A CONTROLLED STUDY OF THE INFLUENCE OF SEGREGATION OF TUBERCULOUS PATIENTS FOR ONE YEAR ON THE ATTACK RATE OF TUBERCULOSIS IN A 5-YEAR PERIOD IN CLOSE FAMILY CONTACTS IN SOUTH INDIA

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Reprinted from the *Bulletin of the World Health Organization,*
1966, **34,** 517-532

WORLD HEALTH ORGANIZATION

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A Controlled Study of the Influence of Segregation of Tuberculous Patients for One Year on the Attack Rate of Tuberculosis in a 5-Year Period in Close Family Contacts in South India*

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This report is the last of a series of nine publications from the Tuberculosis Chemotherapy Centre, Madras, concerning various aspects of an investigation of the role of ambulatory chemotherapy for pulmonary tuberculosis. It presents the attack rates of tuberculosis over a S-year period of follow-up of close family contacts of patients, all of whom were treated for one year with isoniazid plus PAS, half (selected at random) in sanatorium and half at home. The incidence of active tuberculosis and of tuberculous infections was no greater in the contacts ofpatients treated at home than in the contacts of patients treated in sanatorium, either in the first year or over the subsequent four years. The major risk to the contacts resulted from exposure to the patient before diagnosis. These findings reaffirm that close family contacts of patients treated at home were at no additional risk of developing tuberculosis, provided the patients received effective chemotherapy. Finally, this study has shown that it is possible in South India to obtain extremely good co-operation from a group of families over a period of several years.

In 1956-57, a controlled study was undertaken at the Tuberculosis Chemotherapy Centre, Madras (l959), to compare the efficacy of treatment at home and treatment in sanatorium for one year with a standard regimen of isoniazid plus PAS; the response to treatment in the home series was almost as satisfactory as that in the sanatorium series (Tuberculosis Chemotherapy Centre, Madras, 1959). Subsequently, all the patients were managed almost entirely on a domiciliary basis. Of the patients with bacteriologically quiescent disease at one year, about one quarter received maintenance chemotherapy with isoniazid alone for two years, another quarter received isoniazid alone for one year and the rest received no specific chemotherapy; the relapse rates in the home and the sanatorium series over a 4-year period of follow-up have also been reported to be similar (Dawson et al., 1966 [1]). Patients with an unsatisfactory response in the first year and those who had a bacteriological relapse in the second or subsequent years were usually retreated with reserve regimens, first with streptomycin plus pyrazinamide and, if this was ineffective, with cycloserine plus ethionamide. Considering *all* patients originally admitted to the home and sanatorium study, it was found that the proportion of patients with bacteriologically quiescent disease at five years was practically the same in the two series (Dawson et al., 1966 [1]). These studies have firmly established the value of domiciliary chemotherapy for *tuberculous patients* in the Madras community.

As part of the same investigation, it was decided to study the risk of contracting tuberculosis for *contacts* of patients treated at home and for contacts of patients segregated in sanatorium during the first year of treatment. The attack rates of tuberculosis during the first two years did not suggest any special risk to the contacts of patients treated at home (Andrews et al., 1960; Ramakrishnan et al., 1961a). The present report gives the findings for the contacts for the whole 5-year period.

* From the Tuberculosis Chemotherapy Centre, Madras-31, India. The Centre is under the joint auspices of the Indian Council of Medical Research, the Madras State Government, the World Health Organization and the Medical Research Council of Great Britain.

[1] See article on page 533 of this issue.

The great majority of patients in the chemotherapy study came from the lowest income groups in Madras city. Living conditions were poor, the majority of the homes being overcrowded, and the nutritional standards low (Tuberculosis Chemotherapy Centre, Madras, 1959; Ramakrishnan et al., 1961b, 1966 [1]). It was under these conditions that the patients lived and their contacts were exposed to the risk of infection.

DEFINITIONS USED IN THIS REPORT

The index case was defined as the first member of the family suffering from pulmonary tuberculosis to be registered at the Centre.

Close family contacts were defined as those related by blood or marriage and living, cooking and feeding in the same hut or house (or portion of the house) as the index case for at least the three months immediately prior to the start of treatment. The contacts of patients treated at home are termed " home contacts " while those of patients treated during the first year in sanatorium are termed " sanatorium contacts ".

A single-infection family was defined as a family with only one infectious member, namely the index case, at the prevalence survey.

A multiple-infection family was defined as a family with one or more infectious members, *in addition to the index case,* at the prevalence survey.

I. PLAN AND CONDUCT OF THE CONTACT STUDY

The plan of the contact study, the routine for the initial and follow-up examinations of the close family contacts and the procedures adopted when a radiographic abnormality was found have already been described in detail (Andrews et al., 1960; Ramakrishnan et al., 1961a). Briefly, the contacts were to be examined by radiography and tuberculin testing at the start of treatment for the index case, and were to be followed routinely by serial radiography and tuberculin testing for a 5-year period. The first contact was admitted to the study in September 1956 and the last one in September 1957.

FIRST EXAMINATION OF CONTACTS

Each contact was to have the following standard investigations initially :

(a) a full-plate postero-anterior radiograph of the chest;

(b) an intracutaneous tuberculin (Mantoux) test with 5 tuberculin units (TU) of purified protein derivative in 0.1 ml of solution on the left forearm. (Batch RT 22 without Tween 80 (Magnusson et al., 1958) was used throughout.) The greatest diameter of palpable induration after 2-3 (occasionally 4) days was measured in millimetres.

FOLLOW-UP EXAMINATIONS OF CONTACTS

(a) A radiograph was to be taken at 3-monthly intervals during the first year and at 6-monthly intervals in the subsequent four years.

(b) At first the rule was to perform a tuberculin test with 5 TU, 3-monthly in the first year and 6-monthly in the second year, until an induration of 5 mm occurred, when further testing was stopped. This level of induration was soon changed to 10 mm and shortly afterwards to 20 mm, for reasons given by Andrews et al. (1960). From the third year, the procedure was to perform tests only annually, but for *all* contacts, irrespective of the indurations at previous tests.

In addition to the set examinations, contacts were frequently observed during the regular home visits by health visitors, and patients were encouraged to bring their contacts to the Centre if the latter were ill. When a radiographic abnormality appeared for the first time, the procedure was to set up a culture of at least one overnight sputum specimen or a pair of laryngeal swabs and to order further full-plate radiographs as indicated, which was seldom at intervals of more than one month. Further, after the first few months of the study, contacts showing changes in tuberculin sensitivity suggesting a recent infection were to have a full-plate radiograph taken 4-6 weeks later, and this was to be repeated at similar intervals for several months before returning to the normal routine.

SPECIFIC ANTITUBERCULOSIS CHEMOTHERAPY

Antituberculosis chemotherapy was usually not started unless bacteriological confirmation of the diagnosis was obtained; exceptions were made in the case of infants or young children who were clinically

[1] See article on page 553 of this issue.

ill, or where lesions were large, disseminated or showed rapid progression.

