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Research Article

Socio-economic profile and risk factors among pulmonary tuberculosis patients in Madurai, India: a cross sectional study

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ABSTRACT

Background: This study has been carried out to assess the socio-economic profile and underlying risk factors of pulmonary tuberculosis (PTB) patients registered under RNTCP programme of India and to find the differences based on their residential place.
Methods: The study design was cross sectional consisting of 167 PTB patients from three DOTS centres in Madurai, Tamilnadu during August 2015. Data was collected using a questionnaire that included personal details, socio-economic and risk factors.
Results: PTB was most prevalent in the age group of 35–54 years both in the urban (46.7%) and rural (49.4%) side. In the urban population, 67 (74.4%) were men whereas in the rural population they were 53 (68.8%). Maximum of the study subjects were from nuclear family (67.8% in urban and 89.6% in rural). About 20% of the patients studied were illiterates irrespective of their residential place. Labourers were 37% in urban area and 49% in rural area. Smoking, alcoholism and Diabetes Mellitus (DM) were more common among urban PTB patients while under-nutrition and poor housing among rural PTB patients.
Conclusions: The study has concluded that the usual epidemiological pattern of PTB has been observed in both urban and rural setup as reported by other researchers. Socio-economic status and risk factors have played a vital role for treatment success. To eradicate Tuberculosis (TB), a holistic and interdisciplinary approach would be necessary to improve the socio-economic status along with proper screening and treatment of underlying risk factors. More precise health education and proper awareness programmes have to be implemented from the grass-root level to get rid of TB.

Keywords: Pulmonary tuberculosis, Socio-economic factors, Risk factors, Urban area, Rural area

INTRODUCTION

In today's world, Tuberculosis (TB) still remains as a major public health problem. In terms of incidence, the WHO South-East Asia Region (SEAR) accounted for 38% of the global burden of TB. According to the latest estimate in the year 2013, the occurrence of new TB cases were 3.4 million and deaths due to TB were about 4,40,000 each year. Five of the 11 Member countries of SEAR namely Bangladesh, India, Indonesia, Myanmar and Thailand were among the 22 countries in the world with high-burden of TB. India alone accounted for 23% of the world's incident TB cases and 21% of world deaths due to TB. Among all new TB cases detected in 2013 in

SEAR, most cases occurred among young adults, especially males in the most productive age group of 25–34 years.[1]

The prevalence, pattern of TB and the death rates vary from country to country and from one region to another region within a country.[2] These variations depend on prevailing social factors such as poverty, illiteracy, ignorance, poor standard of living, overcrowding etc. which were all inter-related and contributed to the prevalence of TB.[3,4] There are several studies to indicate a higher TB occurrence in patients with smoking, alcoholism, HIV/AIDS, malnutrition and Diabetes Mellitus (DM).[4-7]

Morbidity and mortality due to TB has been brought down significantly through the application of WHO recommended DOTS strategy that was part of the Revised National Tuberculosis Control Programme (RNTCP). The aforesaid socio-economic characteristics were established to have a crucial role in the treatment success of TB patients under DOTS. Hence, these characteristics have to be acknowledged under the programme in an appropriate manner so that those components would not turn out to be barriers of treatment success.[8]

In India, data on socio-economic characteristics and underlying risk factors for Pulmonary Tuberculosis (PTB) were sparse. Very few studies have been performed in India to arbitrate the impact of socio-economic status and the major predisposing factors.

The objective of the present study is to assess the socio-economic profile and underlying risk factors of PTB patients registered under RNTCP Programme of India and to find the differences based on their place of residence.

METHODS

The design of the epidemiological study was cross-sectional observational study and of descriptive type. The study was conducted at DOTS centres of Madurai Government Rajaji Hospital and the field practice area of Institute of Community Medicine, Madurai Medical College, Tamilnadu namely Kallandiri PHC and Chekkanurani PHC during the month of August 2015.

