

**INFLUENCE OF SEGREGATION OF TUBERCULOSIS PATIENTS
FOR ONE YEAR ON THE ATTACK RATE OF TUBERCULOSIS
IN A 2-YEAR PERIOD IN CLOSE FAMILY CONTACTS
IN SOUTH INDIA**

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Influence of Segregation of Tuberculous Patients for One Year on the Attack Rate of Tuberculosis in a 2-Year Period in Close Family Contacts in South India*

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The authors present a second report from the Tuberculosis Chemotherapy Centre, Madras, on the incidence of tuberculosis in close family contacts of tuberculous patients. The patients initially received a year's chemotherapy either at home or in sanatorium in a controlled comparison of the merits of domiciliary as opposed to institutional treatment. The first report presented data relating to the prevalence and the attack rate of tuberculosis among the contacts during the first year of treatment of the index cases ; this second report presents the attack rate for the 2-year period since the start of treatment for the index cases. During the second year all the index cases were managed at home, those with active disease, and half of those with quiescent disease, at the end of the first year receiving further chemotherapy. The findings of the 2-year study confirm those of the earlier study—namely, that the incidence of tuberculosis in the contacts of patients originally treated at home was no greater than that in the contacts of patients originally treated in sanatorium and that the major risk to the contacts resulted from exposure to the patient before diagnosis. As in the earlier report, the question of instituting chemoprophylaxis for the young contacts of tuberculous patients is discussed. The authors consider that close family contacts living in over-crowded, urban conditions in the developing countries are valuable groups for chemoprophylactic investigations.

In 1956 the Tuberculosis Chemotherapy Centre, Madras, undertook a controlled comparison of home and sanatorium treatment of pulmonary tuberculosis for 12 months, all patients receiving isoniazid plus PAS. The main conclusion drawn at the end of this period was “ that the results of domiciliary chemotherapy, as carried out in this study, approach sufficiently closely the results of sanatorium treatment to suggest that it is appropriate to treat the majority of patients at home ” (Tuberculosis Chemotherapy Centre, 1959).

During the second and third years all the patients were managed at home. Of those with bacteriologi-

cally quiescent disease at 12 months, one half, selected at random, received further treatment with isoniazid alone in the second year, and the other half received no specific therapy. Half of the former group, selected at random, received isoniazid throughout the third year also. It was found that the relapse rates in the second and third years for patients treated at home and for those treated in sanatorium during the first year were both small and similar (Velu et al., 1960; Devadatta et al., 1961¹). These three reports have thus firmly established the value of domiciliary chemotherapy for the patients in the Madras community.

As part of the same comparison an investigation was undertaken to discover whether the treatment of patients at home exposed their close family con-

* From the Tuberculosis Chemotherapy Centre, Madras, which 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.

¹See article on page 149 of this issue.

tacts to any special risk of contracting the disease, compared with the risks to the close family contacts of patients segregated in sanatorium for one year. The findings for the contacts during the first 12 months of treatment of the patients have already been reported (Andrews et al., 1960); there was no special risk during this period to the contacts of patients treated at home. The present report gives the findings for the contacts during the second year of follow-up, when all the patients were at home, together with consolidated figures for the attack rate of tuberculosis in the 2-year period. The follow-up,

both of the patients and of their contacts, is continuing and further findings will be reported later.

The patients in the chemotherapy study were drawn from the lower income groups and from the unemployed in Madras City, the largest urban community in South India. Living conditions were, with few exceptions, poor, the majority of families being overcrowded and the nutritional standards low. It was under such conditions (described fully in the 1959 report) that the patients in the home series were treated and their family contacts exposed to the risk of infection from them.

I. PLAN AND CONDUCT OF THE CONTACT STUDY

The plan of the contact study, the routines for the initial and follow-up examinations of the family contacts and the procedure adopted when a radiographic abnormality was found have already been described in detail (Andrews et al., 1960). Only the main points are repeated here.

The close family contacts were examined by radiography and by tuberculin testing at the time of diagnosis of each patient accepted for the chemotherapy study, in order to obtain information on the prevalence of clinical tuberculosis and of tuberculous infection among them. In addition, the close contacts were followed intensively by serial radiography and, if indicated, by serial tuberculin testing, to detect the cases of clinical tuberculosis and the tuberculous infections developing among them. This permitted a comparison of the attack rate of tuberculosis, and the incidence of tuberculous infection, in the close family contacts of the patients treated at home with the corresponding rates in the close contacts of the patients treated in sanatorium. The follow-up is planned to continue for five years.

DEFINITIONS OF "INDEX CASE" AND "CONTACT"

For the purpose of this study the "index case" was defined as the first member of a family suffering from pulmonary tuberculosis to be registered in the Centre. All other members of the family were designated "contacts" of the index case. In this report the contacts of the patients treated at home will be referred to as "home contacts" and those of the patients treated in sanatorium as "sanatorium contacts".

CONTACTS UNDER STUDY

The study was restricted to "close family contacts"—namely, those family members, by blood or marriage, living, cooking and feeding in the same house as the index case for the three months immediately preceding the start of treatment for the index case. Infants less than three months old were also included.

FIRST EXAMINATION OF CONTACTS

Each contact had the following standard examination initially :

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

(b) An intracutaneous tuberculin (Mantoux) test made on the flexor aspect of the left forearm with 5 tuberculin units (TU) of a purified protein derivative (PPD) in 0.1 ml of solution. The greatest diameter of palpable induration after 48 or 72 (occasionally 96) hours was measured in millimetres, using a transparent ruler or a caliper gauge, according to the preference of the reader. If there was no induration, or if its maximum diameter was less than 5 mm, a further intracutaneous test with 100 TU of PPD in 0.1 ml of solution was performed on the right forearm. The greatest diameter of induration after 48 or 72 (occasionally 96) hours was again recorded in millimetres. (For the first six months of the intake for this study 50 TU was given instead of 100 TU.) The tuberculin dilutions were prepared from PPD batch RT22; the diluent did not contain Tween 80.

FOLLOW-UP EXAMINATIONS OF CONTACTS

At three, six, nine, 12, 18 and 24 months, each contact was given the following standard examination :

(a) A 70-mm radiograph (read independently by two of the Centre's doctors); if there was any suspicion of an abnormality, a full-plate radiograph was taken. For children under the age of five years, only full-plate radiographs were taken.

(b) If the indurations to 5 TU at all previous tuberculin tests had been less than 20 mm, an intracutaneous test was made with 5 TU and read as at the first examination. If the maximum diameter of induration to this test was less than 5 mm, a 100 TU test was performed (in the earlier stages, a 50 TU test). All tuberculin testing was stopped when an induration of 20 mm or more to 5 TU had been obtained.

At first, for reasons given in the earlier report (Andrews et al., 1960), testing with 5 TU was stopped after a reaction of 5 mm or more had been obtained. This procedure was later modified, however, and 5 TU tests were performed at each examination until an induration of 10 mm or more was obtained. This procedure was soon modified again to that given in (b) above.

A radiograph was accepted as a 3-, 6-, or 9-month film only if it was taken within the period from six weeks before to six weeks after the set date, this date always being calculated from the date of the start of treatment for the index case. A radiograph was accepted as a 12-month film only if it was taken within the period from six weeks before to three months after the set date. A radiograph was accepted as an 18-month or a 24-month film only if it was taken within the period from three months before to three months after the set date. In fact, the very great majority of radiographs were taken within one month of the set date, and of these most were taken within two weeks; over 75 % of all the radiographs at 18 months and over 90% at 24 months were taken within two weeks of the set date. Tuberculin tests with 5 TU were accepted according to the same criteria.

In addition to the above routine investigations at the set examinations, there were many more opportunities for the staff to observe the contacts, for regular visits were paid to the homes, and all the patients attended the Centre weekly in the first year and monthly in the second year and often brought

contacts with them, especially ill contacts. The contacts were encouraged to attend the Centre for all their medical conditions rather than to go to hospitals or private practitioners and also to come with their domestic and employment problems; the great majority availed themselves of the facilities offered by the Centre.

