



Pulmonary Tuberculosis (Ptb) And Diabetes Mellitus (Dm) Comorbidity in Poverty-Stricken Population of Bhopal

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Abstract

A large proportion of population inhabits urban slums being typically overcrowded hence; these are the settlements of poor people being highly polluted and lack basic amenities Present study demonstrated moderately high incidence of PTB, DM and comorbid PTB and DM in presence of potential contributing factors in slums areas of Bhopal city. The slum areas selected in the city have got deprived status of varying degrees creating poor environmental conditions of living for dwellers being prone to infections and diseases. Over the age 35-40 years excessive edible oil intake and family history of diabetes probably contributed to DM in the slum people. The overall incidence of PTB cases was 5.41% whereas; the overall incidence of DM was noted to be 5.84%. Furthermore, the overall incidence of Comorbidity of PTB and DM was computed to be 1.73%. The incidence of all these three conditions was lower in females as compared to males. Both PTB and DM are major public health problems in our country and comorbid PTB and DM poses more challenges for its being more fatal.

Keywords: Diabetes Mellitus, Pulmonary Tuberculosis, Comorbid PTB and DM, PTB Contributing factors, Poverty, Slum Environment

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INTRODUCTION

Pulmonary Tuberculosis (PTB) and Diabetes mellitus (DM) being transmissible and non-transmissible diseases respectively are different ailments of immense public health importance mutually showing bidirectional relationship with high morbidity and delayed treatment effect. It is argued that diabetes mellitus significantly affects the course of PTB and its treatment (Krishna and Jacob, 2021). Higher chances of intervention failure and mortality have been reported while DM occurs with PTB. Recurrence and reactivation of latent TB infection has also been reported (Jiménez-Corona et al. (2013). In many studies, poverty has been usually recognized as an important risk factor for tuberculosis (TB) disease. Hence, it is argued that TB control approach should be targeted to the deprived segments of populations living in poor environmental conditions being most at risk,

and should address the most important stimulants of this dreaded disease. Pathogenic bacteria *Mycobacterium tuberculosis* remains the source of PTB, which usually has an effect on the lungs but may also adversely affect other organs. Even though airborne transmission is considered as the primary route of *Mycobacterium tuberculosis*, there remains convincing scientific evidence that supports the presence, persistence, and infectiousness of *M. tuberculosis* in the environment. However, there exist other routes of *M. tuberculosis* transmission (Smith, 2003). On the other hand, diabetes mellitus (DM) was identified by WHO (2011) as a global epidemic, mostly affecting low- and middle-income countries where nearly 80% of all deaths are attributed to DM. The greater proportion of population suffers from latent TB rather than TB disease (Kiazky and Ball, 2017). In Madhya Pradesh, the total TB

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subjects notified within two months period in January-February 2021 were nearly 17 thousand in Public Sector and 9 thousand in Private sector of the population of 83 million of the state (Kanabus, 2022). Awad et al. (2020) reported estimation of approximately 20% TB subjects with diabetes morbidity in India being nearly ten times higher odds in context of treatment failure, nearly 1, 5% for relapse and nearly 2% for mortality. They predicted DM epidemic to become a leading force of TB incidence and related deaths in the upcoming decades. In nearly three decades, at least 33% of TB incidence and almost 50% of TB mortality in India will be attributed to DM. A large proportion of population inhabits urban slums being typically overcrowded hence; these are the settlements of poor people being highly polluted and lack basic amenities (UN-Habitat, 2014). The same is true with Bhopal city as in other cities of developing India. Approximately 27% of total population of Bhopal city reside in slums (Census of India, 2011) belonging to underprivileged poor section (Sen and Sanyal, 2019). Present study focused on incidence of Pulmonary Tuberculosis (PTB) and Diabetes mellitus (DM) comorbidity in poor population of Bhopal in Madhya Pradesh state of India in the midst of the environmental risk factors that significantly contribute to high incidence of PTB in slum areas of the selective city. This study reveals the comorbidity of both PTB and DM among the subjects of selective slums attending nearby secondary hospitals for 2 years.

Material and Methods

Sampling

Present study recruited 462 individual belonging to 102 households, aged 15 years or older involving both male and female were selected from 9 slum areas of capital city Bhopal. A pre-tested structured questionnaire was administered in order to obtain selective area and housing related information, demographic variables and information related to self-reported history and current status of PTB and DM in recruited subjects. Medical records and information related to their current disease status and course of treatment were also on record that facilitated identification of PTB, DM and comorbidity of PTB and DM cases.

