Original Article *Ind. J. Tub., 1997, 44, 171*

A TUBERCULOSIS PREVALENCE SURVEY BASED ON SYMPTOMS QUESTIONING AND SPUTUM EXAMINATION

P.G. Gopi[1], R.S. Vallishayee[2], B.N. Appe Gowda[3], C.N. Paramasivan[4], S. Ranganatha[5], K.V. Venkataramu[5], B.S. Phaniraj[5], L. Krishnamacharya[5], J. Devan[6], R. Ponnusamy[7], G. Komaleeswaran[7] and R. Prabhakar[8]

(Original received on 29.4.1997; Revised version received on 25.7.97; Accepted on 12.8.97)

Summary : A sample survey was undertaken in Raichur district of Karnataka state to estimate the prevalence of bacteriologically positive pulmonary tuberculosis among symptomatics aged 15 years and above. A population of 72, 448 persons was registered in a representative sample of 57 villages and 21 enumeration blocks. Of the 42,580 persons aged 15 years and above eligible for symptoms quesioning, 40,657 (95.5%) were examined and 3,846 (9.5%) were found to be symptomatics and eligible for sputum examination. Sputum was collected from 3,685 (95.8%) of the 3,846 symptomatics, and subjected to bacteriological examination i.e. smear, culture and drug susceptibility. Certain important findings were as follows :

(i) the number of symptomatics increased with increase in age, more often among males (11.9%) than among females (7.1%), (ii) the prevalence of tuberculosis, as assessed by smear and/or culture was 10.9 per 1,000 in population aged 15 years and above, (iii) the prevalence increased with age and was 3 times higher among males as compared to females, (iv) cough was found to be the predominant symptom among the symptomatics (87%) as well as among the cases detected (92%), (v) the prevalence rate based on smear examination of the sputum specimens, using the two microscopy methods (Ziehl-Neelsen and Fluorescence) was 7.6 per 1,000, (vi) culture examination of these specimens yielded 3.3 per 1,000 additional cases, (vii) both the microscopy methods were equally efficient in detecting smear positives, (viii) of the 355 culture positive cases, 17.7% were resistant to Streptomycin, 29.6% to Isoniazid and 7.6% to Rifampicin either alone or in combination with other drugs.

INTRODUCTION

Before the introduction of Short Course Chemotherapy (SCC) at the national level. Government of India introduced the SCC in 18 districts, in different regions of the country. under the existing District Tuberculosis Programme (DTP), and the Tuberculosis Research Centre (TRC) was given the responsibility to monitor this activity with a view to improving the efficiency of its various programme components, namely case finding, case holding and chemotherapy. While undertaking this work, it was felt that information obtained about the current or existing prevalence of tuberculosis, at least in a few districts, would be useful to evaluate case finding efficiency of the programme. The findings in these surveys could be compared with those of the earlier studies and also the data could provide reference material for future epidemiological surveys. With this background, a tuberculosis prevalence survey was carried out in Raichur district of Kamataka, from November, 1988 to March, 1989, with the specific objective of obtaining an estimate of the prevalence of bacteriologically positive (smear and/or culture) pulmonary tuberculosis by examining all the chest symptomatics, aged 15 years and above, identified through the survey.

MATERIAL AND METHODS

Raichur district is situated in the north-eastern sector of Karnataka state and has an area of 14,017 square kilometers. As per the 1981 census, the district had a population of 17,83,822, spread over 9 taluks and 10 towns. Most of the population (78.8%) is engaged in agriculture (35.7% cultivators and 43.1% agricultural labourers).

Planning visits by a team of scientists from TRC were made to the district in order to establish the procedure for the smooth conduct of the survey

1. Senior Research Officer, 2. Deputy Director, CJIL Field Unit, (ICMR), Avadi, 3. Senior Technical Officer, 4. Deputy Director, 5. Deputy Field Supervisor, 6. Research Assistant, 7. Statistical Assistant, 8. Former Director

Correspondence : P.G. Gopi, Tuberculosis Research Centre, Mayor Ramanathan Road, Chennai 600 031

with the active support and co-operation of the State Government officials concerned. During these visits, relevant information was also obtained for drawing the sample.

