

A Sociological Inquiry into an Urban Tuberculosis Control Programme in India *

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Tuberculosis control by mass domiciliary chemotherapy is now being attempted on an increasingly large scale in the technically underdeveloped countries. The National Tuberculosis Institute in Bangalore, India, is an important centre for the development of such programmes, and the study reported in this paper is an inquiry into the working of an urban tuberculosis programme which is operated under the auspices of the Institute. The study reveals several fundamental weaknesses in the treatment organization in this particular programme, and the authors show that such weaknesses are in evidence in similar programmes elsewhere. However, the authors conclude that a great proportion of the problems of inadequate treatment can be dealt with by improved administration and organization. In the authors' opinion, such improvements merit a much higher priority than measures to perfect the technical aspects of the programmes.

INTRODUCTION

Domiciliary chemotherapy in individual cases of tuberculosis has proven remarkably successful under certain circumstances (see, for example, Tuberculosis Chemotherapy Centre, 1959). This success has contributed to a widespread belief that tuberculosis control—i.e., significant and relatively rapid reduction of the tuberculosis problem—can be brought about by mass domiciliary chemotherapy. While it is considered out of the question for the underprivileged nations of the world to build sanatoria and hospitals in sufficient numbers to accommodate an epidemiologically satisfactory proportion of infectious cases, it is assumed to be feasible to bring about a reduction of the pool of infectious cases by treating a sizeable proportion of them in their homes.

Even from the epidemiological point of view, this belief must be viewed with certain reservations. It is likely that the emergence of new cases is not, in the first instance, much affected by the removal of present sources of infection, since many infectious cases

appear to occur among persons who were originally infected as much as 10, 20 or even more years previously (Frimodt-Møller, 1960, 1962). Some of Frimodt-Møller's data have been systematized in a simple epidemetric model by Waaler, Geser & Andersen (1962), and the solution of this model lends theoretical support to Frimodt-Møller's finding that quick epidemiological returns in mass chemotherapy programmes are unlikely. If, therefore, considerable and relatively rapid reduction in the problem cannot be brought immediately about by rendering a sizeable proportion of the infectious case-load uninfected, tuberculosis control can be expected to be achieved only by a long-term continuous effort, year after year perhaps for 20 or more years, not only to convert a substantial proportion of the existing pool of infectious cases but also to convert the new infectious cases which, in the initial stages, occur virtually regardless of the reduction of the initial pool.

If only a long-term continuous removal of infectious cases can be expected to bring about a gradual reduction of the tuberculosis problem, the next problem is the practical implementation of such a policy. It is the contention of this paper that these practical implementation problems are immense. Indeed, so great are they that even the theoretical solution of chemotherapy problems, however encouraging, and the suggested answer to the epidemiological problem, even if it carries conviction, are

* This is a report of a study carried out by the Sociological Section of the National Tuberculosis Institute, Bangalore. The study was planned and directed by the authors. The field work was done by the following social investigators: Miss Susy Mathews, Mr Munikrishnappa, Mrs Lalitha Pratap, Miss M. A. Seetha and Mr M. K. Viswanath.

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only small steps towards the goal. This paper gives an example of the working of a clinic in a large city in India which is attempting to follow the policy of gradual removal, year after year, of a sizeable proportion of the infectious case-load in the area under its jurisdiction. The clinic had been in existence since 1941 under the name, "Lady Willingdon Tuberculosis Clinic", but a few months before the present study began it had been upgraded in a special effort to give an urban field area to the National Tuberculosis Institute. It was also given a new name: "Tuberculosis Demonstration and Training Centre, Bangalore". The initial plan was largely confined to the establishment of a sound tuberculosis clinic on more or less traditional lines. Gradually, and partly through the impetus given by results of this study, it was realized that the emphasis had to be shifted towards the establishment of a comprehensive City Tuberculosis Control Programme. This paper is therefore to a certain extent obsolete, as far as this particular clinic is concerned, and here and there in the text brief mention will be made of reforms that have been implemented after the period of the study. Let it be altogether clear that the intention in describing the working of the clinic in Bangalore is not to criticize the hard and sustained work of the staff of this particular clinic, but merely to give an example of some critical problems for achieving tuberculosis control within a reasonable time in the poorer countries of the world.

MATERIAL AND METHODS

Summary of the methods of the clinic

The Tuberculosis Demonstration and Training Centre in Bangalore receives mainly patients who are reporting there by reason of their own worries over chest symptoms and patients referred to the clinic by non-specialized medical institutions and private practitioners. The clinic also receives a certain number of patients referred to it for diagnosis by the technicians of the house-to-house mass BCG campaign on the basis of their tuberculin reactions and age.

All persons attending the clinic are submitted to a tuberculin test and examination by a 70-mm photofluorogram. Everyone who is found to have abnormal shadows on the photofluorogram is given a clinical examination, and from the same persons a sputum specimen is collected on the spot. This sputum specimen is examined by microscopy and culture. Culture and sensitivity tests are carried out

by the Bacteriological Section of the National Tuberculosis Institute. The methods of isoniazid sensitivity tests are those described by the Medical Research Council (1953). Persons who are diagnosed as having active tuberculosis, whether or not sputum-positive, are put on a uniform treatment regimen of 300 mg of isoniazid per day, and the treatment period is always a minimum of one year. At the time when the present study was initiated, no drug other than isoniazid was available to the clinic, but later a limited amount of PAS (*p*-aminosalicylic acid) became available and a few of the sputum-positive persons were given 10 g of PAS per day in addition to isoniazid. The system of drug administration is that the patient collects his drugs once every four weeks at the clinic, and a home visit is paid only if the patient does not turn up to collect his drugs within two days of the appointed date. The home visitor never brings drugs to the patient, but urges him to come to the clinic to collect his drugs. For each defaulting two home visits are paid before the patient is considered a final defaulter. Home visits are paid only to patients living within the City Corporation area, this area being that officially designated as the clinic's area of operation.

Study population

The present study deals with all persons who were diagnosed as having active tuberculosis in the Tuberculosis Demonstration and Training Centre between 13 March 1961 and 5 May 1961—altogether 784 persons. It is considered unnecessary for the purpose of this paper to give a more precise description of the classification system used for defining active tuberculosis considered to require chemotherapy. It may suffice to mention that approximately 54% of the persons who belong to the group studied here and whose sputa were initially examined were found to excrete tubercle bacilli. Of the total number of persons diagnosed (including those whose sputa were not initially examined) 40% were proven bacteriologically positive.

Methods of sociological investigations

Specially trained social investigators from the National Tuberculosis Institute, directed and supervised by the authors, interviewed, first, all patients in the clinic immediately after they had been diagnosed; secondly, all final defaulters in their homes within four weeks of their defaulting; and thirdly, all patients, in their homes, whether regular or not, after the completion of the 12 months' treatment period.