Procedure when an abnormality was found at a follow-up examination

When a radiographic abnormality appeared for the first time, whether this was at one of the set examinations or at an extra one, a culture of at least one overnight sputum specimen or a pair of laryngeal swabs was set up. Further full-plate radiographs were ordered as indicated, usually at intervals of less than a month. Sometimes, extra 5 TU and 100 TU tests were also performed. If indicated, a course of non-tuberculous chemotherapy was given.

After the study had been in progress for a few months, it became a matter of routine, when contacts showed changes in tuberculin sensitivity suggesting that a recent infection might have taken place, to take another full-plate radiograph four to six weeks later and at similar intervals for several months before returning to the set routine. In addition, at least one pair of laryngeal swabs was examined. In the case of infants and young children, the health visitor was instructed to visit the contact weekly, or the family was asked to bring the contact to the Centre weekly.

SPECIFIC ANTITUBERCULOSIS TREATMENT

As explained in the earlier report (Andrews et al., 1960), specific antituberculosis chemotherapy was usually not started unless bacteriological confirmation of tuberculosis had been obtained. Exceptions to this general practice were made, however, in the case of young children who were clinically ill or where lesions showed rapid progression radiographically or were large or disseminate.

INDEPENDENT ASSESSMENT OF THE FINDINGS

The procedure followed by Dr J. Frimodt-Møller, the independent assessor, was set out in detail in the earlier report (Andrews et al., 1960). The present assessment, which was also undertaken by Dr Frimodt-Møller, defines the attack rates for the second year, and, incidentally, revises the figures for the prevalence and attack rate of tuberculosis in the

first year (already reported by Andrews et al., (1960)) in the light of the new information. It will be appreciated that radiographic series called normal in the first year, when supplemented by the radiographs taken in the second year, might be reclassified either as having shown tuberculous lesions at the prevalence survey, or as having shown the development of tuberculous lesions in the first year. There was also a possibility that the assessor, when given the information for the second year, might decide that contacts whom he had regarded as developing tuberculosis in the first year had, in fact, not had a tuberculous lesion. It was also possible that with the new information he would be able to reclassify the doubtfully tuberculous lesions which appeared in the first year as either definitely tuberculous or definitely non-tuberculous.

As in the earlier assessment, the assessor was unaware throughout of whether the contact under review was related to a patient originally treated at home or to one originally treated in sanatorium. He proceeded in the following manner:

1. He first reviewed certain of his assessments for the *prevalence survey* (Andrews et al., 1960), namely:

(a) The four contacts with doubtfully tuberculous lesions.

(b) The 11 contacts with inactive tuberculosis.

(c) The two contacts with tuberculosis of doubtful activity.

For this review the assessor scrutinized the complete radiographic series up to two years.

2. He then viewed the complete radiographic series of all the contacts in whom he had previously reported (Andrews et al., 1960) active tuberculosis (32 contacts) or doubtfully tuberculous lesions (six contacts) in the first year.

3. He then viewed all the remaining series of radiographs (except those for contacts with active tuberculosis at the prevalence survey) to determine the cases of tuberculosis in the second year and to see whether there were any contacts who, in the light of the information available in the second year, should be added to the cases in the prevalence survey or to the cases of definite tuberculosis developing in the first year.

For these contacts he first viewed the radiograph taken on admission of the index case to treatment, the radiograph at 12 months and all those taken in

the second year, and classified each series as normal or abnormal. (Radiographs taken in the first year were available, on request, to the independent assessor.) He subsequently reviewed all the series in which he had noted an abnormality and classified them as follows:

- (1) normal;
- (2) non-tuberculous abnormality;
- (3) doubtfully tuberculous abnormality;
- (4) active tuberculosis;
- (5) tuberculous calcification.

The assessor was then presented with certain series for further assessment in the light of the relevant bacteriological, clinical, pathological and tuberculin-test data. The contacts for further assessment fell into five clearly defined groups:

(a) Those contacts who yielded tubercle bacilli on culture in the second year, if not already classified as active tuberculosis (three contacts).

(b) Those diagnosed as developing active tuberculosis or doubtfully tuberculous lesions in the second year, but in whom only negative cultures were obtained from the time of diagnosis until the end of the 2-year period (three contacts).

(c) All those in whom the diameter of induration to 5 TU was 7 mm or less on admission and increased by 10 mm or more at any time in the two years, if not already diagnosed by the independent assessor as having a tuberculous lesion (87 contacts).

(d) Those for whom there were relevant clinical data in the second year, including evidence of extrapulmonary tuberculosis (22 contacts).

(e) Those who died from any cause during the second year (21 contacts).

4. The assessor reviewed the radiographic series of all the newborn contacts in the 2-year period (53 contacts).

5. Finally, for the extra cases of active tuberculosis added to those occurring in the first year and for the cases of active tuberculosis occurring in the second year, he described the first lesion, each subsequent abnormality and the maximal extent, dating each lesion. He briefly summarized the course of each case.

II. RESULTS

POPULATION UNDER STUDY

As a result of the present assessment there were certain minor changes in the reported prevalence of tuberculosis and in the attack rate of tuberculosis in the first year. The assessor was also able to come to a definite decision on the nature of four of the six doubtfully tuberculous abnormalities arising in the first year (Andrews et al., 1960). The position is summarized in Tables 1 and 2, which set out the figures which were given in the earlier report and the revised figures from the present assessment.

Revised number of cases of tuberculosis in the prevalence survey

The assessor identified three more cases of active tuberculosis at the prevalence survey (Table 1) but made no other alteration. (The revised prevalence findings are summarized in Appendix 1, Table A.) The population at risk of contracting tuberculosis during the first year (defined as those close family contacts who had a normal radiograph, a non-tuberculous abnormality or tuberculous calcification at the prevalence survey) was thereby reduced from 609 to 606.

Revised number of cases of tuberculosis developing in the first year

In the earlier report the findings for the families in which the only infectious member at the prevalence survey was the index case ("single-infection families") were presented separately from the analyses for the families with one or more infectious members *in addition* to the index case ("multiple-infection families"). This permitted a pure comparison between the close family contacts of a single infectious case who had not been segregated from the family and the close family contacts of a single infectious case who had been segregated in sanatorium. In the earlier report 532 of the 609 contacts at risk were classed as being in single-infection families (Table 1); the revised figures for the present report are 530 contacts (256 home, 274 sanatorium) of the total of 606 (Table 2). The revised figure for contacts in multiple-infection families is 76 (40 home, 36 sanatorium), instead of 77.

As a result of the present assessment, the numbers of cases of active tuberculosis which arose during the first year in the single-infection families became nine home and 18 sanatorium contacts (Table 2); the

numbers were nine home and 17 sanatorium contacts in the earlier report (Andrews et al., 1960). The assessor added two cases of active tuberculosis (one home, one sanatorium) and removed one (home) in the light of the subsequent radiographic appearances; this last contact (No. T 1629 in Appendix 1, Table A, of Andrews et al. (1960)) was reclassified as having had a non-tuberculous abnormality.

There was a reduction of one in the number of cases of active tuberculosis in the multiple-infection families (Table 2); a home contact (No. T 0368 in Appendix 1, Table E, of Andrews et al. (1960)) was reclassified as having had a non-tuberculous abnormality.

Population at risk for the second year

In the single-infection families, as already explained, the revised population at risk during the first year was 256 home and 274 sanatorium contacts (Table 2). After excluding the contact who developed the doubtfully tuberculous abnormality, the cases of active tuberculosis and the non-tuberculous deaths in the first year, the population at risk of contracting tuberculosis during the second year was 239 home and 255 sanatorium contacts. For the multiple-infection families the corresponding figures were 34 and 36.

TABLE 1
PREVALENCE FINDINGS IN THE EARLIER REPORT
AND REVISED FIGURES FOR THE PRESENT REPORT

	Original figures (earlier report)	Revised figures (present report)
Total close family contacts	693	693
No initial radiograph	21	21
Doubtfully tuberculous abnormality, present initially	4	4
Activetuberculosis, present initially	46	49
Tuberculosis of doubtful activity, present initially	2	2
Inactive tuberculosis, present initially	11	11
Population at risk in the first year:	609	606
(1) In single-infection families ^a	532	530
(2) In multiple-infection families ^a	77	76

^a For definition, see text opposite.

