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Ecological Analysis of Tuberculosis Patients' – A Case Study of Karachi

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Abstract: Tuberculosis (TB) is endemic in Karachi, Pakistan, and even with the discovery of other infectious diseases no significant change is evident in its epidemiological profile while analyzing spatio-temporal incidence. There are significant evidences to support the fact that poverty is the main cause of TB. A number of scholarly analyses have documented associations among patients' characteristics e.g. sex, age group, social, economic and ecological factors. The purpose of the present study is to investigate pattern of patients' histories regarding recently and previously infected family members because people of the study area have revealed very serious concerns regarding their family members, especially their parent. In addition, the study has identified the more affected age groups and its relationship with income variations among the patients. Eleven selected variables have been employed in the present study for analysis on the basis of data having been compiled through structured and open–ended questionnaires conducted among TB patients at diagnostic centers. An insight into the variables reveals that lopsided, income distribution is of major significance in the purview of socioeconomic factors and is categorically responsible for the spread of tuberculosis in Karachi. The results of the present study can serve as a guideline for city authorities to improve living conditions and quality of life in the city as a whole especially in the down town areas.

Keywords: Tuberculosis, Karachi, Medical Geography, Urban Ecology, Family History

1. Introduction

Karachi is the most thickly populated and largest city of Pakistan recognized for Tuberculosis (TB) growth during the last several years (WHO, 2013). Various scholars have discussed different aspects of TB proliferation such as clinical, medicinal, social, anthropological etc., in the city (Shah, et al., 2003; Rao, et al., 2008, Shakoor, et al., 2009; Ejaz, et al., 2010, &Ayaz, 2012), while some discussed geographic distribution and lingual affiliation of patients (Miandad, et al., 2014). There is global evidence that a TB patient not only transmits mycobacterium thereby perpetrating serious effects on physical health, social and economic wellbeing (Aggarwal, 2010), but also social repercussions which may include loss of jobs, disturbance of marital life, ostracism by family members and the local community, as well as loss of shelter (Lawn, 2000).

There are various socioeconomic factors contributing towards transmission of mycobacterium among human beings (Ananthakrishnan, et al., 2013). Studies have discussed the risk of progression to infection and disease with reference to ecology. Firstly, the risk of infection following TB exposure is primarily governed by social and behavioral factors i.e., overcrowding in houses, smoking,

alcohol and indoor air pollution (Hawker, et al., 1999; Schmidt, 2008; Hargreaves, 2011 & Narasimhan, et al., 2013). In settings with increased chances of social mixing (together with overcrowding) transmission will be high. Secondly, similar conditions which prolong the length of exposure to an infectious patient include health system-related factor such as delay in diagnosis (Collins, 2008). Factors that increase the progression of infection to disease are primarily endogenous (host related). Bentley, (1942) found that patients especially females compared to males, who had history of TB in their intimate families were at critical risk. Researchers described that contact with unidentified TB patients among members of their household was the most crucial risk factor (Diel, et al., 2005; Hargreaves, et al., 2011; Becerra, et al., 2011 & Shah, et al., 2014).

The primary role of countries where incidence of tuberculosis is high, have great responsibility to arrange control programs in order to provide effective treatment and reduce resurgence. Several works have proved Tuberculosis (TB) to be one of the serious epidemic hazards in Pakistan among third world countries (Miandad, et al., 2015a). There is growing opinion that socioeconomic disparity is one of the major causes of vulnerability to TB and that the labor class emerges prominently because of discriminatory policies with regards to income distribution and social protection meted out to them.

Karachi is the capital city of the province of Sindh, located strategically between 24.75 to 25.65 N and 66.65 to 67.57 E on the coast of the Arabian Sea, northwest of the Indus River delta, is an industrial seaport, financial and commercial hub where Pakistanis of all ethnic and linguistic groups reside (Miandad, et al., 2105b). Absence of targeted TB prevention and control strategies for immigrants create significant barriers in achieving TB elimination targets in several low profile areas. Laborers who come from the up country face higher exposure to TB infection due to overcrowded living and working conditions. Delays in TB diagnosis among the infected are commonly associated with difficulty in TB access to centers, poor education and ignorance among health-seekers, cultural beliefs and social stigma.