INDEPENDENT ASSESSMENT OF THE FINDINGS

Dr J. Frimodt-Møller, who was the independent assessor for this study, made the assessment for the attack rates of tuberculosis in the third, fourth and fifth years, following the same procedure as for the first two years (Andrews et al., 1960; Ramakrishnan et al., 1961a). Throughout his assessments, he was unaware of whether an individual contact under review was related to a patient treated at home or in sanatorium in the first year, nor was he aware at any time of the radiographic and bacteriological progress of individual index cases.

The assessor had earlier scrutinized all the radiographs taken in the first and second years for the purpose of determining the attack rate during this period. At the current assessment, the object of which was to define the attack rates in the third, fourth and fifth years, he was shown the radiographs taken at the initial examination and at 24 months, together with *all* the films taken in the third, fourth and fifth years. He first assessed each series either as normal or abnormal. Next, he reviewed the *full* radiographic series (for the whole 5-year period) of those he had called abnormal and classified them as follows :

(a) normal;

(b) non-tuberculous abnormality;

(c) doubtfully tuberculous abnormality;

(d) active tuberculosis.

The assessor was then presented with the full radiographic series of certain groups of contacts and asked to review them in the light of relevant bacteriological, clinical (including the results of tuberculin tests) and pathological data obtained in the third, fourth and fifth years. These contacts were selected on the same basis as described by Ramakrishnan et al. (1961a); however, on account of the difficulties involved in interpreting the results of tuberculin tests undertaken over a period of several years (see page 529), changes in tuberculin sensitivity were not considered as grounds for selection.

The assessor also reviewed the radiographic series of all the new births in the 5-year period. Finally, for all the contact cases of active tuberculosis diagnosed during the five years, he described the first lesion, each subsequent increase and the maximal extent, with particular reference to the date of each; he then summarized the course of the disease in each case.

II. RESULTS

POPULATION UNDER STUDY

As a result of the present assessment, there were certain minor changes in the prevalence (Table 1) and the attack rates of tuberculosis in the first two years (Table 2) reported by Ramakrishnan et al. (1961a). These changes arose because the assessor had more extensive information at the current assessment. For example, a radiographic series that he had reported as doubtfully tuberculous earlier could be reclassified as clearly non-tuberculous or definitely tuberculous in the light of subsequent information; conversely, the presence of a calcified focus in the later years could sometimes be traced back to a small lesion in a series that had previously been reported as normal.

The assessor identified one more contact with active tuberculosis and one more with inactive tuberculosis in single-infection families in the prevalence survey, and one more with a doubtfully tuberculous abnormality in multiple-infection families. Consequently, the population at risk of developing tuberculosis decreased from 530 to 528 in single-infection families and from 76 to 75 in multiple-infection families.

As in earlier reports, in order to make a pure comparison between the infectivity of home index cases and that of sanatorium index cases, the attack-rate of tuberculosis has been studied separately for contacts in single-infection families and for those in multiple-infection families. As a result of the current assessment, there were certain additions to the figures quoted by Ramakrishnan et al. (1961 a). Thus, in single-infection families (Table 2), five more cases of active tuberculosis (3 home, 2 sanatorium) were diagnosed in the first year and two (1 home, 1 sanatorium) in the second; further, one more contact (home) was detected with a doubtfully tuberculous abnormality in the first year and two more (both

TABLE 1
PREVALENCE FINDINGS IN THE 1961 REPORT[a] AND REVISED FIGURES FOR THE PRESENT REPORT

	Figures in 1961 report [a]	Revised figures (present report)
Total close family contacts	693	693
No initial radiograph	21	21
Doubtfully tuberculous abnormality, present initially	4	5
Active tuberculosis, present initially	49	50
Tuberculosis of doubtful activity, present initially	2	2
Inactive tuberculosis, present initially	11	12
Population at risk in the first year:	606	603
In single-infection families [b]	530	528
In multiple-infection families [b]	76	75

[a] See Ramakrishnan et al. (1961a).
[b] For definition, see page 518.

sanatorium) in the second year. (The only addition in the multiple-infection families was a contact (home) with active tuberculosis in the first year.)

FINDINGS IN SINGLE-INFECTION FAMILIES

The population at risk of developing tuberculosis in single-infection families is set out in Table 2, and shows a steady decline in numbers over the years which is due to the removal of contacts who developed tuberculosis or a doubtfully tuberculous abnormality and contacts who died.

Comparability of the two groups

In an earlier report (Andrews et al., 1960), it was shown that the two groups of contacts were similar initially in respect of a number of characteristics–namely, age, sex, family size, and results of radiographic examinations and tuberculin tests. In this report, it is therefore necessary to compare only the intensity of radiography, tuberculin-testing and bacteriology in the two series during the 5-year period of follow-up.

Table 3 shows that in both series of contacts the coverage was very high at all the set radiographic

TABLE 2
POPULATION AT RISK IN SINGLE-INFECTION FAMILIES[a] IN THE FIRST AND SECOND YEARS (EARLIER FIGURES[b] AND REVISED), AND IN THE THIRD, FOURTH AND FIFTH YEARS

Year of observation		Earlier figures (1961 report [b])			Revised figures (present report)		
		Home contacts	Sanatorium contacts	Total	Home contacts	Sanatorium contacts	Total
First	Population at risk	256	274	530	256	272	528
	Active tuberculosis	9	18	27	12	20	32
	Doubtfully tuberculous abnormality	1	0	1	2	0	2
	Non-tuberculous death	7	1	8	7	1	8
Second	Population at risk	239	255	494	235	251	486
	Active tuberculosis	3	4	7	4	5	9
	Doubtfully tuberculous abnormality	0	1	1	0	3	3
	Non-tuberculous death	4	4	8	4	4	8
Third	Population at risk	–		–	227	239	466
Fourth	Population at risk		–	–	215	229	444
Fifth	Population at risk	–	–		211	224	435

[a] For definition, see page 518. [b] See Ramakrishnan et al. (1961a).

TABLE 3
PERCENTAGES OF HOME AND SANATORIUM CONTACTS WITH RADIOGRAPHS TAKEN AT THE 12 SET EXAMINATIONS DURING THE FIVE YEARS

Year	Months after admission to study	Home contacts		Sanatorium contacts	
		Total surviving [a]	Percentage radiographed	Total surviving [a]	Percentage radiographed
First	3	252	91.7	272	91.2
	6	250	87.6	271	86.7
	9	250	86.8	289	88.8
	12	249	92.8	289	94.8
Second	18	231	90.5	247	84.2
	24	230	92.6	247	94.7
Third	30	224	94.6	233	89.5
	36	223	97.3	237	97.9
Fourth	42	214	98.1	228	97.8
	48	214	99.5	228	97.8
Fifth	54	207	98.6	224	97.3
	80	207	99.0	223	98.2

[a] Among the population at risk for the year.