TABLE 2
 NUMBER OF CASES OF TUBERCULOSIS IN THE FIRST YEAR
 (BOTH FOR THE EARLIER REPORT AND AS REVISED FOR THE PRESENT REPORT)
 AND POPULATION AT RISK IN THE SECOND YEAR

		Original figures (earlier report)		Revised figures (present report)	
		home contacts	sanatorium contacts	home contacts	sanatorium contacts
Single- infection families ^a	Population at risk in the first year	257	275	256	274
	Doubtfully tuberculous abnormality	4	1	1	0
	Active tuberculosis	9	17	9	18
	Non-tuberculous death	7	1	7	1
	Population at risk in the second year			239	255
Multiple- infection families ^a	Population at risk in the first year	40	37	40	36
	Doubtfully tuberculous abnormality	1	0	1	0
	Active tuberculosis	6	0	5	0
	Non-tuberculous death	0	0	0	0
	Population at risk in the second year			34	36

^a For definition, see text (page 133).

The results which follow relate almost exclusively to the 256 home and 274 sanatorium contacts in the single-infection families. The results for the multiple-infection families are presented separately on pages 140 and 141.

COMPARABILITY OF THE TWO GROUPS

Before comparing the attack rates of tuberculosis in the two groups of contacts in the course of the two years, it is necessary (a) to verify that, as a result of the random allocation process, the two groups were similar initially and (b) to determine whether the two groups were investigated with equal intensity by radiography, tuberculin testing and bacteriology during the two years. It was shown in the earlier report that the two groups of contacts were, in fact, similar initially in respect of a number of characteristics—namely, age, sex, family size, results of the initial radiographic examination and results of the initial tuberculin tests. It was also shown that the intensity of investigation by radiography, tuberculin

testing and bacteriology was similar for the two groups during the first year. It is therefore necessary here only to investigate whether the intensity of investigation of the two groups was similar in the second year.

Intensity of radiographic examination during the second year

Table 3 gives the percentages of home and sanatorium contacts who had radiographs taken at each of the six set examinations during the two years, i.e., at three, six, nine, 12, 18 and 24 months. (The figures for the first year are included in Table 3 because of the importance of the radiographic assessments.) A high coverage was maintained at all the set examinations. The percentages were particularly high at 12 and at 24 months, being 92.8% for the home contacts and 94.8% for the sanatorium contacts at 12 months, and 92.7% and 95.2%, respectively, at 24 months. There was very little difference in the coverage for the two groups.

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

	Months after initial examination	Home contacts		Sanatorium contacts	
		total surviving contacts	radio-graphed	total surviving contacts	radio-graphed
			No. %		No. %
First year ^a	3	252	231 91.7	274	250 91.2
	6	250	219 87.6	273	237 86.8
	9	250	217 86.8	271	241 88.9
	12	249	231 92.8	271	257 94.8
Second year ^b	18	235	214 91.1	251	212 84.5
	24	234	217 92.7	251	239 95.2

^aNumber of contacts eligible for the attack (population at risk): 256 home, 274 sanatorium.

^bNumber of contacts eligible for the attack (population at risk): 239 home, 255 sanatorium.

The first section of Table 4 sets out, for the contacts in the home and sanatorium groups, the total number of radiographs taken during the course of the second year (subsequent to the radiograph at 12 months), whether these were taken at the set examinations (18 and 24 months) or were extra radiographs. Over half of the contacts—namely, 53.6% of the home and 54.1% of the sanatorium contacts—had two radiographs; just under 12% of each group had one or no radiograph and approximately a third of the contacts in each group had three or more radiographs. The average number of radiographs was 2.4 for the home and 2.3 for the sanatorium contacts. It may be concluded that the intensity of radiographic examination during the second year was very similar for the two groups.

Intensity of bacteriological investigation during the second year

The numbers of cultures for tubercle bacilli in the two groups are also set out in Table 4. The majority of the contacts—namely, 82.8% of the home and 84.3% of the sanatorium contacts—had no bacteriological investigations in the course of the second year. A further 11.3% of the home and 12.5% of the sanatorium contacts had one or two cultures examined; only 3.3% of the home and 2.0% of the sanatorium contacts had four or more cultures. The average number of cultures, for those contacts who had one or more culture examinations, was 2.3 for the home

TABLE 4
INTENSITY OF EXAMINATION OF THE HOME AND SANATORIUM CONTACTS DURING THE SECOND YEAR

	Home contacts		Sanatorium contacts	
	No.	%	No.	%
Number of radiographic examinations	0	10 4.2	12	4.7
		18 7.5	18	7.1
	2	128 53.6	133	54.1
	3	51 21.3	62	24.3
	4	21 8.8	16	6.3
	5 or more	11 4.6	9	3.5
Average number of radiographs	2.4		2.3	
Number of culture examinations	0	198 82.8	215	84.3
	1	21 8.8	22	8.6
	2	6 2.5	10	3.9
	3	6 2.5	3	1.2
	4 or more	8 3.3	5	2.0
Average number of cultures ^a	2.3		2.0	
Number of 5 TU tests	0	65 27.2	73	28.6
	1	72 30.1	89	34.9
	2	80 33.5	67	26.3
	3	18 7.5	25	9.8
	4	4 1.7	1	0.4
Average number of tests	1.3		1.2	
Total	239 100.0		255 100.0	

^aFor those contacts with one or more examinations.

and 2.0 for the sanatorium contacts. Further analyses (not tabulated here) showed that the distributions of sputum cultures and of laryngeal swab cultures were also similar in the two groups.

Intensity of tuberculin testing during the second year

The numbers of 5 TU tests performed in the second year are set out in the lowest section of Table 4. The majority of the contacts in both groups—namely, 63.6% of the home and 61.2% of the sanatorium contacts—had one or two tuberculin tests during the year; a further 27.2% and 28.6%, respectively, had no tuberculin tests. No contact in either group had

TABLE 5
 CASES OF ACTIVE TUBERCULOSIS IN HOME AND SANATORIUM CONTACTS, ACCORDING TO INTERVAL
 BETWEEN ENTRY TO THE STUDY AND EARLIEST RADIOGRAPHIC OR CLEAR-CUT CLINICAL MANIFESTATION
 OF THE ILLNESS

Diameter of induration to initial 5 TU test (mm)	Contact group	First year						Second year					
		population at risk ^a	total cases		interval between entry to the study and start of the illness (to the nearest month)				population at risk ^a	total cases		Interval between entry to the study and start of the illness (to the nearest month)	
			No.	%	1-3	4-6	7-9	10-12		No.	%	13-18	19-24
0-4	Home	86	6	7.0	3	0	3	0	72	0	0.0	0	0
	Sanatorium	87	6	6.9	6	0	0	0	81	0	0.0	0	0
5 or more	Home	159	3	1.9	1	1	1	0	156	3	1.9	3	0
	Sanatorium	178	12	6.7	8	2	0	2	165	4	2.4	2	2

^a There were 20 contacts (11 home, nine sanatorium) for whom no initial 5 TU test results were available; none developed tuberculosis during the two years.

more than four tuberculin tests. The average number of tests was 1.3 for the home and 1.2 for the sanatorium contacts.

In summary, the groups of home and sanatorium contacts were similar initially and were studied with very similar intensity, not only in the first year but also in the second year.

ATTACK RATE OF TUBERCULOSIS AMONG THE CONTACTS

The attack rates of tuberculosis for the home and sanatorium contacts are given in Table 5 separately for the first and for the second year. The contacts are divided into those with indurations to the initial 5 TU tests of 0-4 mm and 5 mm or more. This division was adopted because "it seems likely that in this group of contacts, as with the index cases, an induration of 5 mm or more to the 5 TU test was indicative of tuberculous infection" (Andrews et al., 1960). Considering the contacts with diameters of induration of 0-4 mm, six (7.0 %) of 86 home contacts developed a tuberculous lesion in the first year compared with six (6.9 %) of 87 sanatorium contacts. During the second year there was no case among either the 72 home or the 81 sanatorium contacts at risk. The cases of tuberculosis among these contacts with indurations of 0-4 mm were thus confined to the first year and, moreover, were concentrated in the first three months, in which nine of the 12 cases occurred. Considering the contacts with indurations of 5 mm or more, there were three (1.9 %) cases in 159 home contacts at risk in the first year compared with 12 (6.7%) in 178 sanatorium contacts. New

cases of tuberculosis continued to appear in the second year; three (1.9 %) of 156 home compared with four (2.4%) of 165 sanatorium contacts developed the disease. Thus, the initially tuberculin-positive contacts continued to be a source of cases in the second year.

