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# Associated Factors of Pulmonary Tuberculosis in Rajshahi City of Bangladesh

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**ABSTRACT** Tuberculosis (TB) is a social disease and several socio-economic factors have significant effects on TB. The aim of this study is to assess the factors associated with the Pulmonary TB (PTB). A cross-sectional study was carried out at Rajshahi City, Bangladesh and 384 TB patients were interviewed through a structured questionnaire. Univariate analysis was used to find out the percentage distributions of the variables. Chi-square test was performed to find out the association between dependent and independent variables. Binary logistic regression analysis was carried out to evaluate the effects of selected socio-economic determinant factors of PTB patients. Among 384 TB patients, 74% were PTB and 26% were extra-pulmonary TB patients. Chi-square test identified that the respondents sex, age, educational status, family income, area of living, types of house, cooking facility, smoking, drug addiction, duration of suffering, and body mass index (BMI) are significantly association with PTB. Finally, binary logistic regression analysis identified that age, area of living, cooking facility, smoking status, drug addiction, duration of suffering, and BMI have significant effects on PTB. Therefore, Bangladesh National TB Control Program (NTP) can implement key actions to improve outcomes and case detection among risk groups.

## 1. INTRODUCTION

Coming into the twenty-first century, medical research has improved and provided a lot of actions to eliminate most of the serious communicable diseases. Many diseases, like tuberculosis (TB), smallpox, polio, measles, hepatitis B, etc., can be eradicated through the childhood vaccination programs. But, still, it has become difficult to control the spread of many of these diseases. These diseases are significantly linked with the several socio-economic factors such as poverty, illiteracy, etc. TB is an ancient disease that has remained a curse on mankind for more than 4,000 years (Zaman 2010). TB is a multisystemic chronic disease, caused by the bacillus Mycobacterium TB (MTB), with numerous presentations and signs and is the most common cause of infectious disease-related morbidity and mortality worldwide. There are two types of TB, namely, pulmonary TB (PTB) (TB bacteria generally affects the lungs) and extra-pulmonary TB (TB bacteria generally affects outside the lungs; such as, lymph nodes, pleura, brain, kidneys, or bones). The causative organism (bacillus MTB) of TB was identified over a century ago and near about 100% effective regimens are available but still there has been little impact on the problem of TB (Rajeswari et al. 1999). However, the disease is easy to diagnose and treat, nevertheless it has been ranking among the top ten causes of global mortality (Murray et al. 1997).

The World Health Organization (WHO) has declared that TB is the first infectious disease as a global health enemy in 1993 (Gupta et al. 2002). The Center for Disease Control and Prevention (CDC) states that one-third of the world's population is infected with MTB resulting in annually approximately 1.80 million deaths worldwide (WHO 2011). Re-emergence and association with Acquired Immune Deficiency Syndrome (AIDS) have made TB a global threat (Saqib et al. 2011). An individual with latent TB who contracts Human Immune Virus (HIV) is at high risk of TB becoming active in the body and vice versa. TB is one of the leading killers of people living with HIV responsible for one quarter of all TB deaths (WHO 2011). Every year almost two million people die worldwide due to TB disease (WHO 2011) and most of the deaths occur in the

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developing countries. Importantly, over 95% of TB deaths occur in low and middle-income countries (WHO 2011). TB occurs in every part of the world and 81% estimated of all cases are found in the high burden countries (HBCs) (WHO 2011). The South Asian Association for Regional Cooperation (SAARC) countries carried out 29% of global TB burden (Iqbal et al. 2011). The three SAARC countries, viz. India, Bangladesh and Pakistan have been listed among the 22 HBCs. Highly populous countries of Asia namely, India, China, Indonesia, Bangladesh and Pakistan, have the highest number of TB cases, and together account for more than half of the global burden (WHO 2011).