Sampling Procedure

Assuming a prevalence of 4 per thousand in the general population, a precision of 20% of the prevalence and 5% significance level, after adjusting for a design effect of 1.5, the required sample size was estimated to be about 40,000 persons aged 15 years and above. The sampling frame available was the 1981 census with an enumerated population of about 1.8 million (81.5% rural and the rest urban). The sampling procedure adopted was a two-stage cluster sampling with proportional allocation.

Rural segment : The nine taluks were divided into 57 circles (or hoblis). From each taluk a random sample of circles was obtained so as to cover 25% of the total rural population. Thus, 14 circles got selected with a population of 3,66,265 (25.4%). A random sample of villages was selected from each of the selected circles, to give 3.7% of the circle population, the sampling fraction. In all, 57 villages got selected.

Urban segment : The urban population in the district, spread over 10 towns, was divided into 4 groups by size of the population. From each of the first 3 groups, 50% of the towns were selected at random. Five towns got selected, in addition to Raichur town exceeding 100,000 population, from the fourth group. From- each selected town, a random sample of wards/divisions was selected so as to cover 25% of the urban population. From each of the selected wards/divisions, a random sample of enumeration blocks, each block comprising approximately 100 households, was selected to get the required sample from the urban area. Thus, 21 enumeration blocks got selected.

Field procedure

Four sub-camps were established in the study area and laboratories were set up for direct microscopy of the sputum specimens collected in the field. Arrangements were also made to transport the specimens, under refrigerated condition, from the sub-camps to the main laboratory at TRC.

Census and symptom questioning : Door-to-door census was undertaken in all the villages and enumeration blocks included in the sample and all residents were registered. From all persons aged 15 years and above, information on the nature and duration of symptoms suggestive of pulmonary tuberculosis as well as action taken for the symptoms was elicited by health workers and recorded.

Sputum examination

All persons found to have one or more of the following symptoms were eligible for sputum examination:

(i) cough of two weeks' duration or more. (ii) chest pain of 1 month's duration or more, (iii) fever of 1 month's duration or more, (iv) haemoptysis at any time. In addition, 50% of symptomatics who complained of cough of 7-13 days' duration were also included for sputum examination, in order to find out the yield of positive cases from such symptomatics. Persons with a history of treatment for tuberculosis were also eligible for sputum examination, irrespective of symptom status. From all the eligibles, two sputum specimens, one spot and one overnight, were collected.

Bacteriological Examination

From both the specimens, smears were prepared in the field and examined for AFB using Ziehl-Neelsen (ZN) method in the laboratories established at the camp site. Both the specimens were then examined at TRC for AFB on smear using fluorescence method (Fl), and were also put up for culture and drug susceptibility testing. In addition, all positive smears and a random sample of negatives reported in the field laboratories were read at TRC once again for quality check.

Definition of a case

A person who was bacteriologically positive by either smear ($\geq$ 1 AFB on ZN or $\geq$ 4 AFB on Fl) or culture.

Treatment

All smear and culture positive cases were informed of the diagnosis and referred for treatment

to the nearest health facility under intimation to the Medical Officers of the respective health facilities with a copy sent to the District Tuberculosis Officer.

Statistical analysis

Trend in proportions was tested for significance using Trend Chi-square. Difference in proportions of smear positives using ZN or Fl microscopy was tested for significance using McNemar's Chi-square. The prevalence of bacteriologically positive cases and the 95% confidence interval were calculated using appropriate formulae.

RESULTS

Coverages obtained for symptoms questioning and sputum examination

A population of 72,448 persons was registered of whom 42,580 (58.8%) were aged 15 years or more. Of the 42,580 persons registered, 40,657 (95.5%) were examined for elicitation of symptoms. From among 3,846 symptomatic persons eligible for sputum collection, sputum was collected from 3,685 (95.8%) persons. High coverages were obtained in all age-sex groups, both for symptoms elicitation (92% to 98%) and sputum collection (92% to 99%).