TABLE 4
INTENSITY OF EXAMINATION OF THE HOME AND SANATORIUM CONTACTS DURING THE FIVE YEARS

		First year		Second year		Third year		Fourth year		Fifth year	
		Home	Sanatorium	Home	Sanatorium	Home	Sanatorium	Home	Sanatorium	Home	Sanatorium
Average number of radiographs		4.3[a]	4.5[a]	2.4	2.3	2.3	2.2	2.2	2.2	2.1	2.1
Average number of 5 TU tests		2.0[a]	1.9[a]	1.3	1.2	1.1	1.1	1.0	0.9	0.8	0.9
Contacts with one or more cultures	Percentage of total contacts	21	20	17	15	14	15	9	8	9	6
	Average number of cultures	3.3	3.3	2.3	1.9	2.2	2.2	3.0	3.1	2.8	2.0
Total contacts		258	272	235	251	227	239	215	229	211	224

[a] Excluding the initial examination.

examinations,[1] and particularly so at the yearly examinations, when extra efforts were made to ensure attendance of the contacts. Thus, 92.8% of the home contacts and 94.8% of the sanatorium contacts had a radiograph at 12 months, 92.6% and 94.7 % at 24 months, 97.3% and 97.9% at 36 months, 99.5% and 97.8% at 48 months and 99.0% and 98.2%, respectively, at 60 months.

Table 4 sets out, separately for the two series of contacts, the average number of radiographs taken

[1] The radiograph nearest to a set examination (and not nearer to any other set examination) was regarded as that due for that examination. About 75% of the radiographs were taken within two weeks of the set date.

each year, whether they were taken at the set examinations or at extra examinations; it also gives the corresponding information for tuberculin tests and culture examinations. (Examinations undertaken at or after the start of treatment have not been included.) The findings show that the intensity of investigation was similar in the two series throughout the 5-year period, apart from a slight suggestion that the home contacts were studied rather more intensively bacteriologically.

Attack rate of tuberculosis among the contacts

Table 5 gives the attack rates, year by year, for the home and the sanatorium contacts, according to whether the induration to the *initial 5* TU test was 0-4 mm (presumed tuberculin-negative), or 5 mm or more (presumed tuberculin-positive). This division of the population into uninfected and infected contacts is not entirely satisfactory for an area such as South India, where low-grade tuberculin reactions, presumably due to infection with mycobacteria other than tubercle bacilli, are common (Frimodt-Møller et al., 1961). However, evidence from tuberculin tests in the contacts and their index cases has revealed no better criterion of tuberculous infection (Andrews et al., 1960).

Considering the initially tuberculin-negative contacts, 9 (10.5%) of the home and 10 (11.5%) of the sanatorium contacts developed active tuberculosis in the 5-year period. In both series, the majority of the cases-namely, seven in each series-occurred in the first year, three and six, respectively, occurring in the first 3 months. In subsequent years, only sporadic cases occurred in both series. Considering next the initially tuberculin-positive contacts, 15 (9.4%) of the home contacts and 28 (15.8%) of the sanatorium contacts developed tuberculosis in the 5-year period, a non-significant difference (P>0.1). The higher attack rate in the sanatorium contacts was most conspicuous in the first year, when 13 (7.3 %) of them developed tuberculosis, as compared with 5 (3.1%) in the home series (P>0.1); of these cases, eight and one, respectively, occurred in the first 3 months.[1] In subsequent years, cases

[1] In the families contributing to this comparison, there were 11 home as compared with 5 sanatorium contacts who had active tuberculosis at the *prevalence survey*. If these cases (apart from one home contact who was initially tuberculin-negative) are added to those developing in the first 3 months, there were 11 home and 13 sanatorium contacts with positive reactions to 5 TU initially who were either found to have active tuberculosis when the index case started treatment or else manifested the disease within 3 months; thus the disparity between the home and the sanatorium series largely disappears.

TABLE 5

CASES OF ACTIVE TUBERCULOSIS DURING THE FIVE YEARS IN THE HOME AND SANATORIUM CONTACTS

Diameter of induration to initial 5 TU test (mm) [a]	Contact group	First year					Second year			Third year			Fourth year			Fifth year			Five-year period
		Population at risk (A)	Contacts who developed active tuberculosis				Population at risk	Contacts who developed active tuberculosis		Population at risk	Contacts who developed active tuberculosis		Population at risk	Contacts who developed active tuberculosis		Population at risk	Contacts who developed active tuberculosis		Contacts who developed active tuberculosis
			1-3 months	4-12 months	Total No.	Total %		No.	%		No.	%		No.	%		No.	%	No. % of (A)
0-4	Home	86	3	4	7	8.1	71	0	0.0	69	1	1.4	64	1	1.6	63	0	0.0	9 10.5
	Sanatorium	87	6	1	7	8.0	80	1	1.2	73	2	2.7	71	0	0.0	70	0	0.0	10 11.5
5 or more	Home	159	1	4	5	3.1	153	4	2.6	147	4	2.7	140	1	0.7	139	1	0.7	15 9.4
	Sanatorium	177	8	5	13	7.3	163	4	2.5	158	7	4.4	150	2	1.3	146	2	1.4	28 15.8

[a] There were 19 contacts (11 home, 8 sanatorium) with no initial 5 TU test result; none developed active tuberculosis during the five years.

continued to occur in both groups, although there was a decline in the number in the last two years; thus, in the home and sanatorium groups combined, there were 8 (2.5%) cases in the second year, 11 (3.6%) in the third, 3 (1.0%) in the fourth and 3 (1.1 %) in the fifth year.

Table 6 presents the attack rate of tuberculosis during the five years according to the diameter of the induration to the initial 5 TU test. There was no clear association in either series. Thus, the proportions of home contacts who developed tuberculosis were 10 %, 11 %, 8 % and 8 % corresponding to indurations of 0-4, 5-9, 10-14 and 15 mm or more, respectively ; the corresponding proportions for the sanatorium contacts were 11%, 21%, 16% and 10 %, respectively.

TABLE 6

ATTACK RATE OF TUBERCULOSIS DURING THE FIVE YEARS ACCORDING TO INDURATION TO THE INITIAL 5 TU TEST

Diameter of induration to initial 5 TU test (mm)	Home			Sanatorium		
	Total contacts	Contacts who developed active tuberculosis		Total contacts	Contacts who developed active tuberculosis	
		No.	%		No.	%
0-4	86	9	*10*	*87*	10	*11*
5-9	70	8	*11*	*63*	13	*21*
10-14	39	3	*8*	*55*	9	*16*
15 or more	50	4	*8*	*59*	6	*10*

The associations between sex, age and attack rate of tuberculosis over the 5-year period are presented in Table 7 and in the figure overleaf. The attack rate was high in contacts aged less than 5 years, both in the males (22%) and in the females (28 %), and (not tabulated here) in home contacts (17%) and sanatorium contacts (33 %). Thus, contacts under the age of 5 years constituted a particularly vulnerable group. Considering all age-groups, 34 (12.9%) of the male contacts developed tuberculosis as compared with 28 (10.6%) of the female contacts.