Living conditions of low income people are sordid. They are compelled to reside in damp, dark, dusty, ill ventilated houses with no heating which promotes the survival of TB bacteria. Due to shortage of money, people suffer from stress, causing weakening of the immune system, henceforth contraction of TB. People in developing countries with financial constraints are unable to purchase medicines for the treatment of TB. Living in overcrowded housing areas coupled with housing congestion magnifies the chances of contact with coughing and sneezing people harboring TB germs in their lungs and throats which can be a potent cause of spread of the disease. Density of people also enhances the spread of TB and highly positive correlation has been observed between them (Ploubidis, et al., 2012).

Increased household size and overcrowding have been found to be potent risk factors for TB from a number of studies in various settings (Aubry et al. 2000; Alcaide et al. 1996). It should be noted that ¾ cases and 60% controls with reference to the study in urban Gambia were due to households having high crowding. Congestion within households, coupled with poor ventilation and close contact with TB patients is a potent cause of spread of infection with families having the disease history (Lienhardt, 2005). The purpose of the present study is to investigate patients' family histories regarding previously infected family members because people of the study area have very serious concerns regarding their family members especially their parents, therefore this issue has been considered as a risk factor in terms of mycobacterium influence. In addition, this paper will also identify the correlation between patients in the more affected age groups and their incomes.

2. Materials and Methods

For the present study, data was acquired from questionnaire survey since TB centers and related health organizations do not maintain patients' geographic/ location profile. Interview based data collection is one of the easiest ways through which most precise and pertinent questions may be developed to focus on any problem to be investigated in any study. Questionnaire survey has been deemed as the most common technique in this regard (Burke, et al., 2016, Miandad, et al, 2015a). The structured and open ended questionnaire administered to patients in the present study contained queries regarding relevant risk factors with reference to TB in the perspective of geo-demographic/socio-ecological conditions of the study area. Most of the variables have been selected on the basis of significance of scholarly discussions and interpretations. Fig. 1 displays the spatial variation of population in Union Councils of Karachi and location of TB infected respondents. Prior to interrogation of patients, they were explained and convinced regarding significance of the present study, and their residential location was mapped in order to clarify the situation regarding the ecological conditions. Questionnaires were filled through direct face to face interview of TB patients at the diagnostic centers by the authors of the present study. About 1265 respondents participated in the questionnaire survey during eight months period extending from January 2013 to March 2014. Data was entered into a Microsoft Excel spreadsheet and analyzed with Microsoft Excel and SPSS Version 20 for demographic analysis.

The structured and pre-coded questionnaire in the local language i.e. Urdu and Sindhi was administered to all the subjects. For collection of data, authors took prior permission from provincial Tuberculosis Control Authority and followed all there protocols. The present study followed standard techniques for collection of data and analysis. Questionnaire was designed under the domain of

Pakistan TB Control guidelines and characteristics of the city's socioeconomic conditions (Table 1). The close-ended selected variables consisted on 10 questions. A Likert style was used to elicit each patient's responses. The average incidence of patients (p) at a confidence interval (CI) of 95%, alpha=0.05 and a deviation (d) of 0.02 was 20%. Acceptable sample size was thus determined to be 1265 according to the last population census i.e. 1998 census.