The study population included 167 PTB patients who had visited the priory mentioned DOTS centres to receive drugs. No sample size determination was done because all PTB patients irrespective of their age and sex were included. Patients were informed about the purpose of the study, and their informed oral consent was obtained. They were assured about their confidentiality and anonymity. Study technique used was exit interview. Before the actual study, a proforma was designed with three experts from medicine, community medicine and pulmonology departments. Pretesting was done to assure its validity. Necessary corrections and modifications were done in the proforma for smooth data collection.

The study tool was a predesigned and pretested schedule that contained close-ended questions. Interviews were conducted by trained junior residents conversant in the local Tamil language in order to collect information from the participants. Study variables included were personal details (age, sex, religion, type of family, marital status), socio-economic factors (education, occupation, per capita income, overcrowding, housing, water supply and number of consumer articles) and risk factors (DM, smoking, alcohol, HIV, malnutrition.

The socio-economic data were analysed on the basis of the following variables:

1. Level of education was divided into 5 categories: Group 1 – Illiterate, Group 2 – Semi-literate (Primary education - less than Class V), Group 3 - Secondary education, Group 4 - Graduation, Group 5 - Post graduation and above.
2. Occupational groups were divided into 5 categories: Group 1 – Blue-collar workers (agricultural, non-agricultural and skilled labourers); Group 2 - White-collar workers (salaried personnel, self-employed businessmen, hotel workers and drivers); Group 3 - Retired and unemployed personnel; Group 4 - Household workers and Group 5 - Students.
3. Income based on Revised modified BG Prasad socio-economic classification scale. Per capita monthly income was computed by Total monthly income of the family divided by Total members of family. The income level was categorized into five groups: Group 1 (Upper class): ₹5357 and above, Group 2 (Upper middle class): ₹5356 - ₹2652, Group 3 (Middle class): ₹2651 - ₹1570, Group 4 (Lower middle class): ₹1569 - ₹812 and Group 5 (Lower class): Less than ₹811 per person per month.
4. Overcrowding based on sex separation. If two persons over 9 years of age of opposite sex are obliged to share the same room (Exception: husband and wife)
5. Type of housing: Scores assigned based on construction type (Pucca = 0, semi-pucca = 1 Kutcha = 2) and whether gets flooded/floor gets wet in rainy season (Yes = 1, No = 0), sewage system (Latrine = 0, No system=1), Tenure (Own dwelling = 0, Rented = 1). Based on the total score, the housing was graded from good (Score = 0) to poor (Score = 2-5).
6. Water supply: Graded from good (Score = 0) to poor (Score = 2) based on whether supply was available throughout the day (Yes = 0, No = 1) and based on location of the water supply (Inside the house = 0, Outside the house = 1).
7. Number of consumer items: Categorized depending on the number of consumer items (refrigerator, television, radio, telephone etc.) available in the house (None = 1, One item = 2 and so on).

Data was entered and analysed in SPSS version 17. Results were tabulated using frequency distribution and proportion. Chi-square (χ^2) test was applied for statistical significance. A *p*-value of less than 0.05 was considered statistically significant.

RESULTS

Of the 167 PTB patients studied, 90 (54%) were residing in the urban area and 77 (46%) were living in the rural area. Among the study population, 120 (71.9%) were men and 47 (28.1%) were women and the male female ratio was 2.5:1. In the urban population, 67 (74.4%) were men and 23 (25.6%) were women with the male female ratio of 3:1, whereas in the rural population, 53 (68.8%) were men and 24 (31.2%) were women with the male female ratio of 2.2:1.

PTB was most prevalent in the age group of 35–54 years (46.7%) followed by >55years (22.4%) in urban area. In the rural area, it was more prevalent in the age group of 35-54 years (49.4%) followed by 15-34 years (22%). In the present study, 98.9% and 96.1% of study subjects were Hindus in the urban and rural areas respectively. PTB was more common in married patients in urban (86.7%) and rural (77.9%) areas as compared to the unmarried patients of urban (13.3%) and rural (22.1%) areas.