Distribution of symptomatics by age and sex

Proportion of persons eligible for sputum examination, according to different eligibility criteria, is given in Table 1. The proportion of persons eligible for sputum examination steeply increased with age ($P < 0.001$) and was higher ($P < 0.001$) among males (11.9%) than among females (7.1%). Considering the definition used for symptomatics under DTP, the overall proportion of eligibles for sputum examination was 9.5%; 11.9%

Table 1. Distribution of symptomatics eligible for sputum examination according to age and sex

Age group (yrs.)	Sex	Exmd. for Symptoms	Eligible for sputum examination					
			DTP def.*		7-13 days cough+	H/o Rx.**	Total	
			(no.	%)			No.	%
	M	5695	225	4.0	3	4	232	4.1
15-24	F	5855	129	2.2	5	1	135	2.3
	T	11550	354	3.1	8	5	367	3.2
	M	4899	391	9.0	1	4	396	8.1
25-34	F	5213	234	4.5	4	6	244	4.7
	T	10112	625	6.2	5	10	640	6.3
	M	3827	467	12.2	6	5	478	12.5
35-44	F	3561	275	7.7	4	3	292	7.9
	T	7388	742	10.0	10	9	760	10.2
	M	2636	510	19.3	2	3	515	19.5
45-54	F	2907	334	11.5	3	3	340	11.7
	T	5543	644	15.2	5	6	855	15.4
	M	1676	400	23.9	2	1	403	24.0
55-64	F	1936	261	13.5	2		263	13.6
	T	3612	661	18.3	4	1	666	18.4
	M	987	329	33.3	1	1	331	33.5
65+	F	1465	225	15.4	1	1	227	15.5
	T	2452	554	22.6	2	2	559	22.8
	M	19720	2322	11.8	15	18	2355	11.9
Total	F	20937	1458	7.0	19	14	491	7.1
	T	40657	3780	9.3	34	32	3846	9.5

* Cough of ≥ 14 days/Chest pain and/or Fever of ≥ 1 month/Haemoptysis at any time

** History of treatment for tuberculosis + Only 50% were eligible

for males and 7.1% for females. The additional contribution of persons with cough of 7-13 days' duration (0.2%) and those with a history of treatment for tuberculosis (0.1%) towards sputum eligibility was negligible.

It was also observed that the proportions of symptomatics having symptoms of duration '1 month to 1 year' were 41.7% (1432 of 3434) for cough, 43.3% (1101 of 2541) for chest pain and 61.1% (591 of 967) for fever. The yields of sputum positive cases from these symptomatics with cough, chest pain and fever were 10.7% (153 of 1432), 12.4% (136 of 1101) and 15.1% (89 of 591) respectively. The proportions of symptomatics having symptoms for more than 1 year were 51.2% (1759 of 3434) for cough, 53.6% (1361 of 2541) for chest pain and 25.4% (246 of 967) for fever. The corresponding figures for the yield of cases from such symptomatics were 13.6% (240 of 1759). 13.2% (179 of 1361) and 17.9% (44 of 246) respectively.

Prevalence of bacteriologically positive cases : The overall prevalence was 10.9 per 1,000 among persons aged 15 years or more (Table 2) The prevalence generally increased with age (P < 0.001): it was 2.7, 6.1, 14.7, 18.1, 20.7 and 26.3 per 1.000 in the age groups 15-24, 25-34. 35-44, 45-54, 55-64 and 65+ respectively. However, among females, the prevalence increased less steeply upto the age group 45-54 years after which it slightly decreased. The prevalence was about 3 times higher (P < 0.001) among males (16.3 per 1,000) as compared to females (5.8 per 1,000). As many as 270 (61.4%) of

