳು ಹಾಗೂ ಮನೆ ಮನೆಗೆ ಭೇಟಿನೀಡುವ ಆರೋಗ್ಯ ಸಹಾಯಕರಲ್ಲಿ ರಕ್ತಲೇಪನವನ್ನು ನೀಡಬಹುದು.



ಜ್ವರ ಪೀಡಿತ ವ್ಯಕ್ತಿಯಿಂದ ರಕ್ತಲೇಪನ ಸಂಗ್ರಹಿಸುತ್ತಿರುವುದು.

ರಕ್ತ ಲೇಪನ ಪರೀಕ್ಷೆ : ಸಂಗ್ರಹಿಸಿದ ರಕ್ತಲೇಪನಗಳನ್ನು ಹತ್ತಿರದ ಪ್ರಾಥಮಿಕ ಆರೋಗ್ಯಕೇಂದ್ರ, ಸಾರ್ವಜನಿಕ ಆಸ್ಪತ್ರೆ ಮತ್ತು ಪ್ರಯೋಗಾಲಯ ಸೌಲಭ್ಯವಿರುವ ಯಾವುದೇ ಸರ್ಕಾರಿ ಸಂಸ್ಥೆಗಳಲ್ಲಿ ಪರೀಕ್ಷಿಸಲಾಗುವುದು.

ಚಿಕಿತ್ಸೆ : ಯಾವುದೇ ಜ್ವರವಿರಲಿ, ತಡಮಾಡದೇ ರಕ್ತಪರೀಕ್ಷೆಯನ್ನು ಮಾಡಿಸಿರಿ. ರಕ್ತಲೇಪನವನ್ನು ಪರೀಕ್ಷೆಗಾಗಿ ನೀಡಿದ ತಕ್ಷಣ ವಯೋಮಿತಿಗನುಗುಣವಾಗಿ ಈ ಕೆಳಕಂಡ ಪ್ರಮಾಣದಲ್ಲಿ ಕ್ಲೋರೋಕ್ವಿನ್ ಗುಳಿಗೆಗಳನ್ನು ತಪ್ಪದೇ ತೆಗೆದುಕೊಳ್ಳಿ.

ರೋಗಿಯ ವಯೋಮಿತಿ	ಕ್ಲೋರೋಕ್ವಿನ್ ಗುಳಿಗೆಗಳು (ಪ್ರತಿ ಗುಳಿಗೆ 150 ಮಿಲಿಗ್ರಾಂ ಪ್ರಮಾಣ)	
	ಮಿಲಿಗ್ರಾಂ ಪ್ರಮಾಣ	ಒಟ್ಟು ಗುಳಿಗೆಗಳು
<1	75	½
1 ರಿಂದ 4	150	1
5 ರಿಂದ 8	300	2
9 ರಿಂದ 14	450	3
15 ಮತ್ತು >	600	4

ಮಲೇರಿಯ ರೋಗವೆಂದು ರಕ್ತಲೇಪನ ಪರೀಕ್ಷೆಯಿಂದ ಖಚಿತ ಪಟ್ಟಲ್ಲಿ ಈ ಕೆಳಕಂಡಂತೆ ತೀವ್ರ ಚಿಕಿತ್ಸೆಯನ್ನು ಪಡೆಯಿರಿ :

ಪ್ಲಾಸ್ಮೋಡಿಯಂ ವೈವ್ಯಾಕ್ಸ್ ಮತ್ತು ಪ್ಲಾಸ್ಮೋಡಿಯಂ ಮಲೇರಿಯೇ ಎಂಬ ಜಾತಿಯ ಮಲೇರಿಯ ರೋಗಕ್ಕೆ ತೀವ್ರ ಚಿಕಿತ್ಸೆ ವಿವರ				
ಮೊದಲ ದಿನ ಕ್ಲೋರೋಕ್ವಿನ್ ಮತ್ತು ಪ್ರೈಮಾಕ್ವಿನ್ ಗುಳಿಗೆಗಳನ್ನು ನಿಗದಿಪಡಿಸಿದ ಪ್ರಮಾಣದಲ್ಲಿ ಒಂದೇ ಬಾರಿಗೆ ತೆಗೆದುಕೊಳ್ಳಬೇಕು				
ರೋಗಿಯ ವಯೋಮಿತಿ	ಕ್ಲೋರೋಕ್ವಿನ್ ಗುಳಿಗೆಗಳು (ಪ್ರತಿ ಗುಳಿಗೆ 150 ಮಿಲಿಗ್ರಾಂ ಪ್ರಮಾಣ)		ಪ್ರೈಮಾಕ್ವಿನ್ ಗುಳಿಗೆಗಳು (ಪ್ರತಿ ಗುಳಿಗೆ 2.5 ಮಿಲಿಗ್ರಾಂ ಪ್ರಮಾಣ)	
	ಮಿಲಿಗ್ರಾಂ ಪ್ರಮಾಣ	ಒಟ್ಟು ಗುಳಿಗೆಗಳು	ಮಿಲಿಗ್ರಾಂ ಪ್ರಮಾಣ	ಒಟ್ಟು ಗುಳಿಗೆಗಳು
<1	75	½	0	0
1 ರಿಂದ 4	150	1	2.5	1
5 ರಿಂದ 8	300	2	5.0	2
9 ರಿಂದ 14	450	3	10.0	4
15 ಮತ್ತು >	600	4	15.0	6

ಮೊದಲ ದಿನ ಚಿಕಿತ್ಸೆಯನ್ನು ತೆಗೆದುಕೊಂಡ ನಂತರ, 2ನೇ ದಿನ, 3ನೇ ದಿನ, 4ನೇ ದಿನ ಮತ್ತು 5ನೇ ದಿನಗಳು ಪ್ರೈಮಾಕ್ವಿನ್ ಗುಳಿಗೆಗಳನ್ನು ಮಾತ್ರ ವಯೋಮಿತಿಗನುಗುಣವಾಗಿ ಈ ಕೆಳಕಂಡಂತೆ ತೆಗೆದುಕೊಳ್ಳಬೇಕು.

ರೋಗಿಯ ವಯೋಮಿತಿ	ಪ್ರೈಮಾಕ್ವಿನ್ ಗುಳಿಗೆಗಳು (ಪ್ರತಿ ಗುಳಿಗೆ 2.5 ಮಿಲಿಗ್ರಾಂ ಪ್ರಮಾಣ)	
	ಮಿಲಿಗ್ರಾಂ ಪ್ರಮಾಣ	ಒಟ್ಟು ಗುಳಿಗೆಗಳು
<1	0	0
1 ರಿಂದ 4	2.5	1
5 ರಿಂದ 8	5.0	2
9 ರಿಂದ 14	10.0	4
15 ಮತ್ತು >	15.0	6

ಪ್ಲಾಸ್ಮೋಡಿಯಂ ಫಾಲ್ಸೀಪಾರಂ ಮಲೇರಿಯ ರೋಗಿಗಳಿಗೆ ತೀವ್ರ ಚಿಕಿತ್ಸೆ ಏವರ ಕ್ಲೋರೋಕ್ವಿನ್ ಮತ್ತು ಪ್ರೈಮಾಕ್ವಿನ್ ಗುಳಿಗೆಗಳನ್ನು ನಿಗದಿಪಡಿಸಿದ ಪ್ರಮಾಣದಲ್ಲಿ ಒಂದೇ ಬಾರಿಗೆ ತೆಗೆದುಕೊಳ್ಳಬೇಕು				
ರೋಗಿಯ ವಯೋಮಿತಿ	ಕ್ಲೋರೋಕ್ವಿನ್ ಗುಳಿಗೆಗಳು (ಪ್ರತಿ ಗುಳಿಗೆ 150 ಮಿಲಿಗ್ರಾಂ ಪ್ರಮಾಣ)		ಪ್ರೈಮಾಕ್ವಿನ್ ಗುಳಿಗೆಗಳು (ಪ್ರತಿ ಗುಳಿಗೆ 7.5 ಮಿಲಿಗ್ರಾಂ ಪ್ರಮಾಣ)	
	ಮಿಲಿಗ್ರಾಂ ಪ್ರಮಾಣ	ಒಟ್ಟು ಗುಳಿಗೆಗಳು	ಮಿಲಿಗ್ರಾಂ ಪ್ರಮಾಣ	ಒಟ್ಟು ಗುಳಿಗೆಗಳು
<1	75	½	0	0
1 ರಿಂದ 4	150	1	7.5	1
5 ರಿಂದ 8	300	2	15.0	2
9 ರಿಂದ 14	450	3	30.0	4
15 ಮತ್ತು >	600	4	45.0	6

ವಿಶೇಷ ಸೂಚನೆ : 1. ತೀವ್ರ ಚಿಕಿತ್ಸೆಯನ್ನು ಯಾವಾಗಲೂ ಆಹಾರ ಸೇವನೆಯ ನಂತರವೇ ತೆಗೆದುಕೊಳ್ಳಬೇಕು.

2. ಒಂದು ವರ್ಷದೊಳಗಿನ ಮಕ್ಕಳಿಗೆ ಮತ್ತು ಗರ್ಭಿಣಿಯರಿಗೆ ಪ್ರೈಮಾಕ್ವಿನ್ ಗುಳಿಗೆಗಳನ್ನು ನೀಡಕೂಡದು. ಒಂದು ವೇಳೆ ಇಂತಹವರಲ್ಲಿ ಮಲೇರಿಯ ರೋಗವು ಕಂಡು ಬಂದಲ್ಲಿ ತಕ್ಷಣ ವೈದ್ಯರ ಸಲಹೆ ಪಡೆಯಿರಿ. ಮಕ್ಕಳಿಗೆ ಒಂದು ವರ್ಷ ತುಂಬಿದ ನಂತರ ಮತ್ತು ಗರ್ಭಿಣಿಯರಿಗೆ ಪ್ರಸವವಾದ 40 ದಿನಗಳ ನಂತರ ತೀವ್ರ ಚಿಕಿತ್ಸೆಯನ್ನು ತಪ್ಪದೇ ನೀಡಬೇಕು.

3. ಕ್ಲೋರೋಕ್ವಿನ್ ಮತ್ತು ಪ್ರೈಮಾಕ್ವಿನ್ ಗುಳಿಗೆಗಳು ಎಲ್ಲಾ ಸರ್ಕಾರಿ ಆಸ್ಪತ್ರೆಗಳಲ್ಲಿ ಹಾಗೂ ಆರೋಗ್ಯ ಕಾರ್ಯಕರ್ತರಲ್ಲಿ ಉಚಿತವಾಗಿ ದೊರೆಯುತ್ತದೆ.

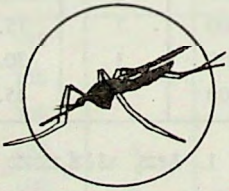
ರೋಗದ ನಿಯಂತ್ರಣ

1. ಯಾವುದೇ ಜ್ವರವಿರಲಿ ಮೊದಲು ರಕ್ತ ಪರೀಕ್ಷೆ ಮಾಡಿಸಿಕೊಳ್ಳುವುದು, ಕ್ಲೋರೋಕ್ವಿನ್ ಮಾತ್ರೆಗಳನ್ನು ತೆಗೆದುಕೊಳ್ಳುವುದು, ರಕ್ತ ಪರೀಕ್ಷೆಯಲ್ಲಿ ಮಲೇರಿಯಾ ರೋಗವೆಂದು ಧೃಡಪಟ್ಟರೆ ತೀವ್ರ ಚಿಕಿತ್ಸೆ ಪಡೆಯುವುದು, ಅತಿ ಮುಖ್ಯ.

2. ಎಲ್ಲಾ ಮನೆಗಳಿಗೂ, ಮನೆಗಳಲ್ಲಿರುವ ಎಲ್ಲಾ ಕೋಣೆಗಳಿಗೂ ತಪ್ಪದೆ ಕೀಟನಾಶಕವನ್ನು ಸಿಂಪಡಿಸುವುದು.

3. ನಿಂತ ನೀರಿನಲ್ಲಿ ಸೊಳ್ಳೆಗಳು ಉತ್ಪತ್ತಿಯಾಗುವುದರಿಂದ ಮನೆಯ ಸುತ್ತಮುತ್ತ ನೀರು ನಿಲ್ಲದಂತೆ ಎಚ್ಚರವಹಿಸುವುದು.

4. ಮಲಗುವಾಗ ತಪ್ಪದೆ ಸೊಳ್ಳೆ ಪರದೆಗಳನ್ನು ಉಪಯೋಗಿಸುವುದು.