Table 1: Demographic factors among study population based on place of residence.

Variable		Urban (N = 90)	%	Rural (N=77)	%	Total (N=167)	%
Age	0-14	9	10.0	6	7.8	15	9
	15-34	17	18.9	17	22.0	34	20.3
	35-54	42	46.7	38	49.4	80	48
	>55	22	24.4	16	20.8	38	22.7
	χ^2_3= 2.058, p ≤ 0.914, Not Significant						
Sex	Male	67	74.4	53	68.8	120	71.9
	Female	23	25.6	24	31.2	47	28.1
	χ^2 = 0.647, p ≤ 0.244, Not Significant						
Religion	Hindu	89	98.9	74	96.1	163	97.6
	Muslim	0	0	1	1.3	1	0.6
	Christian	1	1.1	2	2.6	3	1.8
	χ^2_3= 1.742, p ≤ 0.424, Not Significant						
Family type	Nuclear	61	67.8	69	89.6	130	77.8
	Joint	29	32.2	8	10.4	37	22.2
	χ^2 = 11.47, p ≤ 0.001, Significant						
Marital status	Married	78	86.7	60	77.9	138	82.6
	Unmarried	12	13.3	17	22.1	29	17.4
	χ^2 = 1.644, p ≤ 0.200, Not Significant						

The study has shown that maximum subjects were from nuclear families (i.e.) 67.8% in the urban area and 89.6% in the rural area. There is no statistical significance between place of residence and the demographic factors like age, sex, religion and marital status except for the family type. Table 1 shows the demographic distribution of patients with PTB based on place of residence.

PTB was found to be common in the less educated category. PTB was 19.2% in illiterates (20% in urban and 18.2% in rural), 47.3% in semi-literates (41.1% in urban and 54.5% in rural), 25.7% in patients with secondary level of education (30% in urban and 20.8% in rural) and about 7.8% in graduate patients (8.9% in urban and 6.5% in rural). No post graduate patients were reported in the study. Among the study population, 43.1% were labourers (37.8% in urban and 49.4% in rural), 13.2% were white-collar workers (12.2% in urban and 14.3% in rural), 15.6% were retired or unemployed persons, 16.8% were household workers (16.6% in urban and 16.9% in rural) and 11.3% were students (12.2% in urban and 10.3% in rural).

Based on the revised modified BG Prasad socio-economic classification scale most of the PTB patients were from middle class (42.2%) and upper middle class (38.9%) in the urban area while many were from lower middle class (39%) and middle class (27.4%) in the rural area. There is a statistical significance between the place of residence and per capita monthly income.

Overcrowding was present both in urban (57.8%) and rural areas (46.8%). Housing index, water supply and consumer articles were good in urban area and from fair to poor in rural area. There is a significant difference between the place of residence and housing, water supply and consumer articles. Table 2 shows the socio-economic factors of patients with PTB based on place of residence.

Risk factors among the study population based on place of residence is shown in Table 3. Smoking (68.9% in urban and 46.8% in rural), alcoholism (60% in urban and 19.5% in rural) and DM (22.2% in urban and 7.8% in rural) were more common among PTB patients residing in urban area than those in the rural area. In the PTB patients, under-nutrition was more common in rural side (45.5%) than the urban side (8.9%). The association is found to be significant between place of residence and the risk factors like smoking, alcoholism, DM and BMI. Only 2 cases of HIV were reported in the urban area.

Table 2: Socio-economic factors among study population based on place of residence.