TB highly is associated with poverty and it is more common and well recognized in the developing countries. The highest rates of TB cases were found in the poorest section of the community (Zaman 2010). TB disease has already been declared a social disease which acts as a barometer of social welfare (Gupta et al. 2002). TB is associated with various socio-economic factors that fuel to raise TB related issues in different contexts as well as to the social dimensions (Saqib et al. 2011). Several studies have been undertaken addressing some socio-economic, cultural and healthcare seeking related factors that influence TB (Rajeswari et al. 1999; Gupta et al. 2002; Khurram et al. 2009). Moreover, the social and demographic factors such as, poor housing, low-income, overcrowding, lack of education, smoking habit, drug addiction etc. contribute to the incidence and transmission of TB (Gupta et al. 2002; Khurram et al. 2009; Wen et al. 2010).

Bangladesh is placed 6$^{th}$ among 22 HBCs (Banu et al. 2012). In Bangladesh, the recorded incidence rate was 225/100,000 population/year and the morality rate was 46% in 2010 (WHO 2011). Every year, around 64,000 people die only due to TB disease in Bangladesh **(**WHO 2011). To fight against TB, the Bangladesh National TB Control Program (NTP) has forcefully adopted the brand-name strategy of Directly Observed Treatment short-course (DOTs) since 1993 (Ullah et al. 2006). "Supervised swallowing" or Directly Observed Therapy (DOT), where health workers or trained volunteers watch the patients take their treatment, is one of the five elements of the DOTs strategy. The DOT element means that the patients have to visit the health workers or vice versa. The NTP in Bangladesh follows WHO recommended passive case-finding guidelines for case detection. People having symptoms of TB should be identified when they seek care at a general health facility, and referred to the specialized TB healthcare centers for diagnosis, treatment and case management. Bangladesh is accounted in low human development category based on the value of Human Development Index (HDI=0.500), placed 146 out of 187 countries and territories. Therefore, Bangladesh does not have notable success in the field of healthcare. For the case of estimated TB cases detection rate in Bangladesh, NTP has crossed the WHO target of 70%. However, many infected people remained unreported. There are numerous reasons behind it, viz. socio-economic barrier, lack of education, poor health infrastructure etc. which have already been considered risk factors for TB. It is an important job to determine which socio-economic factors serve as the determinant factors of PTB infection. Therefore, the main aim of the study is to assess the socio-economic risk factors that influence PTB. The paper is organized as follows. Section 2 presents the data collection process and analytical tools. Section 3 represents results obtained from the statistical analysis. Section 4 is the discussion that explains the results elaborately. Section 5 gives the concluding remarks.

## 2. DATA AND METHODS

A cross-sectional study was carried out among 384 TB patients. Of them 284 (74%) were PTB patients and 100 (26%) were extra-pulmonary TB patients in Rajshahi city, Bangladesh. The study was conducted in six different healthcare centers in Rajshahi city namely Rajshahi Medical Collage Hospital (DOTs Corner), Tilottoma (Noudapara Branch), Tilottoma (Bulonpur Branch), Rajshahi Chest Disease Hospital (CDH), Rajshahi Chest Disease Clinic (CDC), and Population Service and Training Centre (PSTC). The study sites were selected according to the random sampling method.

The adult TB patients (PTB and extra-pulmonary TB) who were taking treatment during the study period (June 2011 to February 2012) were selected as the study population. The study included only those patients who began treatment for TB after diagnosis. During the survey period, the patients were $\geq$14 years of aged. The patients who are suspected of TB are sent to the

laboratory for sputum microscopy and they are registered in the TB laboratory register. Patients diagnosed with smear-positive TB are registered for treatment in the TB treatment register. PTB was diagnosed according to any of the following criteria established in the Bangladeshi TB Guidelines as: i) detection by a direct test (Ziehl-Neelsen [ZN] method)- two positive samples; or ii) detection by a direct test (ZN method) one positive sample and a positive culture result for MTB (in Lowenstein-Jensen [LJ] medium); or iii) detection by a direct test (ZN method) one positive sample and radiological findings compatible with TB; or iv) only a positive culture result for MTB (in LJ medium); or v) presence of clinical, epidemiologic and radiographic findings compatible with TB. The diagnosis of extra-pulmonary TB was based on a combination of clinical, radiological, and histopathological findings. In addition to the most common tests as acid-fast bacilli smear, culture, drug susceptibility test and tuberculin skin test. The study sites have all the standard major equipments to conduct biomedical research studies for TB. Patients initiate diagnosis the same day results are confirmed. In these selected study sites, TB is diagnosed and treated without charge. These study areas provide TB treatment under the DOTs which aims to control TB infection.