2. ಫೈಲೇರಿಯ ಅಥವಾ ಆನೆಕಾಲು ರೋಗ

ಕರ್ನಾಟಕ ರಾಜ್ಯದಲ್ಲಿ ಫೈಲೇರಿಯ ರೋಗದ ಸಂಕ್ಷಿಪ್ತ ಪರಿಚಯ

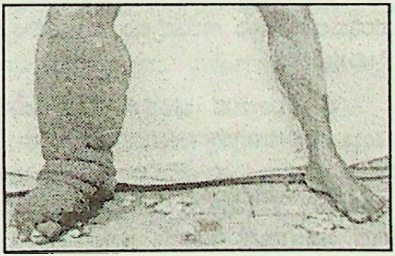
ಫೈಲೇರಿಯ ಸಮೀಕ್ಷೆ ಪ್ರಕಾರ ರಾಜ್ಯದ ಸಮುದ್ರ ತೀರ ಪ್ರದೇಶಗಳಾದ, ಉತ್ತರ ಕನ್ನಡ, ದಕ್ಷಿಣ ಕನ್ನಡ, ಉಡುಪಿ ಒಳನಾಡು ಪ್ರದೇಶಗಳಾದ ರಾಯಚೂರು, ಬಾಗಲಕೋಟೆ, ಬಿಜಾಪುರ, ಗುಲ್ಬರ್ಗ ಮತ್ತು ಬೀದರ್ ಜಿಲ್ಲೆಗಳಲ್ಲಿ ಫೈಲೇರಿಯ ರೋಗವು ವಿಶೇಷವಾಗಿ ಕಂಡು ಬಂದಿರುತ್ತದೆ. ತೇವಾಂಶಗಳಿಂದ ಕೂಡಿರುವ ಉಷ್ಣ ವಾತಾವರಣವು ಈ ರೋಗದ ಇರುವಿಕೆಗೆ ಪ್ರಮುಖ ಕಾರಣವಾಗಿದೆ.

ಆನೆಕಾಲು ರೋಗದ ನಿಯಂತ್ರಣವು ರಾಷ್ಟ್ರೀಯ ಕಾರ್ಯಕ್ರಮವಾಗಿದ್ದು, ಈ ರೋಗವನ್ನು ನಿಯಂತ್ರಿಸುವ ಸಲುವಾಗಿ ಫೈಲೇರಿಯ ನಿಯಂತ್ರಣ ಘಟಕಗಳನ್ನು ಮತ್ತು ಚಿಕಿತ್ಸಾಲಯಗಳನ್ನು ಪ್ರಾರಂಭಿಸಿ ಇವುಗಳ ಮೂಲಕ ಫೈಲೇರಿಯ ನಿಯಂತ್ರಣ ಕಾರ್ಯಕ್ರಮಗಳನ್ನು ಹಮ್ಮಿಕೊಳ್ಳಲಾಗಿದೆ.

ಈ ರೋಗವು ಸೋಂಕಿರುವ ಕ್ಯೂಲೆಕ್ಸ್ ಜಾತಿಯ ಸೊಳ್ಳೆಗಳ ಕಚ್ಚುವಿಕೆಯಿಂದ ಉಂಟಾಗುತ್ತದೆ. ಈ ರೋಗ ಹರಡುವ ಸೊಳ್ಳೆಗಳು ಕೊಳೆಚೆ ನೀರಿನ ತಾಣಗಳಾದ ಚರಂಡಿ ಮುಂತಾದ ನೀರಿನಲ್ಲಿ ಉತ್ಪತ್ತಿಯಾಗುತ್ತದೆ.

ರೋಗದ ಲಕ್ಷಣಗಳು

"ಫೈಲೇರಿಯ" ರೋಗವನ್ನು ಸಾಮಾನ್ಯವಾಗಿ "ಆನೆಕಾಲು ರೋಗ" ವೆಂದು ಕರೆಯುತ್ತಾರೆ. ಕಾರಣ ರೋಗ ಪೀಡಿತ ವ್ಯಕ್ತಿಯ ಕಾಲು ಆನೆ ಕಾಲಿನಂತೆ ದಪ್ಪವಾಗಿರುತ್ತದೆ, (ಚಿತ್ರದಲ್ಲಿ ತೋರಿಸಿರುವಂತೆ).



ರೋಗದ ಪ್ರಮುಖ ಲಕ್ಷಣಗಳೆಂದರೆ, ಕೈ, ಕಾಲು, ವೃಷಣ ಕೋಶ ಮುಂತಾದ ಅವಯವಗಳಲ್ಲಿ ಊತ (Swelling) ಕಂಡು ಬರುತ್ತದೆ.

ರೋಗ ಪತ್ತೆ ಹಚ್ಚುವ ವಿಧಾನ

ರಾತ್ರಿವೇಳೆಯಲ್ಲಿ ಮಾತ್ರ ಈ ರೋಗವನ್ನು ಕಂಡು ಹಿಡಿಯಬಹುದಾಗಿದೆ. ಏಕೆಂದರೆ "ಮೈಕ್ರೋಫೈಲೇರಿಯ" ಜಂತುಗಳು ರಾತ್ರಿ ವೇಳೆಯಲ್ಲಿ ಮಾತ್ರ ರಕ್ತ ಸಂಚಾರದಲ್ಲಿ ಕಾಣಿಸಿಕೊಳ್ಳುವುದರಿಂದ, ರಾತ್ರಿ 8.00 ರಿಂದ ಮಧ್ಯರಾತ್ರಿ 12.00 ರವರೆಗೆ ರಕ್ತಲೇಪನ ಸಂಗ್ರಹಿಸಿ, ಸೂಕ್ಷ್ಮ ದರ್ಶಕದ ಸಹಾಯದಿಂದ ಪರೀಕ್ಷೆ ಮಾಡಿದಾಗ ಮಾತ್ರ ಈ ರೋಗದ ಸೋಂಕು ತಿಳಿಯುತ್ತದೆ.

ಚಿಕಿತ್ಸಾ ಕೇಂದ್ರಗಳು

ಫೈಲೇರಿಯ ಚಿಕಿತ್ಸಾಯದ ಸಿಬ್ಬಂದಿ ವರ್ಗದವರು ಮೈಕ್ರೋ ಫೈಲೇರಿಯ ಇರುವವರನ್ನು ಪತ್ತೆ ಹಚ್ಚುವ ಮತ್ತು ಉಚಿತ ಚಿಕಿತ್ಸೆ ನೀಡುವ ಕಾರ್ಯವನ್ನು ಕೈಗೊಳ್ಳತ್ತಾರೆ. ರಾತ್ರಿ 8 ರಿಂದ ಮಧ್ಯ ರಾತ್ರಿಯವರೆಗೂ ಪ್ರತಿ ಮನೆಗೂ ಭೇಟ ನೀಡಿ ಪ್ರತಿಯೊಬ್ಬರಿಂದಲೂ ರಕ್ತ ಲೇಪನವನ್ನು ಸಂಗ್ರಹಿಸಿ ಪರೀಕ್ಷೆಗೆ ವ್ಯವಸ್ಥೆಮಾಡುತ್ತಾರೆ.

ಆನೆಕಾಲು ರೋಗದ ಚಿಕಿತ್ಸೆ

ಆನೆಕಾಲು ರೋಗದ ಚಿಹ್ನೆಗಳು ಕಾಣಿಸಿಕೊಂಡ ನಂತರ ರೋಗದ ಚಿಕಿತ್ಸೆ ಕಷ್ಟಸಾಧ್ಯ. ಆದರೆ ಈ ರೋಗಾಣುಗಳನ್ನು (ಮೈಕ್ರೋ ಫೈಲೇರಿಯಾ ಪರಾವಲಂಬಗಳು) ರಕ್ತದಲ್ಲಿ ಹೊಂದಿರುವವರು ಪ್ರಾರಂಭದಲ್ಲಿ ಈ ರೋಗದ ಚಿಹ್ನೆಗಳನ್ನು ಮತ್ತು ಲಕ್ಷಣಗಳನ್ನು ವ್ಯಕ್ತಪಡಿಸುವುದಿಲ್ಲ. ಅಂತಹವರಲ್ಲಿ ಈ ರೋಗದ ಅರಿವು ಉಂಟಾಗುವುದಿಲ್ಲ. ಇವರು ಎಲ್ಲರಂತೆ ಆರೋಗ್ಯವಂತರಾಗಿಯೇ ಕಾಣುತ್ತಾರೆ. ಅಂತಹ ಜನರು ಸಮಾಜದಲ್ಲಿ ಈ ರೋಗದ ಹರಡುವಿಕೆಗೆ ಕಾರಣರಾಗುತ್ತಾರೆ ಈ ಜನರು ಪ್ರಾರಂಭದಲ್ಲೇ ಚಿಕಿತ್ಸೆ ಪಡೆದರೆ ಈ ರೋಗದ ಬಾಹ್ಯ ಲಕ್ಷಣಗಳನ್ನು ಹಾಗೂ ಈ ರೋಗವು ಇತರರಿಗೆ ಹರಡುವುದನ್ನು ತಡೆಗಟ್ಟಬಹುದು. ರಾತ್ರಿ ವೇಳೆ ರಕ್ತಪರೀಕ್ಷೆ ಮಾಡಿಸಿದಾಗ, ಮೈಕ್ರೋಫೈಲೇರಿಯ ಪರಾವಲಂಬಗಳು ಇರುವುದು ಖಚಿತಪಟ್ಟಲ್ಲಿ, ಈ ಕೆಳಕಂಡಂತೆ ಔಷಧಿಯನ್ನು ಸೇವಿಸಬೇಕು.

ಈ ರೋಗದ ಚಿಕಿತ್ಸೆಗೆ " ಡೈ ಈಥೈಲ್ ಕಾರ್ಬಮಜೈನ್ ಸಿಟ್ರೇಟ್" ಎಂಬ ಗುಳಿಗೆಗಳನ್ನು ನೀಡಲಾಗುತ್ತದೆ. ಈ ಔಷಧಿಯನ್ನು ಖಾಲಿ ಹೊಟ್ಟೆಯಲ್ಲಿ ಸೇವಿಸಬಾರದು; ಈ ಔಷಧಿಯನ್ನು 12 ದಿನಗಳ ಕಾಲ (ಮೊದಲ 6 ದಿನ ಸತತವಾಗಿ ತೆಗೆದುಕೊಂಡ ನಂತರ ಒಂದು ದಿನ ಬಿಟ್ಟು ಮತ್ತೆ 6 ದಿನಗಳ ಕಾಲ ಸತತವಾಗಿ) ತಪ್ಪದೇ ತೆಗೆದುಕೊಳ್ಳಬೇಕು.

ವಯೋಮಿತಿಗೆ ಅನುಗುಣವಾಗಿ ತೆಗೆದುಕೊಳ್ಳಬೇಕಾದ ಗುಳಿಗೆಗಳ ಪ್ರಮಾಣ ಈ ರೀತಿ ಇದೆ.

ವಯೋಮಿತಿ	ಪ್ರತಿ ದಿನ ತೆಗೆದುಕೊಳ್ಳಬೇಕಾದ ಪ್ರಮಾಣ	ಪ್ರತಿದಿನ ತೆಗೆದುಕೊಳ್ಳಬೇಕಾದ ಒಟ್ಟು ಗುಳಿಗೆಗಳು (ಪ್ರತಿಗುಳಿಗೆಯು 50 ಮಿಲಿಗ್ರಾಂ ರೂಪನಲ್ಲಿರುತ್ತದೆ) - ಎಲ್ಲಾ ಗುಳಿಗೆಗಳನ್ನು ಒಮ್ಮಲೇ (ಒಂದೇ ಹೊತ್ತಿಗೆ) ತೆಗೆದುಕೊಳ್ಳಬೇಕು
1 ವರ್ಷ	30 ಮಿಲಿಗ್ರಾಂ	2/3 ಮಾತ್ರೆ
2 ರಿಂದ 5 ವರ್ಷಗಳು	75 ಮಿಲಿಗ್ರಾಂ	1½ ಮಾತ್ರೆಗಳು
6 ರಿಂದ 11 ವರ್ಷಗಳು	150 ಮಿಲಿಗ್ರಾಂ	3 ಮಾತ್ರೆಗಳು
12 ರಿಂದ 17 ವರ್ಷಗಳು	225 ಮಿಲಿಗ್ರಾಂ	4½ ಮಾತ್ರೆಗಳು
18 ವರ್ಷ ಮತ್ತು ಮೇಲ್ಪಟ್ಟು	300 ಮಿಲಿಗ್ರಾಂ	6 ಮಾತ್ರೆಗಳು

ಈ ಗುಳಿಗೆಗಳನ್ನು ತೆಗೆದುಕೊಳ್ಳುತ್ತಿರುವಾಗ ಸಾಮಾನ್ಯವಾಗಿ ಜ್ವರ, ವಾಕರಿಕೆ, ವಾಂತಿ ಮೊದಲಾದ ಲಕ್ಷಣಗಳು ಕಂಡುಬರಬಹುದು. ಆದರೆ ಇವು ತಾನೇ ತಾನಾಗಿ ಎರಡು ಮೂರು ದಿನಗಳಲ್ಲಿ ಕಡಿಮೆಯಾಗುತ್ತದೆ. ಕಡಿಮೆಯಾಗದಿದ್ದಲ್ಲಿ ಪ್ರತಿಕ್ರಿಯೆಗೆ ಅನುಗುಣವಾದ ಔಷಧಿಯನ್ನು ವೈದ್ಯರಲ್ಲಿ ಕೇಳಿ ತೆಗೆದುಕೊಳ್ಳಬಹುದು. ಆದರೆ ಯಾವ ಕಾರಣಕ್ಕೂ ಮೇಲ್ಕಂಡ ಚಿಕಿತ್ಸೆಯನ್ನು ನಿಲ್ಲಿಸಬಾರದು.