The investigators used interviewing schedules containing a rather large number of entries, but the manner of interviewing was free and conversational. All the initial interviews and virtually all the final interviews were carried out by one investigator while another acted as secretary, so that the interviewer could concentrate completely on the conversation. The interviewing of defaulters was mostly done by one investigator only. A great deal of attention was paid to creating a relaxed and comfortable interview situation (see Banerji & Andersen, 1963).¹

As a control on the possible influence of the social investigation on the behaviour of the patients, one-fifth of the patients were excluded from the major part of the initial interview. Even this one-fifth were briefly seen, but the interview was restricted to 2-4 minutes' questioning about the patient's address. The initial interview with the other patients lasted between 20 and 40 minutes. In the analysis below, the control group (with whom the final interview was very much more careful) has been pooled with the rest, since it was found that the investigation's influence was insignificant.

The coverage of interviewing was 100% for initial interviews, 65% for defaulter interviews, and 76% for final interviews. The low coverage for defaulter interviews was caused by difficulties in finding the patients within the prescribed four-week period. Many of the defaulters thus missed were met during the final interview. The also relatively low percentage of interviews in the final round was partly brought about by the 6% of the patients whose houses could not be found even after the most intensive search (see "Patients whose houses could not be found", below), and partly by the large number of patients from outside the city (see below), of whom only 40% could be found.

RESULTS

During the period from 13 March to 5 May 1961, the clinic was attended by just under 10 000 persons (first attendance), and among these the clinic diagnosed altogether 784 active tuberculosis cases. Of this total, 241 were among persons with infectious tuberculosis who came from inside the city limits. If this figure is expanded to one year's intake of patients, it corresponds to approximately 1650 cases of infectious tuberculosis diagnosed from the city. This was, as a matter of fact, approximately the number that the clinic diagnosed during 1961. The

estimated number of infectious cases in Bangalore (1961 population: 1.2 million) based on the National Sample Survey (Indian Council of Medical Research, 1959) is 2900, if the specific estimate for Bangalore is used, and about 5300, if the average estimate for all cities surveyed is used. This is, therefore, a rather satisfactory proportion of the infectious case-load to deal with in a year, provided the rate of diagnosed cases is kept up year after year, and provided the large majority of these persons are rendered non-infectious.

However, as Table 1 will show, this latter condition is very far from being fulfilled. The major problems are immediately identified and, from a certain point of view, quantified, in the first and second columns of the table. Of the 784 patients under study 84 did not even return to learn the result of the diagnosis; they came to the clinic, had an X-ray taken and a card issued, but did not follow the request to return two days later to learn the result. Another 46 persons were put under treatment and had one or more months' supply of drugs given to them, but they were not under the proper control of the clinic, since no one knew where they lived, and even after a most arduous search the social investigator could not trace their address or get any further information on them. Some 138 patients resided outside the city limits, the majority of them in the rural areas adjoining the city, but quite a few from other districts. Another 48 persons, who resided in the city when the treatment began, left the city during the 12 months' period and were thus lost to the clinic's treatment organization. A further 173 patients were treated—either in addition to or to the exclusion of the treatment given by the clinic—by tuberculosis sanatoria (56), the Employees' State Insurance Scheme (41) or private hospitals and practitioners (76). Only 295 of the 784 patients originally diagnosed were wholly under the clinic's treatment scheme. Out of these, only 156 followed the treatment with an acceptable degree of regularity; 139 interrupted treatment sooner or later during the 12-months' period. For the purpose of this paper regularity is defined as the collection of 80% or more of the pills required to be consumed.

The situation is hardly altered if the proven infectious patients only are considered. Among the 318 persons with proven infectious tuberculosis, 18 were lost because their houses could not be found, 77 because they resided out the city, and 25 because they migrated; 96 were not fully under the control of the Centre in consequence of their taking treat-

¹ See article on page 665 of this issue.

TABLE 1
SUMMARY OF DISTRIBUTION OF 784 PATIENTS BY THEIR ADMINISTRATIVE
STATUS AND THEIR INITIAL SPUTUM STATUS

Administrative status	Total	Initial sputum status			
		Sputum-negative	Sputum not produced ^a	Sputum not examined ^a	Sputum-positive
Persons who did not return to learn the result of their diagnosis	84 (11 %)	0	0	84	0
Patients whose houses could not be found	46 (6 %)	22	5	1	18
Patients residing outside the city	138 (17 %)	47	9	5	77
Patients who emigrated during the treatment period	48 (6 %)	17	6	0	25
Patients who took all or part of their treatment outside the clinic's control	173 (22 %)	61	11	5	96
Patients not completing the full 12-months' treatment	139 (18 %)	70	28	1	40
Regular patients	156 (20 %)	53	35	6	62
Total	784 (100 %)	270	94	102	318

^a All persons with X-ray lesions were requested to produce a sputum specimen on the spot. Those who failed to do so were classified as "Sputum not produced". "Sputum not examined" comprises persons who, by mistake, were not requested to produce a specimen, and those whose specimens, although collected, were, by mistake, not examined.

ment outside; and among the remainder, 40 did not complete their treatment. Thus, only 62 of the original 318 persons with proven infectious tuberculosis were under the regular 12-months' treatment supervised by the clinic.

The optimal result that could have been expected from this clinic's work, if none of the organizational and administrative problems listed above had existed, corresponds to what happened to these 62 sputum-positive persons (see the Appendix Table): 10 of them initially excreted organisms resistant to isoniazid, 49 excreted sensitive organisms, and on 3 no information on sensitivity was available. Of the 59 persons for whom initial sensitivity tests are available, 20 were not followed up with a new sputum examination after the 12-months' treatment period.

This failure to follow up cases also constitutes an organizational problem of some importance, but this problem cannot be considered on a par with the problems mentioned above. Follow-up is, in the first place, arranged for assessment purposes and, at least in the present simplified control programme, there is no provision for changed action on the basis of follow-up results.

Among the 39 patients followed up, 25 were converted to sputum negativity at 12 months and 14 were not, giving a total conversion rate of 64%. The conversion rate among persons with initially isoniazid-sensitive organisms was 68%, and among persons with isoniazid-resistant organisms, 2 of 5. Since the sputum examination was done on one sputum specimen (that is, one at the beginning of treatment and one at the end), it is necessary to view these figures with the reservation implied in the finding that out of the 28 initially sputum-negative patients who took their treatment regularly and who were followed up after 12 months, one (about 4%) became sputum-positive.

This then is the basic finding of the present study: among the patients having isoniazid-sensitive organisms who took their drugs regularly for 12 months, 68% were rendered uninfected; and even though this result from a control point of view may not be quite satisfactory, it is entirely drowned in the huge problems posed by the 62% of the initially diagnosed patients who were outside the treatment organization of the clinic and by the 18% who failed to complete their 12 months' treatment.

