ABSTRACT

Introduction:. TB is a one of the most dangerous infectious diease and a substantial infection that possess a significant thrat to the various developing nations like india, Pakistan, Africa, Iran. In Pakistan prevalence is high with estimated prevalence of 150 per 100,000 population. However limited data is available regarding the risk factos and prevalence that possess a restriction in proper treatment and eradication of TB.

Objective: The present study aimed for assessing prevalence and risk factors of Pulmonary Tuberculosis in order to properly investigate the major risk factors associated with TB and reducing the prevalence of PTB.

Stud Design: This was a prospective, cross-sectional study carried out in DHQ DG Khan.

Methodology: A questionnaire was used to collect data related to patient's demographics, socioeconomic status, habits, medical history, family history and risk factors. The questionnaire was prepared in English and filled by the officials. The data were analyzed using descriptive and inferential statistics.

Results: Total 510 patients were recoded. The prevalence was higher in females. A higher prevalence was observed in age group 46-55. Exposure to certain risk factors like close contact with TB patients, family history about TB, living in sub-standard conditions, smoking and pre-existing medical conditions were the major risk factors for developing PTB.

Conclusion : Risk factors like smoking, inadequate health care, living in substandard conditions, lack of education and pre-existing medical conditions were found. To achieve long term control of TB and for proper treatment of TB, interventions should be followed to reduce the TB prevalence and eradicating the risk factors.

Keywords: Tuberculosis, Risk factors, Prevalence of TB

i

List of Contents

Comment [M1]:

Chapter 01

INTRODUCTION

1.1 Overview:

Tuberculosis (TB) remains one of the most significant infectious diseases affecting populations worldwide. It possess a substantial burden on public health systems, causing significant morbidity and mortality. Today, TB remains highly prevalent in low- and middle-income countries, particularly in sub-Saharan Africa, Asia, and parts of Eastern Europe. However, the disease is not limited to these regions, as global travel and migration contribute to its spread across borders. Additionally, certain population groups are disproportionately affected by tuberculosis, including individuals living with HIV/AIDS, prisoners, healthcare workers, and those with compromised immune systems.

Increased susceptibility to disease, particularly tuberculosis, is associated with overcrowding and poor quality housing, which are associated with poor health and poverty and racial groups. Due to poor indoor air quality, overcrowding, and inadequate ventilation, the presence of mold, smoke, and fumes is a significant contributor to poor respiratory health and has been associated with the increase or progression of tuberculosis .Patients with acute pulmonary tuberculosis spread the bacteria into the air by coughing, sneezing, or talking. Mycobacterium tuberculosis can survive in the air for several hours, depending on environmental conditions. Very few of the bacteria that a person inhales can infect them. Latent tuberculosis is a disease that does not develop tuberculosis despite carrying the bacteria. However, carriers become sick when their immune system is weakened (for example, by another disease). Approximately 0.5–10% of infected individuals develop active tuberculosis for the rest of their lives, most within the first 2 years after infection and then becoming carriers of the infection .

In 2020, an estimated 10 million people fell ill with TB, and 1.5 million people died from the disease. Most of the people who get TB live in low- and middle-income countries. According to the World Health Organization (WHO) report in 2022, T.B. remains a major public health problem, with an estimated 10.6 million people falling ill with TB and 1.5 million people dying from the disease in 2021. The report also found that the TB epidemic is becoming increasingly complex, with a growing number of people infected with drug-resistant TB. In 2021, an estimated 10.6 million people fell ill with TB worldwide. Of these, 5.8 million were men, 3.4 million were women, and 1.4 million were children. The highest burden of TB was in South-East Asia (46%) and Africa (28%). In 2021, an estimated 4.9 million people were living with drug-resistant TB, and 1.6 million people developed drug-resistant TB.

TB is a major public health problem in Pakistan. The prevalence of TB in Pakistan is high, and the disease is most common in the rural areas of the country. Pakistan has a high burden of TB, with millions of cases reported annually. According to the WHO, the estimated prevalence of TB in Pakistan is 150 per 100,000 people. This means that 1.5% of the population of Pakistan is infected with T.B. In 2020, an estimated

410,000 people fell ill with TB in Pakistan, and 69,000 people died from the disease. However, limited data exists regarding the precise prevalence of pulmonary TB and the factors contributing to its transmission and persistence within the country.

The assessment of risk factors associated with pulmonary tuberculosis plays a crucial role in understanding the dynamics of transmission, identifying vulnerable populations, and implementing effective preventive and control measures. Individual factors, environmental conditions, and socio-economic determinants all contribute to the development and transmission of pulmonary tuberculosis.

1.1.1. Individual Risk Factors: Individual risk factors for pulmonary tuberculosis encompass a range of factors such as age, gender, genetic susceptibility, immunosuppression, comorbidities (e.g., HIV/AIDS, diabetes), and lifestyle choices (e.g., smoking, substance abuse). Certain occupations and living conditions, such as healthcare workers, prisoners, and crowded households, may also increase the risk of tuberculosis transmission.