The patients were face-to-face interviewed by using a semi-structured interview schedule containing pre-coded and open-ended questions. In-depth interviews were performed with consenting patients focusing on socio-economic data that influence TB infection. Two trained interviewers and one Public Health Specialist conducted the interviews after obtaining informed consent at the study sites. For each patient, the following information was collected: sex, age, educational status, monthly family income, area of living, type of family, type of house, cooking facility, smoking, drug addiction, duration of suffering and body mass index (BMI). All the questions were categorized except age, educational status, family income and duration of suffering which were categorized by the author and BMI was categorized according to the WHO recommendation. Corrections were made following an evaluation of the pilot survey and a final version of the questionnaire was completed. In order to evaluate the risk factors for TB patients, the study population (type of patients) was divided into two categories: category 1 consisting of extra-pulmonary TB patients and category 2 defining PTB patients. Therefore, type of TB patients is considered dependent variable for this study and coded in the following way:

$$Y=\begin{cases}1, & \text{if the respondent is a PTB patient,}\\ 0, & \text{otherwise.}\end{cases}$$

After data collection, the data were checked and entered into the statistical package, SPSS17.0. Univariate analysis was done to find out the distributions of different socio-economic characteristics associated with TB patients. Cross- study comparisons were carried out between socio-economic characteristics of patients; and type of patients. The Chi-square $(\chi^2)$ test for higher contingency tables was used to determine associations between dependent and independent predictors. Binary logistic regression analysis was performed to find out the effects of the selected socio-economic predictors on the type of patients. The *P* value of $<0.05$ was regarded as statistically significant. The Statistical Package for Social Sciences version 17.0 (SPSS Inc, Chicago, IL, USA) was used for statistical analysis.

## 3. RESULTS

### 3.1 Socio-economic Characteristics of TB Patients

Table 1 represented some selected socio-economic factors that are significantly associated with TB. Chi-square test stated that all the socio-economic indicators (sex, age, educational status, family income, area of living, types of house, cooking facility, smoking status, drug addiction, duration of suffering and BMI) selected for the study were significantly associated with TB disease. Table 1 also highlighted that male TB patients had a higher percentage (58.6%) among all the TB patients. Most of the TB patients (35.90%) were aged 21-35 years and their percentage (23.20%) was comparatively higher for extra-pulmonary TB patients in this age group. But the PTB were aged 36-50 years showed higher percentage (77.90%) as compared to other age groups. Most TB patients (52.60%) were less educated (0-5 years of schooling) and around 87.70% of them were PTB patients which was comparatively higher than other educational categories. Most of the TB patients (46.4%) belonged to low income group (<8000 Tk /month)