Persons who did not return to learn the result of their diagnosis : 11 %

Obviously, little is known about these persons since the information is restricted to the few entries on their registration card made on their first visit to the clinic. Interviewing was carried out among persons with diagnosed active tuberculosis on the day they were diagnosed, i.e., two days after their first visit to the clinic.

Remedial action with regard to this problem would appear to be relatively simple; and indeed the clinic has already, at this time (since the study was carried out), taken the first steps to improve the situation. Postcards are now being sent to all the persons in this category. However, approximately one-third of the postcards are returned by the postal authorities because the addressee cannot be found. Among the remaining two-thirds of these persons, approximately one-half turns up at the clinic for further examination and treatment. The second reform called for in respect of this group of persons is improvement in the taking of the address during the initial registration. Again the efforts of the clinic in this respect have already paid off in a certain reduction in the size of this category. Finally, and not of least importance, it must be stressed to these persons, during registration, that it is in their own interest to return to learn the result. However, the effect of this must necessarily be somewhat tempered by the fact that the overwhelming majority (approximately 11 out of 12) of the persons registered are found not to have tuberculosis.

Patients whose houses could not be found : 6 %

These 46 patients could not be found during the final interview by the social investigators, in spite of the fact the investigators had taken very special pains to take down very complete addresses and had spared no effort in their search, in some cases spending a whole day trying to find a single patient. It should be understood that this is a minimal figure for untraceable persons. While the social investigators, in spite of all their efforts, were unable to find 46 patients, the clinic's home visitors missed altogether 99 patients, partly because their address-taking had been less meticulous, partly because they could not spend so much time searching for the patients' homes.

The observations on this group of patients are the same as those for the previous category: improvement in address-taking and in the initial motivation of the person to return to learn the result of his

examination are the obvious remedial steps. However, for these patients an initial interview is available, and it has been found in retrospect that, probably in many of these cases, the patients did not actually have an address in the city but came from outside the city area and invented an address in order to be given the benefit of the free treatment, which they wrongly believed not to be available to outsiders. The problem with this particular kind of patient is therefore similar to that with the following category—those residing outside the city.

However, the essential issue in respect of the majority of this and the previous category of patients is that of taking addresses of patients with the greatest care. In many cities in India, and presumably in several other countries, an address is not necessarily adequately described in terms of a street and a number. One needs description in terms of landmarks, distances and directions from these, perhaps in terms of names of inhabitants of neighbouring houses, for example, those of shop owners or other publicly known persons. However, even if this much care is taken, the experience of the clinic in question shows that a certain proportion of addresses still cannot be found, and it would seem unlikely that this problem can be solved until the whole street-naming and house-numbering system has been improved.

Patients residing outside the city : 17 %

All big cities are centres of attraction for a population living at a shorter or longer distance from them, from the point of view of trade, entertainment, cultural and political activities and from the point of view of health and medical care. A specialized tuberculosis clinic in a large city attracts patients who do not have similar facilities in their villages and small towns and it also attracts patients who have been unsatisfactorily treated locally and who now use this specialized organization as their last resort. The interviews clearly brought out that a large proportion of the patients from outside the city belong to the latter category. This group of patients also represents, on the average, more severe tuberculosis infection than do patients from within the city—77 of the 124 whose sputum was examined were sputum-positive, and 21 of the 69 for whom sensitivity tests were performed excreted organisms resistant to isoniazid.

This group of patients took treatment very irregularly. Like the patients from inside the city, they were to collect their drugs every four weeks at the

clinic. Only four (3%) of these patients took at least 80% of the required drugs. Some of them had 5 or 10 miles (8-12 km) to travel to the clinic, the majority had from 15 to 50 miles (24-80 km), and a few came from over a 100 miles (160 km) away.

The action required to improve the drug-taking of this category of patients is obvious: in the first place, treatment centres should be established near the homes of patients outside the city on the initiative of the city clinic. Secondly, this special problem is but a reflection of the general problem that no local tuberculosis control effort can be expected to succeed entirely unless a tuberculosis control service is established in the whole country or area concerned. A diagnostic facility will always attract sick people, but the administrator must foresee the results of this attraction and simultaneously establish a treatment service to receive all the diagnosed cases the moment they are diagnosed.

The Tuberculosis Demonstration and Training Centre in Bangalore has in fact already started establishing a system of diagnosis and treatment in collaboration with primary health centres and dispensaries in the rural areas of the district outside the city. However, even these services will cater for only approximately 66% of the problem for this particular clinic; and the larger problem can only be properly dealt with through an all-embracing national programme in which all infectious cases diagnosed are registered in geographically organized case indexes and transferred from one to another as the need arises, when, for instance, a patient is diagnosed in one area and treated in another or moves during the treatment period from one to the other.

Patients who emigrated from the city during the treatment period: 6%

The remarks on the previous category apply to a large extent to this category as well. The interviews of these patients reveal that, even among this category, a certain proportion actually did not belong to Bangalore city to begin with, but lived with relatives or friends in order to have the benefit of the free tuberculosis service. The action required to remedy this problem has already been described above.

Patients who took all or part of their treatment outside the clinic's control: 22%

The problem of treatment outside the clinic's control is a problem peculiar to big cities. In India at least, very little in the way of alternative treatment

facilities to those of the official tuberculosis organization is available to patients in rural areas.

The problem with this category of patients is not necessarily one of inferior treatment, as will be seen from the figures in the Appendix Table. The conversion rate of the patients followed up was actually higher (79% among the isoniazid-sensitive) among these patients than among the regular patients of the clinic, although the difference is not statistically significant. But only 41% of the sputum-positive patients were followed up as against 64% of the clinic's regular drug-takers. What the result of the treatment may have been among those not followed up is entirely a matter of conjecture. It may perhaps be mentioned, however, that among all the 173 patients in this group only 68 patients, according to interview information, received more than 80% of the required amount of isoniazid during the year, only eight patients received 90 g of streptomycin or more, and only two patients appeared to have taken PAS for the whole year.

This problem is, however, not in the first place of a technical nature. Neither is it—in the present context—one of justification for a special treatment scheme for certain employees or for leaving treatment of certain patients to private practitioners and to sanatoria. The problem is, first and foremost, one of co-ordination. If the tuberculosis programme is meant, in the first place, not for relieving the suffering of individual patients, but for controlling the disease in the community, all infectious cases detected must be submitted to the same organization, at least in some respects.

Firstly, admission to government-financed and -controlled sanatoria should be entirely in the hands of the official tuberculosis control services. The admission policy should be explicitly formulated as a part of the total control programme. For example, with the exception of a few emergency beds, admission might be mainly confined to short-term health education admissions with a view to follow-up by domiciliary treatment. In any case, all persons with infectious tuberculosis should be admitted and discharged by the general machinery, both diagnosis and follow-up being the responsibility of the tuberculosis control service. This is also true of patients treated by insurance organizations, private hospitals and practitioners. The tuberculosis control service should make the utmost effort to get initial diagnostic information and full follow-up information on the largest possible proportion of at least proven infectious patients treated by these agencies.