Table 1. *Questionnaire Survey Template: Ecological Analysis of Tuberculosis Patients' – A Case Study of Karachi.*

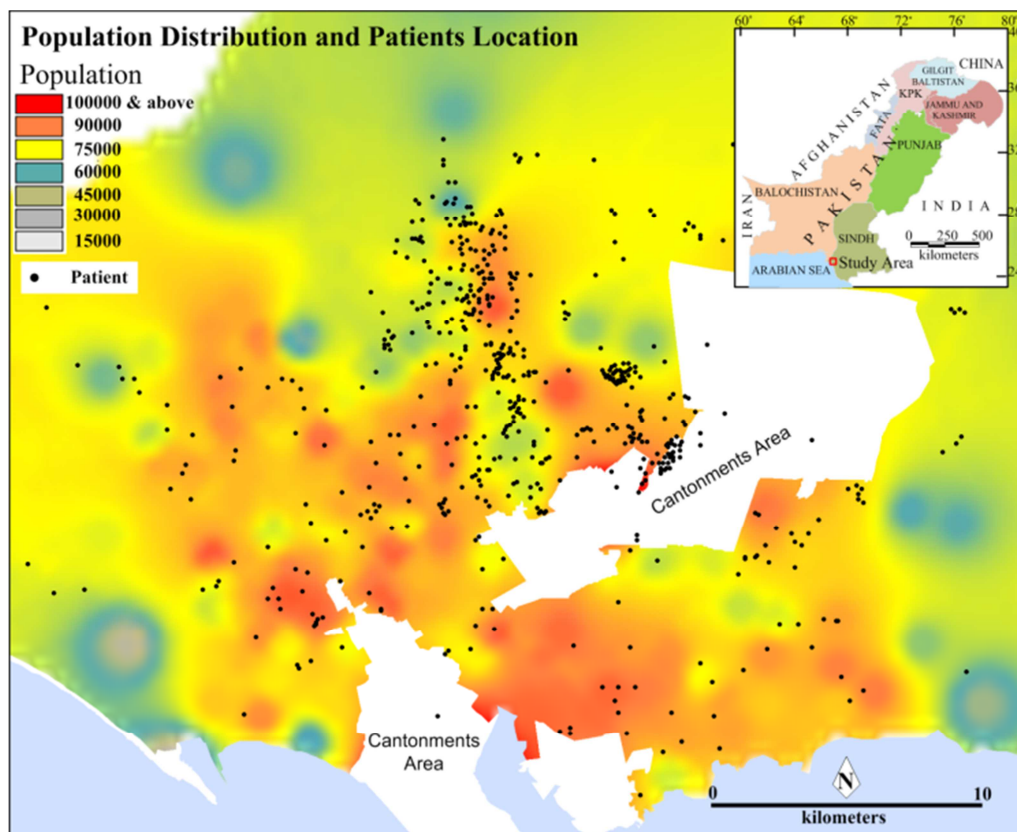| Code								
Name				**Residential Area**				
Age	0-10 11-20	21-30 31-40	41-50 51-60	60 & +	Gender	Male Female	Marital Status	Married Unmarried
Profession	Government Servant Jobless	I.T Department Self-Business	Medical Department Private Job	Laborer	Education Department House wife	Government Servant House jobs Others		
Educational Qualification	Below Primary Middle	Higher Secondary Matriculate	Master Graduate	Madrasah Illiterate	Below Primary Middle	Monthly Income (PKR)	<10,000 <20,000	<15,000 <25,000 <30,000
Language	*Sindhi* *Lasi* *Balochi* Urdu	Punjabi *Pashto*	*Saraiki* *Riasati*	*Hindko* Other	Family Status	Joint Family Nuclear Family		
Place of Birth		Duration of residence in present address			Where resided prior to present residence?			
Nature of House	*Kaccha*	*Pucca*		Ventilated	Sun Light Penetration	Yes	No	
No. of Rooms		Total No. Of Family Members			Drinking Water Availability & Quality	Boring Mineral Water	Tap	Well Other
Nature of Settlement	Sparse Density Broad Street	Moderate Density Narrow Lanes			Congested Garbage Free	Ventilated Environment Other		
Food Availability	Morning	Afternoon	Night	Nutrition Availability	Home Hotel	Food by Work Place	Mess	Quality of Food
Condition of Food	Fresh	Stale	Contaminated	Type of Nutrition	High Meat /Protein Diet	High Consumption of vegetables		Junk Food
Ever Addicted?			Types of Addiction					
When did you came to know you are suffering from TB?					Type of TB are inflicted with?			
Any other disease apart from TB					Other disease before or after TB			
TB diagnosed after infection		1. Month	2. Months	3. Months	6. Months	1. Year		
What should be residential quality of TB patient to prevent spread of disease?		Separate room		No difference if people live together				
Where taking treatment from?				Are you satisfied with the treatment?		Yes	No	
What should we do to decrease incidence of this disease?								