ಮುಂಜಾಗ್ರತಾ ಕ್ರಮಗಳು

1. ರಾತ್ರಿ ವೇಳೆ ಮನೆಗಳಿಗೆ ಭೇಟಿನೀಡುವ ಆರೋಗ್ಯ ಸಿಬ್ಬಂದಿಗೆ ರಕ್ತ ಲೇಪನ ನೀಡುವುದು.
2. ಸಂಜೆ ವೇಳೆ ಸೊಳ್ಳೆಗಳ ಕಚ್ಚುವಿಕೆಯಿಂದ ದೂರವಿರುವುದು.
3. ಮಲಗುವಾಗ ಸೊಳ್ಳೆ ಪರದೆ ತಪ್ಪದೇ ಉಪಯೋಗಿಸುವುದು.
4. ವಾಸಿಸುವ ಮನೆ ಕಿಟಕಿ ಬಾಗಿಲುಗಳಿಗೆ ಕೀಟ ತಡೆಗಟ್ಟುವ ಜಾಲರಿಗಳನ್ನು ಅಳವಡಿಸುವುದು.
5. ಮನೆಯ ಸುತ್ತಲಿನ ಚರಂಡಿಗಳಲ್ಲಿ ನೀರು ಸರಾಗವಾಗಿ ಹರಿದು ಹೋಗುವಂತೆ ವ್ಯವಸ್ಥೆ ಮಾಡುವುದು.
6. ಪರಿಸರ-ನೈರ್ಮಲ್ಯ ರಕ್ಷಣೆಗೆ ಹೆಚ್ಚು ಗಮನ ನೀಡುವುದು.
7. ಉಚಿತವಾಗಿ ನೀಡುವ ಮಾತ್ರೆಗಳನ್ನು ತಪ್ಪದೆ ತೆಗೆದುಕೊಳ್ಳುವುದು.
8. ಈ ರೋಗದ ಬಗ್ಗೆ ಇತರರಿಗೆ ತಿಳುವಳಿಕೆ ನೀಡಿ, ಇದರ ನಿಯಂತ್ರಣಕ್ಕೆ ಸಹಕರಿಸುವುದು.

3. ಮೆದುಳು ಜ್ವರ

ಮೆದುಳು ಜ್ವರವು ಪರಿಮಾಣುವಿನಿಂದ (Virus) ಉಂಟಾಗುವ ರೋಗ. ಈ ರೋಗವನ್ನು ಜ್ಯಾಪನೀಸ್ ಎನ್ಸಿಫಲೈಟಿಸ್ (Japanese Encephalitis) ಎಂದೂ ಕರೆಯುತ್ತಾರೆ. ಈ ರೋಗವು ಸಾಧಾರಣವಾಗಿ ಸೋಂಕಿರುವ ಹಂದಿಗಳಿಂದ ಸೊಳ್ಳೆಗಳ ಮೂಲಕ ಹರಡುತ್ತವೆ. ಮಾನವನಿಗೆ ಇದು ಆಕಸ್ಮಿಕವಾಗಿ ತಗಲುತ್ತವೆ. ಈ ರೋಗಕ್ಕೆ ಹೆಚ್ಚಾಗಿ ಮಕ್ಕಳು ತುತ್ತಾಗುತ್ತಾರೆ. ಈ ವೈರಾಣುಗಳು ನರಸಂಬಂಧಿ ಪಾಯಿಲೆಗಳಿಗೆ ಕಾರಣವಾಗುತ್ತವೆ.

ಮೆದುಳು ಜ್ವರ ರೋಗ ಲಕ್ಷಣಗಳೇನು ?

1. ಪ್ರಾರಂಭದಲ್ಲಿ :

ಜ್ವರ, ತಲೆನೋವು ಮತ್ತು ಸುಸ್ತು ಕಾಣಿಸಿಕೊಳ್ಳುತ್ತದೆ. ಈ ಲಕ್ಷಣಗಳು ಯಾವುದೇ ಔಷಧೋಪಚಾರಗಳಿಗೆ ಅಷ್ಟೇನೂ ಪ್ರತಿಕ್ರಿಯೆ ವ್ಯಕ್ತಪಡಿಸುವುದಿಲ್ಲ ಮತ್ತು ಈ ರೀತಿಯ ಭಾದೆಯು 1 ರಿಂದ 6 ದಿನಗಳವರೆಗೆ ಇರುತ್ತದೆ.

2. ಮೆದುಳಿನ ಸೋಂಕು ಉಲ್ಬಣಸ್ಥಿತಿ : (Acute Encephalitis)

ಈ ಹಂತದಲ್ಲಿ ವಿಪರೀತ ಜ್ವರ, ತಲೆನೋವು, ಕತ್ತಿನ ಬಿಗಿತ, ತಲೆಸುತ್ತುವಿಕೆ ಹಾಗೂ ಎಚ್ಚರ ತಪ್ಪುವುದು, ಮೈ ನಡುಕ ಕಂಡುಬರುವುದು.

3. ಅಂತಿಮ ಸ್ಥಿತಿ :

ತೀವ್ರಗತಿಯಲ್ಲಿರುವ ಸಾಡಿಮಿಡಿತವು ನಿಧಾನವಾಗುತ್ತದೆ. ಜ್ವರ ಕಡಿಮೆಯಾಗಿ ಮೈನಡುಕ, ಸಂಪೂರ್ಣ ಎಚ್ಚರ ತಪ್ಪುವುದು.

ಸಾಮಾನ್ಯವಾಗಿ ಪಾಯಿಲೆಯು ಉಲ್ಬಣಗೊಂಡಾಗ ಮೆದುಳು ಊತಗೊಂಡು ಸಾವು ಸಂಭವಿಸಬಹುದು.

ರೋಗ ಪತ್ತೆ ಹಚ್ಚುವ ಕ್ರಮ ಮತ್ತು ಚಿಕಿತ್ಸೆ :

ಸಾಮಾನ್ಯವಾಗಿ ಪ್ರಾರಂಭಿಕ ಹಂತದಲ್ಲಿ ಎಲ್ಲ ರೀತಿಯ ಸೋಂಕುಗಳಿಗೂ ಜ್ವರ ಲಕ್ಷಣವೇ ಪ್ರಧಾನವಾದ್ದರಿಂದ, ಯಾವುದೇ ರೀತಿಯ ಜ್ವರವಿರಲಿ, ಉದಾಸೀನ

ಮಾಡದೇ ರೋಗಿಯನ್ನು ಆದಷ್ಟೂ ಶೀಘ್ರವಾಗಿ ಹತ್ತಿರದ ಸರ್ಕಾರೀ ಆಸ್ಪತ್ರೆಗೆ ಕರೆದೊಯ್ದು ಮಲೇರಿಯ ಆಗಿರಬಹುದಾದ ಶಂಕೆಯಿಂದ ರೋಗಿಯ ರಕ್ತಲೇಪನವನ್ನೂ ಮತ್ತು ಪರಿಮಾಣುವಿನ ಸೋಂಕು ಕಂಡುಹಿಡಿಯಲು ರಕ್ತದ ಮಾದರಿಯನ್ನು ಪ್ರಯೋಗಶಾಲೆಯಲ್ಲಿ ಪರೀಕ್ಷೆಗಾಗಿ ನೀಡುವುದು ಆತ್ಯಗತ್ಯ. ರೋಗಿಯಿಂದ ಪಡೆದ ರಕ್ತ ಲೇಪನವನ್ನು ಮಲೇರಿಯ ರೋಗ ಪತ್ತೆಗಾಗಿ ಅದೇ ಆಸ್ಪತ್ರೆಯ ಪ್ರಯೋಗಶಾಲೆಯಲ್ಲಿ ಪರೀಕ್ಷಿಸಲಾಗುವುದು. ರಕ್ತದ ಮಾದರಿಯನ್ನು ಹತ್ತಿರದ ನಿಗದಿತ ಪರಿಮಾಣು ಕ್ರಿಮಿ ಪ್ರಯೋಗಶಾಲೆಗೆ ಕಳುಹಿಸಿ ಮೆದುಳು ಜ್ವರವೇ ಆಥವಾ ದೆಂಗಿ ಜ್ವರವೇ ಎಂಬ ಬಗ್ಗೆ ಪತ್ತೆಗಾಗಿ ಕಳುಹಿಸಿಕೊಡಲಾಗುವುದು.

ಮಲೇರಿಯ ರೋಗವಲ್ಲವೆಂದು ಪ್ರಯೋಗಶಾಲೆಯಲ್ಲಿ ರಕ್ತಲೇಪನ ಪರೀಕ್ಷೆಯಿಂದ ದೃಢಪಡಿಸಿಕೊಂಡು, ವೈದ್ಯರ ಸಲಹೆಯಂತೆ ಚಿಕಿತ್ಸೆ ನೀಡತಕ್ಕದ್ದು. ಪರಿಮಾಣು ಕ್ರಿಮಿ ಪತ್ತೆ ಕಾರ್ಯವು ಪ್ರಯೋಗಾಲಯದಲ್ಲಿ ಹೆಚ್ಚಿನ ಸಮಯ ತೆಗೆದುಕೊಳ್ಳುವುದರಿಂದ, ರೋಗಿಗೆ ಆದಷ್ಟು ಶೀಘ್ರವಾಗಿ ರೋಗಲಕ್ಷಣಗಳಿಗೆ ಅನುಗುಣವಾಗಿ ತುರ್ತು ಚಿಕಿತ್ಸೆಯನ್ನು ನೀಡಬೇಕು. ಸರ್ಕಾರಿ ಆಸ್ಪತ್ರೆಯಲ್ಲಿ ಉಚಿತ ಚಿಕಿತ್ಸೆ ದೊರೆಯುವುದು.

ಮೆದುಳು ಜ್ವರ ರೋಗದಿಂದ ಉಂಟಾಗುವ ಪರಿಣಾಮಗಳೇನು ?

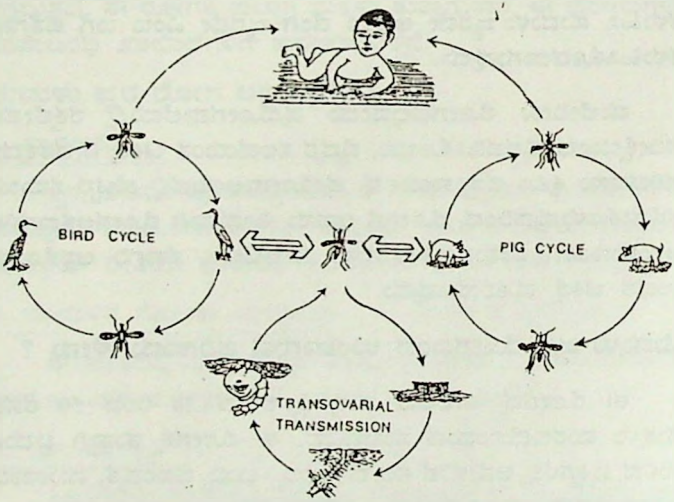
ಈ ರೋಗವು ತಗುಲಿದ ಮಕ್ಕಳಲ್ಲಿ ಶೇಕಡ 30 ರಿಂದ 50 ರಷ್ಟು ಮಕ್ಕಳು ಮರಣಹೊಂದುವ ಸಂಭವವಿದೆ. ಈ ರೋಗಕ್ಕೆ ತುತ್ತಾಗಿ ಬದುಕಿ ಉಳಿದ ವ್ಯಕ್ತಿಗಳಲ್ಲಿ ಅನೇಕರಿಗೆ ನರ ದೌರ್ಬಲ್ಯ, ಬುದ್ದಿ ಮಾಂದ್ಯತೆ, ಮುಂತಾದ ಪರಿಣಾಮಗಳು ಉಂಟಾಗುವುದು ಸರ್ವೇಸಾಮಾನ್ಯ.

ಮೆದುಳು ಜ್ವರವು ಒಂದು ಮಾರಕ ರೋಗವಾಗಿರುವುದರಿಂದ, ಈ ರೋಗವು ಹರಡದಂತೆ ಮುಂಜಾಗ್ರತಾ ಕ್ರಮಗಳನ್ನು ಕೈಗೊಳ್ಳುವಲ್ಲಿ ಸಾರ್ವಜನಿಕರು ಸಹಕರಿಸಿದರೆ, ಈ ರೋಗದ ನಿಯಂತ್ರಣವು ಕಷ್ಟವಾಗಲಾರದು.

ಮೆದುಳು ಜ್ವರ ರೋಗವು ಹೇಗೆ ಹರಡುತ್ತದೆ ?