Forms of active tuberculous lesions. Table 8 sets out the forms of all the 62 active tuberculous lesions that developed during the five years. In all, 54 cases (22 home, 32 sanatorium) were classified as having

TABLE 7

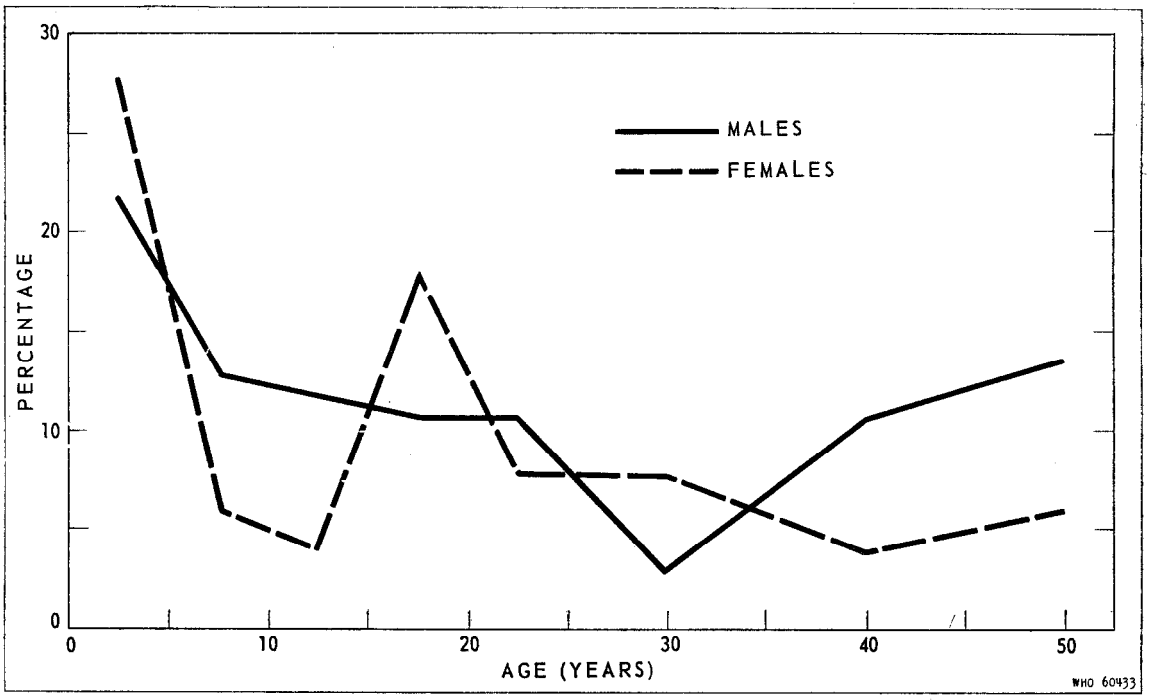
ATTACK RATE OF TUBERCULOSIS DURING THE FIVE YEARS IN THE HOME AND SANATORIUM CONTACTS, ACCORDING TO AGE AND SEX

Sex	Estimated age on admission (years)	Total contacts	Contacts who developed active tuberculosis	
			No.	%
Male	Less than 5	54	12	*22*
	5-14	87	11	*13*
	15-24	46	5	*11*
	25-34	37	1	*3*
	35 or more	40	5	*12*
	Total	264	34	*12.9*
Female	Less than 5	47	13	*28*
	5-14	76	4	*5*
	15-24	41	5	*12*
	25-34	36	3	*8*
	35 or more	64	3	*5*
	Total	264	28	*10.6*

primary or post-primary type disease and 8 (2 home, 6 sanatorium) as having adult-type disease. The former included 3 cases (1 home, 2 sanatorium) of tuberculous meningitis and 2 (both sanatorium) of miliary pulmonary tuberculosis (all 5 occurring in contacts aged under 5 years, in the first 2 years of follow-up), 3 cases (2 home, 1 sanatorium) of pleural effusion and 22 cases (8 home, 14 sanatorium) of progressive primary disease. It will be noted that there was a greater number of disseminated lesions in the sanatorium series.

Results of bacteriological examinations. Cultures were examined from 55 (21 home, 34 sanatorium) of the 62 contacts who developed tuberculosis during the 5-year period, and found to be positive on at least one occasion in 16 (6 home, 10 sanatorium). Tests of sensitivity to streptomycin were undertaken on the first positive culture for 14 contacts and to isoniazid for 15. The cultures were sensitive to both drugs in 11, isoniazid-resistant but streptomycin-sensitive in 2 and isoniazid-sensitive but streptomycin-resistant in 1. The culture that was tested for isoniazid sensitivity but not for streptomycin sensitivity was isoniazid-sensitive. There was no evidence

ATTACK RATE OF TUBERCULOSIS DURING THE FIVE YEARS IN THE CONTACTS, ACCORDING TO AGE AND SEX



that any of the three contacts with resistant cultures had been infected by their index cases.

Doubtfully tuberculous lesions developing during the jive years

The independent assessor classified 13 contacts (7 home, 6 sanatorium) as having developed a doubtfully tuberculous abnormality during the 5-year period; despite careful scrutiny of all the relevant data (radiographs, tuberculin test results, bacteriological findings and clinical notes) during this period, he was unable to identify with certainty the etiology of any of these lesions. The lesions first appeared in the first year in two contacts (both

TABLE 8

FORMS OF TUBERCULOUS LESIONS DEVELOPING DURING THE FIVE YEARS IN THE HOME AND SANATORIUM CONTACTS

Contact group	Total contacts with active tuberculous lesions	Adult-type disease	Primary or post-primary type disease	Form of primary or post-primary type disease					
				Tuberculous meningitis	Miliary pulmonary tuberculosis	Pleural effusion	Progressive primary	Simple primary	Other
Home	24	2	22	1	0	2 [a]	8	9	2 [b]
Sanatorium	38	6 [c]	32	2 [d]	2	1	14 [e]	12	*If*

[a] Includes one case with a progressive primary complex.

[b] One of these had a tuberculin conversion associated with a positive sputum culture and a doubtfully tuberculous radiographic abnormality, while the other had *lupus verrucosus cutis.*

[c] Includes one case with an intra-pulmonary lesion and a pleural *effusion.*

[d] Both with a pulmonary lesion.

[e] Includes one case with spinal tuberculosis, and one with a lobar lesion and pleural effusion.

[f] Tuberculous adenitis.

home), in the second in three (all sanatorium), in the third in three (all home), in the fourth in three (1 home, 2 sanatorium) and in the fifth in two (1 home, 1 sanatorium). Of these 13 contacts, 7 (3 home, 4 sanatorium) were tuberculin-negative initially; a tuberculin conversion by the 10-mm criterion (defined below) occurred either before or at the time the doubtfully tuberculous abnormality developed in three of these-namely, two home contacts (aged 3 and 9 years) and one sanatorium contact (aged 2 years).

