

TABLE I

Inoculum	Number of animals for each strain	Invasiveness			Death in days						Post-mortem	REMARKS	
		2 hours	18 hours	36 hours	1	2	3	4	5	6			
<i>V. cholerae</i> Inaba sub-type 3 strains													
Strain no. 1 ..	4	+	+	±	1	0	1	0	0	0		+	Mortality 50%. Tested twice at 3 weeks' interval.
" no. 2 ..	4	+	+	±	1	1	0	0	0	0			
" no. 3 ..	4	+	+	±	0	1	0	1	0	0			
Non-agglutinating (NAG) vibrios from a cholera case.													
Strain no. 1 ..	4	+	+	±	3	0	0	0	0	0		+	Mortality 62%. Only NAG vibrios were isolated from day to day from this case of cholera.
" no. 2 ..	4	-	-	±	2	0	0	0	0	0			
Hooghly water NAG vibrios.													
Strain no. 1 ..	4	-	-	±	1	0	2	0	0	0			Mortality 75%.
" no. 2 ..	4	-	-	±	1	1	1	0	0	0			
" no. 3 ..	4	-	-	±	1	0	2	0	0	0		+	

+ indicates that the small intestine was congested and contained turbid fluid; vibrios were recovered from the heart's blood, the peritoneum, the intestine and the gall-bladder.
± indicates that some animals showed vibrios and some not.

TABLE II

Old laboratory strain of vibrios	Total number of animals	Dead	Alive
Inaba sub-type ..	4	2	2
Para-cholera vibrios ..	5	5	0
Hooghly water NAG vibrios.	6	5	1

No difference in the pathogenicity of the different types of vibrios could be demonstrated.

Histological section of the intestine showed denudation of epithelium, congestion and the presence of vibrios in the submucosa.

Summary

1. *V. cholerae* and para-cholera vibrios, when injected subcutaneously in suitable doses into guinea-pigs, invade the general circulation, as a rule within 2 hours, but saprophytic vibrios found in Hooghly water do not do so so early.

2. No definite distinction can be made amongst the above types of vibrios by feeding experiments in guinea-pigs, and by intravenous injection into rabbits. All the types of vibrios produce fatal results in the animals, the non-agglutinating vibrios producing a slightly higher percentage of fatality.

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SOME ASPECTS OF TUBERCULOUS INFECTION IN SAIDAPET

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THE material for this article was collected by a tuberculosis survey unit which worked in Saidapet between July 1940 and March 1942 under the auspices of the Indian Research Fund Association.

The scope of the survey included a study of infection, morbidity, mortality and other features, and the findings have been reported in the official reports of the Indian Research Fund Association. This article is confined to certain aspects of the study. The data collected are on the lines recommended by the Indian Research Fund Association Tuberculosis Survey Committee in its report of 1940.

Saidapet is a suburb of the city of Madras and is easily reached by rail or bus in half to one hour from the city of Madras. It is a municipality which has a protected water supply but not to individual houses. Water from open wells and other sources is also freely used. There is no system of drainage. The sullage and sewage that is collected in the houses in concrete receptacles is baled into conservancy carts which the municipality employs, and is discharged within municipal limits and left untreated. Much sewage is also allowed to soak in and around the houses. There are very few public latrines, and streets and open spaces are freely fouled. The total population of Saidapet according to 1941 census is 41,385. This is distributed

in what may be described as Saidapet proper and outlying areas. Saidapet proper area has a population of 21,430.

The population is almost entirely Indian. A few foreigners also live within the municipal limits. Of this non-Indian group, three came within the purview of the survey. They were all Americans.

The composition of the population.—The main section of the population consists of persons engaged in the weaving industry. Dyeing, pot making, clothes washing and the milk trade account for the other major sections of the people. There is a fairly large section of public and domestic servants, whose work is within or outside the town. The weavers and the servants above mentioned frequently visit the city on business or pleasure, taking advantage of quick and easy transport facilities.