It was pointed out in the earlier (1960) report that it was very likely that the negative reactors to 5 TU initially who developed tuberculosis in the first three months of the follow-up (three home, six sanatorium) had already been infected by the index cases before the start of treatment, especially since the sanatorium contacts had been removed from contact when treatment for the index case was started. It is also likely that the positive reactors to tuberculin who developed lesions in the first three months (one home, eight sanatorium) were also incubating the disease when the index cases started treatment. In all likelihood, 18 (67 %) of the 27 cases in the first year were related to contact with the infectious index case in the period immediately before the start of treatment.

In the home and sanatorium groups combined, 20 (74 %) of the 27 contacts who developed active tuberculosis in the first year were under the age of seven years on admission, 14 (52%) being under three years. In the second year, three of the seven contacts who developed tuberculosis were under seven years of age on admission, but none was under three years.

The details of the cases of active tuberculosis in the first year previously observed by the independent assessor were summarized in Appendix 1, Tables A to D, of Andrews et al. (1960). In the present report,

TABLE 6
FORMS OF THE ACTIVE TUBERCULOUS LESIONS DEVELOPING DURING THE TWO YEARS IN THE HOME
AND SANATORIUM CONTACTS

Contact group	All active tuberculous lesions	Adult-type disease	Primary and 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	12	2	10	1	0	1	4	2	2 ^a
Sanatorium	22	5 ^b	17	2 ^c	2	0	11 ^d	2	0

^a One tuberculin conversion with a positive sputum culture and a doubtfully tuberculous abnormality on radiography: one upus verrucosus cutis.

^b Includes one case with an intrapulmonary lesion and a pleural effusion.

^c Both with a pulmonary lesion.

^d Includes one case with spinal tuberculosis and one with a lobar lesion and pleural effusion.

Appendix 2, Table B, gives the details of the two contacts (one home, one sanatorium) added to the number of cases in the first year as a result of the recent reassessment, and Appendix 2, Tables C and D, give the details of all the cases appearing in the second year. Considering the time of onset of grave lesions, there were three cases of tuberculous meningitis, one (sanatorium) in the first year and two (one home, one sanatorium) in the second year, and two cases of miliary tuberculosis (both sanatorium), both in the first year.

Table 6 sets out the forms of all the 34 active tuberculous lesions that developed during the two years. In all, seven cases (two home, five sanatorium) were classified as adult-type disease and the remaining 27 (10 home, 17 sanatorium) as primary or post-primary type disease. The latter included the three cases of tuberculous meningitis (two of which had a pulmonary lesion also), the two cases of miliary pulmonary tuberculosis, a pleural effusion (home) and 15 cases (four home, 11 sanatorium) classified as progressive primary disease; of the last-mentioned 15 contacts, one had a tuberculous spine and another had a pleural effusion. Only four cases (two home, two sanatorium) were classified as simple primary tuberculosis. One home contact, whose occupation brought him into contact with hides, had lupus verrucosus cutis, and another home contact had a positive sputum culture but only a doubtfully tuberculous radiographic abnormality. In summary, the majority of the lesions were primary or post-primary in type, many were progressive, and a number serious.

There were six contacts who yielded positive diagnostic cultures, four in the first year and two in

the second. The results of tests of sensitivity to streptomycin were available for four and to isoniazid for five of these cases. All were sensitive to streptomycin but two were resistant to isoniazid. Because of the difficulty of interpreting PAS-sensitivity tests encountered at the Centre (Selkon et al., 1960; Tuberculosis Chemotherapy Centre, 1960), the results are not reported here.

The distribution by age and sex of all the cases of active tuberculosis that developed in the 2-year period is shown in Table 7. Fig. 1 gives the findings for the home and sanatorium contacts separately and Fig. 2 for the males and females separately. Five of

FIG. 1

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

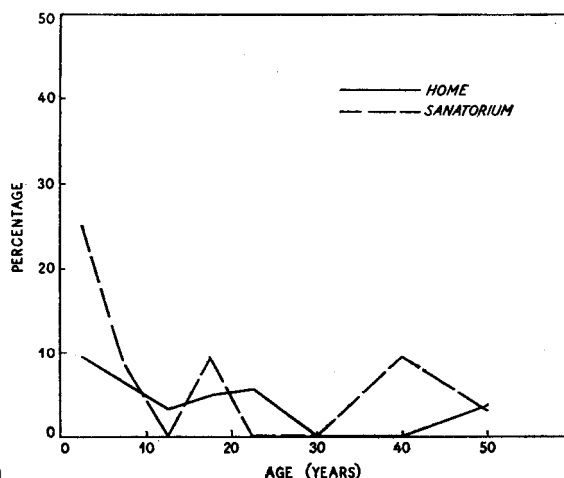
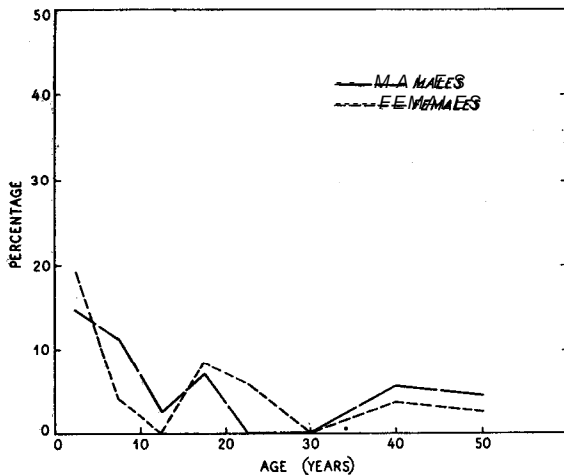


FIG. 2
ATTACK RATE OF TUBERCULOSIS DURING THE
TWO YEARS IN THE CONTACTS, ACCORDING TO
SEX AND AGE



the home and 12 of the sanatorium contacts were children under the age of five years, representing attack rates during the 2-year period of 9.4% for the 53 home and 25.0% for the 48 sanatorium contacts. In the age-group 5-9 years, three (6.4%) of the 47 home contacts and four (8.5%) of the same number of sanatorium contacts developed active tuberculosis. There were fewer cases in the older age-groups, but four occurred in the group aged 15-19 years and four in the group aged 35 years or more. Seven of the 12 cases in the home contacts and 11 of the 22 in the sanatorium contacts were males.

The incidence of active tuberculosis according to the diameter of induration to the initial 5 TU test is given in Table 8 and Fig. 3. Of those contacts with an induration of 0-4 mm initially, six (7.0%) of the 86 home and six (6.9%) of the 87 sanatorium contacts developed active tuberculosis in the 2-year period. In the 5-7 mm group there were three cases (6.5%) among 46 home and also three (7.7%) among 39 sanatorium contacts. Among those with indurations of 8 mm or more to the initial 5 TU test, three (2.7%) of 113 home contacts and 13 (9.4%) of 139 sanatorium contacts developed active tuberculosis. The attack rates in the contact groups were thus similar for those with indurations of less than 8 mm to the initial 5 TU test, while for those with indurations of 8 mm or more, the attack rate was higher among the sanatorium contacts than among the home contacts.