Non-tuberculous pulmonary lesions developing during the five years

The assessor reported one or more non-tuberculous radiographic abnormalities during the 5-year period in 76 contacts (40 home, 36 sanatorium). The first (or only) abnormality appeared in the first year in 28 contacts (13 home, 15 sanatorium), in the second in 14 (9 home, 5 sanatorium), in the third in 18 (8 home, 10 sanatorium), in the fourth in 8 (4 home, 4 sanatorium) and in the fifth in 8 (6 home, 2 sanatorium). Thus, the incidence was broadly similar in the home and sanatorium contacts during each of the five years of follow-up.

Incidence of tuberculin conversion during the jive years

Throughout the period of study, tuberculin tests were given at the Centre by the clinic nurses and the great majority were also read in the Centre by them. To avoid bias, which might have resulted if the reader was aware of the findings of previous tests at the time of reading the current test, the standard procedure was to record the result of each test on a separate card and subsequently to transfer the result to the contact's record sheet.

As in the earlier reports (Andrews et al., 1960; Ramakrishnan et al., 1961a), the principal definition of tuberculin conversion was an increase in induration of at least 10 mm at any subsequent 5 TU test from an initial induration of 0-4 mm; a second and slightly less restrictive definition was an increase of at least 8 mm at any subsequent test. A subsidiary approach consisted in identifying the two groups of contacts who had an induration of 5-7 mm to the initial test and who showed an increase of 10 mm or more, or an increase of 8 mm or more, at any subsequent test.

On the basis of these criteria, it was reported that the incidence of tuberculin conversion was very similar for the home and the sanatorium contacts during the first two years (Ramakrishnan et al., 1961a). This conclusion was confirmed by the findings over the 5-year period. Thus, 39% of 83 home contacts and 45% of 87 sanatorium contacts with indurations of 0-4 mm initially showed tuberculin conversion by the 10-mm criterion, and 46 % and 48 %, respectively, by the 8-mm criterion. In contacts with indurations of 5-7 mm initially, the conversions by the 10-mm criterion were 52 % for the home and 59 % for the sanatorium contacts, and by the 8-mm criterion, 74 % and 77 %, respectively.

Association tables were prepared separately for the home and the sanatorium contacts, relating the induration to the initial 5 TU test to the indurations at one year and at five years. These also showed that tuberculous infections had occurred no more frequently in the home contacts than in the sanatorium contacts. The results are not tabulated here.

Further evidence regarding the relative risk of infection in the two series may be obtained by examining the results of tuberculin tests in infants born during the first year, when the index cases of sanatorium contacts were isolated. Of 12 infants born into the families of the home series and who had at least one tuberculin test, 4 showed an induration of 5 mm or more to 5 TU on one or more occasions, as compared with 2 of 6 in the sanatorium series. The corresponding proportions for the total births during the 5-year period were 15 % of 68 and 15 % of 54, respectively.

In summary, the risk of infection, as assessed by changes in tuberculin sensitivity, was similar for the two groups of contacts.

Deaths

During the five years, there were 22 (8.6 %) deaths among the 256 home contacts, as compared with 12 (4.4%) among the 272 sanatorium contacts; the difference between the two series borders on statistical significance ($P = 0.07$). All the deaths were reviewed by the independent assessor, who was provided with all the available data-radiographic, bacteriological and clinical (including tuberculin test results). He classified four (1 home, 3 sanatorium) of them as due to tuberculosis. Of these, two (1 home, 1 sanatorium) were due to tuberculous meningitis, in children aged 4 years and 1 year, respectively, and occurred in the second and first years, respectively. A third (sanatorium), a male aged 75, died of a massive effusion in the first year, and the fourth (sanatorium), a female aged 30, died in the third year with a positive sputum and cavitated pulmonary disease. All four were tuberculin-positive at the initial examination.

Of the remaining 30 contacts (21 home, 9 sanatorium) who died, many had not been seen by a doctor during the terminal illness, and autopsies were not performed on any of them. Consequently, clinical details regarding deaths had often to be gathered from relatives (occasionally after a lapse of months), and were frequently incomplete and inconclusive. On the available evidence, the independent assessor did not regard any of them as due to tuberculosis.

Of these 30 deaths, eight (7 home, 1 sanatorium) occurred in the first year, nine (5 home, 4 sanatorium) in the second, six (4 home, 2 sanatorium) in the third, two (1 home, 1 sanatorium) in the fourth and five (4 home, 1 sanatorium) in the fifth year. The age at death was 5 years or less in 15 contacts (11 home, 4 sanatorium), including 4 (all home) aged under 1 year; of these, 12 died with symptoms of diarrhoea and vomiting which were frequently associated with marasmus and dehydration, while in the remaining 3, death was due to smallpox, bronchopneumonia and drowning, respectively. None of these contacts had an induration of 5 mm or more to the initial 5 TU test; however, in three (all home), in whom death had been ascribed to gastroenteritis, the induration was 5 mm or more at the last test before death, two showing a conversion by the 10-mm criterion.

Of the remaining 15 deaths (10 home, 5 sanatorium), five were ascribed to heart failure, two to cerebral catastrophes, two to hepatic failure, and one each to pulmonary embolism, typhoid, dysentery, post-vaccinal encephalitis, *status epilepticus* and complications following a fractured femur. An induration of less than 5 mm to the initial 5 TU test was recorded in four contacts (all home); of these, two had an induration of 5 mm or more at the last test before death, including one (whose death followed a fractured femur) who showed a conversion by the 10-mm criterion.

In all, 3 (all home) of 19 contacts (15 home, 4 sanatorium) with an induration of less than 5 mm to the initial 5 TU test had a conversion by the 10-mm criterion at the last test before death, but none had evidence of active tuberculosis.

In summary, there is no firm evidence that these deaths were related to tuberculous infection; however, there is no simple explanation for the finding of a greater number of deaths among the home contacts.

Births

There were 72 births in the home families and 57 in the sanatorium families during the five years. Of these contacts, 11 (15%) and 12 (21%), respectively, died, including one (home) who had an induration of 10 mm to 5 TU at three months before death followed by no induration at two subsequent tests. On the basis of the available evidence, the independent assessor considered that none of the deaths was due to tuberculosis. Of the 61 home and 45 sanatorium contacts who were alive at five years, one (born in the fifth year) and none, respectively, had developed active tuberculosis and three (1 born in the first year and 2 in the second) and one (born in the third year), respectively, had developed doubtfully tuberculous abnormalities. Tuberculin tests were undertaken in 68 of the home contacts and 54 of the sanatorium contacts; the results have been described earlier (see preceding page).