The bulk of the population lives in Saidapet proper, which is a small area compared with the rest of the Saidapet municipal area. Hence in Saidapet proper there is overcrowding. For descriptive purposes, reference is made to two different areas. One is called the fresh survey area where the tuberculosis investigation was made for the first time commencing from July 1940. The other area is called the re-survey area, as in this area a preliminary tuberculosis investigation was made in 1938-39. This division makes possible a comparative study of a fresh area with the findings of the previous survey.

The selection of the areas for survey.—The fresh survey area was made up as follows. From a central point in the heart of Saidapet streets all round about were taken for the study. In three of these streets an attempt was made to include every member of every house within the scope of the survey. In the other streets many of the homes were visited, and tests were done wherever co-operation was forthcoming. Eight streets far from the centre and on the fringes of Saidapet proper were also surveyed.

By the above process all topographical groups of the population were adequately represented. Further, by this process, representative occupational groups were included. Thus in one section the entire population belonged to the weaving industry. Another area was a scavenger colony. In a third area, the people worked in the milk trade. In the rest of the area surveyed, there was a generous mixture of domestic and menial servants, potters, dyers, weavers, trade and factory employees.

The re-survey area was fixed by the previous survey. The attempt was made not merely to get as many persons as possible for the test, but also to test a second time all those who had previously been tested in 1938-39. Experience of severe and unpleasant reactions as a result of the test, and a failure to obtain treatment facilities for persons who were told during the last survey that they should get treated, were responsible for the less co-operative attitude of the people in this area.

The Mantoux tuberculin test.—The Mantoux tuberculin tests and the collection of information regarding age, sex, etc., were done at the homes by regular visits made by the survey unit.

The test was done with old tuberculin (H) (supplied by Burroughs Wellcome & Co.) diluted 1 in 500 in normal saline with 0.2 per cent phenol. 0.1 c.cm. of the test solution was injected intradermally on the palmar aspect of the forearm about its middle. The dilution 1 in 500 was used as a result of experience gained in the previous survey, when many individuals who had the test with 1 in 1,000 dilution and were negative, either could not be found or refused to have a second test with the stronger dilution of 1 in 100 which it is necessary to employ before a person can be declared to be negative. The tests were given by one medical officer and read by him at the end of 48 to 72 hours.

The results of the test were divided into negative and positive. The negatives were those who showed no response except that due to the piercing of the skin by the needle, or showed a weal or redness of insignificant dimension. The positives were grouped in four grades.

One plus (+), slight but defined œdema raised 1 mm. above skin surface with diameter not more than 10 millimetres in the largest axis.

Two plus (++), well-defined œdema raised somewhat more than 1 mm. above skin surface, diameter between 10 to 15 mm.

Three plus (+++), more extensive œdema with diameter exceeding 15 mm. and thickness exceeding 1.5 mm. above skin surface, wide area of redness beyond but no vesiculation or necrosis of the skin.

Four (++++), characterized by extensive œdema, redness, vesiculation and necrosis, possibly associated with temperature and malaise.

Findings of the Mantoux test

In all, 5,931 tests were done. Of these 3,559 or 60 per cent gave positive results.

(a) Infection according to streets

Fresh survey area.—The percentage of persons giving a positive reaction varied in the several streets. For the whole area including 31 streets, the Mantoux positives were 2,498 out of 4,160 examined, or 60.0 per cent. In no street were the positives more than 90 per cent. In only one street was the percentage over 80 per cent. Six streets had a figure from 60 to 70 per cent. The largest group of streets, ten in number, gave figures between 50 and 60 per cent. In four streets the figure was from 40 to 50 per cent. Two streets only gave a figure below 40. The highest figure for any street was 80.9 and the lowest 31.5.

Re-survey area.—This included 16 streets. In only one street were the positives over 80 per cent; in two streets the figure was between 70 and 80. In six streets the figure was between 60 and 70; this is the largest group. In four streets the figure was between 50 and 60 and in

three streets between 40 and 50. There was no street with a figure below 40 per cent. The highest figure was 81 and the lowest 41.