TABLE 7
ATTACK RATE OF TUBERCULOSIS DURING THE
TWO YEARS IN THE HOME AND SANATORIUM
CONTACTS, ACCORDING TO AGE AND SEX

Sex	Estimated age on admission (years)	Number of contacts in the comparison		Contacts who developed active tuberculosis			
		home	sanatorium	home		sanatorium	
				No.	%	No.	%
Both sexes	0-4	53	48	5	9.4	12	25.0
	5-9	47	47	3	6.4	4	8.5
	10-14	32	37	1	3.1	0	0.0
	15-19	20	32	1	(5.0) ^a	3	9.4
	20-24	15	20	1	(6.7)	0	(0.0)
	25-34	37	37	0	0.0	0	0.0
	35 or more	52	53	1	1.9	3	5.7
Total		256	274	12	4.7	22	8.0
Male	0-4	34	20	4	11.8	4	(20.0)
	5-9	22	23	2	(9.1)	3	(13.0)
	10 or more	74	91	1	1.4	4	4.4
Female	0-4	19	28	1	(5.3)	8	28.6
	5-9	25	24	1	4.0	1	(4.2)
	10 or more	82	88	3	3.7	2	2.3

^a Percentages based on fewer than 25 observations are enclosed in parentheses, as an indication of the small totals.

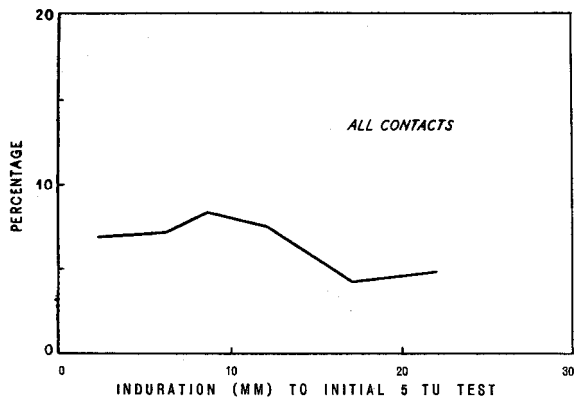
TABLE 8
ATTACK RATE OF TUBERCULOSIS DURING THE
TWO YEARS IN THE HOME AND SANATORIUM
CONTACTS, ACCORDING TO INDURATION TO THE
INITIAL 5 TU TEST

Diameter of induration to initial 5 TU test (mm)	Number of contacts in the comparison		Contacts who developed active tuberculosis			
	home	sanatorium	home		sanatorium	
			No.	%	No.	%
0-4	86	87	6	7.0	6	6.9
5-7	46	39	3	6.5	3	7.7
8-9	24	24	1	(4.2) ^a	3	(12.5)
10-14	39	55	1	2.6	6	10.9
15-19	24	24	0	(0.0)	2	(8.3)
20 or more	26	36	1	3.8	2	5.6
Total	245	265	12	4.9	22	8.3

^a Percentages based on fewer than 25 observations are enclosed in parentheses, as an indication of the small totals.

FIG. 3

ATTACK RATE OF TUBERCULOSIS DURING THE TWO YEARS IN THE CONTACTS, ACCORDING TO INDURATION TO THE INITIAL 5 TU TEST



DOUBTFULLY TUBERCULOUS LESIONS DEVELOPING DURING THE TWO YEARS

In the earlier report the assessor classified five contacts (four home, one sanatorium) as having had doubtfully tuberculous lesions in the first year; it was suggested in that report that a longer period of follow-up might clarify the diagnoses. At the present reassessment, the assessor decided in the light of a longer period of observation that four (three home, one sanatorium) of the five doubtfully tuberculous lesions were non-tuberculous; there remains a male (home) aged nine years (Andrews et al., 1960) as the only contact with a doubtfully tuberculous lesion presenting in the first year. In the second year the assessor reported one doubtfully tuberculous abnormality, in a female contact (sanatorium) who was aged four years on admission.

NON-TUBERCULOUS PULMONARY LESIONS DEVELOPING DURING THE TWO YEARS

At the present reassessment, the assessor reported 16 (6.2%) non-tuberculous abnormalities in the home contacts in the first year and 16 (5.8%) in the sanatorium contacts; the corresponding findings for the second year were nine (3.8%) and five (2.0%), respectively.

CRITERIA OF TUBERCULIN CONVERSION

Since it is difficult to be certain when conversion from tuberculin insensitivity to tuberculin sensitivity has occurred, and in view of the many technical variations in tuberculin tests, the results of the tuberculin tests have been analysed in several ways.

The principal definition of conversion from tuberculin insensitivity to sensitivity used in the study is an increase in induration of at least 10 mm to any 5 TU test, from an initial induration of 0-4 mm, an induration which, in this study (Andrews et al., 1960), apparently indicates that the contact has not acquired sensitivity to tuberculin as a result of tuberculous infection. A second, and slightly less restrictive, definition is an increase of 8 mm or more at any subsequent 5 TU test, from an initial induration of 0-4 mm. A subsidiary approach adopted has been to identify the two groups of contacts who had an induration of 5-7 mm to the initial 5 TU test and who showed an increase in induration of 10 mm or more or an increase of 8 mm or more to any later 5 TU test.

INCIDENCE OF TUBERCULIN CONVERSION DURING THE TWO YEARS

It was shown in the earlier report that, during the first year, the incidence of tuberculin conversion was very similar for the home and sanatorium groups. Thus, by the 10 mm definition, the proportions of conversions in the contacts with initial indurations of 0-4 mm were 23.3% for the home and 21.8% for the sanatorium contacts, and by the 8 mm definition, the proportions of conversions were 27.9% for the home and 26.4% for the sanatorium contacts. The corresponding proportions for the contacts with initial indurations of 5-7 mm were 32.6% and 33.3%, respectively, by the 10 mm criterion, and 45.7% and 46.2% by the 8 mm criterion (Andrews et al., 1960). Table 9 presents the corresponding data for the full 2-year period. It will be seen that 29.1% of 86 home and 33.3% of 87 sanatorium contacts with small initial indurations showed tuberculin conversion by the 10 mm criterion during the 2-year period and 36.0% and 36.8%, respectively, showed tuberculin conversion by the 8 mm criterion. Considering the contacts with initial indurations of 5-7 mm, the conversions by the 10 mm criterion were 45.7% for the home and 51.3% for the sanatorium contacts, and, by the 8 mm criterion, 56.5% for the home and 64.1% for the sanatorium contacts. It may be concluded that the incidence of tuberculin conversion, as indicated by the criteria adopted, was very similar in the two groups both for the first year and for the second; the majority of the conversions occurred in the first year.

DEATHS DURING THE TWO YEARS

All the deaths in the 2-year period were reviewed by the independent assessor, who was provided with

TABLE 9
INCIDENCE OF TUBERCULIN CONVERSION DURING THE TWO YEARS IN THE HOME AND SANATORIUM CONTACTS, ACCORDING TO AGE

Diameter of induration to initial 5 TU test (mm)	Estimated age on admission (years)	Total contacts		Contacts in whom the induration to any later 5 TU test exceeded the initial induration by:							
				10 mm or more				8 mm or more			
		home	sanatorium	home		sanatorium		home		sanatorium	
				No.	%	No.	%	No.	%	No.	%
0-4	0-4	43	41	6	14	14	34	8	19	16	39
	5-14	27	36	10	37	10	28	11	41	11	31
	15-24	5	4	2	(40) ^a	3	(75)	3	(60)	3	(75)
	25 or more	11	6	7	(64)	2	(33)	9	(82)	2	(33)
	Total	86	87	25	29.1	29	33.3	31	36.0	32	36.8
5-7	0-4	4	2	2	(50)	0	(0)	2	(50)	1	(50)
	5-14	12	6	4	(33)	5	(83)	7	(58)	5	(83)
	15-24	11	10	5	(45)	5	(50)	6	(55)	8	(80)
	25 or more	19	21	10	(53)	10	(48)	11	(58)	11	(52)
	Total	46	39	21	45.7	20	51.3	26	56.5	25	64.1

^a Percentages based on fewer than 25 observations are enclosed in parentheses, as an indication of the small totals.

all the available data and the fullest possible details of the course of the terminal illness.

In the first year seven home and three sanatorium contacts died, two (both sanatorium) from tuberculosis which had developed during the year. In the second year there were 10 deaths, six in the home and four in the sanatorium contacts. Of these, one was due to tuberculosis; this was in a home contact who had presented with tuberculous meningitis in the fifteenth month. The remaining nine deaths were regarded as non-tuberculous by the independent assessor.