Demography and infrastructure

Qualitative and quantitative data related to the selective slum areas, households, family size, gender and age of the recruited subjects were recorded in the questionnaire. Recruited subjects exposed to selective risk factors involving smokers, Smokeless tobacco users, and moderate and excessive alcohol drinkers were identified and recorded. Infrastructural facilities status in the slum areas was determined by taking notes on conditions of colony roads, service road, house condition, toilet facility, sewerage, drainage system, cooking fuel usage and water logging. Household deprivation variable was used as an indicator of household deprivation in the housing dimension. It was actual number of rooms minus rooms that are actually required for all the members of the households is -1 or less.

Data collection

Information on history and current status of both bacteriologically positive PTB and DM was noted for the recruited subjects of the selective households in the slum areas. Both male and female subjects participated in the study. Subjects who reported current PTB and DM status received a test recently and are on treatment in varied Government and private hospitals whereas; those who reported PTB and DM history underwent diagnosis and treatment nearly one year back when the study was carried out.

Results and Discussion

Demography and infrastructure

Table 1 depicts sample population distribution in selective poverty-stricken slum areas. This involves selective slum areas, Infrastructural facilities Status, Number of households and population in each slum settlement. In majority of slum areas, there either exist damaged metalled or unmetalled colony and service roads. Majority of houses were kachcha house made of mud, stones and bricks without inbuilt toilets. The poor households usually live in kachcha houses. There were sewerage, drainage system problems and areas were not found clean. Moreover, water logging problem was also encountered in majority of settlements. In some houses, traditional smoke producing fuel is still used for cooking purpose. These problems were of varying degrees in



different selective areas. The average family size of all the households selected was 5+2 and average Household deprivation variable ranged from -1 to -3 in different settlements. This revealed that majority of households were overcrowded hence; considered deprived. All the slum areas have got deprived status of varying degrees creating poor environmental conditions of living for dwellers being prone to infections and diseases. The sample size for different slum areas ranged from 25 to 65 persons.

Table 1: Sample population distribution in selective poverty-stricken slum areas of Bhopal

S.No	Slum Area (Ward No.)	Infrastructural facilities Status	No. of households sampled	Population
1	KC (69)	Deprived	13	65
2	VN (35)	Deprived	14	56
3	AN (57)	Exceedingly Deprived	15	61
4	BG (23)	Deprived	12	60
5	BC (40)	Exceedingly Deprived	12	56
6	BN (31)	Exceedingly Deprived	9	48
7	RP (30)	Exceedingly Deprived	11	46
8	SN (43)	Deprived	10	45
9	CB (28)	Deprived	6	25
Total			102	462

*Figures in parenthesis indicate ward number as assigned by the Municipal Corporation, Bhopal

Noykhovich et al. (2019) reviewed and carried out a meta analysis on the potential risk of tuberculosis among populations living in slum settlements. This revealed an increased likelihood from three to five times for an individual to be infected with TB in slum settlements when compared to their country as a whole. The results of this meta-analysis support our observations where significantly high frequencies of PTB cases were noted.

PTB, DM and Comorbidity of PTB and DM

Table 2 shows gender-wise distribution of PTB, DM independently and Comorbidity of PTB and DM in the selective population. Out of 462 recruited subjects 239 (52%) and 223 (48%) were male and female respectively. The overall incidence of PTB cases was 5.41% that involved 3.46% males and 1.95% females. The overall incidence of DM was 5.84% that involved 3.68% males and 2.16% females in the whole sample size. Furthermore, the overall incidence of Comorbidity of PTB and DM was 1.73% involving 1.30% males and 0.43% females (Figure 1, 2).

Table 2: Distribution of PTB, DM and Comorbidity of PTB and DM in the selective population

Samples (N)			PTB cases (Total)			DM cases (Total)			Subjects with comorbidity of PTB and DM		
M	F	Total	M	F	Total	M	F	Total	M	F	Total
239	223	462	16	9	25	17	10	27	6	2	8
(52)	(48)	(100)	(3.46)	(1.95)	(5.41)	(3.68)	(2.16)	(5.84)	(1.30)	(0.43)	(1.73)

Figures in parenthesis indicate percentage of the total sample size being 462 (100%)