Fig. 1. *Study Area Population at Union Councils level and locations of TB respondents.*

3. Results

According to the questionnaire survey of 1265 notified patients, 26% fell in the 11-20 age group, 31% in 21-30, while 12,13,9 and 9% in 31-40, 41-50, 51-60 and 61 & above age groups respectively. Gender distribution of the patients has been portrayed in Fig. 2a. There was marginal difference among male and female respondents i.e., 50.17% and 49.83% respectively. The pyramid shows that highest number of patients were females, primarily in the early ages while male patients dominated in the age group 21-30 years, thus 60% of patients have been recorded in the 11 to 30 years age group among females. However among males it has been observed as less than 07% to females. Figs. 2b&c, reveal patients by type, in which Pulmonary TB can be observed as being in significant numbers compared to Extra Pulmonary, because 85% of the patients appear to be affected by Pulmonary TB. Fig. 2b, shows age and sex distribution where males dominate by 04% but in the case of Extra Pulmonary TB females dominate twice that of males. There were 25% males and females to total

respondents who reported another TB patient in their family. Fig. 2d depicts that proportion of females are 15% higher than that of males but both males and females reported respondents who were in the age category 11 to 30 and 21 to 30 years. Fig. 2e has depicted age and sex distribution of patients affected by TB during the tenure /period of caring of other patients in the family.