(b) *Infection according to age*

The tested persons were divided into two main groups, adults and children (those 15 years and below)—the relevant figures for infection according to the area are given below.

Fresh survey area.—Adults : Of 2,285 tested, 1,771 or 77.8 per cent gave a positive result. Children : Of 1,875 tested, 720 or 38.4 per cent gave a positive result.

Re-survey area.—Adults : Of 854 persons tested, 702 or 82.1 per cent gave a positive result. Children : Of 917 tested, 360 or 39.3 per cent gave a positive result.

Infection according to age groups.—For this purpose the age groups considered are—2, -5, -10, -15, -20, -30, -40, -50, -60, -70, -80 and -90. The large majority of the persons tested come under the six age groups, -5 to -40, and account for 5,339 out of 5,931, or nearly 90 per cent. The other age groups together represent only 10 per cent of the tested persons. The single age group in which the largest number of persons were tested, i.e. 1,110, is the 21 to 30 age group. This is the same age group that had the largest number of tests in the 1938-39 survey also. On an analysis of the results of the Mantoux test into the above age groups, the number of positive Mantoux reactions was found to rise progressively from 11.9 per cent in the -2 age group, to 84.8 per cent in the -40 age group. From the -40 age group to the -70 age group, there was a progressive decrease from 84.8 per cent to 66.7 per cent, but curiously enough, in the -80 age group, all the six tested were positive. Owing to the small numbers tested, no significance is attached to this finding. This progressive decrease in the Mantoux positives from the -40 age group to the -70 age group is noted particularly in the males, from 84.4 per cent in the -40 age group to 50 per cent in the -70 age group. In females the decrease is not so marked, 85.2 per cent in the -40 age group and 78.6 in the -60 age group. In the -70 and -80 age groups in the females, the numbers were too small to justify conclusions.

(c) *Infection according to sex*

This was worked out separately for children and adults in the survey area. The infection rate according to sex was also further studied in relation to specific age groups. The findings are given and discussed later.

(d) *Contacts and infection*

Infection in known contacts of open cases of tuberculosis.—The following table indicates the information with regard to contact and infection with tuberculosis.

It is seen that the open contacts show a higher incidence of positive results. Moreover the degree of reaction was enhanced.

The plus two and plus three reactors in the contact group were more than twice as common

Number examined	Percentage of positives in familial contacts of open cases	Percentage of positives in general population
Adults 83 ..	92.8	78.4
Children 47 ..	80.9	38.2
Total 130 ..	88.5	59.3

as in the corresponding group in the general population (19.2 per cent and 8.13 per cent). Those which showed a plus four reaction were nearly three times more common. The higher incidence and degree of positive reaction in open contacts were seen at all ages, but particularly in children.

Infection and contact history.—A definite attempt was made to obtain a history of contact with a tuberculous individual of all reactors who showed a reaction of plus 3 and above*. The gross results were as follows :—

Of 746 high reactors who were interrogated for the purpose, only 327 gave a definite history of contact. These contacts can be classified as intimate contact 142, close contact 108, past distant contact 77.

Even among strong reactors (3 and 4 plus) it was possible to obtain a definite contact history only in 43 per cent of cases.

(e) *Infection in relation to habitat and change of habitat*

Saidapet as stated earlier is an urban area, but there is frequent interchange of population with rural and other urban areas, as workers and property owners frequently come to and go from Saidapet in pursuit of occupation or other interests.

A study of 126 high reactors (plus 3 and above) who had moved into Saidapet during the last two years showed that 74 had come from urban areas, 45 from rural areas and 7 from semi-rural areas.

Correspondingly 155 persons tested within the last two years and showing a similar (3 or 4 plus) positive reaction, moved away from Saidapet. Eighty-two moved away to urban, 26 to semi-rural and 47 to rural areas.