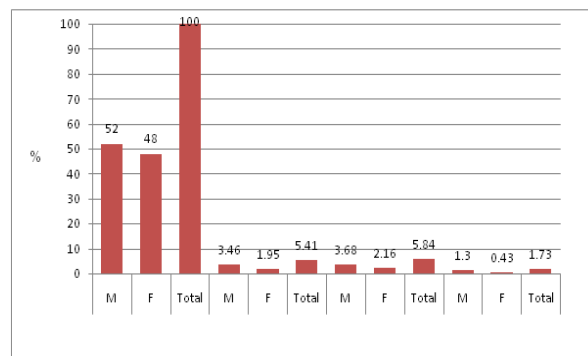


Figure 1: Gender wise distribution of all samples, PTB, DM and Comorbidity of PTB and DM in the selective population

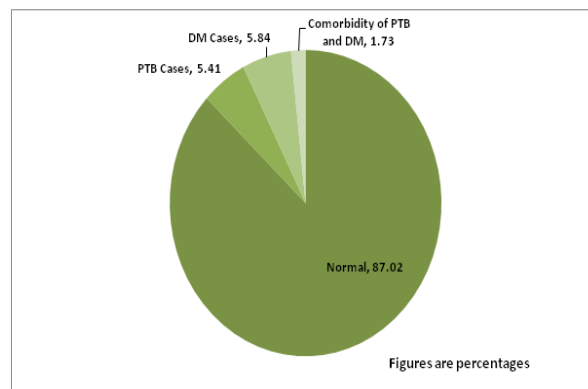


Figure 2: Percentage Distribution of PTB, DM and Comorbidity of PTB and DM in the selective population

The global prevalence of comorbid PTB and DM was estimated to be nearly 14%. Li et al. (2021) recently published a a systematic review and meta-analysis on Comorbidity of PTB and DM and they conclude that Comorbidity of PTB and DM remain prevalent worldwide being nearly 20% in America, 17% in Europe, 15% in Southeast Asia, 14% in western Pacific region, 10% in eastern Mediterranean region and 9% in Africa. As compared to the global scenario and in different continents, our data revealed significantly lower incidence of comorbid PTB and DM. This may be due to effective interventions initiated by the Government agencies to control and manage PTB. There have also been efforts for the management of



DM in the region of the study. Table 3 depicts Mean age in different categories involving PTB, DM and Comorbidity of PTB and DM. The mean age of the subjects with comorbidity of PTB and DM was computed to be 41±5 years. Gender-wise distribution showed 41±3 and 43±6 years in males and females respectively. The mean age of the subjects with PTB cases independently was 31±6 years and gender-wise distribution showed 31±4 and 34±6 years for males and females respectively. Further, the mean age of the subjects with DM cases independently was 40±8 years and gender-wise distribution showed 38±7 and 42±5 years for males and females respectively.

Table 3: Mean age in different categories

PTB cases (Total)			DM cases (Total)			Subjects with comorbidity of PTB and DM		
M	F	Total	M	F	Total	M	F	Total
31±4	34±6	31±6	38±7	42±5	40±8	41±3	43±6	41±5

Over the age 35-40 years excessive edible oil intake and family history of diabetes were identified as significant predictors of DM (Guo et al. 2022). It is believed that in countries with high prevalence of DM, the influence of this disease on tuberculosis could be the same as HIV (WHO, 2010). Many earlier investigations have revealed that developing TB is higher in DM patients as compared to non-diabetics (Coker et al. 2006). However, due to controversial reports in many parts of the world, the important role of DM as a main risk factor for TB is still unclear. However, some reports concluded that nearly one fourth of PTB was attributable to DM (Jeon and Murray, 2008; Ponce-De-Leon et al. 2004)

Conclusion

Present study demonstrated moderately high incidence of PTB, DM and comorbid PTB and DM in presence of potential contributing factors in slums areas of Bhopal city. The slum areas selected in the city have got deprived status of varying degrees creating poor environmental conditions of living for dwellers being prone to infections and diseases. Households in general, had congested space in their homes as they are usually overcrowded which poses adverse health effects by favoring transmission of the pathogen, increasing the chances of extended close contact between susceptible people and infectious PTB cases. Over the age 35-40 years excessive edible oil

intake and family history of diabetes probably contributed to DM in the slum people. The overall incidence of PTB cases was 5.41% whereas, the overall incidence of DM was noted to be 5.84%. Furthermore, the overall incidence of Comorbidity of PTB and DM was computed to be 1.73%. The incidence of all these three conditions was lower in females as compared to males. Both PTB and DM are major public health problems in our country and comorbid PTB and DM poses more challenges for its being more fatal. Apart from the success of current health policies and programmes, there remains even more to prevent the development of TB among DM patients.

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