Patients not completing the full 12-months' treatment :
18%

This is a problem only too familiar to all workers in tuberculosis control. The problem is not even confined to domiciliary chemotherapy; premature discharge from tuberculosis hospitals and sanatoria has been a problem throughout the history of tuberculosis work. The essential finding of the present study is that the straightforward defaulter problem, the classical problem of discontinuation of chemotherapy, is actually a *smaller* problem than the combination of a number of other administrative and organizational problems, as shown above. However, while this has proven to be a relatively modest actual problem, it is, of course, potentially an immense one, because the problems dealt with in the above paragraphs can all be partly or fully solved by suitable administrative action. The same is not necessarily true of the defaulter problem in the restricted sense.

Of the 139 defaulters in this study, 30 had less than one month's treatment, 34 more than one month's but less than three months' treatment, and 75 had more than three months' treatment but failed to collect at least 80% of their drugs. The figures in the Appendix Table show that the proportion of sputum-positives in the defaulter group was somewhat lower than in the group of regular patients and considerably lower than in some of the other groups mentioned above. The Appendix Table also shows that among the few that were followed up (19 of 40 sputum-positives), eight were converted (seven among 11 excreting isoniazid-sensitive organisms and one for whom no sensitivity test had been done). None of the seven patients with isoniazid-resistant organisms was converted.

A major portion of the interviews dealt, naturally, with the reasons for default; and the explanations given by patients for their default are virtually as numerous as the patients themselves. The authors have been studying defaulter problems over the past few years in various contexts and have not arrived at a satisfactory categorization of the reasons for default. However, for the main purpose of the present paper, the most important distinction appears to be between that part of the defaulting which can conceivably be avoided by organizational, administrative and similar measures and that part which cannot. A careful study of each individual questionnaire leads to the following results. Altogether 18 defaulters interrupted their treatment in connexion with a shortcoming in the organization—

for example, "Lost card, thought I could then not get pills"; "Health visitor behaved very rudely"; "Was advised special diet that I could not afford, therefore thought it no use taking pills"; "Was told by doctor I was now all right". Another 10 defaulters interrupted for one definite reason of an organizational nature: they pretended to live in the city and gave the address of relatives: these relatives collected pills for them and had the pills sent to the patients, and this arrangement failed before the end of the 12 months. In essence, therefore, these 10 patients belonged to the category "Patients residing outside the city" (see above). Thus altogether 28 defaults could, in all likelihood, have been avoided by organizational and administrative measures. For an additional 31 defaulters, giving a variety of reasons for their default, the authors' judgement is that a better initial motivation could have brought about regularity. This, of course, is an entirely subjective judgement. Some patients in this group said that they did not believe they had tuberculosis; others had relied more on the advice of other physicians, relatives, friends and neighbours than on that of the clinic's personnel; others again referred to their pregnancy and to real or imagined side-effects of the drug, which the clinic could have dealt more adequately with. This means that 59 of the 139 instances of defaulting (or about 42%) could probably have been avoided with a very good organization.

There remain 80 defaulters to be accounted for. Of these, 14 died during the treatment period. Conceivably a better regimen could have rescued some of these. Concerning the remaining 66 defaulters, or about half, it is difficult to proffer any positive statement at this stage. Several negative—and therefore not, in the first instance, very helpful—statements can be made.

It is not true that relief of symptoms usually, or even often, leads to default. That patients discontinue treatment as soon as they feel better has been reported so often that it is now widely believed always to be true. This is not borne out by the present study, nor is it borne out by several other studies in which the authors are engaged. For 13 patients in the present study disappearance of symptoms appears to be the major reason for discontinuation. It is not unlikely that this factor has played a role for other patients, but there is no doubt that irregularity in drug-taking is a far more complex problem than the simple "Now I feel better; now I don't take any more drugs". It is likely that this

generally accepted belief is, to a large extent, based on the experience of general practitioners, because the practitioner usually treats the patient "symptomatically". The control service has a great advantage over the practitioner in being able to say, right from the beginning, completely honestly and as strongly as possible, that the patient should go on taking treatment for at least one year and that it does not matter in the least whether the patient feels better early on. The practitioner does not always feel in a position to be so ruthlessly frank.

In close association with the above it can be stated that there is a certain positive correlation between regularity and initial severity of disease. That this is so can immediately be seen from the proportion of sputum-positives among regular and defaulters respectively. Among the regulars 40% are sputum-positive, among the defaulters 29%. The fact that regularity is correlated positively with initial severity of the disease is, at least from a certain point of view, epidemiologically fortunate, but it is not in itself of much help in suggesting remedial action for default.

In the present study, as well as in several other studies yet to be published by the National Tuberculosis Institute, it is found that irregularity in drug taking does not seem correlated with the economic, social, educational or other status of the patients and his family (see Table 2). The composition of the defaulter group is virtually the same as that of the regular group, not only in age and sex, but also in respect of status in family, religion, caste, profession and living conditions. The defaulters appear to include somewhat fewer persons in the lowest income bracket and somewhat more in the highest. On the other hand, illiterate persons appear to have defaulted slightly more often than the literate, but other studies of the National Tuberculosis Institute show the opposite trend and the result must be considered of doubtful significance.

Since drug administration was based on the patient himself collecting his pills, one might well imagine that distance to the clinic would be an important factor. This was not found to be so. Although quite a number of patients gave distance to the clinic as their major reason for defaulting, analysis showed that the average distance to the clinic was exactly the same for regular patients and defaulters—namely, 2.7 km.

There are certain groups of defaulters that it would appear to be extremely difficult, in any circumstances, to deal effectively with; for example, people who travel much or otherwise lead an irregular

TABLE 2
PERCENTAGE DISTRIBUTION OF 156 REGULAR AND 139 DEFAULTING PATIENTS, BY VARIOUS DEMOGRAPHIC, ECONOMIC AND SOCIAL CHARACTERISTICS

Characteristics	Regular	De- defaulters
Age:		
0-14 years	31	26
15-24 years	26	29
25-49 years	35	32
50 years and over	8	11
Sex:		
Male	47	48
Female	53	52
Status in household:		
Breadwinner	27	26
Housewife	33	29
Child	32	29
Other dependant	8	16
Profession of family head:		
Unskilled	27	23
Semi-skilled	7	8
Skilled	33	41
White-collar	33	28
Literacy and education:		
Illiterate	20	34
Minimal education	37	31
Medium or higher	28	27
Children, not in school	15	8
Religion and caste:		
Hindu, high and medium castes	56	52
Hindu, low castes	19	19
Muslim	21	22
Christian	4	7
Family's <i>per caput</i> monthly income: ^a		
Less than 10 rupees	37	28
10-19 rupees	37	39
20-29 rupees	20	15
30 rupees or more	6	18
Family's living accommodation <i>per caput</i>: ^b		
Less than 20 square feet	24	22
20-39 square feet	36	40
40-59 square feet	18	20
60 square feet or more	22	18

^a 10 rupees = US\$2.09.