1.1.2. Environmental Risk Factors: Environmental factors can significantly influence the risk of acquiring pulmonary tuberculosis. Poor ventilation, overcrowded living conditions, inadequate housing, and exposure to indoor air pollution can create environments conducive to TB transmission. Additionally, close contact with individuals who have active TB disease, particularly within households or congregate settings, increases the likelihood of infection.

1.1.3. Socio-Economic Risk Factors: Socio-economic factors play a critical role in the epidemiology of tuberculosis. Poverty, lack of access to healthcare services, malnutrition, limited education, and unemployment contribute to increased vulnerability to TB infection and poor treatment outcomes. Socio-economic disparities further exacerbate the burden of tuberculosis, as marginalized populations often face barriers to timely diagnosis, treatment adherence, and access to quality healthcare.

1.2. Problem Statement:

Pulmonary tuberculosis (TB) remains a significant public health challenge globally, and Pakistan bears a substantial burden of this disease. Despite efforts to control TB, its prevalence in Pakistan remains alarmingly high, necessitating a comprehensive assessment of the underlying risk factors to inform effective intervention strategies According to the World Health Organization (WHO), Pakistan ranks among the top ten countries with the highest TB burden, accounting for a significant number of new cases and deaths annually. The prevalence of pulmonary tuberculosis in Pakistan has shown persistent levels, which calls for urgent action. Understanding the risk factors contributing to the transmission and development of TB is crucial for the formulation

of targeted preventive measures, early detection, and effective treatment strategies. This research article seeks to address the knowledge gap by conducting a comprehensive assessment of the prevalence and risk factors associated with pulmonary tuberculosis in Pakistan. The study will utilize real-time data collected from a diverse sample population across DHQ DG Khan. The statistical analysis will involve rigorous epidemiological techniques to determine the prevalence rate and identify significant risk factors, such as socio-economic status, overcrowded living conditions, malnutrition, immunosuppression, and lack of access to healthcare services.

By addressing the identified risk factors, it is anticipated that the burden of tuberculosis in Pakistan can be significantly reduced, ultimately leading to improved health outcomes and a healthier population. This study holds great significance for public health in Pakistan and will contribute to the global efforts aimed at achieving the Sustainable Development Goal of ending the TB epidemic by 2030.

1.3. Aim of Study:

Our aim of study was to assess the prevalence and identify the risk factors associated with pulmonary tuberculosis among Population of DG Khan.

1.4. Objective:

The findings of this research will provide valuable insights into the current state of pulmonary tuberculosis in Pakistan, allowing policymakers, healthcare providers, and other stakeholders to develop evidence-based interventions.

1.5. Study Tool:

A questionnaire was prepared keeping in view the prevalence and risk factors of pulmonary tuberculosis. The questionnaire was composed of socio-economic and demographic factors, educational details and risk factors of Pulmonary Tuberculosis. The questionnaire was prepared in English and it took 05-08 minutes for the observer to interview each patient and fill the Questionnaire form. The questions related to risk factors were in "Yes" or "No" format.

1.6. Study Area :

The current study was conducted at the DHQ DG Khan. The DHQ DG Khan, also known as the Allama Iqbal Teaching Hospital, is a government-run hospital in Dera Ghazi Khan, Punjab, Pakistan that facilitates almost 1200 patients from city and peripheral areas on daily basis.

1.7. Inclusion Criteria:

Only those patients were included in the study that ;

- The residents of DG Khan
- must have answered all questions
- Must had the T.B.(active or latent)
- Were receiving medications according to the protocols

1.8. Exclusion Criteria:

- Not the residents of DG Khan
- Didn't properly answered all the questions
- Not co-operative with Observer
- Improper patient data

.

1.9. Sample Size:

A total of 531 patients were interviewed for assessing the prevalence and risk factors of pulmonary tuberculosis out of which 20 patients were excluded while 511 patients were considered fit for this study.

1.10. Limitation of Study:

This study is conducted among population of DHQ DG Khan that is located in DG Khan city in south Punjab, Pakistan, so this study cannot be generalized to whole province or whole country or whole world. This because DG Khan is one the backward area and living conditions here are way too different from rest of the world especially from developed cities and countries of the world. Moreover, knowledge level of healthcare providers also different which leads to limited knowledge of patients about their pathological condition. Sample size of the study was calculated to be 531 patients as some of the patients were not able to respond at the time of study so excluded patients may have different approach towards the risk factors.

Chapter 02
Literature review

According to a cross-sectional study conducted in November 2007 in two hospitals adjacently located in the same block of Hai Ba Trung District in Hanoi city, Viet Nam. A total of 300 HCWs including all staff members in a municipal TB referral hospital received an interferon-gamma release assay (IGRA), QuantiFERON-TB Gold In-TubeTM, followed by one- and two-step tuberculin skin test (TST) and a questionnaire-based interview. Agreement between the tests was evaluated by kappa statistics. Risk factors for TB infection were analyzed using a logistic regression model. Among the participants aged from 20 to 58 years (median=40), prevalence of TB infection estimated by IGRA, one- and two-step TST was 47.3%, 61.1% and 66.3% respectively. Although the levels of overall agreement between IGRA and TST were moderate, the degree of agreement was low in the group with BCG history (kappa=0.29). Working in TB hospital was associated with twofold increase in odds of TB infection estimated by IGRA. Increased age, low educational level and the high body mass index also demonstrated high odds ratios of IGRA positivity. Prevalence of TB infection estimated by either IGRA or TST is high among HCWs in the hospital environment for TB care in Viet Nam and an infection control program should be reinforced. In communities with heterogeneous history of BCG vaccination, IGRA seems to estimate TB infection more accurately than any other criteria using TST.