ಕ್ಯೂಲೆಕ್ಸ್ ಜಾತಿಯ ಹೆಣ್ಣು ಸೊಳ್ಳೆ (ಆದರಲ್ಲೂ ವಿಶೇಷವಾಗಿ ವಿಷ್ಣುಯಿ ಎಂಬ ಗುಂಪಿನ ಹೆಣ್ಣು ಸೊಳ್ಳೆಗಳು) ಈ ರೋಗದ ವೈರಾಣುವಿನ ಸೋಂಕನ್ನು

ಹೊಂದಿದ ಹಂದಿಗಳನ್ನು ಕಚ್ಚಿ ರಕ್ತಹೀರಿದಾಗ, ಈ ವೈರಾಣುಗಳು ಸೊಳ್ಳೆಯ ದೇಹವನ್ನು ಸೇರಿ 9 ರಿಂದ 12 ದಿನಗಳಲ್ಲಿ ವೃದ್ಧಿ ಹೊಂದಿ ನಂತರ ಸೋಂಕು ಹೊಂದಿದ ಸೊಳ್ಳೆಯು ಆಕಸ್ಮಿಕವಾಗಿ ಮನುಷ್ಯನನ್ನು ಕಚ್ಚಿದಾಗ, ಅಂತಹ ಮನುಷ್ಯನಲ್ಲಿ 5 ರಿಂದ 15 ದಿನಗಳ ಅಂತರದಲ್ಲಿ ಈ ರೋಗ ಲಕ್ಷಣಗಳು ಕಾಣಿಸಿಕೊಳ್ಳುತ್ತವೆ.



ಈ ರೋಗವು ಹರಡುವ ಕಾಲ ಯಾವುದು ?

ಈ ರೋಗವು ಹೆಚ್ಚಾಗಿ ಮುಂಗಾರಿನ ನಂತರ ಸೆಪ್ಟೆಂಬರ್, ಅಕ್ಟೋಬರ್, ನವೆಂಬರ್ ಮತ್ತು ಡಿಸೆಂಬರ್ ತಿಂಗಳುಗಳಲ್ಲಿ ಕಾಣಿಸಿಕೊಳ್ಳುತ್ತದೆ. ಏಕೆಂದರೆ, ಈ ಋತುಗಳಲ್ಲಿ ಗದ್ದೆ ಬಯಲುಗಳಲ್ಲಿ ಹೆಚ್ಚಾಗಿ ನೀರು ನಿಂತು ಅಂತಹ ನೀರಿನ ತಾಣಗಳಲ್ಲಿ ಅತಿ ಹೆಚ್ಚಿನ ಸಾಂದ್ರತೆಯಲ್ಲಿ ಸೊಳ್ಳೆಗಳು ಉತ್ಪತ್ತಿಯಾಗಿ ರೋಗ ಹರಡಲು ಕಾರಣವಾಗುತ್ತವೆ.

ಈ ರೋಗವನ್ನು ತಡೆಗಟ್ಟಲು ವಹಿಸಬೇಕಾದ ಮುನ್ನೆಚ್ಚರಿಕೆ ಕ್ರಮಗಳು ಯಾವುವು ?

1. ರೋಗ ಲಕ್ಷಣಗಳು ಕಂಡುಬಂದಲ್ಲಿ ತಡಮಾಡದೇ ಹತ್ತಿರದ ಪ್ರಾಥಮಿಕ ಆರೋಗ್ಯ ಕೇಂದ್ರ, ಅಥವಾ ಸರ್ಕಾರೀ ಆಸ್ಪತ್ರೆಗೆ ಕರೆದೊಯ್ದು ಸೂಕ್ತ ಚಿಕಿತ್ಸೆ ನೀಡುವುದು.
2. ಹಂದಿಗಳನ್ನು ಜನರು ವಾಸಸ್ಥಳದಿಂದ ಕನಿಷ್ಟಪಕ್ಷ 3 ಕಿಲೋಮೀಟರ್ ದೂರಕ್ಕೆ, ಸ್ಥಳಾಂತರಿಸಬೇಕು.
3. ಈ ರೋಗವಾಹಕ ಸೊಳ್ಳೆಗಳ ನಿಯಂತ್ರಣಕ್ಕೆ ಸಂಜೆವೇಳೆ (ಸೂರ್ಯಾಸ್ತಮದ ವೇಳೆಯಲ್ಲಿ) ಕೀಟನಾಶಕ ಧೂಮೀಕರಣ ಕಾರ್ಯವನ್ನು ಮನೆಗಳ ಸುತ್ತಮುತ್ತಲಿನ ಬೇಲಿ, ಗಿಡಗಳು ಮತ್ತು ಪೊದೆಗಳಲ್ಲಿ ಕೈಗೊಳ್ಳುವುದರಿಂದ ಸೊಳ್ಳೆಗಳ ಸಾಂದ್ರತೆಯನ್ನು ಸಾಕಷ್ಟು ಮಟ್ಟಿಗೆ ಹತೋಟಿಯಲ್ಲಿಡಬಹುದು.
4. ಹಂದಿ ಮತ್ತು ಜಾನುವಾರು ಕೊಟ್ಟಿಗೆಗಳಿಗೆ ಕೀಟನಾಶಕ ಸಿಂಪಡಿಸುವುದು.
5. ಹಂದಿಗೂಡುಗಳಿಗೆ ಸೊಳ್ಳೆ ನಿರೋಧಕ ಜಾಲರಿಗಳನ್ನು ಅಳವಡಿಸುವುದು.
6. ಸಂಜೆ ವೇಳೆಯಲ್ಲಿ ಮಕ್ಕಳು ಮೈತುಂಬ ಬಟ್ಟೆ ಧರಿಸಿ ಓಡಾಡುವುದು ಹಾಗೂ ಮಕ್ಕಳು ಮುಸ್ಸಂಜೆಯಲ್ಲಿ ಹೊರಗಿನ ಚಟುವಟಿಕೆಗಳನ್ನು ಆದಷ್ಟು ಕಡೆಮೆಗೊಳಿಸುವುದು.
7. ಮಕ್ಕಳನ್ನು ಮನೆಯ ಹೊರಗಡೆ, ಅಥವಾ ಜಾನುವಾರಗಳ ಸಂಪರ್ಕಕ್ಕೆ ಹತ್ತಿರವಾಗಿ ಮಲಗಿಸುವುದನ್ನು ಖಂಡಿತ ತಪ್ಪಿಸಬೇಕು.
8. ಮಲುಗುವಾಗ ತಪ್ಪದೇ ಸೊಳ್ಳೆ ಪರದೆಗಳನ್ನು ಉಪಯೋಗಿಸುವುದು ಹಾಗೂ ಸೊಳ್ಳೆ ಕಡಿತದಿಂದ ಪಾರಾಗಲು ಸಂಜೆವೇಳೆಯೂ ಸಹಾ ಸೊಳ್ಳೆ ನಿರೋಧಕ ಬತ್ತಿಗಳನ್ನು ಉರಿಸುವುದು, ಹಸಿ ಬೇವಿನಸೊಪ್ಪಿನ ಹೊಗೆಯನ್ನು ಹಾಕುವುದು.
9. ಗದ್ದೆ ಬಯಲು ಮುಂತಾದ ಪ್ರದೇಶದಲ್ಲಿ ನೀರುನಿಂತಾಗ ಲಾರ್ವಾಹಾರಿ ಮೀನುಗಳನ್ನು ಬಿಡುವುದು.

4. ಡೆಂಗೀ ಜ್ವರ

ಡೆಂಗೀ ಜ್ವರವು ಮಾರಕವಾದ ಖಾಯಿಲೆ. ಇದು ಡೆಂಗೀ ವೈರಸ್‌ನಿಂದ ಉಂಟಾಗುತ್ತದೆ. "ಈಡೀಸ್ ಈಜಿಪ್ಟೈ" ಸೊಳ್ಳೆಯು ಕಚ್ಚುವಿಕೆಯಿಂದ ಹರಡುತ್ತದೆ.

ಹಗಲಿನಲ್ಲಿ ಕಚ್ಚುವ ಈ ಸೊಳ್ಳೆಗಳು ಸಾಮಾನ್ಯವಾಗಿ ಮಕ್ಕಳಲ್ಲಿ ಹೆಚ್ಚಾಗಿ ಕಾಣ ಬರುತ್ತದೆ. ಡೆಂಗೀ ಜ್ವರದಲ್ಲಿ ಮೂರು ವಿಧಗಳು :

1. ಡೆಂಗೀ ಜ್ವರ
2. ಡೆಂಗೀ ರಕ್ತ ಸ್ರಾವ ಜ್ವರ (DHF)
3. ಡೆಂಗೀ ಶಾಕ್ ಸಿಂಡ್ರೋಮ್ (DSS)

ಡೆಂಗೀ ಜ್ವರದ ಲಕ್ಷಣಗಳು :

ಇದ್ದಕ್ಕಿದ್ದಂತೆ ತೀವ್ರ ಜ್ವರ, ವಿಪರೀತ ತಲೆ ನೋವು, ಕಣ್ಣುಗಳ ಹಿಂಭಾಗದಲ್ಲಿ ನೋವು, ಮಾಂಸಖಂಡ ಮತ್ತು ಕೀಲುಗಳಲ್ಲಿ ವಿಪರೀತ ನೋವು ಕಾಣಿಸಿಕೊಳ್ಳುವುದು ಈ ರೋಗದ ಪ್ರಮುಖ ಲಕ್ಷಣಗಳು.

ಡೆಂಗೀ ರಕ್ತ ಸ್ರಾವ ಜ್ವರ (DHF)

ತೀಕ್ಷ್ಣವಾದ ಜ್ವರದ ನಂತರ ರಕ್ತಸ್ರಾವ, ಮೈ ಊತ, ರಕ್ತದ ಒತ್ತಡದ ಕುಸಿತ ಸಹ ಉಂಟಾಗಿ ಮರಣ ಸಂಭವಿಸಬಹುದು. ಸಾಮಾನ್ಯವಾಗಿ ಇದು ಮಕ್ಕಳಲ್ಲಿ ತೀವ್ರವಾಗಿ ಕಂಡು ಬರುತ್ತದೆ.

ಜ್ವರ ಬಂದ 3-5 ದಿನಗಳಲ್ಲಿ ರಕ್ತ ಸ್ರಾವದ ಮತ್ತು ಮೈಊತದ ಲಕ್ಷಣಗಳು ಕಂಡು ಬರುತ್ತದೆ. 5-6 ದಿನಗಳ ನಂತರವೂ ಜ್ವರ ಮುಂದುವರೆದಲ್ಲಿ ಮಧ್ಯದಲ್ಲಿ ಸ್ವಲ್ಪ ಕಡಿಮೆಯಾಗಿ ಮತ್ತೆ ಹೆಚ್ಚಾಗುತ್ತದೆ. ರೋಗಿಯು ತೀವ್ರ ನಿಶ್ಯಕ್ತಿಯಿಂದ ಬಳಲಿದಂತಾಗುತ್ತಾನೆ.

ಡೆಂಗೀ ಜ್ವರವನ್ನು ಗುರ್ತಿಸುವಿಕೆ

ಈ ರೋಗವನ್ನು ಕೆಳಕಂಡ ಲಕ್ಷಣಗಳಿಂದ ಬಹು ಬೇಗ ಗುರ್ತಿಸಬಹುದು.

1. ಇದ್ದಕ್ಕಿದ್ದಂತೆ ತೀವ್ರ ಜ್ವರ ಕಾಣಿಸಿಕೊಳ್ಳುವುದು.
2. ತೀವ್ರ ತರವಾದ ತಲೆನೋವು ಹೆಚ್ಚಾಗಿ ಹಣೆಯ ಮುಂಭಾಗದಲ್ಲಿ ಕಾಣಿಸುವುದು.
3. ಕಣ್ಣಿನ ಹಿಂಭಾಗದ ನೋವು ಕಣ್ಣಿನ ಚಲನೆಯಿಂದ ಹೆಚ್ಚಾಗುತ್ತದೆ.
4. ಮೈಕೈನೋವು ಮತ್ತು ಕೀಲು ನೋವು.
5. ವಾಕರಿಕೆ ಮತ್ತು ವಾಂತಿ.

ಡೆಂಗೀ ರಕ್ತಸ್ರಾವ ಜ್ವರ ಮತ್ತು ಆಘಾತವನ್ನು ಗುರ್ತಿಸುವಿಕೆ

ಈ ಮೇಲ್ಕಂಡ ಡೆಂಗೀ ಜ್ವರದ ಲಕ್ಷಣಗಳ ಜೊತೆಗೆ, ಕೆಳಕಂಡ ಯಾವುದಾದರೊಂದು ಲಕ್ಷಣಗಳು ಕಂಡು ಬರುತ್ತದೆ.