FINDINGS IN MULTIPLE-INFECTION FAMILIES

In all, 75 contacts with no initial evidence of tuberculosis (apart from calcification in seven cases) were excluded from the main comparison because they came from multiple-infection families (see pages 518 and 519); of these, 39 were from the home series and 36 from the sanatorium series. The two series were distributed similarly in terms of sex, initial 5 TU test results and family size, and were investigated with similar intensity by radiography and tuberculin testing over the 5-year period. However, the home series had rather more contacts under the age of 5 years (28 %) than the sanatorium series (17 %) and, further, there was some evidence that the intensity of bacteriological investigations was rather greater in the former series; on the other hand, a greater proportion of the contacts had calcification initially in the sanatorium series (14 %) than in the home series (5%).

In the first year, six (15 %) of the 39 home contacts developed active tuberculosis, as compared with none of the 36 sanatorium contacts; the six contacts were aged 9 months, 2, 3, 4, 22 and 32 years, and included two who were tuberculin-negative initially. In subsequent years, no cases of tuberculosis developed in the home contacts, as compared with two in the sanatorium contacts (both tuberculin-positive initially), one in the second year and one in the fourth year. One home contact (with an induration of 15 mm to the initial 5 TU test), as compared with none of the sanatorium contacts, developed a doubtfully tuberculous lesion; this was in the first year.

Considering the tuberculin test results, seven of the home and nine of the sanatorium contacts had

an induration of 0-4 mm to the initial 5 TU test. During the 5-year period, four of the former and five of the latter had a tuberculin conversion by the IO-mm criterion, and five and six, respectively, by the 8-mm criterion. Of nine home contacts with an induration of 5-7 mm initially, five had conversion by the 10-mm criterion as did two of four sanatorium contacts; the numbers who had a conversion by the 8-mm criterion were seven and three, respectively.

There were four deaths (3 home, 1 sanatorium) in the 5-year period and all were classified as non-tuberculous by the independent assessor.

There were 19 births (12 home, 7 sanatorium) during the 5-year period. Of these, one (sanatorium) developed tuberculosis in the third year, two (1 home, 1 sanatorium) died from non-tuberculous causes and two (1 home, 1 sanatorium) developed an induration of 5 mm or more to the 5 TU test.

CONSOLIDATED FINDINGS FOR CONTACTS IN SINGLE-INFECTION AND MULTIPLE-INFECTION FAMILIES

In all, 295 home contacts and 308 sanatorium contacts were exposed to the risk of developing tuberculosis over the 5-year period. Of these, 30 (10.2 %) home contacts developed tuberculosis, as compared with 40 (13.0%) sanatorium contacts, including 10 and 12, respectively, with at least one positive culture. A doubtfully tuberculous abnormality was reported in eight (2.7%) home and six (1.9 %) sanatorium contacts. There were 25 deaths (8.5%) in the home contacts, as compared with 13 (4.2%) in the sanatorium contacts, a difference which just attains statistical significance (P=0.05); however, only one and three, respectively, were classified as due to tuberculosis by the independent assessor. Tuberculin conversions occurred with similar frequency in both series. Thus, in initially tuberculin-negative contacts, 36 (40%) in the home series and 44 (46%) in the sanatorium series had a conversion by the 10-mm criterion, and 43 (48 %) and 48 (50 %), respectively, by the 8-mm criterion.

During the 5-year period, there were 84 births in the home families and 64 in the sanatorium families. Of these, 12 (14 %) home and 13 (20 %) sanatorium died, none from tuberculous causes. One contact in each series developed active tuberculosis, and three and one, respectively, developed a doubtfully tuberculous abnormality. An induration of 5 mm or more to 5 TU was observed in 14% of the home contacts and 15% of the sanatorium contacts.

In summary, both the risk of infection and the risk of developing tuberculosis over the 5-year period were similar for the home contacts and the sanatorium contacts.

III. DISCUSSION

The present report gives information on the attack rate of tuberculosis during a 5-year period among the close family contacts of patients with newly diagnosed infectious pulmonary tuberculosis who came from a poor, overcrowded section of a large urban community in South India. The index cases were, on diagnosis, allocated at random to treatment with isoniazid plus PAS for one year either at home or in sanatorium (Tuberculosis Chemotherapy Centre, Madras, 1959). Subsequently, about half the patients with bacteriologically quiescent disease at one year received maintenance chemotherapy with isoniazid alone for one or two years (the rest receiving no specific chemotherapy) while patients with bacteriologically active disease and those who had a bacteriological relapse were prescribed reserve regimens (Dawson et al., 1966 [1]). As a result of the random allocation in the first year, the close family contacts (all of whom had been living, feeding and cooking with the patients for at least the three months immediately prior to diagnosis) were divided into " home contacts " and " sanatorium contacts ". None of these contacts was given BCG vaccination or chemoprophylaxis, as the aim of the present study was to assess whether there was any special risk to the home contacts which might indicate the use of these preventive measures; instead, they were all followed by an intensive routine of supervision.

The main comparison is between 256 home and 272 sanatorium contacts in families in which the only source of infection at the prevalence survey had been the index case. The two groups of contacts were similar at this time in respect of sex, age, family size and results of initial radiographic examinations and tuberculin tests. Further, there were only minor differences in the intensity of subsequent investigations by bacteriology, radiography and tuberculin testing in each of the five years. A particularly high coverage by radiography was achieved, a coverage which actually increased in the later

[1] See article on page 533 of this issue.

years; thus, the proportion of contacts who had a radiographic examination was 94% at one and at two years, 98% at three years and 99% at four and at five years. The attack rates of tuberculosis in this study are therefore based on exceptionally comprehensive radiographic information. Further, in order to avoid bias, they have been based on assessments of the radiographic series and other relevant data by an experienced independent assessor who was unaware throughout, for any individual contact under review, of the identity of the index case (home or sanatorium) or his response to treatment.

Over the 5-year period, 10.5% of 86 home contacts who were tuberculin-negative on admission to study developed tuberculosis, as compared with 11.5 % of 87 sanatorium contacts, the attack rates in the first year being 8.1 % and 8.0%, respectively. Among the initially tuberculin-positive contacts, 9.4% of 159 home and 15.8% of 177 sanatorium contacts developed tuberculosis, the attack rates in the first year being 3.1% and 7.3 %, respectively. Thus, the home contacts were at no special risk of developing tuberculosis, either over the whole 5-year period or, indeed, even in the first year, when the infectious index cases were under treatment at home.

The sanatorium contacts were exposed to the risk of contracting tuberculosis from two sources. First, from the index case before the diagnosis of tuberculosis had been made and before the patient had been segregated in sanatorium and, secondly, from some other source in the urban community in which the family lived (approximately 90 % of the patients were non-infectious when discharged from sanatorium at the end of the first year). The home contacts were exposed to both these risks and, *in addition*, to the risk of continued contact with the index case during treatment, since the index case was under treatment in his own home from the outset.