In one street in the surveyed area, a special study of the movement of population and its relation to infection was made. It was found that 163 persons tested in 1938-39 had moved out of the street. These persons had given a total positive percentage of 85.9 per cent, for adults alone 89.3 per cent, and for children alone 78.4 per cent.

* Does this statement not vitiate to some extent the previous statement that in open contacts, the incidence and degree of reaction were high?—EDITOR, I. M. G.

One hundred and thirty-seven persons who had moved into this street since the last survey gave a positive percentage of 57.7. The adults had 77.9

There is no significant difference in infection rate between the outskirts and the centre of the town.

Occupation	Street number and area	ADULTS AND CHILDREN		CHILDREN		ADULTS	
		Number examined	Percentage positive	Number examined	Percentage positive	Number examined	Percentage positive
Dhobi	Re-survey area						
	11	17	82.4	9	66.7	8	100.0
	14	56	76.8	28	60.7	28	92.9
Weaving	Survey area						
	1	495	59.4	164	34.0	331	71.0
	4	277	58.8	112	35.7	165	74.5
Milk trade	22	169	44.4	94	25.5	75	68.0
Public scavenging ..	25	221	72.8	51	31.4	170	85.3

per cent positives and the children 23.6 per cent positives.

(f) Occupation and infection

Four group-occupations were selected for study. The persons studied in each occupational group lived in separate localities or streets. Only actual family occupations in which every member of the family had some contribution to make were considered.

Discussion

The general infection rate.—The dilution used for the Mantoux test was 1 in 500. On this routine it was found that 60 per cent were positive in the fresh survey area and in the re-survey area 59 per cent. In the 1938-39 survey, the positives were 58.1 per cent. In Madura the percentage of positives detected during a recent survey was 65 per cent which is higher than the Saidapet incidence, but a smaller group was tested and a dilution of 1 in 100 was used in cases where the reaction to the 1 in 1,000 solution was negative. In the 1938-39 survey it was found that, of 254 persons who did not react to a 1 in 1,000 strength, 125 gave a positive reaction when the higher strength of 1 in 100 was used. Thus nearly 50 per cent of original negatives were positive to the 1 in 100 dilution. Therefore it can be safely assumed that at least 10 per cent more of our negatives would have turned positive if a 1 in 100 solution had been used for a second test. On this basis the positive rates would be at least 70 per cent.

Infection according to streets.—As indicated in the findings, there is much variation in the infection rate from street to street. The accompanying table indicates the extent of infection, showing the heaviest and the least infected streets in the survey and re-survey area. This will be useful material for planning a further intensive survey in the areas, and for obtaining information likely to point to factors influencing the intensity of infection.

Streets in which infection is heavy

ADULTS AND CHILDREN COMBINED		ADULTS ALONE		CHILDREN ALONE	
Street number	Infection percentage	Street number	Infection percentage	Street number	Infection percentage
(1) Fresh survey area					
15	80.9	16	100.0	15	70.7
11	77.9	17	93.3	12	59.3
17	77.2	11	91.5	16	56.3
12	75.2	15	91.2	11	61.5
(2) Re-survey area					
11	82.4	11	100.0	11	66.7
14	76.8	14	92.9	14	60.7
18	70.9	17	87.6	18	57.8
17	67.8	7	85.9	10	52.9

Streets in which infection is light

ADULTS AND CHILDREN COMBINED		ADULTS ALONE		CHILDREN ALONE	
Street number	Infection percentage	Street number	Infection percentage	Street number	Infection percentage
(1) Fresh survey area					
30	31.5	30	57.1	30	16.7
28	36.7	27	66.7	29	24.6
22	44.4	22	68.0	8 and 3	26.3
29	48.3	10	67.4	22	25.5
(2) Re-survey area					
2	42.1	2	64.0	4	22.2
3	45.8	3	66.7	2	22.8
4	46.2	4	75.9	5	30.8
5	53.5	18	80.4	8	32.5