Table 2. Distribution of sputum positive cases according to age and sex

Age group (yrs)	Sex	Examined for		Number sputum positive						Rate per 1,000
		Symp-toms*	Spu-turn	ZN (sp)	ZN (ov)	F1 (sp)	F1 (ov)	Sm. Neg. Cu1*	All post.	
15-24	M	5678	215	10	1	3		4	18	3.2
	F	5844	124	7	2	–	–	4	13	2.2
	T	11522	339	17	3	3	–	9	31	2.7
25-34	M	4880	377	17	1	2	4	7	31	6.4
	F	5205	236	15	5	2	1	9	31	6.0
	T	10095	613	32	6	4	5	15	62	6.1
35-44	M	3812	463	45	6	6	2	23	92	21.5
	F	3557	279	14	6	–	3	3	26	7.3
	T	7369	741	59	12	6	5	26	109	14.7
45-54	M	2615	494	36	9	8	3	17	73	17.9
	F	2898	331	11	4	4	1	7	27	9.3
	T	5513	825	47	13	12	4	23	100	18.1
55-64	M	1659	386	22	5	3	6	23	59	35.6
	F	1922	249	5	3	1	1	5	15	7.8
	T	3581	635	27	8	4	7	28	14	20.7
65+	M	975	319	21	5	3	*	27	56	57.4
	F	1451	213	*	4	*	*	4	8	5.5
	T	2426	532	21	9	3		31	64	26.3
Total	M	19619	2254	151	27	25	15	101	319	16.3
	F	20877	1431	52.24	7	6	32	121	5.8	
	T	40496	3685	203	51	32	21	133	440	
Rate (per thousand)				5.0	1.3	0.8	0.5	3.3		10.9

*Excluding 161 individuals who were absent for sputum collection
ZN - Ziehl Neelsen method, Fl - fluorescense method
OV - Overnight specimen, SP - spot specimen

Table 3. Distribution of sputum positive cases by symptom status

Symptom	Sputum examined		Sputum positive				
	No.	%	S+ C+	S-C+	S+ C-	Total	
						No.	%
Cough only ≥ 14d (C)	1061	28.8	41	34	19	94	21.4
Chest pain only ≥ 1m (P)	343	9.3	1	10	10	21	4.8
Fever only ≥ 1 m (F)	17	0.5	–	–	–	–	
C + P	1388	37.7	91	56	37	184	41.8
C + F	147	4.0	17	5	1	23	5.2
P + F	48	1.3	1	4	1	6	1.4
C + P + F	597	16.2	71	21	12	104	23.6
Haemoptysis	26	0.7	1	I	*	2	0.5
Cough 7-13d	28	0.8	*	*	2	2	0.5
History of treatment	30	0.8	1	2	1	4	0.9
Total	3685	100.0	224	133	83	440	100.0
C (all)	3193	86.6	220	116	69	405	92.1
P (without C)	391	10.6	2	14	11	27	6.1
F (without C,P)	17	0.5	–	–	–	–	–
Others	84	2.3	2	3	3	8	1.8

the 440 cases were males aged 35 years or more.

Distribution of sputum positive cases by symptom status : It can be observed from Table 3 that of the 3,685 symptomatics, as many as 3,193 (86.6%) had cough of 14 days or more and contributed 405 (92.1%) of the 440 sputum positive cases. There were 391 (10.6%) symptomatics without cough but with chest pain of one month or more who contributed 27 (6.1%) sputum positive cases There were only 17 symptomatics (0.5%) with fever alone and none of them was sputum positive. Others, having haemoptysis, cough of 7-13 days or a history of tuberculosis treatment comprised 84 (2.3%) and yielded 8 (1.8%) sputum positive cases of whom 2 (0.5%) were from 28 persons having cough of 7-13 days' duration.

Drug sensitivity status : Of the 355 patients for whom drug sensitivity results were available, 234 (65.9%) were sensitive to all the three drugs (Isoniazid, Streptomycin and Rifampicin); 27 (7.6%) were resistant to both Isoniazid and Rifampicin and another 78 (22.0%) to Isoniazid alone; 16 (4.5%) patients were resistant to Streptomycin alone (Table 4). Considering the sexes, 28.3% (751265) of male and 33.3% (30/90) of female patients were resistant to Isoniazid or Rifampicin. The overall resistance to Streptomycin. Isoniazid and Rifampicin were 17.7%, 29.6% and 7.6% respectively.

Resistance to Isoniazid was observed in 58 (52.3%) of the 111 cases with a history of previous treatment and 47 (19.2%) of the 244 cases without a history of previous treatment. Combined resistance to Isoniazid and Rifampicin was observed in 19 (17.1%) cases with and 8 (3.3%) cases without a history of previous treatment.