Information on the relative importance of these three sources of infection is provided by the findings of the present study. Of the total of 62 cases that arose in the 5-year period among the home and the sanatorium contacts, no less than 32 occurred in the first year, 18 of them in the first 3 months. These 18 included six of the seven cases that occurred in the first year among the sanatorium contacts who were tuberculin-negative initially and whose index cases had been segregated within a few days of diagnosis. This strongly suggests that these 18 contacts had already been infected and were incubating the disease when treatment was started for the index case, although the disease (and in nine contacts even the sensitivity *to* tuberculin) became manifest only afterwards. Further, the finding that, despite the segregation of the index cases of the sanatorium contacts for a year, the attack rate in the first year in the initially tuberculin-positive sanatorium contacts was higher than in the tuberculin-positive home contacts also suggests that infection had occurred before the diagnosis of the index case, and that the isolation was effected too late to influence the risk to the contacts. Thus, it is clear that the major part of the risk to the contacts of developing tuberculosis had occurred before the diagnosis of the index cases, the great majority of whom had presented with symptoms at chest clinics; it therefore follows that an early diagnosis of tuberculosis can be expected to play an important role in preventing cases of tuberculosis arising in close contacts.

Cases of tuberculosis occurred sporadically after the first year in initially tuberculin-negative contacts –two in the home series and three in the sanatorium series–and might well have been due to exposure to an urban community with a high prevalence of tuberculosis. (The national sample survey of tuberculosis in India (Indian Council of Medical Research, 1959) showed that the prevalence of active and probably active tuberculosis in those aged 5 years or more ranged from 1.5 % to 2.1% in six large cities.) However, the possibility that one or more of the cases in the home contacts may have arisen from exposure to the index case during his treatment at home cannot be excluded.

Considering next the contacts who were initially tuberculin-positive, cases continued to emerge in both the home and the sanatorium series in the second and subsequent years. However, there was some evidence of a decline in the incidence in the last two years. Thus, considering both the home and sanatorium series combined, there were 18 cases in the first year, 8 in the second, 11 in the third, 3 in the fourth and 3 in the fifth.

It is noteworthy that of the 62 cases, 40 were under the age of 15 years, including 25 under the age of 5 years. Further, a number of lesions in the contacts under 5 years of age were serious and included three cases of tuberculous meningitis, two of miliary pulmonary tuberculosis and one of spinal tuberculosis with a pulmonary lesion (five of the six occurred in sanatorium contacts). The attack rate for the 5-year period was 25% in contacts under 5 years of age, 9% in those aged 5-14 years and 8 % in those aged 15 years or more; the correspond-

ing rates for the first year were 18 %, 4 % and 3 %, respectively. These findings suggest that there is scope for chemoprophylaxis in close family contacts, which has been reported to be effective by Ferebee & Mount (1962) and Ferebee (1964). However, any such measure must necessarily be fitted into the over-all tuberculosis programme for the country, and be given a lower priority than the treatment of index cases (Fox, 1964), particularly in developing countries with limited resources.

There is now evidence of the protective value of BCG in tuberculin-negative subjects in India (Frimodt-Møller, Thomas & Parthasarathy, 1964). In the present study, all 19 (11%) cases of tuberculosis in initially tuberculin-negative contacts were aged 8 years or under, and 5 of these occurred in the second or subsequent years. This suggests that there is scope for BCG vaccination among initially tuberculin-negative contacts, particularly in children.

Although the main serial assessment of the contacts was radiographic, tuberculin testing was used as a subsidiary measure of infection. Tuberculin conversion has been defined for the purpose of this study in several ways, the principal definition being an increase in diameter of induration of 10 mm or more from an initial induration of 0-4 mm, to 5 TU. The observed incidence of such conversions during the 5-year period was 39% of 83 home contacts and 45% of 87 sanatorium contacts, including 25% and 23%, respectively, in the first year-findings which do not indicate any special risk to the home contacts. These figures, as well as others based on less restrictive definitions, are useful for making valid *comparisons* between the risk of infection among the home contacts and the sanatorium contacts. However, for reasons stated below, the comparisons themselves are not very precise nor do the figures above measure the true *infection rates* in the two series. First, a high incidence of non-specific reactions, presumably due to infection with mycobacteria other than tubercle bacilli, has been reported in South India (Frimodt-Møller et al., 1961). Secondly, there is evidence from the USA (S. H. Ferebee, personal communication, 1964) and South India (Raj Narain et al., 1966 [1]) that repeated tuberculin testing enhances allergy to tuberculin. Thirdly, the magnitude of the error of the tuberculin test is such (Raj Narain et al., 1966 [1]) that it was not unusual in this study to find that contacts who had a tuberculin " conversion " had low indurations repeatedly at subsequent tests. Lastly, it is possible that variations in standards of tuberculin testing and reading could have occurred during the period of follow-up, resulting, for example, in a systematic over-reading of the test indurations at the later stages. However, in the present instance, information is available concerning the standards of tuberculin testing and reading over the 6-year period of study (that is, the l-year period of intake plus the 5-year period of follow-up); this is in the form of distributions of 5 TU test results in *newly diagnosed* index cases and their close family contacts on admission to various studies at the Centre during the period. These showed that, despite numerous changes in the personnel giving and reading the tests, there was no real variation in standards, apart from a slight tendency for smaller reactions to be recorded in the last 9 months of the 6-year period of study (unpublished data).

The present report is the last of a series of nine publications concerning an investigation of the role of ambulatory chemotherapy for pulmonary tuberculosis, which was initiated at the Tuberculosis Chemotherapy Centre, Madras, nearly 10 years ago. These have shown, from the point of view both of the patients (Tuberculosis Chemotherapy Centre, Madras, 1959; Velu et al., 1960; Devadatta et al., 1961; Ramakrishnan et al., 1961b, 1966[2]; Dawson et al., 1966 [3]) and of their contacts (Andrews et al., 1960; Ramakrishnan et al., 1961a), the high degree of effectiveness of well-organized domiciliary chemotherapy. Further, the striking level of co-operation, both of the patients and of their close family contacts for the five years, is an important finding, not only for long-term field research in other diseases in India, but for the general field of social inquiry also.

IV. SUMMARY

1. In a controlled study undertaken in South Indian families to assess the value of domiciliary treatment of pulmonary tuberculosis for one year as compared with sanatorium treatment, there were 693 close family contacts-that is, relatives living, cooking and feeding with the infectious patients for at least the three months immediately prior to diag-

[1] See article on page 623 of this issue.
[2] See article on page 553 of this issue.
[3] See article on page 533 of this issue.

nosis. The great majority of the families came from the lower income groups in Madras city and their living conditions and dietary standards were poor.

2. The contacts were followed by serial radiography and tuberculin testing, and, where necessary, bacteriological examinations, to determine the attack rate of tuberculosis during a 5-year period.

3. The main comparison is among contacts in families in which the only source of infection initially was the index case. In these "single-infection" families, there were 256 contacts of patients treated at home (home contacts) and 272 contacts of patients isolated in sanatorium in the first year (sanatorium contacts). In subsequent years, all patients were followed up at home.