According to the responses to the questionnaires, 35% to total respondents were infected by tuberculosis (Gender configuration shows that females were more affected in comparison to males). Nine percent of patients replied in the affirmative regarding having had patients in their families. Fig. 2f reveals that patients mostly belong to the younger age groups. Since the government of Pakistan, under the auspices of WHO, is providing free medicines and treatment to TB patients, resurgence is a serious issue. In terms of gender variation 52.14% males and 42.86% females to total resurgence patients i.e. an average of 47% respondents to total respondents have been recorded (Fig. 2g).
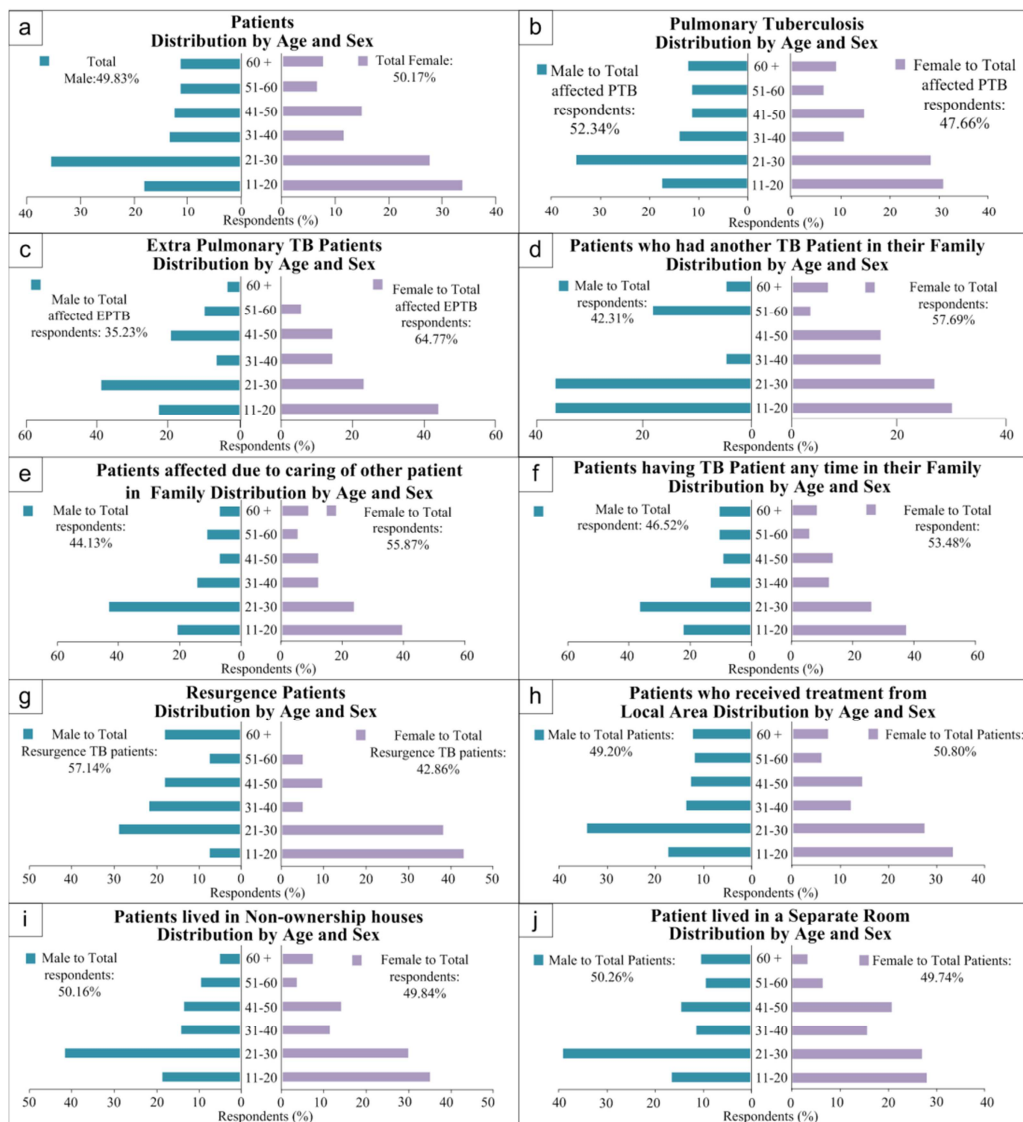

Fig. 2. *Patient's distribution at various age groups, gender, types, family history and housing conditions.*

With reference to the question regarding treatment, 94% of the TB patients to total respondents replied that they had received treatment from the local doctor and not from TB diagnosis centres. Fig. 2h reveals slightly different picture for males in comparison to females. Due to non-ownership of houses, patients had to pay as much as 1/4 or even 1/3 of their incomes as rent for which they had to work longer hours or make good the expenditure on housing by drastic cuts in food as well as recreational activities. During the survey, 51% patients to total respondents recorded that their dwellings were rented abodes. Fig. 2i reveals that both males and females who lived in non-ownership houses were in almost the same proportion. Only 31% of patients to total respondents replied that they had a separate room for living. The age-sex pyramid for patients living in separate rooms (Fig. 2j) reveals that males in age group 21-30 have emerged as most advantageous in this reference, while among females it encompasses both age groups, 11-20 and 21-30. It is highly indicative of the socioeconomic status of nuclear families which appear to have better living standards as revealed by this variable.

4. Discussion

In the Islamic society, family care including care of all types of patients is an integral part of social life. In view of this social integrity, families exhibit immortal love towards their patients, without consciousness or abhorrence regarding precautions towards infectious diseases. This attitude can be corroborated with the fact revealed in this study that on an average 35% patients have become affected because of this noble mentality, 39.35% and 31.44% among females and males to total female and male respondents respectively. Fig. 2e reveals that demographically females and males most affected in this manner were in the age groups 11-20 and 21-30 years respectively. Due to the infectious nature of Mycobacterium it is pertinent to discuss family history of TB patients (Lienhardt, 2005). 11.64% to total respondents replied in the affirmative with reference to their relatives' deaths due to TB. The study has also revealed that most of the patients who expired due to TB belonged to the low income group. Although treatment was available for free, their poverty prevented them from taking supportive diets. This coupled with the insanitary hygienic conditions and polluted environment of the immediate surroundings posed as serious hurdles to curing of patients.