Comparison of smear results by ZN and Fl methods : Results of 7,219 sputum specimens (3,683 spot and 3,536 overnight) were available by both methods (Table 5). Considering individuals with smear result of upto 3 AFB by Fl microscopy as negative, and not requiring treatment. the numbers of positive smears for spot specimens using ZN and Fl microscopy were 203 and 210 respectively. Similarly, for overnight specimens, the corresponding numbers were 203 and 209 respectively. It was observed that among the spot specimens, 41 cases were negative by Fl method

Table 4. Distribution of culturepositive cases by drug sensitivity status

Age group (yrs)	Sex	No. cult. post.	Sens. to S,H,R	Resistant to				
				S	H	S,H	H,R	S,H,R
	M	12	10	0	1	1	*	*
15-24	F	10	6	2	1	1	*	*
	T	22	16	2	2	2	*	*
	M	93	63	3	11	5	5	6
25-44	F	44	26	3	2	4	4	5
	T	137	89	6	13	9	9	11
	M	211	108	6	25	17	I	3
45+	F	43	21	2	7	3	I	2
	T	254	129	8	32	20	2	5
	M	265	181	9	37	23	6	9
Total	F	90	53	7	10	8	5	7
	T	355	234	16	47	31	11	16
		(65.9)	(4.5)	(13.2)	(8.7)	(3.1)	(4.5)	
Prev.	No.	244	186	11	26	13	5	3
treatment	Yes	111	48	5	21	18	6	13

S-Streptomycin, H-Isoniazid, R-Rifampicin

Table 5. Comparison between smear results using Ziehl-Neelsen and Fluorescence methods

ZN microscopy in field (AFB)	Fl. microscopy at TRC (AFB)					Total
	0	1-3	4-10	1+	2+	
			Spot specimen			
0	3401	31	1	46	1	3480
1-3	18			10	1	29
4-10	5	–	–	6	–	11
1+	17	–	–	69	46	132
2+	1	–	–	6	24	31
Total	3442	31	1	137	72	3683
			Overnight specimen			
0	3263	33	1	35	1	3332
1-3	16	1	–	4	1	22
4-10	2	–	–	12	–	14
1+	12	–	–	52	62	126
2+	–			0	33	41
Total	3293	34	1	111	97*	3536**

* Includes 16 cases with smear '3+' on Fl, (1 with 0 AFB, 6 with '1+' and 9 with '2+' on ZN)

** 5 specimens for which only one of the results was available are excluded

but positive by ZN method (56% were scanty positive, viz., 1-10 AFB), and 48 cases positive by Fl method were negative by ZN method. Corresponding figures for overnight specimens were 31 and 37 respectively. **The difference in proportions of smear positives using the two techniques was not statistically significant ($P < 0.05$) for both spot and overnight specimens.**

All positive slides and 25% of the negative slides examined at field laboratory using ZN technique were subjected to a second reading at TRC main laboratory (Table 6). There were 27 slides read as positive (63% scanty) in the field but were read

Table 6. Comparison between smear results using ZN microscopy at field and TRC

Field reading (AFB)	TRC Reading (AFB)					Total
	0	1-3	4-10	1+	2+	
0	1532	16	3	6	–	1557
1-3	11	10	2	7	–	30
4-10	6	2	1	11	–	20
1+	8	6	3	151	57	225
2+	2	1	–	11	50	64
Total	1559	35	9	186	107	1896

negative in the main laboratory. Another 25 were read as negative in the field but positive (73% scanty) in the main laboratory. The difference in proportions of positives as obtained in field camps and in TRC main laboratory was not statistically significant ($P < 0.05$).

DISCUSSION

This study was a cross sectional sample survey done with a view to obtain a quick and reliable estimate of bacteriologically positive pulmonary tuberculosis cases from chest symptomatics in a population aged 15 years and above in a district. Other parameters such as chest X-ray examination using Mass Miniature Radiography (MMR) and tuberculin testing were not done as screening methods in the diagnosis of tuberculosis in this survey.