4. The two groups of contacts were similar initially in respect of age, sex, family size, radiographic findings and tuberculin test results; further, they were followed with similar intensity by radiography and tuberculin testing throughout the five years. The coverage by radiographic examination was very high, the proportion of contacts examined being 94%, 94%, 98%, 99% and 99% at 1, 2, 3, 4 and 5 years, respectively.

5. All the radiographic series, together with bacteriological and clinical information (including tuberculin test results), were reviewed by an independent assessor, who was unaware throughout of the identity (home or sanatorium), or the progress, of the index case of any individual contact under review.

6. During the 5-year period, there were 34 deaths (22 home, 12 sanatorium) of which four (1 home, 3 sanatorium) were classified by the independent assessor as due to tuberculosis.

7. Tuberculosis developed during the 5-year period of follow-up in 24 (9.4%) home and 38 (14.0%) sanatorium contacts, including 12 (4.7%) and 20 (7.4%), respectively, in the first year; of these, 4 and 14, respectively, occurred in the first 3 months.

8. In all, 8 cases (2 home, 6 sanatorium) were classified as having adult-type disease and the remaining 54 as having primary or post-primary disease; the latter included three cases (1 home, 2 sanatorium) of tuberculous meningitis and two cases (both sanatorium) of miliary pulmonary tuberculosis, all in contacts under 5 years of age.

9. The attack rate of tuberculosis over the 5-year period in initially tuberculin-negative contacts was 10.5 % in the home series and 11.5 % in the sanatorium series, including 8.1% and 8.0%, respectively, in the first year; the corresponding figures for initially tuberculin-positive contacts were 9.4% and 15.8% over the 5-year period, and 3.1 % and 7.3% in the first year.

10. The attack rate in contacts under the age of 5 years was 24.8 %, as compared with 8.7 % in those aged 5 years or more.

11. An increase in the induration of at least 10 mm at any subsequent 5 TU test from an initial induration of 0-4 mm was observed in 39% of the home and 45% of the sanatorium contacts.

12. The findings in this report, together with those published previously for patients, demonstrate that ambulatory treatment of patients with pulmonary tuberculosis is practicable and effective, and safe for the close family contacts.

ACKNOWLEDGEMENTS

We are greatly indebted to all the clinic staff, particularly the public health nurses, health visitors and social workers, whose efforts have largely been responsible for the completeness of the data.

RÉSUMÉ

Le Centre de Chimiothérapie de la Tuberculose, à Madras (Inde), a publié antérieurement les résultats d'une étude comparant, aprés un an de chimiothérapie, les avantages respectifs de la cure à domicile et du traitement hospitalier de la tuberculose pulmonaire. En liaison avec cette enquête principale, 693 personnes ayant vécu en contact familial étroit avec des tuberculeux contagieux pendant 3 mois au moins avant l'établissement du diagnostic ont été observées pendant cinq ans. La majorité d'entre elles appartenaient à des classes sociales économiquement faibles de Madras et ne bénéficiaient que de conditions de logement et d'alimentation trés modestes.

Par des examens radiographiques en série, des épreuves tuberculiniques et, éventuellement, des investigations bactériologiques, les auteurs se sont efforcés de determiner l'incidence de la tuberculose chez ces contacts pendant les cinq années d'observation.

L'étude concemait en ordre principal les personnes appartenant à des familles où n'existait à l'origine qu'une source de contagion unique. Pour 272 contacts, la source possible de contagion était représentée par un tuberculeux traité en sanatorium durant la 1re année, pour 256 contacts, par un malade traité à domicile, également pendant un an. Pendant les quatre années suivantes, tous les malades suivirent un traitement ambulatoire. Les deux groupes de contacts étaient initialement trés semblables sous le rapport de l'âge, du sexe et de la structure familiale. Les examens radiographiques et les épreuves tuberculiniques, qui fournissaient au début des résultats du même ordre pour chacun des groupes, furent répétés de façon identique pendant toute la durée de l'observation. Les examens radiographiques furent particulièrement nombreux, et durant chacune des cinq années de l'enquête, respectivement 94%, 94%, 98 %, 99% et 99% des contacts furent examinés. Toutes les donnés radiographiques, bactériologiques ou cliniques (y compris les résultats des épreuves tuberculiniques) concernant les contacts furent vérifiées par un examinateur indépendant et non informé des modalités (sanatorium ou domicile) du traitement applique à chacun des malades contagieux et de 1'évolution de son cas.

Au cours des cinq annés d'observation, 34 décès (12 contacts de malades hospitalisés, 22 contacts de malades traités à domicile) furent enregistrés, dont 4 furent attribués à la tuberculose (3 contacts de malades hospitalisés, 1 contact de malade soigné à domicile). Vingt-quatre (9,4%) contacts de malades traités à domicile et 38 (14%) contacts de malades hospitalisés furent atteints de tuberculose dont respectivement 12 (4,2%) et 20 (7,4%) au cours de la 1re année d'observation. Parmi ces derniers, respectivement 4 et 14 contacts contract&rent la tuberculose au cours des trois premiers mois.

Au total, 8 contacts (2 contacts de malades traités à domicile, 6 contacts de malades hospitalisés) furent reconnus atteints de lésions tuberculeuses du type observe chez l'adulte; 54 présentèrent des manifestations primaires ou postprimaires, dont 3 cas (1 contact de malade soigné à domicile, 2 contacts de malades hospitalids) de méningite tuberculeuse et 2 cas (contacts de malades hospitalisés) de tuberculose pulmonaire miliaire, survenus chez des sujets âgés de moins de 5 ans.

Chez les contacts initialement tuberculino-négatifs, l'incidence de la tuberculose, au cours des cinq annés d'observation, fut de 10,5 % pour les contacts de malades traités à domicile, et de 11,5 % pour les contacts de malades hospitalisés; au cours de la 1re année, elle atteignait respectivement 8,1 %0 et 8 %. Chew les contacts tuberculino-positifs à l'origine, les chiffres correspondants furent, en cinq ans, de 9,4 % et de 15,8 %, et pendant la 1re année, de 3,1% et 7,3 %, respectivement. Chez les contacts âgés de moins de 5 ans, l'incidence globale fut de 24,8% comparée à une incidence de 8,7% chez les contacts âgés de 5 ans ou plus.

Les épreuves tuberculiniques (5 UT de tuberculine) mirent en evidence une augmentation du diamètre de l'induration (pour une valeur initiale de 0-4 mm) atteignant au moins 10 mm chez 39 % des contacts de malades traités à domicile et chez 45% des contacts de malades hospitalisés.

Les résultats de cette enquête, de même que ceux de l'étude antérieure évaluant les avantages respectifs de diverses modalités de traitement des malades avérés, montrent que le traitement ambulatoire des tuberculeux pulmonaires est non seulement possible, mais aussi efficace, et qu'il offre des garanties suffisantes de sécurité pour les membres de la famille qui vivent en contact étroit avec les malades.

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PRINTED IN SWITZERLAND