Income plays a significant role in improving quality of life (Huda, et al., 2013). However, insufficient income may result in improper diet, unhygienic living conditions, low levels of education etc., all leading to poor health through contraction of infections and diseases. With reference to monthly income above PKR 8000/=, 15.80% of the respondents were in this category. The response to monthly income below PKR 8000/= was a soaring 84.17%. As regards response of male and female patients with PKR 8000/= monthly income and below PKR 8000/=, 52.63% females replied that they had a member of their family with more than PKR 8000/= monthly income, while 47.37% males gave this response. Such responses were mainly from younger age groups. 50.69% females and 49.31% males. Resurgence is a potent cause of deaths due to tuberculosis. Although it has been reported that occupational environment and local conditions also create higher risk for tuberculosis expansion (Hassan, et al., 2005 & Babalik, 2012) with reference to patient respondents who were professional employees, the response by males and females was 90.56% and only 09.44% respectively out of total employed. Female respondents were mainly in age groups 31-40, 11-20 and 41-50, while males were in the age group 21-30 years. This indicates that the female patients in the age group 21-30 i.e. the productive age group were not employed probably because of their ailment.

The significance of nutrition also lies in the fact that along with income it is one of the significant criteria of measuring poverty, which is one of the chief causes as well as manifestations of malnutrition. This is one of the basic causes of the occurrence of many diseases (Gupta, et al., 2009: Hawker, et al., 1999). Tuberculosis and chronic illness are found disproportionately more often among the poor than in the middle classes because of inadequate diet. In the context of employment, nutrition is of crucial importance as it affects the ability as well as efficiency of work. Sufficient and proper nutrition is also essential for the proper fulfillment of employment. Fig. 3, depicts patients' source of income in the study area where most significant numbers are engaged as laborers, preceded by workers in the textile sector.
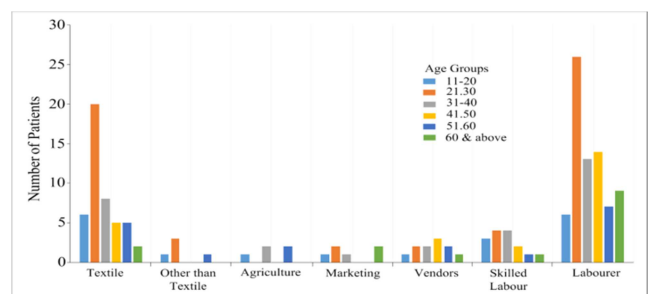

Fig. 3. *Source of income of TB Patients-Karachi.*

5. Conclusion

In the present study, poverty and ignorance of precautions on the part of both patients and their attendants have proved to be major causes of proliferation and strengthening of mycobacterium. In addition to this, the city administration is also responsible for the spread of this disease as labor and environmental laws are not implemented commensurate with the growth of population. It has also been suggested that improvement of economy, better housing and living conditions, attainment of education for both males and females and reduction of poverty are long term goals for reduction of susceptibility to diseases, especially TB. The ownership of a house not only enhances socioeconomic

standards but also lends an aura of status to its owner. Satisfactory housing and a supportive physical and social environment are essential to sustain human living; therefore, the inclusion of housing and environment is essential for an insight into ecology of TB patients. In addition, the study of non-ownership of houses is also essential in the broader spectrum of the study of infectious diseases because it sheds light on the accompanying social evils associated with residence in slums and squatter settlements, beginning from illegal occupation of land to drug addiction, prostitution and engagement in counter legal activities. Improvement of ecological, environmental, social and economic conditions in the city is essential for control of contagious epidemiological infections among which tuberculosis is not only globally proliferating but spreading rampantly in Pakistan, especially in a highly congested megacity like Karachi.

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