Variable		Urban (N = 90)	%	Rural (N=77)	%	Total (N=167)	%
Education	Illiterate	18	20	14	18.2	32	19.2
	Semi-literate (Primary)	37	41.1	42	54.5	79	47.3
	Secondary	27	30	16	20.8	43	25.7
	Graduate	08	8.9	05	6.5	13	7.8
	χ_3^2= 3.33, p ≤ 0.343, Not Significant						
Occupation	Blue collar	34	37.8	38	49.4	72	43.1
	White collar	11	12.2	11	14.3	22	13.2
	Retired/ Unemployed	19	21.2	07	9.1	26	15.6
	Household worker	15	16.6	13	16.9	28	16.8
	Student	11	12.2	08	10.3	19	11.3
	χ_4^2 = 2.866, p ≤ 0.5804, Not Significant						
Income	Class I	08	8.9	08	10.4	16	9.6
	Class II	35	38.9	16	20.8	51	30.5
	Class III	38	42.2	21	27.4	59	35.3
	Class IV	07	7.8	30	39.0	37	22.2
	Class V	02	2.2	02	2.6	04	2.4
	χ_4^2 = 25.42, p ≤ 0.00001, Significant						
Overcrowding	Yes	52	57.8	36	46.8	88	52.7
	No	38	42.2	41	53.2	79	47.3
	χ^2 = 2.203, p ≤ 0.155, Not Significant						
Housing	Good	69	76.7	18	23.4	87	52.1
	Fair	11	12.2	27	35.1	38	22.8
	Poor	10	11.1	32	41.5	42	25.1
	χ_2^2 = 47.43, p ≤ 0.0001, Significant						
Water supply	Good	51	56.6	25	32.5	76	45.5
	Fair	28	31.1	42	54.5	70	41.9
	Poor	11	12.2	10	13.0	21	12.6
	χ_2^2 = 10.8, p ≤ 0.005, Significant						
Consumer articles	≥ 4	36	40.0	9	11.7	47	27.0
	3	27	30.0	14	18.2	41	24.5
	2	10	11.1	20	26.0	30	18.0
	1	17	18.9	34	44.1	51	30.5
	χ_3^2 = 28.4, p ≤ 0.00002, Significant						

DISCUSSION

To control PTB, it is essential to understand the demographic factors, socio-economic dimensions and complex risk factors of the disease in the community. Thus, in this descriptive cross sectional study, the frequency distribution of the above mentioned factors based on the place of residence has been studied.

In the current study, urban dwellers had higher prevalence of PTB in comparison with those living in the rural area. A study at Mumbai, India by Almeida et al and another study by Bjerregaard-Andersen et al in Guinea Bissau showed similar results and indicated that the disease burden was higher in urban area than the rural area.[9,10] However, this finding had been opposed by Dubey et al and Ali et al in their studies where the prevalence of TB was shown to be more in rural area than the urban area.[11,12]

Several studies both globally as well as in India had supported the strong confounding effects of age and sex on the incidence of TB.[13,14] TB had mostly affected the economically productive age group.[15,16] The study population in the middle age group between 15 and 54 years were the worst affected according to the current study. The middle age group had accounted for more than 60% of PTB both in urban and rural areas which were similar to the previous studies.[4,17-19]

Table 3: Risk factors among study population based on place of residence.

Variable		Urban (N = 90)	%	Rural (N=77)	%	Total (N=167)	%
Smoking	Yes	62	68.9	36	46.8	98	58.7
	No	28	31.1	41	53.2	69	41.3
	$\chi^2 = 8.386$, $p \leq 0.005$, Significant						
Alcoholism	Yes	54	60.0	15	19.5	69	41.3
	No	36	40.0	62	80.5	98	58.7
	$\chi^2 = 28.1$, $p \leq 0.001$, Significant						
DM	Yes	20	22.2	6	7.8	26	15.6
	No	70	77.8	71	92.2	141	84.4
	$\chi^2 = 3.41$, $p \leq 0.02$, Significant						
BMI	Underweight	8	8.9	35	45.5	43	25.7
	Normal	82	91.1	42	54.5	124	74.3
	$\chi^2 = 8.542$, $p \leq 0.001$, Significant						

