Correspondence

Risk factors of pulmonary tuberculosis in tea garden communities of Assam, India

Sir,

In the northeast India, especially in the tea garden communities of Assam pulmonary tuberculosis (PTB) is one of the major health concerns[1]. Although there is a growing body of evidence suggesting a number of factors which put individuals at the risk of acquiring PTB, there are scanty data available on risk factors of PTB concerning these communities of Assam. Studies have pointed to the association of lower socio-economic status (SES) with the risk of developing PTB[2,3]. Underlying repercussions of low SES which include illiteracy, under-nourishment and close contact to smear positive patients are also significant risk factors of pulmonary tuberculosis[2,4,5]. Co-morbidities such as HIV, diabetes mellitus, smoking and consumption of alcohol which debilitate the immune system put individuals at a greater risk of developing TB[6-9]. Kitchen smoke where biomass fuel is used, is also shown to be associated with PTB[5,10,11].

We conducted a case control study in the tea garden communities of upper Assam (Tinsukia, Dibrugarh, Sivasagar and Jorhat) to determine the important risk factors associated with PTB. The cluster sampling method was used to recruit PTB cases and controls. Over a period of two years (2010–2012), 291 consecutive newly diagnosed (<6 months) sputum smear and culture positive PTB cases and retreatment cases as per the RNTCP (Revised National Tuberculosis Control Programme) register in each tea garden and 582 age (±5 years) and sex matched apparently healthy controls were recruited from 30 randomly selected tea gardens from a total of 379 tea gardens. A close ended and pre coded questionnaire was administered by trained interviewers to record the personal health, demographic and socio-economic related factors. The study protocol was approved by the Institutional ethical committee of Regional Medical Research Centre, Dibrugarh, Assam.

Statistical analysis of the underlining risk factors associated with PTB was performed using EGRET^R for Windows v2.0.3, USA. Crude Odds ratios (OR) and their 95% confidence intervals (CI), were derived using univariate conditional logistic regression with age and sex as matching variables. To identify factors independently associated with tuberculosis and to remove confounding variables multivariate conditional logistic regression analysis was also performed using backward elimination procedure. $P \leq 0.05$ (both tails) was considered significant.

Of the 291 PTB cases recruited, 176 (60.5 %) were male and 115 (39.5 %) were female with a male to female ratio of 1.53: 1. The median age of both cases and controls was 33 yr. PTB was most prevalent in the age group of 16-30 yr (121/291; 41.6%), followed by 31-45 yr (106/291; 36.4%), ≥46 yr (49/291; 16.8%) and ≤15 yr (15/291; 5.2%). Of the 276 cases (age≥15 yr), 132 (47.8%) were pluckers, 116 (42.0%) were daily wagers including housewives, 19 (6.9%) were factory workers and 9 (3.3%) were sprayers. Only 19 (6.9 %) patients reported of having at least one underlying chronic condition. Four individuals reported of liver disease, while hypertension and diabetes were reported by one individual each. The overall prevalence of malnutrition (BMI lower than 18.5 kg/m^2) was 51 per cent. However, in PTB cases the prevalence of malnutrition was significantly more in cases (203/285; 71.2%) than controls (242/576; 42%).

Table I shows the results of the conditional univariate logistic regression. Among the host related risk factors, being illiterate (OR 2.09; 95% CI, 1.52-2.88), consuming alcohol (OR 1.52; 95% CI, 1.07-2.15), and a lower BMI (<18.5 kg/m^2) (OR 3.54; 95% CI, 2.56-4.91) increased the risk of PTB significantly. Individuals without a regular income (OR 2.01; 95% CI, 1.41-2.88), without basic household amenities (OR

Table I. Univariate analysis showing association of selected factors and risk of pulmonary tuberculosis in tea garden communities of Assam

Variable	Cases (n=291) (%)	Controls (n=582) (%)	Crude OD (95% CI)	*P* value
Marital status				
Married	226 (32.8)	463 (67.2)	1	
Single	65 (35.3)	119 (64.7)	1.26 (0.71-2.06)	0.35
Literacy				
Literate	115 (26.4)	320 (73.6)	1	
Illiterate	176 (40.1)	262 (59.8)	2.09 (1.52-2.88)	<0.001
Regular family income£				
Yes	125 (28.3)	316 (71.7)	1	
No	135 (39.2)	209 (60.8)	2.01 (1.41-2.88)	<0.001
Household income				
>5000	20 (35.1)	37 (64.95)	1	
≤5000	271 (33.2)	545 (66.8)	0.91 (0.51-1.61)	0.75
No. of persons per room£				
≤ 2	196 (34.2)	377 (65.8)	1	
>2	72 (30.5)	164 (69.5)	0.85 (0.60-1.18)	0.34
Possession of modern facilities				
Modcons	150 (29.4)	360 (70.6)	1	
Basic	55 (36.2)	97 (63.8)	1.4	0.09
None	86 (40.8)	125 (59.2)	1.72 (1.21-2.43)	0.002
Housing condition				
Pucca	195 (33.9)	379 (66.0)	1	
Kaccha	96 (32.1)	203 (67.9)	0.92 (0.68-1.24)	0.58
Kitchen				
Separate	257 (32.5)	533 (67.5)	1	
Living room	34 (40.9)	49 (59.0)	1.43 (0.90-2.27)	0.13
Fuel				
LPG.	7 (15.2)	39 (84.8)	1	
Wood only	284 (34.3)	543 (65.7)	2.93 (1.29-6.68)	0.01
Alcohol consumption$				
No	121 (29.9)	283 (70.1)	1	
Yes	156 (36.5)	271 (63.5)	1.52 (1.07-2.15)	0.018
Smoking habit$				
No	230 (33.1)	466 (66.9)	1	
Yes	47 (34.8)	88 (65.2)	1.10 (0.71-1.68)	0.67
BMI£				
BMI ≥ 18.5	82 (19.7)	334 (80.3)	1	
BMI < 18.5	203 (45.6)	242 (54.4)	3.54 (2.56-4.91)	<0.001