**Table 1: Distribution of socio-economic factors according to type of TB patients and corresponding associations**

| *Explanatory variables* | *Frequency (%)* | *Type of TB patients* | | *P values* |
|---|---|---|---|---|
| | | *Extra-pulmonary* | *Pulmonary* | |
| *Sex* | | | | |
| Male | 225 (58.6%) | 43 (19.1%) | 182 (80.9%) | |
| Female | 159 (41.4%) | 57 (35.8%) | 102 (64.2%) | 0.000 |
| *Age* | | | | |
| <20 years of age | 42 (10.9%) | 20 (47.6%) | 22 (52.4%) | |
| 21-35 years of age | 138 (35.9%) | 32 (23.2%) | 106 (76.8%) | |
| 36-50 years of age | 122 (31.8%) | 27 (22.1%) | 95 (77.9%) | |
| >50 years of age | 82 (21.4%) | 21 (25.6%) | 61 (74.4%) | 0.008 |
| *Educational Status* | | | | |
| 0-5 years of schooling | 202 (52.6%) | 33 (16.3%) | 169 (83.7%) | |
| 6-12 years of schooling | 128 (33.3%) | 44 (34.4%) | 84 (65.6%) | |
| >12 years of schooling | 54 (14.1%) | 23 (42.6%) | 31 (57.4%) | 0.000 |
| *Monthly Family Income* | | | | |
| <8000 Tk./month | 78 (46.4%) | 21 (11.8%) | 157 (88.2%) | |
| 8001-15000 Tk./month | 88 (22.9%) | 26 (29.5%) | 62 (70.5%) | |
| >15000 Tk./month | 118 (30.7%) | 53 (44.9%) | 65 (55.1%) | 0.000 |
| *Area of Living* | | | | |
| Rural | 148 (38.5%) | 10 (6.8%) | 138 (93.2%) | |
| Urban | 236 (61.5%) | 90 (38.1%) | 146 (61.9%) | 0.000 |
| *Types of Family* | | | | |
| Nuclear family | 303 (78.9%) | 85 (28.1%) | 218 (71.9%) | 0.082 |
| Joint family | 81 (21.1%) | 15 (18.5%) | (81.5%) | 0.082 |
| *Type of House* | | | | |
| Clay made | 165 (43.0%) | 14 (8.5%) | 151 (91.5%) | |
| Brick built | 219 (57.0%) | 86 (39.3%) | 133 (60.7%) | 0.000 |
| *Cooking Facility* | | | | |
| Wood and coal | 213 (55.5%) | 24 (11.3%) | 189 (88.7%) | |
| Kerosene | 93 (24.2%) | 38 (40.9%) | 55 (59.1%) | |
| Gas | 78 (20.3%) | 38 (48.7%) | 40 (51.3%) | 0.000 |
| *Smoking Status* | | | | |
| No | 212 (55.2%) | 73 (34.4%) | 139 (65.6%) | |
| Yes | 172 (44.8%) | 27 (15.7%) | 145 (84.3%) | 0.000 |
| *Drug Addiction* | | | | |
| No | 307 (79.9%) | 96 (31.3%) | 211 (68.7%) | |
| Yes | 77 (20.1%) | 4 (5.2%) | 73 (94.8%) | 0.000 |
| *Duration of Suffering* | | | | |
| ≤ 6 months | 266 (69.3%) | 89 (33.5%) | 177 (66.5%) | |
| > 6 months | 118 (30.7%) | 11 (9.3%) | 107 (90.7%) | 0.000 |
| *BMI ($Kgm^{-2}$)* | | | | |
| Under weight | 221 (57.6%) | 21 (9.5%) | 200 (90.5%) | |
| Normal | 140 (36.5%) | 64 (45.7%) | 76 (54.3%) | |
| Over weight | 23 (6.0%) | 15 (65.2%) | 8 (34.8%) | 0.000 |
| Total | 384 (100.0%) | 100 (26.0%) | 284 (74.0%) | |

and higher percentage (88.20%) of PTB patients were found in this income group. Most of the TB patients (61.50%) lived in urban areas. Among the rural TB patients, almost all (93.2%) were PTB patients. Most of the patients (57%) lived in brick built houses. Among the TB patients living in the clay made houses (43.00%), almost all PTB patients (91.5%) were found living in clay made houses. Most of the TB patients (88.70%) used wood and coal for cooking material as compared to other cooking materials (kerosene and gas). The higher percentage (84.30%) PTB patients were found to have smoking habit than extra-pulmonary TB patients. Similar results are seen for drug addiction. More PTB patients are found who are suffering more than six months and under weight.