It is noteworthy in the present study that 24.4% in urban area and 20.8% in rural area affected by PTB belonged to the age group of above 55 years. Since, in older age groups PTB might be present only as cough that could be ignored. Also, chest symptoms in the elderly people may be treated for other chronic respiratory tract infections such as asthma or chronic bronchitis or emphysema that are of major importance in the upper decades of life. Therefore, a higher surveillance would be required for older people with history of cough visiting the health facilities.[20] The study done by Khan at rural Aligarh and by Raviglione et al in Western Europe reported maximum cases in the age group of 60 years and above.[5,21]

The present study has revealed that more than 65% of the study subjects in both urban and rural area were male. The reason for higher incidence of TB in men could be attributed to their gender specific role that would require them to have many social contacts. This in turn could have increased their TB exposure risk.[22] Similar male dominance for PTB was found by Khan in rural Aligarh and in the study based on NFHS-2 by Kaulagekar & Radkar.[5,23]

In the current study more than 95% of the study subjects were Hindus in both urban and rural area. This was similar to the observation made in the study of Shetty et al done at Bangalore that reported higher number of cases in Hindus (72%).[14] Also, the study by Jethani et al at Dehradun reported 74.3% of the study population were Hindus.[24]

PTB was more prevalent in married patients (more than 75%) irrespective of the place of residence when compared to unmarried patients. This might be due to the fact that married people have more liabilities. Therefore, they could have paid lesser attention towards their health as compared to unmarried persons. Similar findings were reported by Dubey et al in 1975 and by Ali et al in 2013.[11,12]

The present study has shown that maximum subjects were from nuclear families (i.e. 67.8% in urban and

89.6% in rural area) which were opposed in the previous studies of Khan, Ali et al and Jethani et al where a higher percentage of cases were found in joint families.[5,12,24] In the current study, association between family type and place of residence is statistically significant.

TB is a disease of poverty, associated with resource poor countries. However, the association of specific socio-economic factors and TB was not clear.[14] In the study population almost 20% were illiterates irrespective of the place of residence while semi-literates were 41% in urban area and 54% in rural area. Statistically no significant association between educational status of study participants and their place of residence is observed in the present study. Similarly studies by Rajeswari et al and Muniyandi et al in India showed that the study population were illiterates.[15,25] The studies by Bogam & Sagare in India and Silveira et al in Southern Brazil found no significant association between level of education and frequency of TB.[3,26]

Some prior studies had documented that the percentage of PTB was greater in waged workers than salaried or self-employed people in India but another study from Wardha, India showed that the TB percentage in white collar workers was higher compared to blue collar workers.[15,16] In the present study, labourers were 37% and unemployed individuals (retired persons, students and housewives) were 33.4% in urban area but labourers were 49% and unemployed individuals (retired persons, students and housewives) were 19.4% in the rural area. This was very similar to the findings of Gupta et al, Khan, Muniyandi et al, Rajeswari et al and Gajbhare et al.[4,5,15,25,27]

A study by Schoeman et al argued that the role of socio-economic status as a risk factor for TB was shown to be unclear but the study by Muniyandi et al reported that 61.75% cases belonged to Below Poverty Line (BPL).[25,28] In the present study, majority of the study participants were from middle and upper middle class in urban area and lower, middle, and upper middle class in rural area. Statistical significance is found between the place of residence and per capita monthly income.

Overcrowding would increase the risk of disease transmission.[29] Overcrowded homes and living in densely populated neighbourhoods were elements that contributed to the development of TB.[30] When a TB patient sneezes or coughs, aerosol droplets with the tubercle bacilli are released into the open atmosphere. Fine droplet nuclei remain suspended in the air stream that reaches the alveolar space, thereby starting the infection. Overcrowding decreases the degree of air space that is shared that result in increased exposure to *M.tuberculosis*. A study done at Guinea-Bissau showed that overcrowding was a risk factor for TB.[31] In the current study, overcrowding was common in urban area than in rural area. However, no statistical significance between the place of residence and overcrowding is found in the present study.