Contd...

Variable	Cases (n=291) (%)	Controls (n=582) (%)	Crude OD (95% CI)	P value
History of TB in family				
No	180 (29.1)	438 (70.9)	1	
Yes	11 (43.5)	144 (56.5)	1.80 (1.34-2.42)	<0.001
TB awareness£				
No	179 (29.4)	429 (70.6)	1	
Yes	106 (42.6)	143 (57.4)	1.00 (0.72-1.39)	0.977

Odds ratio (OR), 95% confidence interval (CI) and P value were derived using conditional logistic regression with age and sex as matching variables.
Modcons, Motor vehicle and electronic household gadgets; Basic, bicycle only.
$Children (age less than 15 yr) were excluded from analysis of alcohol consumption and smoking.
£Data missing in some cases which were excluded in the analysis
LPG, liquefied petroleum gas

1.72; 95% CI, 1.21 – 2.43), using wood as fuel (or 2.93; 95% CI 1.29-6.68) or have a family history of PTB (OR 1.80; 95% CI, 1.34-2.42) had a greater risk of acquiring PTB.

Multivariate analysis (Table II) revealed that illiteracy [adjusted OR (AOR) 1.65; 95% CI, 1.11-2.46], alcohol consumption (AOR 1.48; 95% CI, 0.94-2.33), history of TB patient within the family (AOR 1.82; 95% CI, 1.25 - 2.65), irregular income (AOR 1.78; 95% CI, 1.18-2.67), and a lower BMI (< 18.5 kg/m^2) (AOR 3.41; 95% CI, 2.32-4.99) were independent risk factors for PTB.

The present study revealed that the family history of PTB was an important and independent risk factor of PTB in the tea garden communities. Thus early detection and treatment of TB cases will be an important factor for an effective TB control programme. Besides, screening of family members or close contacts of the

Table II. Factors independently associated with pulmonary TB in tea garden communities				
Variable	Cases (n=235) Number (%)	Controls (n=483) Number (%)	Adjusted OR (95% CI)	P value
Literacy				
Literate	91 (26.4)	254 (73.6)	1	
Illiterate	144 (38.6)	229 (61.4)	1.65 (1.11-2.46)	0.013
Regular family income				
Yes	119 (27.9)	308 (72.1)	1	
No	116 (39.9)	175 (60.1)	1.78 (1.18-2.67)	0.005
Alcohol consumption				
No	104 (29.6)	247 (70.4)	1	
Yes	131 (35.7)	236 (64.3)	1.48 (0.94-2.33)	0.088
BMI				
BMI≥18.5	68 (19.1)	289 (80.9)	1	
BMI<18.5	167 (46.3)	194 (53.7%)	3.41 (23.32-4.99)	<0.001
History of TB in family				
No	147 (28.9)	361 (71.1)	1	
Yes	88 (41.9)	122 (58.1)	1.82 (1.25-2.65)	0.001

(Multivariable model based on conditional logistic regression analysis with strata defined by age and sex matched sets. The final model is based on backward elimination procedure to remove insignificant and confounding variables)

TB cases will also be critical factor in preventing the spread of TB infection in the family and the community. To effectively lessen the impact of risk factors such as illiteracy, alcohol consumption and delay in seeking TB treatment (resulting in more exposure of family members or close contacts to PTB patients) there is an urgent need to generate TB awareness and to provide better health education among the community members. The present study also showed that the majority (51%) of tea garden workers were underweight with BMI less than 18.5 kg/m^2. Such a low BMI was found to be a significant and independent risk factor for PTB. Improving the living standard in tea garden workers can significantly lessen the risk of TB. For example facilities may be provided to the tea garden workers so that these people do not use biomass as fuel and the kitchen should be separate from the living room. In the present study also use of wood as fuel and kitchen within the living room significantly increased the risk of PTB. In the multivariate model though the use of biomass as fuel and location of kitchen were not included in the final model because both these risk factors were correlated with family income which was retained in the model. Limitations of this study included small sample size, and the effect of co-morbidities such as HIV, diabetes mellitus could not be investigated Also, as the information was collected from individuals verbally certain risk factors could have been over-or underestimated.

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