The estimated prevalence of bacteriologically positive tuberculosis in Raichur district, after adjusting for stratification, was 10.7 (95% CI : 9.7-11.7) per 1,000 population aged 15 years and above. Although differing prevalence rates of tuberculosis have been reported in the various studies conducted in different parts of India, the prevalence rate found in our study was similar to the findings reported from Chingleput[1] (Tamilnadu) in 1980 and Madanapalle[2] (Andhra Pradesh) in 1981. The prevalence of bacteriologically positive cases observed in the NSS[3] varied from 2 to 8 per 1,000. An overall prevalence rate of 2.1 per 1,000, based on symptoms screening of population aged 5 years and above, was reported in a study[4] in Nelamangala taluk of Bangalore district. The authors of this study recommended that population upto 14 years of age could safely be excluded for estimating prevalence, thus reducing work load, as they found only one case in the age group 5-14 years constituting about 30% of the total population. In a longitudinal study[5,6] in an urban population of New Delhi during 1962-77, prevalence rate of 4.0 per 1,000 was reported in the first three resurveys and 2.1, 2.8 and 3.2 per 1.000 in the subsequent three resurveys. National Tuberculosis Institute (NTI), Bangalore. reported a prevalence rate of 4 per 1,000 in a rural population of South India[7]. Gothi *et al.* [8] observed no appreciable change in the overall prevalence rate among persons aged 10 years and above in Tumkur district over a period of 12 years (4.4 and 4.1 per 1,000 in 1961 and 1973, respectively). In a study by Chakraborty *et a1.*[9] conducted during 1961-77 in a rural population aged 5 years and above in Bangalore district, prevalence rates were found unchanged in five surveys (3.96 to 4.92 per 1,000

Table 7. Prevalence of bacteriologically positive pulmonary tuberculosis* (previously reported)

Area.	Rural or Urban	Period of the study	Age group (yrs.)	Screening method used	Prevalence** per 1000
New Delhi[6]	Urban	1962	%+	X-ray	4.0
		1977	5+	X-ray	3.2
Tumkur[8]	Rural	1961	10+	X-ray	4 4
		1973	10+	X-ray	4.1
Bangalore	Rural	–	5+	Symptom and X-ray	3.2
				Symptom	2.1
Chingleput[1]	Rural	1980	15+	X-ray	11.0
Madanapalle[2]	Semi - urban	1961	15+	X-ray	9.3
		1968	15+	X-ray	9.8
Bangalore	Rural	1961	5+	X-ray	4.0
		1977	5+	X-ray	4.9
Wardha[11]	Rural	1982-88	5+	Symptom	1.8
Bangalore[12]	Rural	1984-86	10+	Tub. testing	4.4
Raichur (present study)	Rural	1988-89	15+	Symptom	10.9

* The rates are not comparable because of different screening procedures and age groups

** Smear and/or culture positives

from first to fifth survey). Chakraborty *et al* [10] reported a much lower prevalence rate among persons aged 15 years and above in a peri-urban community of Bangalore, even after adjusting for a methodological variation. Narang *et al* [11] reported (1982-88) a low prevalence of 1.82 per 1,000 population aged 5 years and above in Wardha district. In another study[12] in Bangalore district (rural) done during 1984-86, using tuberculin testing as the screening method, the prevalence rate was observed to be 4.38 per 1,000 population aged 10 years and above similar to the rates observed in earlier surveys conducted in the same area[7,9]. These results have been summarised in Table 7. It should be noted that the surveys reviewed are not uniform with respect to area of the study, time-point of the study, age-groups included, screening method used and are, strictly, not comparable. The efficiency of the implementation of the tuberculosis control programme, over a period of time, in terms of case finding, case holding and chemotherapy, in these areas, might also have varied.

Currently available information on prevalence of bacillary tuberculosis cases in different areas varies a lot because the conducted surveys were not technically uniform and are not comparable.

That prevalence increased with age and was higher among males as compared to females is consistent with the findings of the NSS[3] and other studies[4,6.8,9]. Even though the present study was intended to estimate the overall prevalence rate in the district, the data were analysed separately for rural and urban segments in order to find out whether there was any difference in the prevalence rates in rural and urban areas. The prevalence of sputum positive cases in the rural segment was 11.4 (95% C.I. : 10.3-12.6) per 1,000 as compared to 6.5 (95% C.I. : 4.8-8.1) in the urban segment ($P < 0.05$) which was not in line with the NSS finding of similar prevalence rate in both rural and urban populations. The difference, perhaps, reflects ready accessibility of a health facility for those patients who reside in the urban areas.