### 3.2 Socio-economic Risk Factors for PTB Patients

Table 2 summarized some selected socio-economic factors those were marked as determinants

**Table 2: Results of logistic regression analysis to determine the effects of selected socio-economic factors on PTB patients**

| *Explanatory variables* | *β* | *SE* | *Wald* | *P values* | *OR* | *95% CI* | |
|---|---|---|---|---|---|---|---|
| | | | | | | *Lower* | *Upper* |
| *Sex* | | | | | | | |
| Male (RC) | | | | | | | |
| Female | -0.563 | 0.423 | 1.770 | 0.183 | 0.569 | 0.248 | 1.305 |
| *Age* | | | | | | | |
| <20 years of age (RC) | | | 11.738 | 0.008 | | | |
| 21-35 years of age | 1.756 | 0.518 | 11.482 | 0.001 | 5.792 | 2.097 | 15.996 |
| 36-50 years of age | 1.335 | 0.551 | 5.859 | 0.015 | 3.799 | 1.289 | 11.198 |
| >50 years of age | 1.141 | 0.593 | 3.706 | 0.054 | 3.130 | 0.980 | 10.003 |
| *Educational Status* | | | | | | | |
| 0-5 years of schooling (RC) | | | 0.789 | 0.674 | | | |
| 6-12 years of schooling | -0.398 | 0.477 | 0.696 | 0.404 | 0.672 | 0.264 | 1.710 |
| >12 years of schooling | -0.178 | 0.580 | 0.094 | 0.759 | 0.837 | 0.268 | 2.610 |
| *Monthly Family Income* | | | | | | | |
| <8000 Tk./month (RC) | | | 1.691 | 0.429 | | | |
| 8000-15000 Tk./month | 0.344 | 0.543 | .402 | 0.526 | 1.411 | 0.487 | 4.087 |
| >15000 Tk./month | 0.817 | 0.644 | 1.610 | 0.205 | 2.264 | 0.641 | 8.003 |
| *Area of Living* | | | | | | | |
| Rural (RC) | | | | | | | |
| Urban | -1.077 | 0.516 | 4.353 | 0.037 | 0.341 | 0.124 | 0.937 |
| *Type of Family* | | | | | | | |
| Nuclear family (RC) | | | | | | | |
| Joint family | 0.195 | 0.417 | 0.220 | 0.639 | 1.216 | 0.537 | 2.753 |
| *Type of House* | | | | | | | |
| Clay made (RC) | | | | | | | |
| Brick built | -0.095 | 0.597 | 0.025 | 0.874 | 0.910 | 0.282 | 2.934 |
| *Cooking Facility* | | | | | | | |
| Wood and coal (RC) | | | 6.551 | 0.038 | | | |
| Kerosene | -1.113 | 0.498 | 5.003 | 0.025 | 0.329 | 0.124 | 0.871 |
| Gas | -1.523 | 0.633 | 5.796 | 0.016 | 0.218 | 0.063 | 0.753 |
| *Smoking Status* | | | | | | | |
| No (RC) | | | | | | | |
| Yes | 0.501 | 0.441 | 1.291 | 0.256 | 1.651 | 0.695 | 3.917 |
| *Drug Addiction* | | | | | | | |
| No (RC) | | | | | | | |
| Yes | 1.015 | 0.638 | 2.532 | 0.112 | 2.760 | 0.790 | 9.637 |
| *Duration of Suffering* | | | | | | | |
| 6 months (RC) | | | | | | | |
| > 6 months | 1.251 | 0.434 | 8.320 | 0.004 | 3.495 | 1.493 | 8.177 |
| *BMI (Kgm-2)* | | | | | | | |
| Under weight (RC) | | | 39.053 | 0.000 | | | |
| Normal | -2.189 | 0.361 | 36.686 | 0.000 | 0.112 | 0.055 | 0.228 |
| Over weight | -2.156 | 0.588 | 13.452 | 0.000 | 0.116 | 0.037 | 0.366 |