1. ತೀವ್ರ ತರವಾದ ಮತ್ತು ಒಂದೇ ಸಮನೆ ಹೊಟ್ಟೆ ನೋವು.
2. ಬಾಯಿ, ಮೂಗು ಮತ್ತು ಒಸಡುಗಳಿಂದ ರಕ್ತಸ್ರಾವ ಹಾಗೂ ಚರ್ಮದ ಮೇಲೆ ಅಲ್ಲಲ್ಲಿ ರಕ್ತಸ್ರಾವದ ಗುರುತುಗಳು.
3. ರಕ್ತ ಸಹಿತ ಅಥವಾ ರಕ್ತ ರಹಿತವಾದ ವಾಂತಿಯು ಪದೇ ಪದೇ ಆಗುವುದು.
4. ಡಾಂಬರಿನಂತಹ ಕಪ್ಪು ಮಲ ವಿಸರ್ಜನೆ.
5. ವಿಪರೀತ ಬಾಯಾರಿಕೆ (ಬಾಯಿ ಒಣಗುವುದು).
6. ತಣ್ಣನೆಯ ಬಿಳಿಚಿದ ಚರ್ಮ.
7. ಚಡಪಡಿಸುವಿಕೆ ಅಥವಾ ಜ್ಞಾನ ತಪ್ಪುವುದು.

ಚಿಕಿತ್ಸೆ

ಈ ರೋಗದ ಚಿಕಿತ್ಸೆಗೆ ನಿರ್ದಿಷ್ಟವಾದ ಔಷಧಿ ಇರುವುದಿಲ್ಲ. ಆದಾಗ್ಯೂ ಸರಿಯಾದ ಮತ್ತು ಪೂರ್ವ ಭಾವಿ ಚಿಕಿತ್ಸೆಯನ್ನು ನೀಡಿದಲ್ಲಿ ಈ ರೋಗದ ಲಕ್ಷಣಗಳನ್ನು ಪರಿಹರಿಸಿ ಮುಂದಾಗಬಹುದಾದ ತೊಂದರೆ ಮತ್ತು ಸಾವನ್ನು ನಿಯಂತ್ರಿಸಬಹುದು. ಡೆಂಗೀ ಜ್ವರದಲ್ಲಿ " ಆಸ್ಪಿರಿನ್" ಮತ್ತು "ಬ್ರೂಫಿನ್" ಕೊಡಬಾರದು. ಏಕೆಂದರೆ ಇವು ರಕ್ತಸ್ರಾವ ಮತ್ತು ಹೊಟ್ಟೆನೋವನ್ನು ಇನ್ನಷ್ಟೂ ತೀವ್ರಗೊಳಿಸುತ್ತವೆ. ವೈದ್ಯರ ಸಲಹೆ ಮೇರೆಗೆ "ಪ್ಯಾರಸಿಟಮಾಲ್" ಅನ್ನು ಕೊಡಬಹುದು. ಡೆಂಗೀ ರಕ್ತಸ್ರಾವ ಜ್ವರದ ಲಕ್ಷಣಗಳು ಒಂದಕ್ಕಿಂತ ಹೆಚ್ಚು ಕಂಡು ಬಂದಲ್ಲಿ ರೋಗಿಯನ್ನು ತುರ್ತಾಗಿ ಹತ್ತಿರದ ಆಸ್ಪತ್ರೆಗೆ ಸೇರಿಸಿ ಚಿಕಿತ್ಸೆ ಒದಗಿಸಬೇಕು. ರೋಗಿಯನ್ನು ಆಸ್ಪತ್ರೆಗೆ ಕೊಂಡೊಯ್ಯುವಾಗ ದ್ರವ ಆಹಾರವನ್ನು ಕುಡಿಯಲು ಕೊಡಬೇಕು.

ಡೆಂಗೀ ಹರಡುವ ರೀತಿ

ಸೋಂಕು ಹೊಂದಿದ "ಈಡೀಸ್ ಈಜಿಪ್ಟೈ" ಸೊಳ್ಳೆ ಕಡಿತದಿಂದ ಡೆಂಗೀ ಜ್ವರ ಉಂಟಾಗುತ್ತದೆ. ಸೋಂಕು ಹೊಂದಿದ ವ್ಯಕ್ತಿಯನ್ನು ಕಚ್ಚುವುದರ ಮೂಲಕ ಈ ಸೊಳ್ಳೆಯು ಡೆಂಗೀ ವೈರಸ್ ಅನ್ನು ಪಡೆಯುತ್ತದೆ. ಸೊಳ್ಳೆ ಕಚ್ಚಿದ 5-7 ದಿವಸಗಳ ನಂತರ ರೋಗದ ಪ್ರಾಥಮಿಕ ಲಕ್ಷಣಗಳು ಕಂಡು ಬರುತ್ತವೆ.

ಸೊಳ್ಳೆಗಳ ಉತ್ಪತ್ತಿಯ ತಾಣಗಳು

ಈಡೀಸ್ ಸೊಳ್ಳೆಗಳು ಹೆಚ್ಚಿನ ಮಟ್ಟಿಗೆ ಮನೆಯಲ್ಲಿರುವ ನೀರು ಶೇಖರಣೆಯ ತೊಟ್ಟಿಗಳು, ಬ್ಯಾರೆಲ್‌ಗಳು, ಡ್ರಮ್‌ಗಳು, ಬಕೆಟ್‌ಗಳು, ಹೂವಿನ ಕುಂಡಗಳಲ್ಲಿ ಬೆಳೆಯುತ್ತವೆ, ಇದಲ್ಲದೆ ಮನೆ ಸುತ್ತ - ಮುತ್ತಲಿರುವ ಪಿಂಗಾಣಿ ವಸ್ತುಗಳು, ಒಡೆದ ಬಾಟಲಿಗಳು, ಬಯಲಿನಲ್ಲಿ ಬಿಸಾಡಿದ ಟೈರುಗಳು, ಒಡೆದ ಎಳನೀರಿನ ಚಿಪ್ಪುಗಳಲ್ಲಿ ಮತ್ತು ಇತರೇ ನೀರು ಸಂಗ್ರಹಣಾ ತಾಣಗಳಲ್ಲಿ ಹೆಚ್ಚಾಗಿ ಉತ್ಪತ್ತಿಯಾಗುತ್ತವೆ.

ಡೆಂಗೀ ಜ್ವರ ನಿಯಂತ್ರಣ ಕ್ರಮಗಳು

1. ಮನೆಯೊಳಗೆ ಮತ್ತು ಮೇಲ್ಚಾವಣಿಯ ನೀರಿನ ತೊಟ್ಟಿಗಳಲ್ಲಿ ತಪ್ಪದೆ ವಾರಕೊಮ್ಮೆ ನೀರನ್ನು ಖಾಲಿಮಾಡಿ, ಉಜ್ಜಿ ಒಣಗಿಸಿ ಮತ್ತೆ ಭರ್ತಿಮಾಡಿ ಭದ್ರವಾಗಿ ಮುಚ್ಚಳಿಕೆಯಿಂದ ಮುಚ್ಚುವುದು.

2. ಮನೆಯ ಒಳಗೆ ಹಾಗೂ ಹೊರಗೆ ಯಾವುದೇ ಕಾರಣಕ್ಕೂ ನೀರು ನಿಲ್ಲದಂತೆ ಎಚ್ಚರ ವಹಿಸಬೇಕು.

3. ಒಡೆದ ಬಾಟಲಿ, ಟಿನ್, ಟೈರು ಇತ್ಯಾದಿಗಳಲ್ಲಿ ನೀರು ಸಂಗ್ರಹವಾಗದಂತೆ ನೋಡಿಕೊಳ್ಳಬೇಕು.

4. ಏರ್‌ಕೂಲರ್‌ಗಳಲ್ಲಿ ನೀರನ್ನು ಆಗಾಗ್ಗೆ ಬದಲಾಯಿಸುತ್ತಿರಬೇಕು.

5. ಏರ್‌ಕೂಲರ್ ಕೆಟ್ಟಾಗ, ಉಪಯೋಗಿಸದೇ ಇದ್ದಾಗ ಏರ್‌ಕೂಲರ್‌ನ ನೀರನ್ನು ಖಾಲಿ ಮಾಡಬೇಕು.

6. ಬೆಂಕಿ ಆರಿಸಲು ಉಪಯೋಗಿಸುವ ಬಕೆಟ್‌ಗಳಲ್ಲಿರುವ ನೀರನ್ನು ವಾರಕ್ಕೊಮ್ಮೆ ಖಾಲಿ ಮಾಡಿ, ಭರ್ತಿ ಮಾಡಿಕೊಳ್ಳುವುದು.

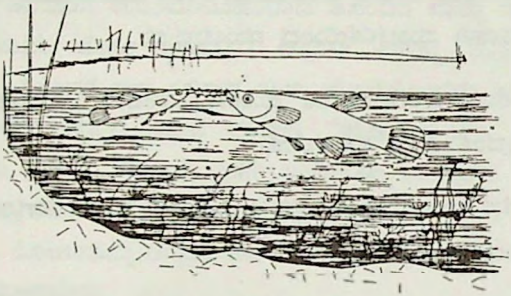
7. ಯಾವಾಗಲೂ ಮೈತುಂಬಾ ಬಟ್ಟೆ ಧರಿಸಬೇಕು.

8. ಹಗಲು ಹೊತ್ತಿನಲ್ಲಿ ನಿದ್ದೆ ಮಾಡುವ ಮಕ್ಕಳು ಮತ್ತು ವಿಶ್ರಾಂತಿ ಪಡೆಯುವ ವಯಸ್ಸಾದವರೂ ತಪ್ಪದೆ ಸೊಳ್ಳೆ ಪರದೆಯನ್ನು ಉಪಯೋಗಿಸಬೇಕು.

9. ಕಿಟಕಿ ಬಾಗಿಲುಗಳಿಗೆ ಸೊಳ್ಳೆ ನಿಯಂತ್ರಣ ಜಾಲರಿಗಳನ್ನು ಆಳವಡಿಸಬೇಕು.

10. ಡೆಂಗೀ ಜ್ವರದಿಂದ ನರಳುವ ರೋಗಿಗಳು ಸಹ ತಪ್ಪದೆ ಸೊಳ್ಳೆ ಪರದೆಯನ್ನು ಉಪಯೋಗಿಸುವುದು.

ರೋಗವಾಹಕ ಸೊಳ್ಳೆಗಳ ಉತ್ಪತ್ತಿಯನ್ನು ನಿಯಂತ್ರಿಸಲು ಒಂದು ಸರಳ ಉಪಾಯ-"ಜೈವಿಕ ನಿಯಂತ್ರಣ ವಿಧಾನ" (ಸೊಳ್ಳೆ ನಿಯಂತ್ರಣಕ್ಕೆ ಲಾರ್ವಾಹಾರಿ ಮೀನುಗಳ ಉಪಯೋಗ)



ಜೈವಿಕ ನಿಯಂತ್ರಣ ವಿಧಾನ (Biological Method of Control)

ಮಲೇರಿಯ, ಫೈಲೇರಿಯ, ಡೆಂಗೀ ಮತ್ತು ಮೆದುಳು ಜ್ವರಗಳು ಸೊಳ್ಳೆಗಳಿಂದ ಒಬ್ಬರಿಂದ ಒಬ್ಬರಿಗೆ ಹರಡುತ್ತವೆ. ಈ ಸೊಳ್ಳೆಗಳ ಉತ್ಪತ್ತಿಯನ್ನು ನಿಯಂತ್ರಿಸಲು ಇರುವ ಹಲವಾರು ವಿಧಾನಗಳಲ್ಲಿ "ಜೈವಿಕ ನಿಯಂತ್ರಣ" ಒಂದು ಬಹುಮುಖ್ಯ ವಿಧಾನ.

ನೀರಿನಲ್ಲಿ ಉತ್ಪತ್ತಿಯಾಗುವ ಸೊಳ್ಳೆಗಳ ಲಾರ್ವಾ ಮತ್ತು ಪ್ಯೂಪ ಹಂತಗಳನ್ನು ಸೊಳ್ಳೆಗಳಾಗಿ ಬೆಳೆಯುವ ಮುಂಚೆಯೇ ಆಹಾರವಾಗಿ ತಿನ್ನುವ ಮೀನುಗಳನ್ನು ಲಾರ್ವಾಹಾರಿ ಮೀನುಗಳೆಂದು ಕರೆಯುತ್ತಾರೆ. ಈ ಮೀನುಗಳನ್ನು ಬಳಸಿಕೊಂಡು ಸೊಳ್ಳೆಗಳ ಉತ್ಪತ್ತಿಯನ್ನು ನಿಯಂತ್ರಿಸಿದರೆ, ಅವುಗಳಿಂದ ಹರಡುವ ರೋಗಗಳನ್ನು ಸಹ ನಿಯಂತ್ರಿಸಬಹುದು.

ಜೈವಿಕ ನಿಯಂತ್ರಣ ವಿಧಾನವು ಅತೀ ಸರಳವಾದ, ಅಗ್ಗವಾದ ಮತ್ತು ಶಾಶ್ವತವಾಗಿ ಬಳಸಬಹುದಾದ ಸುಲಭ ವಿಧಾನ. ಇದು ಪರಿಸರಕ್ಕೆ ಹೊಂದಿಕೊಳ್ಳುವ "ಹಾನಿ ರಹಿತ" ವಿಧಾನವಾಗಿದೆ.