Under the DTP, sputum microscopy for AFB by ZN technique is recommended on one spot specimen for diagnosis of tuberculosis in the community. In the Revised National Tuberculosis Programme (RNTP), three sputum specimens, viz., 2 spot and 1 overnight, are collected and at least two positive smears are considered necessary for initiating treatment with SCC. In case of patients with only one positive smear, an X-ray examination of the chest is considered mandatory in the RNTP. In our study , the prevalence of patients with a positive smear. using ZN technique, for spot specimen, was 5.0 per 1,000, as compared to 6.6 per 1,000 in Chingleput[1] and 4.8-6.8 per 1.000 in Madanapalle[2]. **Addition of ZN positive smears on overnight specimens and the positive smears from spot and overnight specimens using Fl microscopy increased the prevalence rate from 5.0 to 7.6 per 1,000. There was a substantial increase of 3.3 per 1,000 in the prevalence rate by culture examination of these specimens.** This showed that the total prevalence rate was two times higher than that obtained by examining the spot specimens using the ZN technique, the technique used under the DTP. The significant yield (3 per 1,000) of smear negative, culture positive cases showed that the prevalence rate will be under-estimated if the specimens are not simultaneously subjected to culture examination. This also helps in early detection and treatment of additional tuberculosis patients, who would otherwise be detected at a later date. However, except for a few centres, the country, as a whole, is not equipped at present to do routine culture examination of symptomatics.

The criteria for offering sputum microscopy to symptomatics under DTP or RNTP being operational in nature will give lower yield of cases compared with the estimated case load based on prevalence survey.

There were 133 (30%) cases who were negative on smear and positive on culture examination. Nagpaul *et al* [13] and Narang *et al* [11] have also reported high percentages of such cases. Among the 83 (19%) cases who were positive on smear but negative on culture, 11 had a history of previous treatment and 32 (38%) were scanty positive (1-7 AFB) by ZN microscopy.

A majority (87%) of the symptomatics reported cough as a symptom at the time of screening and yielded 405 (92%) of 440 sputum positive cases. This shows the relative importance of cough as a predominant symptom for screening the population

for tuberculosis. Baily *et al* [14] and Gothi *et al* [4] also found cough as a major symptom in their studies.

The proportions of positive smears for spot specimens using ZN and Fl microscopy were 5.5% and 5.7% respectively, and for overnight specimens, 5.7% and 5.9% respectively. This indicated that both ZN and Fl methods were equally good. Repeat examination of all positive smears and a 25% sample of negative smears showed that quality of ZN microscopy at field camps was good.

Resistance to Rifampicin was 3.3% among patients without a history of treatment compared to 17.1% among patients with a history of treatment. Rifampicin resistance among those who did not report a history of treatment indicated that these patients might have concealed the history of treatment or were not aware of treatment containing Rifampicin received from outside.

Information was also collected on the preferred place of treatment and reasons for preference from 334 patients who gave a history of treatment. As many as 194 (58%) of them went to private agencies for treatment, and the remaining 140 (42%) went to government agencies; of the latter only 27 (8%) went to the nearest Primary Health Institution (PHI). About half of the patients who went to private agencies felt that they received better service. Half of the patients who went to PHI attributed the proximity to the health agency as the reason for their preference.

Among the previously treated cases in the survey, a majority (58%) had gone to private agencies because of perceived better service there and a minority (42%) had attended government facilities.

In this prevalence survey, meticulous care was taken in eliciting symptoms, and the subsequent collection and examination of sputum specimens for bacteriological examination was found to be a satisfactory tool for estimating the prevalence. This has particular relevance to many of the developing countries where organising additional parameters such as tuberculin testing and chest X-ray would not be practicable. However, there is little relevance in suggesting better methods to enhance case finding efficiency without augmenting the other two important components, namely, case holding and chemotherapy. This can be achieved through improved health care delivery system and active participation and involvement of the community in the programme. Until then, tuberculosis will continue to be a major health problem in our country.