*Note:* RC = reference category, β = coefficient, SE = standard error, OR = odds ratio, CI = confidence interval

for the risk of PTB. Age, area of living, cooking facility, smoking, drug addiction, duration of suffering, and BMI had significant effects on type of PTB patients. The TB patients aged 21-35 years had 5.792 times (OR = 5.92, 95% CI=2.097-15.996) more risk to have PTB than patients aged <20 years (reference category). Further, the TB patients aged 36-50 years and >51 years were 3.799 times (OR = 3.799, 95% CI=1.289-11.198) and 3.150 times (OR = 3.150, 95% CI=0.980-10.003) at higher risk to have PTB than patients aged <20 years. The TB patients belonging to urban areas had 64% (OR = 0.370, 95% CI=0.124-0.937) less possibility to having PTB than the rural TB patients. The TB patients who used kerosene oil (OR = 0.329, 95% CI=0.124-0.871) and gas (OR = 0.218, 95% CI=0.063-0.753) had lower chance to have PTB than the patients who used wood and coal for cooking materials. The patients who suffered for >6 months (OR = 2.995, 95% CI= 1.493-8.177) had three times more possibility to have PTB.

BMI is an important predictor that influences TB. In this study, the TB patients having normal weight (OR=0.112, 95% CI=0.055-0.228) and overweight (OR = 0.166, 95% CI=0.037-0.366) had lower risk to have PTB compared to underweighted TB patients.

## 4. DISCUSSION

TB has the ability to obstruct the development of both individuals as well as society (Connolly et al. 1996). According to the present study, sex, age, educational status, family income, area of living, types of family, types of house, cooking facility, smoking, drug addiction, duration of suffering, and BMI were significantly associated with the TB patients. In accordance with other studies (Mishra et al. 1999; Maurya et al. 2002; Kaulagekar et al. 2007; Soomro et al. 2009; Zaman 2010) the significant associations of socio-economic factors with TB patients were well established.

In this study, more males were found to be affected by TB. It can be attributed to males' increased involvement in social and labor activities which increase their chances of acquiring TB compared to females (Khurram et al. 2009). In the developing countries, male TB patients dominate two- thirds of total reported TB patients (Nakagawa et al. 2001). Globally approximately 70% males are notified smear-positive TB than females (Diwan et al. 1999). According to WHO, the prevalence of TB is more common among men than women and the proposed male/female ratio is $1.96 \pm 0.6$ for the worldwide case notification rate (Neyrolles et al. 2009). These findings raise the argument that TB among women might be under-reported in developing countries. It has been supported by the results of several studies (Holmes et al. 1998; Wang et al. 2008, etc.). Socio-economic and cultural factors are responsible for creating obstacles for women to receive adequate health care facilities than men (Long et al. 1999).

Age is marked as a considerable factor for TB infection which is, significantly associated with the types of patients. In this study, the number of TB patients found majority among the age group 21-35 years. Majority of the TB cases are found among the economically productive age group in the developing countries. This issue increased the participation in social and labor activities which enhance the possibilities of acquiring TB disease among males and in this age group. On the other hand, females remain busy with household activities and also females within this age group in the rural communities are mostly illiterate, live in poor housing conditions, and have restricted movements due to socio-cultural norms. The above factors may put them at higher risk for getting TB from the untreated reservoir of cases (Ahsan et al. 2004; Khurram et al. 2009; Tungdim et al. 2010). This study result also reveals the significant association between education and TB. A higher number of PTB patients were found who were less educated (0-5 years of schooling). The less educated TB patients may contribute to the higher burden of TB disease due to their lower level of knowledge and awareness about TB (Khan et al. 2004). Health education is an important determinant of health-seeking behavior as well as faithfulness to defensive measures and treatment (Jittimanee et al. 2009).

Considering the percentage distribution, the result reveals that the PTB patients were more prevalent in the rural area. It may be due to lack of education, poor income, poor housing condition, lack of healthcare facility, lack of knowledge about the transmission of TB etc. Some previous studies showed that income and residence were significantly correlated with TB patients (Demissie et al. 2002; Ahsan et al. 2004; Storla et al. 2008; Gele et al. 2009).

Houses with good ventilation reduce the chance of developing active TB disease. Persons living in higher quality housing have lower risk of TB (Mishra et al. 1999). In this study, most of the PTB patients were recorded to living in clay made houses. Similar result was found in India which highlighted that most of the TB patients lived in *kachha* (clay made) houses (Mishra et al. 1999).