BIRTHS DURING THE TWO YEARS

There were 12 births in the home and six in the sanatorium families in the first year. Of the newborn in the home families one died in the first year, at the age of five months, and one in the second year, at the age of nine months, both from non-tuberculous conditions. Of the remaining 10, nine were radiographed at two years; the radiographs were normal. None of the newborn in the sanatorium families died in the first year but one died in the second year, at the age of 13 months, also from a non-tuberculous condition. Of the remaining five, three were radio-

graphed at two years and had normal radiographs.

There were 14 births in the second year in the home and 14 in the sanatorium families. One of the newborn in the home families died at the age of eight days. Of the surviving 13, 11 were radiographed at two years and all the radiographs were normal. Of the 14 newborn in the sanatorium families two died from non-tuberculous conditions at the ages of two months and three months, respectively. Ten of the 12 survivors were radiographed at two years; all the radiographs were normal.

ATTACK RATE OF TUBERCULOSIS IN THE FAMILIES WITH MORE THAN ONE INFECTIOUS MEMBER INITIALLY

As a result of the recent reclassification, 22 families containing a total of 76 contacts (40 home, 36 sanatorium) with no initial evidence of tuberculosis (apart from calcification in four cases) were excluded from the above comparison of the attack rates of tuberculosis and the incidence of tuberculin conversion because each had one or more members, in addition to the index case, excreting tubercle bacilli at the prevalence survey. This section presents briefly the findings in these contacts.

In the first year, five of the 40 home contacts developed active tuberculosis, three being initially tuberculin-positive and two tuberculin-negative. In the light of information in the second year, a sixth contact (No. T 0368 in Appendix 1, Table E, of Andrews et al. (1960)) was regarded by the assessor as having had a vascular abnormality. There were no cases of tuberculosis in the first year in the 36 sanatorium contacts. In the second year, none of the 34 home contacts at risk developed tuberculosis, compared with one of the 36 sanatorium contacts (see Appendix 2, Table E, page 148).

One contact (home) developed a doubtfully tuberculous lesion in the first year but none developed such a lesion in the second 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. By the end of the first year, one of the former and three of the latter had an increase in induration of 10 mm or more; the numbers who had an increase of 8 mm or more were the same. In the second year, only one contact (sanatorium) had converted, and by both definitions. Considering the contacts with an induration of 5-7 mm to the initial 5 TU test, one of 10 home contacts had an increase of 8 mm and one of four sanatorium contacts had an increase of 10 mm

in the first year. In the second year, two further home and one further sanatorium contact had converted both by the 8 mm and by the 10 mm definition.

There were two deaths (one home, one sanatorium) in the two years; both were classified as non-tuberculous.

In this subgroup of 22 families there was one birth (sanatorium) in the first year and six births (four home, two sanatorium) in the second year. One of the latter (home) died at the age of 3 days; none of the others showed evidence of tuberculosis up to the end of the second year.

DEATHS OF CONTACTS EXCLUDED FROM THE STUDY OF THE ATTACK RATE OF TUBERCULOSIS

In the first year, there was one death among the 21 contacts with no initial radiographic examination and five among the 63 contacts with tuberculous lesions initially (Andrews et al., 1960). In the second year, there were no further deaths among the contacts with no initial radiograph. Three contacts (all home) with abnormalities at the prevalence survey died; one had been classified initially as having active tuberculosis and two as having doubtfully tuberculous lesions. None of these deaths was regarded by the assessor as being due to tuberculosis.

III. DISCUSSION

The present report gives further information on the attack rate of tuberculosis among the close family contacts of patients with newly diagnosed infectious pulmonary tuberculosis, drawn from a poor and overcrowded section of a large urban community in South India.

Half the index cases, chosen at random, were treated with standard chemotherapy for a year in sanatorium, and the other half received the same chemotherapy for a year, but at home (Tuberculosis Chemotherapy Centre, 1959), so that the contacts were divided, as a result of this random process, into "home contacts" and "sanatorium contacts". The attack rate of tuberculosis in the first year has already been reported (Andrews et al., 1960). In the present report, the attack rate has been studied over a 2-year period, all the patients in both series living at home in the second year, and more than half receiving further antituberculosis chemotherapy. Since the aim was to study the attack rate of tuber-

culosis, the contacts were given neither BCG vaccination nor chemoprophylaxis. Instead, they were followed by an intensive routine of supervision.

The main home and sanatorium contact groups, which numbered 256 and 274, respectively, were similar at the time of diagnosis of the index cases and were studied with similar intensity by radiography, tuberculin testing and bacteriology, both in the first year and in the second year. A high coverage was obtained at the four set radiographic examinations in the first year and at the two set radiographic examinations in the second year; thus, 93.8 % of the surviving contacts were examined at one year and 94.0 % at two years. Many of the contacts had additional radiographic examinations. The information on the attack rate of tuberculosis in each year is therefore based on comprehensive radiographic information. In order to avoid bias, the attack rates of tuberculosis have been based on assessments of the radiographic series and other relevant data made by an observer

who was unaware of whether any contact under review was related to a home or to a sanatorium patient.

As pointed out in the earlier report (Andrews et al., 1960), the sanatorium contacts were exposed to the risk of contracting tuberculosis from two sources - from the index case before the diagnosis of the tuberculosis had been made and before the case had been segregated in sanatorium (practically all the patients were non-infectious when discharged from sanatorium at the end of the first year) and from some other source in the urban community in which the family lived. The home contacts were exposed to both these risks and, *in addition*, to the risk of continued contact with the index case. The Z-year follow-up gives information on the relative importance of these three sources of infection. In 18 of the total of 34 home and sanatorium contacts who developed tuberculosis in the Z-year period, the lesions became apparent during the first three months of observation. These 18 included all six of the cases among the sanatorium contacts who were tuberculin-negative initially, the index case having been segregated within a few days of this finding. This strongly suggests that these 18 contacts had already been infected and were incubating the disease when the index case started treatment, although the disease (and, in the tuberculin-negative contacts, even sensitivity to tuberculin) only became manifest afterwards. Thus, the main risk of tuberculosis among the contacts in this study was from exposure to the index case before treatment had begun. Of the 12 tuberculin-negative contacts who developed tuberculosis in the 2-year period, nine did so in the first three months, and no contact, home or sanatorium, developed tuberculosis in the last 15 months of the period - an observation which suggests that in this study neither the environment nor, for the home contacts, the continued contact with the index case in the first year was a source of much risk to the tuberculin-negative contacts. The initially tuberculin-positive contacts were a source of cases in both years; in the first year three (1.9%) of the home and 12 (6.7%) of the sanatorium contacts developed active tuberculosis, and in the second year three (1.9%) of the home and four (2.4%) of the sanatorium contacts developed tuberculous lesions. There were grave lesions in both years, for in the first year there were two cases of miliary tuberculosis and one case of tuberculous meningitis (all in sanatorium contacts) and in the second year two cases of tuberculous meningitis, one in each group. Twenty of the 27 cases which developed in the first year were in

contacts under the age of seven years on admission, as were three of the seven cases in the second year. All the grave lesions were in young contacts.

The earlier report (Andrews et al., 1960) discussed the possible value of giving antituberculosis chemoprophylaxis to all young household contacts of newly diagnosed sputum-positive patients living in overcrowded urban conditions, even if the contacts have normal radiographic appearances, whether they are tuberculin-negative or tuberculin-positive, and whether the index case is segregated in sanatorium or treated at home. The findings over the 2-year period confirm the scope which exists for chemoprophylaxis to prevent substantial numbers of cases of tuberculosis, some of them serious. Studies of the role of chemoprophylaxis in close family contacts would be clearly valuable. The scope for BCG among such contacts is less clear when the patients are either isolated in sanatorium on diagnosis or are given *effective* chemotherapy at home. In this comparatively small *family contact group* over only a 2-year period there would have been little scope for BCG to demonstrate its protective value, because there were so few cases after the first three months of follow-up among the initially tuberculin-negative contacts.