^b 20 square feet = 1.86 m².

life. Among these, it is difficult to imagine how one feature of regularity could be introduced in a pattern of general irregularity of life. In the present study, no fewer than 27 patients of the 66 among whom organizational change appeared to be unlikely to bring about change gave just such irregular habits of life as their major reason for default.

Finally, in the search for the basic reasons for patients' not taking drugs, common sense should not be forgotten. Except under very special circumstances of mass hysteria, it has never been demonstrated that a large group of people can be persuaded, without force, to adopt a new habit from which they never deviate. Even the most refined advertisement techniques using deep motivation, subliminal perception, etc., have never claimed 100% success.

The study of reasons for default and methods of preventing default must continue and be intensified. There is little doubt that more progress can be expected over the next few years than the insignificant steps of the past. It is possible that improvements in this regard will be as much associated with change in public consciousness, as with "tricks" and cleverness in persuading individual citizens. Until such changes occur, or are more or less consciously brought about, one may seek considerable consolation in the fact that through a proper organization perhaps 40% of the defaulting can be controlled and, as has been demonstrated above, that 62% of the total problem as it now presents itself, at least in the circumstances described in this paper, is not one of straightforward defaulting but is directly dependent on solutions to specific organizational problems.

Regular patients : 20%

This paper deals, in the main, with organizational, administrative and allied problems. However, if the picture is to be reasonably complete it is necessary to give at least a summary idea of the fate of regular patients. As the Appendix Table shows, 26 of the 62 sputum-positive patients in this group were converted, 14 were not, and no information is available on the remaining 22. Among the 34 persons excreting isoniazid-sensitive organisms, 23 (68%) were converted; among the five persons excreting isoniazid-resistant organisms, two were converted. It is not unlikely that treatment was less successful among persons who were not followed up than among those who were. As stated above, a majority of patients were treated with isoniazid alone, and the regularity of patients is defined in terms of this treatment only.

Of the 62 patients in this group, 39 were treated with isoniazid alone throughout the 12 months, whereas nine patients were given 10 g of PAS per day during the whole 12-month period. Five patients were given PAS for 6-11 months, and nine for 1-5 months. Only four of the 14 patients who were given PAS for less than a year received PAS from the first month; the remaining 10 were only given PAS in addition to isoniazid later during the treatment. This somewhat haphazard application of the companion drug was due to the fact that PAS was not available to the clinic during the period under review. At the present time all sputum-positive patients detected by the clinic who live in Bangalore city receive isoniazid and PAS.

If the lack of follow-up and the initial resistance status of the patients (16% of sputum-positive patients excreted organisms resistant to isoniazid) is disregarded, the theoretical maximum benefit that could have been derived from the application of an ideal drug combination (if such a combination existed) in this group corresponds to an increase in the conversion rate from 64% to 100% among 20% of the sputum-positive patients, i.e., approximately 7%. This finding would seem to justify the statement that relatively inexpensive changes in organizational procedures merit a higher priority than changes in the treatment regimens employed. This is not only true in respect of achieving the objective of attaining the highest possible conversion rate among infectious patients; it is also true in respect of the objective of reducing to the minimum the number of patients rendered drug-resistant as a result of the programme, since a far larger number of resistant patients appear to have emerged because of incomplete treatment than because of a less than ideal drug regimen.

To this must be added that this is the *actual* situation, and one may imagine quite a different *potential* situation. Just as the defaulter problem, in the restricted sense, will increase considerably in significance as and when the various specific organizational problems are solved, so also the problems associated with the choice of drug regimen can be expected to become more important when a larger and larger proportion of patients is kept under regular treatment. It is also likely that there is a certain positive interaction between good organization, a low defaulter rate and an effective treatment regimen, each supporting the others. However, as in all developmental work, the immediate choice in the expenditure of effort and money must be on the key variable, i.e. the variable in the system the change

TABLE 3
DISTRIBUTION OF 276 SPUTUM SPECIMENS BY THEIR ISONIAZID-RESISTANCE
AND BY THE JUDGED DEGREE OF PREVIOUS ISONIAZID TREATMENT
OF THE PERSONS WHO EXCRETED THEM

Status of sputum specimen	No treatment (1)	Symptomatic treatment (isoniazid unlikely) (2)	Some measure of tuberculosis chemotherapy						Total (9)
			Isoniazid doubtful		Isoniazid likely		Isoniazid definite		
			≤ 1 month (3)	> 1 month (4)	≤ 1 month (5)	> 1 month (6)	≤ 2 months (7)	> 2 months (8)	
Isoniazid-resistant	6	3	1	4	1	9	4	27	55
Doubtful	3	4	1	0	0	4	1	9	22
Isoniazid-sensitive	39	71	22	4	16	14	9	24	199
Total	48	78	24	8	17	27	14	60	276

of which is likely to bring about the greatest beneficial effect in the total system. At the present time, treatment organization would seem to be the key variable *par excellence* in tuberculosis control.

Isoniazid-resistance among patients at the time of clinic's diagnosis

The problem of isoniazid-resistance is mainly technical and only indirectly administrative and organizational; it is therefore not strictly within the scope of this paper. However, one aspect of it is clearly a subject for sociological investigation: the extent to which persons excreting isoniazid-resistant organisms have—and give—a history of previous treatment, particularly in respect of isoniazid treatment.

The social investigators interviewed all patients very thoroughly on the subject of possible treatment before diagnosis at the clinic. Four-fifths of the patients were interviewed on this subject during the initial interview, and one-fifth (the control group) during the final interview. The results of these interviews are shown in Table 3.

In this table a distinction is made between "doubtful resistance to isoniazid" and "resistance to isoniazid". Doubtful resistance is defined as growth on a medium containing 0.2 µg of isoniazid per ml and no growth on a medium containing 1.0 µg of isoniazid per ml. The organisms are called resistant if they grow on a medium with 1.0 µg of isoniazid per ml or with a higher concentration. This distinction has not been employed in the Appendix Table or in the remainder of the text, where all

doubtful resistance has been counted as resistance. But for the present purpose it appeared essential to give the fullest possible information on the degree of resistance, correlated with patients' statements on their previous treatment.

For 276 specimens which were tested for sensitivity, information on the patients' previous treatment was available. For 19 no information was available because the patients were controls during the initial interviewing round and could not be found during the final interviewing round.