Infection and movement of population.—In an analysis of the results of the Mantoux test in 137

persons who were not living in street no. 1 re-survey area in 1938-39, but had moved into that street since then, in general it was found that those who moved away from the street were more commonly infected than those who moved into the street. This disparity in infection rate has influenced the infection rate in the street which according to the present survey is much less infected than in the previous survey*. The findings are given in the following table :—

Street No. 1, Re-survey Area
Infection rate in 1938-39 and 1940-42

Survey	ADULTS AND CHILDREN COMBINED		CHILDREN ALONE		ADULTS ALONE	
	Number examined	Positive percentage	Number examined	Positive percentage	Number examined	Positive percentage
1938-39 ..	410	84.6	164	76.8	246	89.8
1940-42 ..	249	61.4	109	34.9	140	82.1

The figure for positives in children is much lower than in 1938-39, but for adults only slightly lower.

Tuberculin reaction in relation to age.—It was found that 38.4 per cent of the population below the age of 16 had been infected in the fresh survey area and 39.3 per cent in the re-survey area.

Page1 quoting from Goldberg gives the crude infection rate of children 15 years and under as below :—

Philadephia	68.5 per cent
Minneapolis	47.3 " "
London	43.1 " "
San Francisco	23.5 " "

Our figures are lower than the first three. It is also well to remember that in all these cities well-established clinics and anti-tuberculosis measures have existed for a long time. In Sialkot in India, in a recent survey of school children between the ages of 5 and 18 Dr. Sahni found 33.6 per cent to be the infection rate.

In the fresh survey area, it was found that 12 per cent of the children are infected before they are 2 years old, that the rate is doubled when the age of 5 is reached, trebled by the time 10 years is passed, and multiplied by 5 when the children reach 15 years of age. Hence the data collected indicate that the process of 'tubercularization' is rapid in childhood.

The study in Saidapet 'therefore indicates a serious situation with very early infection. It also indicates that the infection takes place

mainly before the children are much in contact with the outside world. It points rather to serious home or possibly school infection, which requires further investigation'. One cannot easily dismiss the implied suggestion that with growing years the child's contacts increase and thus the chances of infection also increase. The big jump in infection rate in the later years of childhood may also be accounted for by this.

Infection according to age and sex.—The findings are given in the following tables :—

Sex	Fresh survey area	Re-survey area	1938-39 survey
<i>Adults and children considered together</i>			
Males ..	62.4	61.3	60.2
Females ..	57.8	58.7	57.7
<i>Adults alone</i>			
Males ..	80.5	82.7	69.7
Females ..	75.2	81.5	68.3
<i>Children alone</i>			
Males ..	39.6	42.0	42.5
Females ..	37.2	36.8	36.3

It is seen that in all surveys in both areas, both in childhood and adult life, the infection rate in males is higher than in females. The difference is sometimes slight and never very marked but nevertheless is probably significant.

As the following table shows however, this difference is not seen in early infancy, when the female rate exceeds the male rate in all the surveys. In individual surveys in one or more but varying groups, the female rate slightly exceeded the male rate. These were probably chance findings.

Infection according to age groups in the two sexes

Age	FRESH SURVEY AREA		RE-SURVEY AREA		1938-39 SURVEY	
	Males	Females	Males	Females	Males	Females
- 2	8.0	15.2	12.0	14.3	36.9	38.5
- 5	23.5	21.7	21.5	18.8	29.8	29.4
-10	35.7	32.7	40.9	35.6	41.4	38.4
-15	59.7	58.0	61.8	52.6	44.0	38.0
-20	72.7	65.1	70.8	69.6	61.6	64.6
-30	82.1	72.9	83.1	81.6	68.4	67.8
-40	84.4	85.2	91.4	89.9	73.0	69.4
-50	82.7	85.2	89.2	91.2	76.8	71.7
-60	82.9	78.6	78.0	87.5	100.0	71.4

Ages above 60 are not considered as the numbers are meagre.