The policy in this study was to make the primary serial assessment of the contact radiographic, and tuberculin testing was a subsidiary measure which was not undertaken on all the contacts at regular intervals. For this reason, conversions from tuberculin insensitivity to tuberculin sensitivity (defined for the purpose of this study in several ways, the principal definition being an increase in the diameter of induration of 10 mm or more from an initial induration of 0.4 mm) may not have been completely enumerated. The observed incidence of such 10 mm conversions during the 2-year period was similar in the home and sanatorium contacts (29.1% and 33.3%, respectively). Of those conversions the majority (80% and 66%, respectively) occurred in the first year but were not confined to the early months of the year, suggesting that tuberculous infections were occurring from sources outside the family (Andrews et al., 1960).

The follow-up is continuing, with a high rate of response, and the further findings will be reported later. It may, however, already be concluded that, at least for a period of follow-up of two years, no special risk to the contacts resulted from treating the index cases at home with *effective* chemotherapy.

IV. SUMMARY

1. A total of 191 South Indian patients with pulmonary tuberculosis (in a comparison of a year of home and sanatorium chemotherapy) had 693 close family contacts, that is, relatives living, cooking and feeding with them for at least the three months immediately prior to diagnosis.

2. The families were drawn from the lower income groups in Madras city and their living conditions and dietary standards were poor.

3. The contacts were studied to determine the attack rate of tuberculosis during the first two years of a 5-year follow-up.

4. The main comparison was between 256 contacts of 75 patients treated at home and 274 contacts of 73 patients treated in sanatorium, in the families where the only infectious member was the index case. (The index cases had been allocated at random to treatment at home or in sanatorium, all with combined chemotherapy, for a year. In the second year all were treated at home, the patients with active disease at 12 months and half of those with quiescent disease receiving further chemotherapy.)

5. The two contact groups were similar at the start of treatment for the index cases and were followed with equal intensity by radiography, tuberculin testing and bacteriology, both in the first year and in the second year. The coverage by radiographic examination at three, six, nine, 12, 18 and 24 months in the two groups combined was 91%, 87%, 88%, 94%, 88% and 94%, respectively.

6. There were 20 deaths, 13 in the home and seven in the sanatorium contacts. One of the home and two of the sanatorium contacts died of tuberculosis.

7. During the first year active tuberculosis developed in 27 contacts—namely, nine (3.5%) home contacts (six initially tuberculin-negative) and 18 (6.6%) sanatorium contacts (six initially tuberculin-negative). There were no cases among the initially tuberculin-negative contacts in either group in the second year, but there were three (1.9%) in the initially tuberculin-positive home contacts and four (2.4%) in the corresponding group of sanatorium contacts.

8. Of the 34 cases which developed in the 2-year period, 17 were under the age of five years and 24 under the age of 10 years. A number of the lesions were serious and there were three cases of tuberculous meningitis and two of miliary pulmonary tuberculosis.

9. Eighteen (53%) of the cases arose in the first three months. These have all been attributed to infection by the index case *before* the start of treatment, since they included all the six cases in initially tuberculin-negative sanatorium contacts who had been immediately segregated from the index case.

10. Serial tuberculin tests were made during the two years; they did not give evidence of more tuberculous infection in the home than in the sanatorium contacts.

11. The attack rate of tuberculosis in the contacts of the patients treated at home with effective chemotherapy was no greater than that in the contacts of the patients segregated in sanatorium. It is concluded that the major risk to the contacts in this study resulted from exposure to the index case *before* diagnosis and, further, that close family contacts offer scope for the investigation of chemoprophylaxis.

ACKNOWLEDGEMENTS

It would not have been possible to undertake the study reported here without the devoted work of the entire staff—clinical, laboratory, statistical, radiological, secretarial and administrative.

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RÉSUMÉ

Poursuivant l'étude comparée du traitement de la tuberculose en sanatorium et à domicile, et celle de la contagiosité des malades pour leurs contacts, le Centre de Madras publie dans cet article les résultats de l'observation des personnes qui furent en contact étroit avec 191 tuberculeux, durant les deux années qui ont suivi le début du traitement du cas avéré, par les médicaments anti-tuberculeux. Au cours de la deuxième année, tous les cas avérés séjournaient dans leur famille. Tous ceux qui présentaient encore une tuberculose active et la moitié de ceux en quiescence à la fin de la première année ont été soumis à une deuxième année de chimiothérapie.

L'étude a porté sur la recherche des cas de tuberculose parmi ces contacts à la fin de la deuxième année de la période de surveillance, qui doit s'étendre sur 5 ans. La comparaison porta essentiellement sur 256 contacts de 75 malades traités à domicile, et 274 contacts de 74 malades traités en sanatorium, chaque famille n'ayant qu'un seul cas avéré. Les deux groupes à comparer étaient les mêmes au moment où le cas avéré fut traité, et ils furent suivis avec la même attention par des examens radiographiques, tuberculiques et bactériologiques. Durant la première année, 27 contacts présentèrent une tuberculose

active – soit 9 (3,5%) contacts domiciliaires, dont six étaient à l'origine tuberculino-négatifs, et 18 contacts d'hospitalisés, dont 6 étaient à l'origine tuberculino-négatifs. Au cours de la seconde année, aucun cas ne se déclara parmi les contacts tuberculino-négatifs de l'un ou l'autre groupe, mais trois cas apparurent parmi les contacts domiciliaires tuberculino-positifs et quatre parmi les contacts d'hospitalisés tuberculino-positifs. De ces 34 cas, 17 étaient en dessous de 5 ans et 24 en dessous de 10 ans. Parmi eux, il y eut trois méningites tuberculeuses et deux tuberculoses pulmonaires miliaires. Dix-huit des cas survinrent pendant les trois premiers mois. Tous purent être attribués à l'infection par le cas avéré avant le début du traitement. Des tests tuberculiques en série ont été effectués pendant les deux années. Ils ne révélèrent pas un nombre plus grand d'infections tuberculeuses parmi les contacts des malades soignés à domicile que parmi les contacts des malades soignés en sanatorium.

Toutes les données réunies au cours de cette étude s'accordent à montrer que le risque de contagion n'est pas plus élevé pour les contacts des cas traités à domicile que pour les contacts de ceux qui sont traités en sanatorium, quand les malades sont soumis, à la maison, à une chimiothérapie bien conduite.

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APPENDIX 1

Appendix 1, Table A, gives the revised figures for the prevalence of tuberculosis in the contacts according to age and sex after the addition of three cases diagnosed at the reassessment (see page 133). This table supersedes Table 5 of the earlier report (Andrews et al., 1960). In order that the reader can add these three cases to the other tables in the section on prevalence in the earlier report, short notes on them are given hereunder :

Home

1. Female, aged 40 years. Adult-type disease, 1-2 interspaces in extent, without cavitation. Progressive in course. Initial 5 TU test, 30 mm induration. Bacteriological findings in the first year negative; positive culture in the second year.

Sanatorium

1. Male, aged two years. Primary pulmonary lesion, less than 1 interspace in extent. Regressive without treatment, and calcified in the second year. Initial 5 TU test, 17 mm induration. Bacteriological findings in both years negative.

2. Male, aged 11 years. Adult-type disease, 1-2 interspaces in extent. Progressive in course. Initial 5 TU test, 10 mm induration. Bacteriological findings in the first year negative; positive culture in the second year.

TABLE A
REVISED PREVALENCE OF TUBERCULOSIS IN THE CONTACTS, ACCORDING TO AGE AND SEX

Estimated age (years)	Number of contacts with initial radiograph			Contacts with active tuberculosis						Contacts with active, doubtfully active or inactive tuberculosis					
	male	female	total	male		female		total		male		female		total	
				No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0-4	68	63	131	5	7	8	13	13	10	5	7	8	13	13	10
5-9	56	58	114	3	5	2	3	5	4	3	5	3	5	6	5
10-14	53	32	85	2	4	0	0	2	2	3	6	0	0	3	
15-19	33	27	60	0	0	0	0	0	0	0	0	0	0	0	0
20-24	25	22	47	3	12	4	(18) ^a	7	15	3	12	4	(18)	7	15
25-34	43	46	89	0	0	3	7	3	3	1	2	4	9	5	6
35-44	24	35	59	3	(12)	4	11	7	12	5	(21)	6	17	11	19
45-54	18	30	48	4	(22)	5	17	9	19	5	(28)	7	23	12	25
55 or more	18	21	39	3	(17)	0	(0)	3	8	4	(22)	1	(5)	5	13
All ages	338	334	672	23	6.8	26	7.8	49	7.3	29	8.6	33	9.9	62	9.2

^aPercentages based on fewer than 25 observations are enclosed in parentheses, as an indication of the small totals.