ನಮ್ಮ ದೇಶವಲ್ಲಿ ಹಲವಾರು ಜಾತಿಯ ಲಾರ್ವಾಹಾರಿ ಮೀನುಗಳಿದ್ದು ಅವುಗಳಲ್ಲಿ ಮುಖ್ಯವಾಗಿ ಕೆಲವು ಜಾತಿಯ ಮೀನುಗಳು ಹೆಚ್ಚಾಗಿ ಸೊಳ್ಳೆಮರಿಗಳನ್ನು ತಿನ್ನುವುದರಿಂದ ಮತ್ತು ಅವುಗಳ ವಿಶೇಷ ಗುಣಗಳಿಂದ ಸೊಳ್ಳೆ ನಿಯಂತ್ರಣಕ್ಕೆ ಬಳಸಲಾಗುತ್ತಿದೆ.

ಈ ಎರಡು ಜಾತಿಯ ಮೀನುಗಳಿಂದ ಸೊಳ್ಳೆಗಳನ್ನು ನಿಯಂತ್ರಣಕ್ಕೆ ಬಳಸಲಾಗುತ್ತಿದೆ. ಅವುಗಳೆಂದರೆ :-

1) ಗ್ಯಾಂಬುಸಿಯ ಮೀನುಗಳ 2) ಗಪ್ಪಿ ಮೀನುಗಳು

ಲಾರ್ವಾಹಾರಿ ಮೀನುಗಳ ಗುಣ ಲಕ್ಷಣಗಳು

1. ಇವುಗಳು ಗಾತ್ರದಲ್ಲಿ ಸಣ್ಣದಾಗಿದ್ದು ನೀರಿನಲ್ಲಿ ವೃದ್ಧಿಯಾಗುವ ಸೊಳ್ಳೆ ಮರಿಗಳನ್ನು ತಿನ್ನುತ್ತವೆ.
2. ಇವುಗಳು ಗಡುಸಾಗಿದ್ದು ನೀರಿನ ತಾಣಗಳಲ್ಲಿ ಜೀವಿಸುತ್ತವೆ ಮತ್ತು ಯಥೇಚ್ಛವಾಗಿ ವೃದ್ಧಿಯಾಗುತ್ತವೆ.
3. ಇವುಗಳನ್ನು ಆಹಾರವಾಗಿ ಬಳಸಲು ಯೋಗ್ಯವಲ್ಲ.

ಗ್ಯಾಂಬುಸಿಯ ಮತ್ತು ಗಪ್ಪಿ ಮೀನುಗಳ ಬಗ್ಗೆ ವಿವರಗಳು

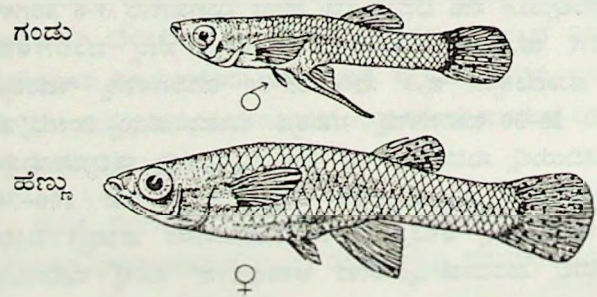
1) ಗ್ಯಾಂಬುಸಿಯ : ಈ ಮೀನುಗಳ ಗಾತ್ರ ಗಂಡು 4.5 ಸೆ.ಮೀ., ಹೆಣ್ಣು 5-6 ಸೆ. ಮೀ.ವರೆಗೆ ಇರುತ್ತವೆ. ಈ ಮೀನುಗಳು ಗಡುಸಾಗಿದ್ದು ತಿಳಿನೀರಿನ ತಾಣಗಳಲ್ಲಿ ಹೆಚ್ಚಾಗಿ ವೃದ್ಧಿಯಾಗುತ್ತವೆ. 24-34° ಸೆ. ಉಷ್ಣಾಂಶದಲ್ಲಿಯೂ ಸಹ ಬದುಕುತ್ತವೆ. ಹೆಣ್ಣು ಮೀನುಗಳು 3-6 ತಿಂಗಳಲ್ಲಿ ಬೆಳವಣಿಗೆ ಹೊಂದಿ ಪ್ರತಿ ತಿಂಗಳು ಸಣ್ಣ, ಸಣ್ಣ ಮರಿಗಳನ್ನು ಉತ್ಪತ್ತಿ ಮಾಡುತ್ತವೆ. ಪ್ರತಿ ಸಾರಿ 25-30 ಮರಿಗಳನ್ನು ಇಡುತ್ತವೆ. ಪ್ರತಿ ಸಾರಿ 25-30 ಮರಿಗಳನ್ನು ಇಡುತ್ತವೆ. ಒಂದು ಹೆಣ್ಣು ಮೀನು ತನ್ನ ಜೀವಿತಾವಧಿಯಲ್ಲಿ ಸುಮಾರು 900-1200 ಮರಿಗಳನ್ನು ವೃದ್ಧಿಮಾಡುತ್ತವೆ. ಬೆಳವಣಿಗೆಯಾದ ಪ್ರತಿಯೊಂದು ಮೀನು ಪ್ರತಿ ದಿನ 100-300 ಸೊಳ್ಳೆ ಮರಿಗಳನ್ನು ತಿನ್ನುತ್ತವೆ. ಈ ಮೀನುಗಳು ಹೆಚ್ಚಾಗಿ ನೀರಿನ ಮೇಲ್ಭಾಗದಲ್ಲಿ ಪರಿದಾಡುವುದರಿಂದ ಅನಾಫಿಲೀಸ್ ಸೊಳ್ಳೆ ಮರಿಗಳನ್ನು

ಸುಲಭವಾಗಿ ತಿನ್ನುತ್ತವೆ. ಇವುಗಳನ್ನು ತಿಳಿ ನೀರಿನ ತಾಣಗಳಾದ ಕೆರೆ, ಕುಂಟೆ, ಬಾವಿ, ಹಳ್ಳ, ಕೊಳ್ಳ, ತೊಟ್ಟಿ ಕಾರಂಜಿ ಮುಂತಾದ ಸ್ಥಳಗಳಲ್ಲಿ ಬೆಳೆಸಲು ಯೋಗ್ಯವಾಗಿರುತ್ತವೆ. ಇವುಗಳ ಬೆಳವಣಿಗೆಗೆ ಕಲುಷಿತ ನೀರು ಯೋಗ್ಯವಲ್ಲ.

2) ಗಪ್ಪಿ : ಈ ಜಾತಿಯ ಮೀನುಗಳು ರಾಜ್ಯದ ಎಲ್ಲಾ ಭಾಗಗಳಲ್ಲಿಯೂ ದೊರೆಯುತ್ತವೆ. ಗಾತ್ರದಲ್ಲಿ ಸಣ್ಣದಾಗಿದ್ದು , ಗಡುಸಾಗಿದ್ದು, ಎಲ್ಲಾ ನೀರಿನ ತಾಣಗಳಲ್ಲಿ ಜೀವಿಸುತ್ತವೆ. ಗಂಡು ಮೀನು 2.5 ಸೆ.ಮೀ. ಉದ್ದ, ಹೆಣ್ಣು ಮೀನು 4 ಸೆ.ಮೀ. ವರೆಗೆ ಉದ್ದವಿರುತ್ತವೆ. ಈ ಮೀನುಗಳ ಬೆಳವಣಿಗೆಗೆ ಸುಮಾರು 90 ದಿವಸಗಳು ಬೇಕಾಗುವುದು. ಹೆಣ್ಣು ಮೀನು ಪ್ರತಿ ತಿಂಗಳಿಗೊಮ್ಮೆ 50 ರಿಂದ 200 ರವರೆಗೆ ಮರಿಗಳನ್ನು ಹಾಕುತ್ತವೆ. ಪ್ರತಿ ಮೀನು ದಿನಕ್ಕೆ 80-100 ಸೊಳ್ಳೆ ಮರಿಗಳನ್ನು ತಿನ್ನುವ ಸಾಮರ್ಥ್ಯ ಹೊಂದಿರುತ್ತವೆ. ಈ ಮೀನುಗಳು ಸ್ವಲ್ಪ ಕಲುಷಿತ ನೀರಿನಲ್ಲಿಯೂ ಸಹ ಬದಕುತ್ತವೆ. ಈ ಮೀನುಗಳು ಕ್ಯೂಲೆಕ್ಸ್ ಸೊಳ್ಳೆಗಳ ನಿಯಂತ್ರಣಕ್ಕೆ ಉಪಯೋಗಿಸಲು ಯೋಗ್ಯವಾಗಿರುತ್ತವೆ. ಇವುಗಳನ್ನು ಬೇರೆ ಕಡೆಗೆ ಸಾಗಿಸುವಾಗ ಜೀವಿಸುವ ಸಾಮರ್ಥ್ಯ ಹೊಂದಿರುತ್ತವೆ ಮತ್ತು ಸಾಗಿಸಲು ವಿಶೇಷ ಉಪಕರಣಗಳು ಬೇಕಾಗುವುದಿಲ್ಲ.

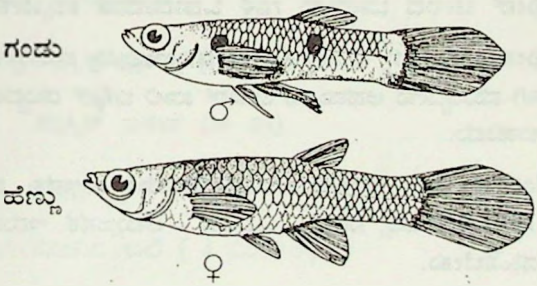
ಗಪ್ಪಿ ಮತ್ತು ಗ್ಯಾಂಬುಸಿಯ ಮೀನುಗಳ ವ್ಯತ್ಯಾಸ :

ಗ್ಯಾಂಬುಸಿಯ (ಗ್ಯಾಂಬುಸಿಯ ಅಫಿನಿಸ್)



1. ಗಂಡು ಮೀನಿನ ಗಾತ್ರ 4.5 ಸೆ. ಮೀ. ಹೆಣ್ಣು ಮೀನಿನ ಬೆಳವಣಿಗೆ 5-6 ಸೆ.ಮೀ.
2. ಗುದದ ಮತ್ತು ಬೆನ್ನಿನ ಈಜು ರೆಕ್ಕೆಗಳ ಮೂಲ ಒಂದೇ ರೇಖೆಯಲ್ಲಿರುವುದಿಲ್ಲ.
3. ಬಾಲದ ಈಜು ರೆಕ್ಕೆ ದುಂಡಾಗಿರುತ್ತದೆ.
4. ಬಾಲದ ಮತ್ತು ಬೆನ್ನಿನ ರೆಕ್ಕೆಗಳಲ್ಲಿ ಕಪ್ಪು ಚುಕ್ಕೆಗಳಿರುತ್ತವೆ.
5. ಗಂಡು ಮೀನುಗಳು ಬಣ್ಣ ಹೊಂದಿರುವುದಿಲ್ಲ.

ಗಪ್ಪಿ (ಲೆಬಿಸ್ಟಸ್ ರೆಟಿಕ್ಯೂಲೇಟಸ್)



1. ಗಂಡು ಮೀನಿನ ಗಾತ್ರ 2.5 ಸೆ.ಮೀ., ಹೆಣ್ಣು ಮೀನಿನ ಬೆಳವಣಿಗೆ 4. ಸೆ.ಮೀ.
2. ಗುದದ ಮತ್ತು ಬೆನ್ನಿನ ಈಜು ರೆಕ್ಕೆಗಳ ಮೂಲ ಒಂದೇ ರೇಖೆಯಲ್ಲಿರುತ್ತದೆ.
3. ಬಾಲದ ಈಜು ರೆಕ್ಕೆ ಚೂಪಾಗಿ ಭರ್ಜಿ ಆಕಾರದಲ್ಲಿರುತ್ತದೆ.
4. ಬಾಲ ಮತ್ತು ಬೆನ್ನಿನ ರೆಕ್ಕೆಗಳಲ್ಲಿ ಕಪ್ಪು ಚುಕ್ಕೆಗಳಿರುವುದಿಲ್ಲ.
5. ಗಂಡು ಮೀನುಗಳು ವಿಧ ವಿಧವಾದ ಬಣ್ಣಗಳನ್ನು ಹೊಂದಿರುತ್ತದೆ.

ಮೀನು ಸಾಗಿಸುವ ವಿಧಾನ :

ಗಪ್ಪಿ ಮತ್ತು ಗ್ಯಾಂಬುಸಿಯ ಮೀನುಗಳನ್ನು ಒಂದು ಕಡೆಯಿಂದ ಇನ್ನೊಂದು ಕಡೆಗೆ ಸಾಗಿಸಲು ಈ ಕೆಳಕಂಡ ಕ್ರಮಗಳನ್ನು ತೆಗೆದು ಕೊಳ್ಳುವುದು ಉತ್ತಮ.