ACKNOWLEDGEMENT

The authors are grateful to the State Tuberculosis Officer, the District Medical Officer and the District Tuberculosis Officer for their co-operation and support at various stages of the study and for providing free accommodation for the field teams during the study. And, the field teams for their meticulous work in the collection of the data. The authors would like to place on record their gratitude and indebtedness to Dr. R.V.S.N. Sarma, who was associated with the survey in the initial stages offering valuable contributions. Without his enthusiasm and hard work; it would not have been possible to proceed further. Special acknowledgement is due to Mr. K.R. Bhimarao in arranging the data for computerisation, Mr. B.N. Gopalan for laboratory support and Mr. B. Doraiswamy for the secretarial help. The authors express their gratitude to Dr. P.R. Narayanan, Director, Tuberculosis Research Centre, for his encouragement and help in making it possible to bring out this report.

REFERENCES

1. Tuberculosis Prevention Trial of BCG Vaccine in South India for Tuberculosis Prevention. Ind. J Med. Res., July 1980, 72, (Suppl). 1-74.
2. Frimodt-Moller. J, Acharyulu, G.S., Pillai, P.K. A controlled study of the effect of domiciliary bacillary tuberculosis chemotherapy programme in a rural community in South India. Ind. J. Med. Res., 1981, 73 (Suppl.). 1-80.
3. ICMR, Tuberculosis in India. A Sample Survey 1955-58, 59, Special Report 34, 1959.
4. Gothi, G.D., Narain, R., Nair, S.S., Chakraborty, A.K., Srikantaramu, N. Estimation of prevalence of bacillary tuberculosis on the basis of chest X-ray and/or symptomatic screening- Ind. J. Med. Res, 1976, 64, 1150.
5. Pamra, S.P., Goyal, S.S., Mathur, G.P., Changes in prevalence and incidence of pulmonary tuberculosis in recent years. Ind. J. Tub., 1973, 20, 57.
6. Goyal, S.S., Mathur, G.P., Pamra, S.P. Tuberculosis trends in an urban community - Ind.

J. Tub. 1978, 25, 77.

7. National Tuberculosis institute,. Tuberculosis in a rural population of South India, A five year epidemiological study. Bull. World Health Orga., 1974, 51, 473.

8. Gothi, G.D., Chakraborty, A.K., Nair, S.S., Ganapathy, K.T., Banerjee, G.C. Prevalence of tuberculosis in a South Indian district-twelve years after initial survey. Ind. J. Tub., 1979, 26, 121.

9. Chakraborty, A.K., Singh, H., Srikantan, K., Rangaswamy, K.R., Krishnamurthy, M.S., Stephen, J.A. Tuberculosis in a rural population of South India : Report on five surveys. Ind. J. Tub. 1982, 29, 153.

IO. Chakraborty, A.K., Channabasavaiah, R., Krishnamoorthy, MS., Sashidhara A.N., Krishnamoorthy, V.V. and Chaudhari, K. Prevalence of pulmonary Tuberculosis in a peri-urban community of Bangalore under various methods of population screening. Ind. J. Tub., 1994, 41, 17.

11. Narang, P., Nayar, S., Mendiratta, D.K., Tyagi, N.K. and Jajoo V. : Smear and cultural positive cases of tuberculosis found among symptomatics surveyed in Wardha district. Ind. J. Tub., 1992, 39, 159.

12. Chakraborty, A.K., Suryanarayana, H.V., Krishnamurthy, V.V., Krishnamurthy, M.S., Sashidhara, A.N., Prevalence of tuberculosis in a rural area by an alternative survey method without prior radiographic screening. Tuber, and Lung Disease Vol. 76, Number 1 : 20, Feb. 1995.

13. Nagpaul, D.R., Naganathan, N., Prakash, M. Some aspects of sputum examination in tuberculosis case-finding. Ind. J. Tub. 1979, 26, 11.

14. Baily, G.V.J., Savic, D., Gothi, G.D., Naidu, V.B., Nair, S.S., Potential yield of pulmonary tuberculosis cases by direct microscopy of sputum in a district of South India. Bull. World Health Org., 1967, 37, 875.