APPENDIX 2

Appendix 2, Table B, summarizes the results of the examinations of the two contacts who were added to the number of cases of tuberculosis developing in the first year. Tables C, D and E summarize the findings for the contacts who developed tuberculosis in the second year, Tables C and D referring to the families in which the only source of infection initially was the index case, and Table E to a contact who had one other infectious member initially, in addition to the index case. The dating of the radiographic abnormalities and their descriptions were made by the independent assessor, as were the summaries in the last column.

TABLE B. ADDITIONAL CONTACTS WHO DEVELOPED AN ACTIVE TUBERCULOUS LESION DURING THE FIRST YEAR AND ARE THUS ADDED TO THE FIRST YEAR ATTACK^a
(INDEX CASE WAS ONLY SOURCE OF INFECTION IN THE FAMILY INITIALLY)

Registration numbers of contact (T No.) and of index case (P No.)	Sex and age (years)	Radiographic findings (all early normal and important abnormal radiographs)			Tuberculin-test results			Culture results (sputum and laryngeal swab)				Summary	
		interval from date of start of treatment of the index case (mths)	independent assessment of radiographs			interval from date of start of treatment of the index case (mths)	diameter of induration (mm)		before any chemotherapy for contact ^c		after start of chemotherapy for contact		
			normal or abnormal ^b	type of abnormality	extent (rib inter-spaces)		5 TU	100 TU	No. positive	No. negative	No. positive		No. negative
T 1503 (P 98) (Home)	Female 20	0 4 5 6 9	N N N A	Parenchymal lesion	Less than 1	0 9 2	13 18 15	— — —	0	2	No chemotherapy		Progressive adult-type lesion; regressive without chemotherapy
T 2208 (P 174) (Sanatorium)	Male 2/12	0 2 3 4	N N A M	Parenchymal lesion Parenchymal lesion plus gland	1-2 More than 2	0 2 4 6 9 12	0 0 0 0 7 5	— 0 — — — —	0	5	No chemotherapy		Progressive primary tuberculosis; regressive without chemotherapy; positive culture obtained in the second year

^a See Andrews et al., 1960.^b N=normal; A=first abnormality; M=maximal abnormality.^c By chemotherapy is meant *antituberculosis* chemotherapy.

TABLE C. HOME CONTACTS WITH 5 MM INDURATION OR MORE TO 5 TU INITIALLY WHO DEVELOPED AN ACTIVE TUBERCULOUS LESION DURING THE SECOND YEAR
(INDEX CASE WAS ONLY SOURCE OF INFECTION IN THE FAMILY INITIALLY)

Registration numbers of contact (T No.) and of index case (P No.)	Sex and age (years)	Radiographic findings (early normal and important abnormal radiographs)			Tuberculin-test results			Culture results (sputum and laryngeal swab)				Summary	
		interval from date of start of treatment of the index case (mths)	independent assessment of radiographs			interval from date of start of treatment of the index case (mths)	diameter of induration (mm)		before any chemotherapy for contact ^b		after start of chemotherapy for contact		
			normal or abnormal ^a	type of abnormality	extent (rib inter-spaces)		5 TU	100 TU	No. positive	No. negative	No. positive		No. negative
T 1529 (P 101)	Male 12	0 18 24	N N N			0 18 24	5 18 16	— — —	0	0	No chemotherapy		Lupus verrucosus cutis; onset in the 19th month; diagnosis made at two years with biopsy confirmation
T 1751 (P 115)	Female 62	0-10 12 18	N (4 films) N A	Parenchymal lesion	Less than 1	0 3 10 12 18 24	8 12 15 9 9 9	— — — — — —	0	0	No chemotherapy		Progressive adult-type lesion
T 2186 (P 151)	Male 3	0 12	N N			0 12	7 8	— —	0	0	0	0	Admitted to hospital in the 15th month with advanced tuberculous meningitis and died in the same month; post-mortem confirmation of the diagnosis

^a N=normal; A=first abnormality.^b By chemotherapy is meant *antituberculosis* chemotherapy.

TABLE D. SANATORIUM CONTACTS WITH 5 MM INDURATION OR MORE TO 5 TU INITIALLY WHO DEVELOPED AN ACTIVE TUBERCULOUS LESION DURING THE SECOND YEAR
(INDEX CASE WAS ONLY SOURCE OF INFECTION IN THE FAMILY INITIALLY)

Registration numbers of contact (T No.) and of index case (P No.)	Sex and age (years)	Radiographic findings (early normal and important abnormal radiographs)			Tuberculin-test results			Culture results (sputum and laryngeal swab)				Summary	
		interval from date of start of treatment of the index case (mths)	independent assessment of radiographs			interval from date of start of treatment of the index case (mths)	diameter of induration (mm)		before any chemotherapy for contact ^b		after start of chemotherapy for contact		
			normal or abnormal ^a	type of abnormality	extent (rib inter-spaces)		5 TU	100 TU	No. positive	No. negative	No. positive		No. negative
T 0933 (P 48)	Male 5	0-9	N (4 films) N A	Gland plus parenchymal lesion	1-2	0	15	—	0	2	No chemotherapy		Progressive primary tuberculosis; regressive without chemotherapy
		12				0	0						
		19				12	—						
T 1126 (P 68)	Male 4	0-12	N (8 films) N N A I I M	Paratracheal glands Bilateral paratracheal glands Paratracheal glands Paratracheal glands		0	5	—	0	1+1CSF	0	4	Enlarged paratracheal glands at 18 months; developed tuberculous meningitis within a few days; lumbar puncture confirmation; responder to chemotherapy
		15				5	12						
		17				9	6						
		18				11	13						
		21				18	10						
T 1426 (P 91)	Male 17	0-12	N (5 films) N N A	Parenchymal lesion	Less than 1	0	20	—	3	2	No chemotherapy		Progressive adult-type lesion
		18											
		22											
		24											
T 2520 (P 177)	Female 40	0-9	N (5 films) N A M	Parenchymal lesion Parenchymal lesion	Less than 1 Less than 1	0	30	—	0	0	No chemotherapy		Progressive adult-type lesion
		12				18							
		24											

^a N=normal; A=first abnormality; I=increased abnormality; M=maximal abnormality.

^b By chemotherapy is meant *antituberculosis* chemotherapy.

TABLE E. SANATORIUM CONTACT WHO DEVELOPED AN ACTIVE TUBERCULOUS LESION DURING THE SECOND YEAR, BUT WHO WAS IN CONTACT WITH ANOTHER SOURCE OF INFECTION IN THE FAMILY INITIALLY

Registration numbers of contact (T No.) and of index case (P No.)	Sex and age (years)	Radiographic findings (early normal and important abnormal radiographs)			Tuberculin-test results			Culture results (sputum and laryngeal swab)				Summary	
		interval from date of start of treatment of the index case (mths)	independent assessment of radiographs			interval from date of start of treatment of the index case (mths)	diameter of induration (mm)		before any chemotherapy for contact ^b		after start of chemotherapy for contact		
			normal or abnormal ^a	type of abnormality	extent (rib inter-spaces)		5 TU	100 TU	No. positive	No. negative	No. positive		No. negative
T2238 (P 187)	Female 45	0-12	N (7films) A	Parenchymal	Less than 1	0	5	—	0	0	No chemotherapy		Progressive adult-type lesion
		7				5							
		9				15							
		2				15							
		7				32							

^a N=normal; A=first abnormality.

^b By chemotherapy is meant *antituberculosis* chemotherapy.