Of these 276 specimens, 199 were isoniazid-sensitive; 22 could grow on medium containing 0.2 µg of isoniazid per ml, but not on that containing 1.0 µg per ml; and 55 could grow on medium containing 1.0 µg per ml or more. If doubtful resistance is counted as resistance, as has been done in the rest of the paper, altogether 77 (or 28%) of the 276 patients whose sputum was tested for sensitivity excreted resistant organisms; if doubtful resistance is excluded, the proportion is 20%.

What is the proportion of persons excreting resistant organisms in whom the resistance was unlikely to have been brought about by previous isoniazid treatment ("primary resistance")?

In the first place, it would seem reasonable to continue to consider the doubtfully resistant organisms resistant. Persons with the two kinds of organisms apparently have much the same (low) chance of being converted; 5 of 7 remained positive after one year among patients with doubtfully resistant organisms, while 16 of 20 remained positive among patients with resistant organisms. The two

groups also appear to have had nearly the same degrees of previous treatment.

Secondly, it must be considered unlikely that considerable errors have been committed in the direction of patients declaring *more* treatment than they have actually had, whereas it is possible that patients' recollection has occasionally failed in the opposite direction, i.e., they have understated the amount of previous treatment.

With these two points as guiding lines it would seem reasonable to suggest that the analysis might best be performed by the reader himself who—according to his own experience—might judge whether 6, 9, 17, 18, 22, 23, or even more of the patients are likely to have had insufficient treatment to bring about isoniazid-resistance. To the authors it appears most appropriate to express the results as follows. In this group of 276 infectious tuberculosis patients the *minimum* proportion of persons excreting isoniazid-resistant organisms unlikely to have been brought about by isoniazid treatment of these persons themselves is 9/276 (column 1 in Table 3)=3.3%; the *best* estimate is 16/276 (column 1+2)=5.8%; and the *maximum* estimate is 23/276 (column 1+2+3+4+5)=8.3%. Obviously, these figures are not representative of all infectious cases in the whole city where the clinic is situated; only random sample surveys can give such information. The National Tuberculosis Institute is engaged in such surveys in certain areas, and representative information on prevalence of drug-resistance will become available within the next year or two.

DISCUSSION

The present paper deals largely with three types of problem encountered in the operation of an urban tuberculosis programme: first, problems related to patients who are, at least in principle, under the supervision of the tuberculosis clinic, e.g., patients not returning to learn about the result of their diagnosis, patients whose addresses cannot be located and patients who do not take the full 12-months' treatment; secondly, problems related to patients who prefer to take treatment through institutions other than the clinic; and, thirdly, problems related to patients who come from outside the city limits or who emigrate from the city during the treatment period. The solution of these problems is of the greatest importance for the development of a tuberculosis control programme for a region. No less than 80% of the 784 patients in the present study belonged to one or another of these three

categories. In the programme studied the problems of all the categories are now being very vigorously—and partly already successfully—dealt with.

However, the question arises whether this programme is only a particularly unfortunate example or whether it has more general application. How do other clinics in India compare with the one dealt with in this study?

On the one hand, many other clinics do not have such a satisfactory diagnostic apparatus, and they may therefore be in a better position to deal with the fewer patients that they discover. On the other hand, few clinics have the facilities for treatment organization which were available to this clinic. There was an ample supply of drugs, though only isoniazid during most of the period under review. The clinic was reasonably well-staffed, with four to six medical officers, with public health nurses and health visitors; and the recording and routing system in the clinic was very nearly perfect. Many of these conditions do not obtain in many clinics in underdeveloped countries. If, for example, a sufficient supply of drugs is not available and the clinic has to resort to prescribing drugs which the patient must buy himself, the defaulting rate will increase markedly.

Thus, some clinics are no doubt in a far worse position than the one dealt with here, while a few may be somewhat better off. It is the author's conviction that in practically all clinics there is a very large proportion of patients who are not properly dealt with, for organizational and administrative reasons more often than for technical reasons.

In order to throw a little light on the problem of the wider applicability of the findings, a few figures may be quoted from the latest report from the New Delhi Tuberculosis Centre (1962). It is not possible to group the patients discovered in the New Delhi Tuberculosis Centre in 1961 in exactly the same categories as those used in this paper. However, the report gives certain figures which tend to show that problems in New Delhi are not widely different from those in Bangalore. Of a total of 4158 persons diagnosed as having pulmonary tuberculosis during the year, 2583 lived outside the area of the Centre's control. Here, it should be noted, the Centre is only one of several clinics in the city, and the Centre covers only a certain defined area of the city, comprising perhaps one-third of the city's population. However, the problem of extension and co-ordination remains the same in Delhi as in Bangalore. Of the remaining 1575 patients who lived within the

so-called "Organized Home Treatment Area" a further 550 received no treatment from the Centre for reasons similar to those described above: 177 could not be traced, 218 left the locality, 57 died, 90 were hospitalized and 8 had their diagnosis changed to "not tuberculosis". There are thus only 1025 of 4158 patients (approximately 25%) available for the analysis of defaulting in the narrower sense. The defaulting among these 1025 patients is not particularized in the report, but from other sources it would seem indicated that defaulting in the narrower sense is somewhat less frequent in this group than in the comparable group in Bangalore, a fact which can probably largely be explained by the far superior facilities available in Delhi, including a larger treatment staff and financial means to provide subsidies in the form of food, milk powder, small money contributions, etc.

Many of the problems described for the programme in Bangalore city are less severe in rural work. In the first place, the problem of outsiders will virtually not arise and the emigration will be of a smaller magnitude. Treatment by outside agencies such as sanatoria, private practitioners and insurance schemes is far less frequent in rural areas. Even to locate houses is less of a problem in a village where everyone knows everyone else. The National Tuberculosis Institute has suggested a "district tuberculosis programme" which is mainly designed for application in rural areas. The approach and methods of this programme have been summarized by Piot (1962). This programme, which has now been accepted by the Government of India as the basis for its National Tuberculosis Programme, is based on treatment through primary health centres and other basic rural health services; and there is every likelihood that in district programmes some of the problems described above will be considerably smaller than in a city area. In these programmes, therefore, it is the defaulter problem in the restricted sense which dominates the picture. From having approximately an 18% importance in the city programme, it assumes its full 40%-50% importance, or even more, in rural areas. Studies are now being conducted by the National Tuberculosis Institute on defaulting in rural areas, and it must be admitted that most results are less than satisfactory. It is very difficult indeed with the strict conditions, laid down for this programme, of national applicability, to retain more than 50% of the diagnosed patients under domiciliary or ambulatory drug treatment for a full year.

In the main analysis of the paper the principal distinction has been between various patient groups characterized by their administrative status. This was considered an effective way of exposing the severity of the administrative and organizational problems of tuberculosis control. However, this analysis has tended to obscure the fact that even in the least favourable administrative circumstances at least a few patients managed to complete one year's regular treatment.

An alternative analysis is to make the principal distinction between regular and irregular patients and then to associate the variations in defaulting with the classification of patients in the various administrative groups. Such an analysis leads to the following results.