1. 5 ಲೀಟರ್ ಆಳತೆಯ ಒಂದು ಪಾಲಿಥೀನ್ ಚೀಲ.
2. ಇದಕ್ಕೆ 2½ ಲೀಟರ್ ನೀರು ತುಂಬಿಸುವುದು.
3. ಪಾಲಿಥಿನ್ ಚೀಲದಲ್ಲಿ ನೀರು ಮತ್ತು ಮೀನು 3½ ಲೀಟರ್‌ವರೆಗೆ ಸಮಾನಾಗಿರುವಂತೆ ತುಂಬಿಸುವುದು.
4. ಈ ಚೀಲದಲ್ಲಿ ಆಮ್ಲಜನಕವಿರುವಂತೆ ನೋಡಿಕೊಳ್ಳಬೇಕು
5. ಪಾಲಿಥೀನ್ ಚೀಲದ ಬಾಯನ್ನು ಗಾಳಿ ಓಡಾಡುವಂತೆ ಕಟ್ಟಬೇಕು.
6. ಪಾಲಿಥೀನ್ ಚೀಲವನ್ನು ಥರ್ಮೋಕೂಲಿನ ಡಬ್ಬಿಯಲ್ಲಿಟ್ಟು ಮುಚ್ಚಳವನ್ನು ಭದ್ರವಾಗಿ ಮುಚ್ಚಬೇಕು ಅಥವಾ 16 ಲೀಟರ್ ಪೈಲಿ ಬಿಸ್ಕೆಟ್ ಡಬ್ಬದಲ್ಲಿಟ್ಟು ಸಾಗಿಸಬಹುದು.
7. 24 ಗಂಟೆಗಳ ಕಾಲ ಮೇಲಿನಂತೆ ಸಂರಕ್ಷಿಸಬಹುದು. ಇನ್ನೂ ಹೆಚ್ಚು ಕಾಲ ಸಾಗಿಸಬೇಕಾದಲ್ಲಿ ನೀರನ್ನು ಬದಲಿಸಿ ಆಮ್ಲಜನಕ ಇರುವಂತೆ ಎಚ್ಚರವಹಿಸಬೇಕು.

ಎಚ್ಚರಿಕೆ :

1. 15 ರಿಂದ 20ರಷ್ಟು ಮೀನುಗಳು ಸಾಯಬಹುದು. ಆದ್ದರಿಂದ ಹೆಚ್ಚಿನ ಮೀನುಗಳನ್ನು ಮೊದಲೇ ತೆಗೆದುಕೊಂಡು ಸರಿದೂಗಿಸಬೇಕು. ಸಾಗಿಸುವಾಗ ಹವಾಮಾನ ಹೆಚ್ಚು ಕಡಿಮೆಯಾಗದಂತೆ ಎಚ್ಚರವಹಿಸಬೇಕು.
2. ಮೀನುಗಳಿಗೆ ಆಹಾರ ನೀಡಿದ 10-12 ಗಂಟೆಗಳ ನಂತರ ಸಾಗಿಸಬೇಕು.
3. ಅತಿ ಹೆಚ್ಚು ಸಂಖ್ಯೆಯ ಮೀನುಗಳನ್ನು ದೂರದ ಊರಿಗೆ ಸಾಗಿಸುವಾಗ ಹತ್ತಿರದ ಮಲೇರಿಯ ಆಧಿಕಾರಿಗಳನ್ನು ಸಂಪರ್ಕಿಸಬೇಕು.

4. ಮೀನುಗಳನ್ನು ಸಾಗಿಸಿದ ನಂತರ ಕೆರೆ, ಕುಂಟೆಗಳಲ್ಲಿ ಬಿಡುವಾಗ ಬೆಳಗಿನ ಅಥವಾ ಸಂಜೆಯ ವೇಳೆಯಲ್ಲಿ ಮಾತ್ರ ಬಿಡಬೇಕು.

5. ನೀರಿಗೆ ಮೀನುಗಳನ್ನು ಬಿಟ್ಟ ನಂತರ ಅವುಗಳ ಚಲನೆಯನ್ನು ಗುರುತಿಸಬೇಕು.

6. ಸೊಳ್ಳೆಗಳ ಉತ್ಪತ್ತಿ ತಾಣಗಳನ್ನು ಗುರ್ತಿಸಿ, ಅವುಗಳಲ್ಲಿ ಮೀನುಗಳನ್ನು ಬಿಡಬೇಕು.

ಮೀನುಗಳ ಸಂಗ್ರಹಣೆ, ಸಾಗಿಸಲು ಮತ್ತು ಬಿಡಲು ಈ ಕೆಳಕಂಡ ಸಲಕರಣೆಗಳು ಅವಶ್ಯವಾಗಿರುತ್ತದೆ.

1. ಜಿಲ್ಲಾ ಮಟ್ಟದಲ್ಲಿ

1.	ಪ್ಲಾಸ್ಟಿಕ್ ಡ್ರಮ್ (100 ಲೀ)	-	6
2.	ಪ್ಲಾಸ್ಟಿಕ್ ಬಕೆಟ್ (10 ಲೀ)	-	24
3.	ಪ್ಲಾಸ್ಟಿಕ್ ಸೋಸುವ ಜಾಲರಿ (ದೊಡ್ಡದು)	-	12
4.	ಮೀನಿನ ಬಲೆ (4 ಮೀಟರ್)	-	4
5.	ಉದ್ದನೆಯ ಲೋಹಕ್ಕೆ ಲಗತ್ತಿಸಿರುವ ದುಂಡಾಕಾರದ ಬಲೆ (ಹಿಡಿ ಸಹಿತ)	-	20
6.	ಹತ್ತಿಯ ಹಗ್ಗ (50 ಅಡಿ)	-	20
7.	ಪಾಲಿಥೀನ್ ಬ್ಯಾಗ್ (5 ಲೀ)	-	500
8.	16 ಲೀ. ಆಳತೆಯ ಡಬ್ಬ (ಖಾಲಿ ಬಿಸ್ಕೆಟ್ ಡಬ್ಬ)	-	100

2. ಪ್ರಾಥಮಿಕ ಆರೋಗ್ಯ ಕೇಂದ್ರ ಮಟ್ಟದಲ್ಲಿ :

1.	ಪ್ಲಾಸ್ಟಿಕ್ ಡ್ರಮ್ (100 ಲೀ)	–	2
2.	ಪ್ಲಾಸ್ಟಿಕ್ ಬಕೆಟ್ (10 ಲೀ)	–	6
3.	ಪ್ಲಾಸ್ಟಿಕ್ ಸೋಸುವ ಜಾಲರಿ (ದೊಡ್ಡದು)	–	3
4.	ಮೀನಿನ ಬಲೆ (4 ಮೀಟರ್) (ಸೊಳ್ಳೆ ಪರದೆಯಂತಿರುವ)	–	1
5.	ಉದ್ದನೆಯ ಲೋಹಕ್ಕೆ ಲಗತ್ತಿಸಿರುವ ದುಂಡಾಕಾರದ ಬಲೆ (ಹಿಡಿ ಸಹಿತ)	–	1
6.	ಹತ್ತಿಯ ಹಗ್ಗ (50 ಅಡಿ ಬಂಡಲ್)	–	4

ವಿ. ಸೂ. : ಆಮ್ಲಜನಕದ ಸಿಲಿಂಡರ್ ಎಲ್ಲಾ ಆಸ್ಪತ್ರೆಗಳಲ್ಲಿ ಸಿಗುವುದರಿಂದ ಅದನ್ನೇ ಉಪಯೋಗಿಸಬಹುದು. ಒಂದು ವೇಳೆ ಸಿಗದದ್ದಲ್ಲಿ ಸೈಕಲ್ ಪಂಪಿನಿಂದ ನಿಧಾನವಾಗಿ ಮೀನುಗಳಿಗೆ ಅಪಘಾತವಾಗದಂತೆ ನೀರು ಮತ್ತು ಮೀನು ತುಂಬಿದ ಪಾಲಿಥಿನ್ ಚೀಲದಲ್ಲಿ ಗಾಳಿಯನ್ನು ತುಂಬಬೇಕು.

ಮೀನುಗಳನ್ನು ಬಿಡುವ ಸ್ಥಳಗಳು :

ನಿರಂತರ ಅಥವಾ ಕನಿಷ್ಟ 6 ತಿಂಗಳು ನೀರು ನಿಲ್ಲುವ ಜಾಗಗಳು, ಕೆರೆ, ಕುಂಟೆ, ಬಾವಿ, ಹಳ್ಳ, ನೀರಿನ ಝರಿಗಳು, ನೀರಿನ ತೊಟ್ಟಿಗಳು ಇತ್ಯಾದಿ ಶಾಶ್ವತ ನೀರಿನ ತಾಣಗಳು

ಮೀನುಗಳನ್ನು ಬಿಟ್ಟ ನಂತರ ಅನುಸರಿಬೇಕಾದ ಕ್ರಮಗಳು :

1. ಪ್ರತಿ ವಾರಕ್ಕೊಮ್ಮೆ ಮೀನುಗಳನ್ನು ಬಿಟ್ಟ ಸ್ಥಳಗಳಿಗೆ ಭೇಟಿ ನೀಡಿ, ಮೀನುಗಳ ಚಲನೆ, ಬದುಕುಳಿದಿರುವ ಬಗ್ಗೆ ಪರಿಶೀಲಿಸಬೇಕು.
2. ಮೀನುಗಳು ಸತ್ತಿದ್ದರೆ/ಸಾಯುತ್ತಿದ್ದರೆ ಕೂಡಲೇ ಹತ್ತಿರದ ಅಧಿಕಾರಿಗಳ ಗಮನಕ್ಕೆ ತರಬೇಕು ಹಾಗೂ ಕಾರಣಗಳನ್ನು ಪರಿಶೀಲಿಸಿ ಸರಿಪಡಿಸಬೇಕು.
3. ಮೀನುಗಳ ಚಲನೆಗೆ ಅಡಚಣೆಯಿಲ್ಲದಂತೆ ವ್ಯವಸ್ಥೆ ಮಾಡಿರಬೇಕು. ಏನಾದರೂ ತೊಡಕುಗಳಿದ್ದರೆ ಕೂಡಲೆ ಸರಿಪಡಿಸಬೇಕು. ಗಿಡಗಂಟೆಗಳು ಬೆಳೆಯದಂತೆ ನೋಡಿಕೊಳ್ಳಬೇಕು.

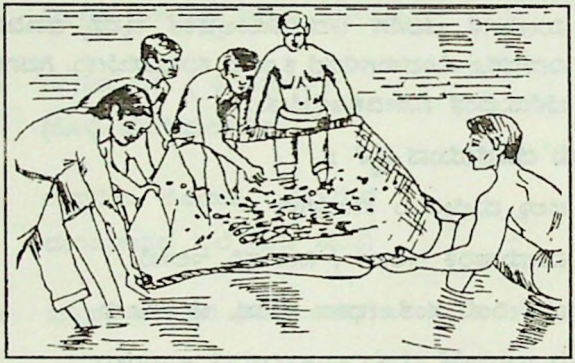
ಮೀನು ದೊರೆಯುವ ಸ್ಥಳ :

1. ಜಿಲ್ಲಾ ಮಲೇರಿಯ ಕೇಂದ್ರಗಳು
2. ಮೀನುಗಾರಿಕೆ ಇಲಾಖೆ / ನೀರಾವರಿ ಇಲಾಖೆ
3. ಮಲೇರಿಯ ಸಂಶೋಧಾನಾ ಕೇಂದ್ರ, ಬೆಂಗಳೂರು

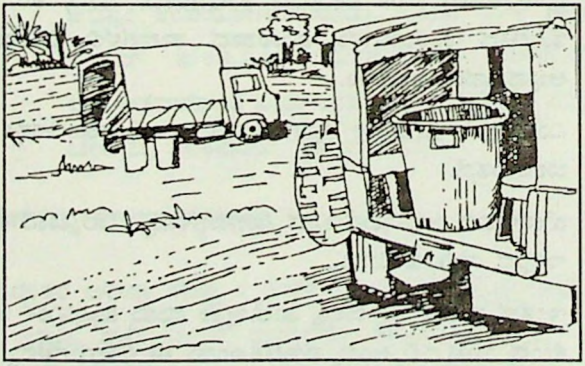
ಮೀನು ಸಾಗಾಣಿಕೆ ಮತ್ತು ಉತ್ಪಾದಿಸುವ ತಾಣಗಳು

1. ನೈಸರ್ಗಿಕವಾಗಿ ಸದಾ ನೀರಿರುವ ತಾಣಗಳಾದ, ಬಾವಿ, ಕೆರೆ, ಕುಂಟೆ, ತೋಟದ ಕಾರಂಜಿಗಳು ಮುಂತಾದ ತಾಣಗಳಲ್ಲಿ ಮೀನುಗಳನ್ನು ಅಭಿವೃದ್ಧಿಪಡಿಸಬಹುದು.
2. ಮೀನುಗಳು ನೀರಿನಲ್ಲೇ ನೈಸರ್ಗಿಕವಾಗಿ ಸಿಗುವ ಆಹಾರವನ್ನೇ ತಿಂದು ಬದುಕುತ್ತವೆ.
3. ಹೇರಳವಾಗಿ ಅಭಿವೃದ್ಧಿಪಡಿಸಿದ ಮೀನುಗಳನ್ನು, ಬೇರೆ ಬೇರೆ ಸ್ಥಳಗಳಿಗೆ ಇಲ್ಲಿಂದ ಸಾಗಿಸಬಹುದು.
4. ಇಂತಹ ತಾಣಗಳನ್ನು ಜಿಲ್ಲಾ, ತಾಲ್ಲೂಕು ಮತ್ತು ಪ್ರಾಥಮಿಕ ಆರೋಗ್ಯ ಕೇಂದ್ರ ಮಟ್ಟದಲ್ಲಿ ಆಯ್ಕೆ ಮಾಡಿಕೊಂಡು ಈ ಮೀನುಗಳನ್ನು ಸಾಕಲು ಮತ್ತು ವಿತರಣೆ ಮಾಡಲು ವ್ಯವಸ್ಥೆ ಮಾಡಿಕೊಳ್ಳಬೇಕು.