Infection and occupation.—In the table relating to occupation it will be observed that dhobi

* This statement presupposes that this migration is a new or a markedly increased factor since 1938-39. It seems doubtful if this is so.—EDITOR, I. M. G.

children are more infected than children living in homes where the other occupations are pursued. Next in order comes weaving. The third is public scavenging and the least infected are children in houses engaged in the milk trade.

In adults, the occupation of dhobi takes the first place; next comes public scavenging; weaving takes the third place. The last here also is the milk trade.

Although it must be admitted that definite conclusions cannot be arrived at from the above findings, there is here an indication for further investigation of the occupation of a community in relation to infection.

Summary

The paper deals with certain aspects of tuberculous infection in Saidapet.

The area selected is briefly described, and note is made of the condition of communications, water supply, drainage and public sanitation as also special medical relief.

The manner of selection of areas for the Mantoux test is mentioned and the technique adopted is described.

The results are analysed in both the fresh and the re-survey areas, and compared wherever possible with findings of the 1938-39 Saidapet survey. Infection is studied in relation to its distribution in the various streets surveyed, in relation to age, the population being first divided into adults and children and then into various smaller age groups. Infection according to sex is next studied. Other items of the findings relate to the influence of contact on the results of the Mantoux test.

A study of movement of population and its influence on the infection in one street that was surveyed in 1938-39 and again 1940-42 is made.

A study is made of infection in four occupational groups.

Finally four streets are indicated in which there is a heavy infection rate and also four other streets where the infection is least, for a further intensive study of the factors which tend to produce the difference in the infection rate.

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THE ADMINISTRATION OF SULPHUR THROUGH DRUGS AND FOODS IN THE COURSE OF SULPHONAMIDE THERAPY

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It has generally been considered unsafe to give onions, eggs and other sulphur-containing foodstuffs, as well as medicines containing sulphur, to a patient who is receiving the sulphonamide group of drugs. It has been said that the sulphur moiety may lead to sulphæmoglobinæmia which causes cyanosis; the sulphæmoglobin, not being reconvertible into hæmoglobin, reduces the oxygen-carrying capacity of the blood. Archer and Discombe (1937) suggested that only one or two eggs should be taken daily, and that aperients should be forbidden. They particularly forbade magnesium sulphate. The work of Richardson (1941) on mice leads one to conclude that foods containing sulphur are more likely to produce sulphæmoglobinæmia. An editorial (1941) in the *Lancet* concluded 'clinical experience suggests that provided purgatives are avoided, sulphæmoglobinæmia is rare with sulphanimide therapy even without restriction of diet'. Smith (1940), as a result of a studying of a small but carefully controlled series, feels that patients receiving sulphapyridine can safely be given pentothal and magnesium sulphate at the same time.

The present study was undertaken to ascertain by clinical methods if there was really any danger of producing cyanosis, and, even if it was produced, whether there was any serious damage to the health of the patient.

Plan of work.—Alternate cases of lobar pneumonia on sulphonamide therapy were given sulphur, either in the diet or as a purgative in the form of magnesium and sodium sulphate; the presence of cyanosis was looked for as evidence of sulphæmoglobinæmia; the dosage and the administration of the drug were controlled carefully.

Clinical material was made available by the courtesy of the Officer Commanding, British Military Hospital, Jhansi, and the authorities of the Cantonment General Hospital, Jhansi; five private cases have also been included in the series.

The plan of treatment adopted in all the cases was simple and, as far as practicable, uniform. The patients were nursed in the verandah day and night, being screened from direct sunlight and inclement weather whenever necessary. Fluids were given freely, at least three and a half pints being given in twenty-four hours, and sulphapyridine (M.&B. 693) was administered according to the under-noted dosage.

First dose, 4 tablets. Second dose, 4 hours later, 4 tablets. Third and subsequent doses, 2 tablets every four hours, including sleeping hours, until the temperature touched normal and