The over-all defaulting rate among all 784 patients was 68%, i.e., only 32% of all patients diagnosed completed at least 80% of their treatment, as defined on page 687. It has been shown above (see pp. 691-693) that among the group of patients wholly under the supervision of the clinic (groups VI and VII in the Appendix Table), the defaulting amounted to approximately 47%. Nearly half of this defaulting was shown to be probably avoidable with very good organization.

In the other administrative groups the defaulter rates were as follows:

I. Persons who did not return to learn result of diagnosis . . .	100% of 84 = 84
II. Patients whose house could not be found by investigators . . .	76% of 46 = 35
III. Patients residing outside the city limits	89% of 138 = 123
IV. Patients who emigrated during treatment period	92% of 48 = 44
V. Patients taking all or part of the treatment outside clinic's control	61% of 173 = 105
Total	391

Thus $391/784 = 50\%$ of the total number of patients defaulted in consequence of their belonging to one of the five special administrative categories. Taking 47% as the basic propensity to default in the whole group, it may then be said that belonging to category II increased the chance of defaulting by 60%, belonging to category I, III or IV nearly doubled the chance of defaulting, whereas belonging to category V increased the chance by 30%.

It is unfortunately not possible to give a reasonably well-founded estimate of the sputum conversion among defaulters. This is because defaulting from follow-up is closely associated with defaulting in

treatment. It may perhaps—admittedly somewhat arbitrarily—be assumed that conversion occurred among only 25% of the defaulters; among all the 530 defaulters, 114 received no treatment at all, 110 were treated for less than a month, 129 for one to three months, and 177 were treated for more than three months but did not receive at least 80% of their treatment. With this treatment-efficiency among defaulters, it is possible to restate the problem distribution between technical factors and organizational factors (see pp. 687-688) as follows (in terms of sputum positive patients only).

Default for all reasons entailed that approximately 75% of 68% of all patients did not convert, i.e., a 51% problem. Among the altogether 32% of regular patients, 36% did not convert for technical reasons (including a less than ideal regimen), i.e., a 12% problem.

Again, however, it may be stated that whereas this appears to be the approximate ratio between the weights of the two kinds of problem under present circumstances, technical problems will, of course, increase in relative importance as and when administrative and organizational problems are solved. Let it, on the other hand, be abundantly clear that no technical improvement—within the range of presently known techniques of tuberculosis control—can be expected to dispense with the need for organizational and administrative change.

The presentation of the findings of this study may have left the impression that in spite of the considerable case-finding work of the clinic very little was achieved because of a weak treatment organization. This is true when the results are compared with what could have been achieved. However, compared with no tuberculosis work at all, and compared with areas where only the most sporadic efforts are made, the impact of this clinic's work can be looked upon in a somewhat different light.

It was mentioned on page 687 that approximately 3000-5000 infectious (sputum-positive) persons are believed to exist in the city of Bangalore, and also that the annual case-finding in the city corresponded to approximately 1650 of these. (By the end of March 1963, after the upgraded clinic had been in operation for about two years and four months, the clinic had diagnosed approximately 14 000 active cases of tuberculosis, including approximately 3600 sputum-positive cases from inside Bangalore city.) Using the various figures in the Appendix Table for the city alone, assuming that sputum conversion was half as frequent among the persons not followed up

as among the patients followed up and assuming that the rates of detection and conversion during the period under review are typical, the following immediate epidemiological results are likely. Of the 1650 infectious persons, about 150 died during the year. Among those who remained alive after a year, about 400 had excreted isoniazid-resistant bacilli to begin with (the death-rates among originally resistant and sensitive persons appeared to be much the same), and on the basis of the admittedly very limited material it would seem likely that about 50 of them were converted, while about 350 remained positive and resistant. Among the approximately 1100 persons excreting isoniazid-sensitive organisms, perhaps half were converted and half were not. A certain proportion of the 500-600 who were not converted received so small an amount of the drug that the development of resistance is unlikely, but there can be little doubt that the majority of them were left excreting resistant organisms. It is considered outside the scope of this paper to pass judgement on the long-term epidemiological consequences of these results. However, it may be appropriate to suggest that just as the conversion of sputum-positive cases is of considerable magnitude, so is also the addition to the pool of isoniazid-resistant cases, and that organizational improvements may be viewed as no less important for the reduction of the latter pool than for the increase of the former achievement.

CONCLUSIONS

Results of tuberculosis work are often given in terms of a certain proportion only of the patients dealt with. The reader is thereby, whether by design or not, led to too favourable an impression of the over-all value of the work. Even results of this study, dealing with 784 patients diagnosed in a large city clinic, could have been presented in quite rosy terms with no dishonesty other than that inherent in the fact of omission. For example, figures such as 68% sputum conversion among regular drug-takers and 53% regularity could have been taken as the main themes. However, the intention of this paper is to highlight difficulties of tuberculosis control, and on the basis of the figures presented here the only honest conclusion one can reach would seem to be that tuberculosis control by mass chemotherapy is difficult. BCG vaccination has been shown to be applicable on a mass scale, though even here the problems of achieving high coverage and of making sure that only highly potent

vaccine is given plus the epidemiological problems associated with possible interference of agents causing nonspecific tuberculin sensitivity should not be dismissed lightly. But the other principal tool in tuberculosis control—chemotherapy—has yet to be shown to be operationally feasible on a mass scale. This paper has attempted to demonstrate some of the immense problems involved and to indicate the size of these problems in a certain context. It was found that only about one-third of the patients whose fate was studied were adequately dealt with; but it was also found that the greater part of the problems could be overcome by administrative and organizational measures. The paper has sought to outline some of the possible measures:

1. National programmes must be adopted; local programmes fail because they attract patients who are thereafter not adequately dealt with.

2. All anti-tuberculosis efforts must be co-ordinated by a central controlling agency; without such co-ordination efforts are wasted and follow-up becomes difficult.

3. Other administrative and organizational improvements can deal with a considerable proportion of losses of patients, for example, those caused by initial defaulting and lack of care in taking addresses.

4. Even default in the restricted sense (discontinuation of drug-taking) can be very considerably reduced by administrative and organizational improvements.

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RÉSUMÉ

La chimiothérapie ambulatoire de la tuberculose est appliquée de façon de plus en plus générale dans les pays en voie de développement technique. Les difficultés qu'elle rencontre sont considérables. Certaines d'entre elles sont analysées dans cet article, d'après les données recueillies au cours d'une enquête faite dans un centre urbain de traitement antituberculeux, l'Institut national de la Tuberculose, à Bangalore, Inde. Les principales difficultés proviennent des causes suivantes: 1. Certains des malades censés être sous le contrôle du centre de traitement se dérobent à la seconde visite et ignorent ainsi le résultat des examens de diagnostic; 2. Le domicile de certains autres ne peut être retrouvé; 3. Une certaine proportion interrompt avant le délai fixé le traitement prévu pour une année; 4. Certains préfèrent se faire soigner ailleurs qu'au dispensaire; 5. L'immigration vers la ville ou l'émigration hors de celle-ci, au cours de la période de traitement, entraîne des fluctuations incontrôlables.