5. ಗ್ರಾಮಪಂಚಾಯತಿಗಳು, ಮುನಿಸಿಪಾಲಿಟಿ / ನಗರಸಭೆಗಳು, ಕಾರ್ಪೋರೇಷನ್‌ಗಳು ಜೈವಿಕ ನಿಯಂತ್ರಣದ ಬಗ್ಗೆ ವಿಶೇಷ ಗಮನಹರಿಸಿ ಸಿಬ್ಬಂದಿಗಳಿಗೆ ತರಬೇತಿ ನೀಡಿ, ನಿಂತ ನೀರಿನ ತಾಣಗಳಲ್ಲಿ ಗಪ್ಪಿ / ಗ್ಯಾಂಬುಸಿಯ ಮೀನುಗಳನ್ನು ಬಿಟ್ಟು ಸೊಳ್ಳೆಗಳ ಉತ್ಪತ್ತಿಯನ್ನು ನಿಯಂತ್ರಿಸಲು ಸಹಕರಿಸಬೇಕು.



ಗ್ರಾಮದ ಶಾಶ್ವತ ನೀರಿನ ತಾಣದಲ್ಲಿ ಲಾರ್ವಾಹಾರಿ ಮೀನುಗಳ ಸಂಗ್ರಹಣೆ



ಲಾರ್ವಾಹಾರಿ ಮೀನುಗಳ ಸಾಗಣಿಕೆ

ಸೊಳ್ಳೆಗಳಿಂದ ಹರಡುವ ರೋಗಗಳ ನಿವಾರಣೆಗೆ ಜನತೆ ವಹಿಸಬೇಕಾದ ಪಾತ್ರವೇನು ?

ಎಲ್ಲಾ ಸರ್ಕಾರದ ಕಾರ್ಯಕ್ರಮಗಳು ಯಶಸ್ವಿಯಾಗಬೇಕಾದರೆ ಜನತೆಯ ಪಾತ್ರ ಅತಿ ಮುಖ್ಯ. ಹಾಗೆಯೇ, ಸೊಳ್ಳೆಗಳಿಂದ ಹರಡುವ ಖಾಯಿಲೆಗಳಾದ ಮಲೇರಿಯ, ಮೆದುಳು ಜ್ವರ, ಡೆಂಗೀ ಜ್ವರ ಮತ್ತು ಆನೆಕಾಲು ರೋಗಗಳನ್ನು ತಡೆಗಟ್ಟಲು / ನಿಯಂತ್ರಿಸಲು ಜನತೆಯು ಈ ಕೆಳಕಂಡ ಮುಂಜಾಗ್ರತಾ ಕ್ರಮವನ್ನು ಕೈಗೊಳ್ಳಬಹುದು.

1. ಯಾವುದೇ ಜ್ವರವಿರಲಿ, ಮೊದಲು ರಕ್ತ ಪರೀಕ್ಷೆ ಮಾಡಿಸುವುದು.

2. ಆರೋಗ್ಯ ಸಿಬ್ಬಂದಿಯು ನಿಮ್ಮ ಮನೆಯ ಹತ್ತಿರ ಬಂದಾಗ ಜ್ವರ ಪೀಡಿತರು ರಕ್ತ ಲೇಪನ ನೀಡಿ ಸಹಕರಿಸುವುದು.

3. ಸೊಳ್ಳೆಗಳ ನಾಶಕ್ಕೆ ಕೀಟನಾಶಕ ಸಿಂಪಡಿಸಲು ಬರುವ ಆರೋಗ್ಯ ಸಿಬ್ಬಂದಿಗೆ ನೆರವಾಗಿ ಎಲ್ಲಾ ಕೋಣೆಗಳಿಗೂ ಬಿಡದೆ ಕೀಟನಾಶಕ ಸಿಂಪಡಿಸಲು ಅವಕಾಶ ನೀಡುವುದು, ಹಾಗೂ ಕೀಟನಾಶಕ ಸಿಂಪಡಿಸಿದ ನಂತರ ಸುಣ್ಣ ಬಣ್ಣವನ್ನು ಸಿಂಪಡಿಸಿದ ಗೋಡೆಗಳಿಗೆ ಬಳಿಯಕೂಡದು.

4. ಮನೆಯ ಸುತ್ತ ಮುತ್ತ ನೀರು ನಿಲ್ಲದಂತೆ ಎಚ್ಚರ ವಹಿಸಿ, ಚರಂಡಿ ಮತ್ತು ನಾಲೆಗಳಲ್ಲಿ ಕಸ ಕಡ್ಡಿಗಳನ್ನು ಎಸೆದು ನೀರಿನ ಸರಾಗವಾದ ಹರಿಯುವಿಕೆಗೆ ತಡೆಯೊಡ್ಡದಂತೆ ನೋಡಿಕೊಳ್ಳುವುದು.

5. ಮನೆಯಲ್ಲಿರುವ ನೀರು ಸಂಗ್ರಹಣಾ ಪಾತ್ರೆಗಳು ಮತ್ತು ಡ್ರಂಗಳನ್ನು ಸರಿಯಾದ ಮುಚ್ಚಳದಿಂದ ಮುಚ್ಚಿರಿ ಹಾಗೂ ದೊಡ್ಡ ತೊಟ್ಟಿಗಳನ್ನು ವಾರಕೊಮ್ಮೆ ಸಂಪೂರ್ಣವಾಗಿ ಖಾಲಿ ಮಾಡಿ ಒಣಗಿಸಿ ಮತ್ತೆ ನೀರಿನಿಂದ ಭರ್ತಿಮಾಡಿ ಸರಿಯಾಗಿ ಮುಚ್ಚಿರಿ ಅಥವಾ ಸೊಳ್ಳೆ ನಿಯಂತ್ರಣ ಜಾಲರಿಯನ್ನು ಆಳವಡಿಸಿರಿ.

6. ಮನೆಯ ಸುತ್ತ ಒಡೆದ ಡಬ್ಬ, ಟೈರು, ಎಳೆನೀರಿನ ಚಿಪ್ಪು ಮುಂತಾದ ಸಣ್ಣ ಸಣ್ಣ ಮಳೆನೀರು ಸಂಗ್ರಹಣೆಗೆ ಅವಕಾಶವಾಗುವಂತಹ ಯಾವುದೇ ವಸ್ತುವನ್ನು ಬಯಲಿನಲ್ಲಿ ಎಸೆಯದಿರಿ.

7. ಸಂಜೆಯ ವೇಳೆ ಆದಷ್ಟೂ ಮೈತುಂಬ ಬಟ್ಟೆ ಹೊದೆಯಿರಿ ಮತ್ತು ಮನೆಯ ಕಿಟಕಿ ಬಾಗಿಲುಗಳನ್ನು ಮುಚ್ಚಿರಿ, ಏಕೆಂದರೆ ಈ ವೇಳೆಯಲ್ಲಿ ಸೊಳ್ಳೆಯ ಚಟುವಟಿಕೆಗಳು ಹೆಚ್ಚಿರುತ್ತವೆ.

8. ಮನೆಯ ಎಲ್ಲಾ ಕಿಟಕಿ ಬಾಗಿಲುಗಳಿಗೆ ಕೀಟ ತಡೆಗಟ್ಟುವ ಜಾಲರಿಗಳನ್ನು ಆಳವಡಿಸಿಕೊಳ್ಳಿ.

9. ಮಲಗುವಾಗ ಸೊಳ್ಳೆಪರದೆಯನ್ನು ತಪ್ಪದೇ ಉಪಯೋಗಿಸಿ ಗದ್ದೆ ಅಥವಾ ತೋಟದ ಮನೆಯಲ್ಲಿ ಇಲ್ಲವೇ ಹೊರಾಂಗಣದಲ್ಲಿ ಮಲಗಿದ್ದಾಗಲಂತೂ ಖಂಡಿತವಾಗಿ ಸೊಳ್ಳೆಪರದೆಯನ್ನು ಉಪಯೋಗಿಸಿ.

10. ನೀರಿನ ಬಾವಿ, ಕಾರಂಜಿಗಳು, ಕಟ್ಟಡ ನಿರ್ಮಾಣಕ್ಕಾಗಿ ಸಂಗ್ರಹಿಸಿದ ನೀರು ಶೇಖರಣೆ, ಕೆರೆ, ಕುಂಟೆ, ಹೊಂಡ, ತೋಟದ ಬಾವಿಗಳು, ಗದ್ದೆ, ಜೌಗುಪ್ರದೇಶದಲ್ಲಿ ಸೊಳ್ಳೆಮರಿಗಳನ್ನು ತಿನ್ನುವ ಗ್ಯಾಂಬುಸಿಯ ಮತ್ತು ಗಪ್ಪಿಯೆಂಬ ಲಾರ್ವಾಹಾರಿ ಮೀನುಗಳನ್ನು ಬಿಟ್ಟು ಸೊಳ್ಳೆಗಳ ಉತ್ಪತ್ತಿಯನ್ನು ನಿಯಂತ್ರಿಸಿ.

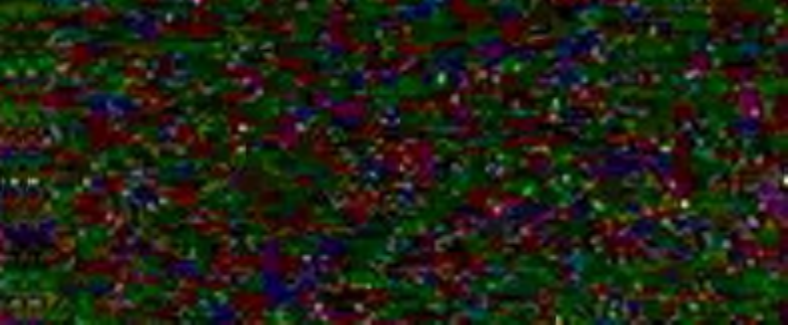
ಹೆಚ್ಚಿನ ಮಾಹಿತಿಗಾಗಿ

ಸಹನಿರ್ದೇಶಕರು (ಮಲೇರಿಯ ಮತ್ತು ಫೈಲೇರಿಯ),
ಜಿಲ್ಲಾ ಮಲೇರಿಯ ಅಧಿಕಾರಿಗಳು, ಇಲ್ಲವೇ ಹತ್ತಿರದ ಪ್ರಾ.ಆ.ಕೇಂದ್ರ,
ಸರ್ಕಾರಿ ಆಸ್ಪತ್ರೆ ಅಥವಾ ಆರೋಗ್ಯ ಕಾರ್ಯಕರ್ತರನ್ನು ಸಂಪರ್ಕಿಸಿ.

ಜೌಗು ಪ್ರದೇಶ

ಭತ್ತದ ಗದ್ದೆ

ನೀರಾವರಿ ಕಾಲುವೆ



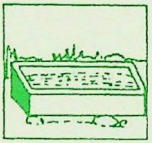
ಮೀನುಗಳನ್ನು ಬಿಡಲು ಯೋಗ್ಯವಾದ ನೀರಿನ ತಾಣಗಳು

ಬಾವಿ

ಕುಂಟೆ

ರಸ್ತೆ ಬದಿಯ ಹಳ್ಳಗಳು

ಚರಂಡಿ



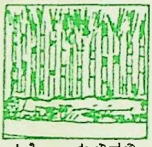
ನೀರಿನ ತೊಟ್ಟಿ

ನೀರಾವರಿ ತೊಟ್ಟಿ

ಜೌಗು ಪ್ರದೇಶ

ಭತ್ತದ ಗದ್ದೆ

ನೀರಾವರಿ ಕಾಲುವೆ

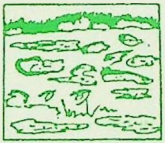


ಗದ್ದೆ ಬಯಲಿನಲ್ಲಿ ನಿಂತ ನೀರು

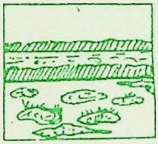
ನಿಂತ ಕೆರೆ ನೀರು

ಮುಚ್ಚಿರುವ ನಾಲೆ

ಮಳೆ ನೀರಿನ ಸಂಗ್ರಹಣೆಗಳು



ಬಯಲಿನಲ್ಲಿರುವ ನಿಂತ ನೀರಿನ ಹಳ್ಳಗಳು



ಸೋರಿಕೆಯಾದ ನೀರಿನ ಸಂಗ್ರಹಣೆಗಳು