Among the PTB patients in the present study, housing and water supply were poor in rural area when compared to the urban area. Similar to overcrowding, poor housing was also an independent factor for increased frequency of PTB. It is well known that a feasible bacillus that is dried out or exposed to sunlight frequently is phenotypically very weak to outset an infection. Poor housing with poor ventilation (that would prolong contact with infectious droplet nuclei) and increased dampness (that would promote viability of tubercle bacillus) would increase the risk of transmission and development of the disease.[29]

Smoking and alcoholism were more common in urban PTB population than the rural PTB population and the difference is found to be statistically significant in the present study. There is a clear association between smoking and reduced local immunity within the lungs. In smokers, the mucous membranes of the lungs would be damaged and inflamed with paralyzed hair cells. The impact of smoking would make the lungs susceptible to infections including TB. In addition to the fact that the TB bacteria are not efficiently removed after inhalation, chronic lung damage impairs the lung immunity and might increase susceptibility to TB.[32]

In support to the present study, Maiti et al had revealed that both smoking and alcoholism had independently and synergistically increased the TB severity significantly in urban and rural part of Eastern India.[33] Khan had suggested about 30–50% increased risk of TB in smokers.[5] As per the findings of Kolappan & Gopi alcohol consumption could increase health problems and occurrence of infectious diseases.[34] Chronic alcoholism had been associated with TB and chronic alcoholics had increased incidence of bacterial pneumonia due to immune system suppression.[34]

Studies carried out by Lonnroth et al in 2008 in developed countries reported about 10–50% prevalence of alcoholic disorders in TB patients.[6] Gajalakshmi & Peto[35] in rural areas of Tamilnadu, India had found an increased incidence of PTB among smokers and alcoholics. On the contrary, a similar study from South India had shown history of smoking and alcohol consumption to be a non-significant risk factor for TB.[14] Also, Gopi et al found no statistical association between smoking or alcoholic habits and TB.[36]

In the present study, DM was more common among urban PTB patients than rural patients. Other researchers have also demonstrated the association of DM with TB.[14,37,38] As a result of rapid economic transition in countries like India, the complex relationship between communicable and non-communicable diseases is particularly relevant and merits further study.

Increase in BMI would lower the risk of TB and that association is probably bidirectional. A low BMI indicates malnutrition and is therefore a risk factor for the development of TB but TB in turn leads to anorexia and catabolism.[30] TB is a disease of the poor and therefore, malnourished people are at risk for developing TB[14]. In the present study, under-nutrition was more common among rural PTB patients than urban patients. These findings were endorsed by Cegielski & McMurray in their work that nutritional support of undernourished population who were at higher risk of TB might reduce the incidence in such groups.[39]

Limitations

This hospital based cross sectional study design includes only those patients seeking services from the government health facilities and not from the private sector. These findings, therefore, could not be generalized to all PTB affected individuals. Causal association cannot be infested with this study design. In order to ascertain the true significance of the socio-economic risk factors larger studies are needed to confirm the strength of associations.

CONCLUSION

In general, the current study had followed the usual epidemiological pattern of PTB in both urban and rural areas as reported in many other studies. PTB has mainly affected the productive age group of the society. Thus, it has thwarted not only the social and economic development of individuals but also their families, society and the nation. It is mostly prevalent in the middle and lower middle class community which are already struggling for their survival in the day to day life. The underlying risk factors like smoking, alcoholism and DM were more common in the urban population whereas poor housing and under nourishment were more common in the rural population.

Socio-economic status and risk factors have played a vital role for treatment success. Most public health efforts are focused on control of TB through early diagnosis and prompt treatment of patients. It is not surprising that cost effective strategies such as DOTS therapy have been successful to a larger extent even in the lesser socio-economic status group. But the current predominantly treatment-based approach to TB control could not lead to its eradication unless matching and forceful efforts of prevention through socio-economic status improvement are initiated. In order to eradicate TB, a holistic and interdisciplinary approach with proper screening and treatment of underlying risk factors are highly needed. More precise health education and proper awareness programmes have to be implemented from the grass root level to get rid of TB.

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