L'enquête dont les résultats sont discutés dans cet article a porté sur 784 malades. Ceux-ci ont été interrogés et examinés au moment de la mise en traitement et un an plus tard. En outre, les sujets réfractaires au traitement ont été interrogés une fois en cours d'année. L'évolution clinique des 318 malades bacillaires a été évaluée d'après l'évolution bactériologique.

Il apparaît en première analyse que 295 malades seulement (38%) ont été réellement sous le contrôle du

centre antituberculeux pendant l'année; 156 de ce groupe (20%) ont été réguliers (sont considérés comme tels ceux qui ont reçu au moins 80% des médicaments prescrits). Chez les malades réguliers, le résultat du traitement, qui peut être considéré comme optimum dans les conditions données, correspond à un taux de conversion des expectorations de 64% des sujets initialement bacillaires.

Il semble que des défauts d'organisation soient essentiellement à l'origine des échecs ou déficiences dus aux cinq causes mentionnées antérieurement. Ces problèmes d'organisation ont une signification d'autant plus grande que le centre antituberculeux étudié a une valeur nettement supérieure à la moyenne. Pourtant, l'enquête a montré qu'environ un tiers seulement des malades étudiés avaient reçu les soins que nécessitait leur état. Les auteurs estiment qu'une meilleure organisation et des mesures administratives efficaces permettraient d'améliorer cette situation. Ils citent les suivantes: a) adoption de programmes nationaux; les programmes locaux sont insuffisants par le fait qu'ils dépitent des malades dont ils ne peuvent ensuite assurer le plein traitement; b) la coordination, par un organisme central de contrôle, des activités de lutte antituberculeuse; faute de quoi les efforts sont gaspillés et la surveillance des malades difficile; c) une exactitude plus grande dans l'enregistrement des adresses des malades en particulier. De telles améliorations permettraient de remédier même à l'irrégularité dans l'absorption des médicaments prescrits.

APPENDIX TABLE
DISTRIBUTION OF 784 PATIENTS BY ADMINISTRATIVE STATUS, BY INITIAL SPUTUM STATUS,
AND BY FATE AFTER 12 MONTHS

After 12 months	Initial sputum status															
	Total	Negative	Not produced ^a	Not examined ^a	Positive	Isoniazid-resistant	No sensitivity test	Isoniazid-sensitive	Total	Negative	Not produced ^a	Not examined ^a	Positive	Isoniazid-resistant	No sensitivity test	Isoniazid-sensitive
Total	I. Did not return to learn result of diagnosis								II. House not found by social investigator							
	84	0	—	84	—	—	—	—	46	22	5	1	18	6	1	11
Total	III. Resided outside city limits								IV. Emigrated during treatment period							
	138	47	9	5	77	21	8	48	48	17	6	0	25	7	1	17
Dead		4	1		8	3	0	5		0	0		0	0	0	0
Not followed up (sputum)		34	13		52	13	6	33		15	6		23	6	1	16
Followed up (sputum)		9	0		17	5	2	10		2	0		2	1	0	1
Sputum-negative		7	0		6	2	2	2		2	0		1	0	0	1
Sputum-positive		2	0		11	3	0	8		0	0		1	1	0	0
Not followed up (X-ray)		25	9		49	13	5	31		14	6		23	6	1	16
Followed up (X-ray)		18	4		20	5	3	12		3	0		2	1	0	1
Improved		12	4		7	2	1	4		2	0		1	0	0	1
Stationary		4	0		13	3	2	8		1	0		1	1	0	0
Deteriorated		2	0		0	0	0	0		0	0		0	0	0	0
Total	V. Treated outside clinic's control								VI. Defaulters							
	173	61	11	5	96	28	7	61	139	70	28	1	40	11	3	26
Dead		1	3		12	3	3	6		4	2		8	1	0	7
Not followed up (sputum)		44	13		45	16	3	26		50	25		13	3	2	8
Followed up (sputum)		16	0		39	9	1	29		16	2		19	7	1	11
Sputum-negative		13	0		26	2	1	23		16	2		8	0	1	7
Sputum-positive		3	0		13	7	0	6		0	0		11	7	0	4
Not followed up (X-ray)		31	5		34	14	2	18		34	8		12	3	2	7
Followed up (X-ray)		29	8		50	11	2	37		32	19		20	7	1	12
Improved		24	7		35	6	2	27		29	16		10	1	1	8
Stationary		5	1		13	4	0	9		3	3		9	5	0	4
Deteriorated		0	0		2	1	0	1		0	0		1	1	0	0
Total	VII. Regulars								Grand Total							
	156	53	35	6	62	10	3	49	784	270	94	102	318	83	23	212
Dead		0	0		0	0	0	0								
Not followed up (sputum)		25	38		22	5	2	15		71	5		117	27	5	85
Followed up (sputum)		28	3		40	5	1	34		65	5		67	6	5	56
Sputum-negative		27	3		26	2	1	23		6	0		50	21	0	29
Sputum-positive		1	0		14	3	0	11								
Not followed up (X-ray)		9	5		8	3	0	5								
Followed up (X-ray)		44	36		54	7	3	44		126	67		146	31	9	106
Improved		38	31		40	4	2	34		105	58		93	13	6	74
Stationary		5	4		13	2	1	10		18	8		49	15	3	31
Deteriorated		1	1		1	1	0	0		3	1		4	3	0	1

^a All persons with X-ray lesions were requested to produce a sputum specimen on the spot. Those who failed to do so were classified as "Sputum not produced". "Sputum not examined" comprises persons who, by mistake, were not requested to produce a specimen, and those whose specimens, although collected, were, by mistake, not examined.

REFERENCES

- Banerji, D. & Andersen, S. (1963) *Bull. Wld Hlth Org.*, **29**, 665
- Frimodt-Møller, J. (1960) *Bull. Wld Hlth Org.*, **22**, 61
- Frimodt-Møller, J. (1962) *Indian J. Tuberc.*, **9**, 187
- Indian Council of Medical Research (1959) *National sample survey of tuberculosis*, New Delhi
- Medical Research Council, Tuberculosis Chemotherapy Trials Committee (1953) *Lancet*, **2**, 213
- New Delhi Tuberculosis Centre (1962) *Annual report for 1961*, New Delhi
- Piot, M. (1962) *Indian J. Tuberc.*, **9**, 151
- Tuberculosis Chemotherapy Centre, Madras (1959) *Bull. Wld Hlth Org.*, **21**, 51
- Waler, H. T., Geser, A. & Andersen, S. (1962) *Amer. J. publ. Hlth*, **52**, 1002