Cooking smoke can increase the risk of TB by reducing resistance to the initial infection or by promoting the development of active TB in people who are already infected, or both. PTB is the most common form of the disease which is transmitted by coughing and increases by the smoke. Recent research suggests that the people living in houses depending on bio-fuels for cooking have greater chance to develop TB (Fullertona et al. 2008). The present study highlighted that the frequency of PTB was higher for those who used bio-fuels (wood and coal) for cooking. This result was supported by another study (Mishra et al. 1999).

Smoking and drug addiction are widely recognized by the medical research as well as the major public health problem. It is the single most important preventable risk to human health in industrialized countries, and an important cause of premature deaths worldwide (Maurya et al. 2002). A case-control study from Barcelona, Spain, assessed the influence of cigarette smoking on the development of active PTB in young people who were in close contact with a case of newly diagnosed sputum-positive PTB (Alcaide et al. 1996). In this study, more than two- thirds of the patients who had PTB had smoking habit and were addicted to illegal drugs. Several studies were conducted on PTB patients regarding smoking which was found to have adverse effects (Alavi et al. 2009; Ghasemian et al. 2009; Sahiratmadja et al. 2011).

BMI is a determinant factor which is closely related to the TB patients. In Hong Kong, TB was more prevalent among underweighted people (Leung et al. 2007). In this study, underweighted and normal weighted TB patients were found as PTB patients. This result was supported by another study carried out in Rawalpindi Medical College and Allied Hospitals, in Pakistan where it was found that underweighted and normal weighted patients had PTB (Khurram et al. 2009).

Socio-economic and cultural factors might play the major roles in determining the risk factors for TB infection. In this study, binary logistic regression analysis focused on the different risk factors on PTB patients. This study results revealed that the TB patients aged 21-35 years had risk of having PTB (Chan-Yeung et al. 2002; Usmani et al. 2011). Previous studies showed that low income and rural residence considered the risk factors for TB patients that support the present study (Demissie et al. 2002; Ahsan et al. 2004; Gele et al. 2009; Storla et al. 2008). Smoking habit and drug addiction were the risk factors for TB patients. Recent research suggests that use of bio-fuels (wood and coal) for cooking enhance the risk to develop PTB (Fullertona et al. 2008) which supported the present study. This study found a significant association between smoking and TB. The binary logistic regression analysis identified the risk of becoming infected PTB when a person was a smoker. In a previous study, the multiple logistic regression analysis identified only smoking was the significant predictor of PTB (Maurya et al. 2002).

Improving socio-economic conditions has been associated with the decline of TB. Increased availability of cheaper food has been reported with improving socio-economic conditions (Leung et al. 2007). The normal BMI contributes a net 23% risk to reduce the PTB infection (Leung et al. 2007). The previous studies supported the present study and observed effect of BMI having a possible link between underweight and the risk of PTB.

## 5. CONCLUSION

This study demonstrated some socio-economic factors that have significant effects on PTB patients at the urban area. Young age (21-35 years), lower education, rural residence, use of bio-fuel (wood and coal), smoking habit, drug addiction, underweight are the risk factors for PTB patients which are identified the multivariate analysis. Therefore, efforts should be made to improve and strengthen the NTP activities by improving the referral from the private to the public health sectors. The future works are needed to build on the concept that specialized and integrated approaches are mutually inclusive. The maintaining visibility of the TB programs at the central level of the ministries of health and enlisting experts are essential in TB management to help planning, training, monitoring, and assessing programs. Engagement of other sectors beyond health, such as private, educational, and development sectors, should be targeted as an opportunity to widen national coalitions against TB and promote sustainable approaches. Increasing the access to DOTS is the global priority and needs to be pursued beyond government health services. Internationally, TB control must be promoted as a top priority for health and development, with due consideration to human rights and social justice. In addition, it is important to facilitate prompt utilization of the health services by raising public awareness about the TB disease.

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