Another five-year cross-sectional study on Prevalence of biologic, behavioral and psychosocial determinant of tuberculosis in tuberculosis patients of Semnan city aimed to investigate the factors affecting TB in TB patients in Semnan, Iran. All patients with confirmed TB, who were referred to primary healthcare centers in Semnan for receiving medication, enrolled in the study (2012 to 2016). Data collected from clinical records and in-person interviews. The questionnaire consisted of two parts; the first part was demographic data and the other was related to the risk factors for TB. The household crowding index was 1.86 ± 0.88. Most of patients (48.1%) were elderly (≥60 years old), female (59.7%), housewife (48.1%), had a pre-diploma education (63.6%), low-monthly income (62.3%) and married (63.6%). Around13.0% had diabetes. 20.8% drug abuser, 16.9% cigarettes and tobacco smokers, and 1.3% consumed alcoholic beverages. Besides, 40.3% were Afghans and 1.3% had the Pakistani nation.

A retrospective analysis was conducted on incidence and assessment of demography-

related risk factors associated with pulmonary tuberculosis in Saudi Arabia. The objective of the study was to evaluate pulmonary TB incidence rates and conclude the potential high-risk patients to highlight the burdened regions in Saudi Arabia for the health authorities, which could help to establish policies of infection control as necessary. It retrospectively investigated the incidence of pulmonary TB data reported by the ministry of health (MOH) in 2018. It analyzed pulmonary TB incidence data by nationality, age, gender, and region using Chi-square test to identify demography-related risk factors associated with pulmonary TB and its significance. The results indicated that the incidence of pulmonary TB was significantly higher in males than in females in both Saudi and non-Saudi nationals. The number of cases was particularly high in major cities. Also, infections were mainly associated with certain age groups that were different between the Saudi and non-Saudi nationals. TB control seems to be facing some challenges in several regions of the Kingdom, particularly major cities.

A cross-sectional study was conducted to estimate the prevalence of and identify risk factors associated with tuberculin skin test (TST) positivity among household contacts of acid-fast bacilli (AFB) sputum smear-positive pulmonary tuberculosis cases, registered at the Umerkot Anti-Tuberculosis Association clinic from August 1999 to September 1999 in Umerkot Taluka, Sindh, Pakistan. The contact's Mycobacterium tuberculosis infection status was assessed using TST. On the day of the TST, a pre-designed questionnaire was administered to collect data on putative risk factors for TST positivity among contacts. The data were analyzed using a marginal logistic regression model by the method of generalized estimating equations (GEE) to determine risk factors independently associated with TST positivity. The prevalence of TST positivity among household contacts of AFB sputum smear-positive index patients was 49.4%. The final multivariate GEE model showed that contact's age and sleeping site relative to the index case, the intensity of the index case's AFB sputum-smear positivity and the contact's BCG scar status were independent predictors of TST positivity among house- hold contacts of AFB sputum smear-positive index cases. The results suggested that the household contacts of AFB sputum smear-positive tuberculosis patients in a poor neighborhood of rural Sindh had a high prevalence of M. tuberculosis infection as determined by TST. Poor housing conditions seem to contribute to the spread of M. tuberculosis infection. Early

diagnosis of pulmonary TB through evaluation of TST-positive household contacts, followed by appropriate therapy, may prevent further spread of M. tuberculosis infection.

A retrospective analysis of the TB prevention scheme administered in 2006 among the poor in Warminsko-Mazurskie Province in the northern region of Poland and financed by the Provincial Assembly. The study material was based on the data of 7380 participants, including 243 homeless adults, aged be- tween 18 and 96 years. The scheme covered virtually the entire region of Warmia and Mazury, Poland, which covers an area of 24191.8 km2 and has a population of 1426000. The TB incidence rate in the group studied was estimated at 730 per 100000 population. The main risk factor was homelessness, with a TB incidence rate in the homeless group of 4290/100000. According to the data, socio-economic factors correlated much more closely with a final TB diagnosis than subjective disease symptoms. Efficient TB control requires prevention programs aimed at systematic monitoring of the homeless. A population with such a high proportion of TB patients is a dangerous source of TB. A study on Spatio-temporal variation in tuberculosis incidence and risk factors for the disease in a region of unbalanced socio-economic development was conducted in North China Plain. The aim of the was to explore the spatio-temporal variation in TB incidence and examine risk determinants of the disease among aging populations in a typical region. The study region was the North China Plain and consisted of the Beijing Municipality, Tianjin Municipality and Hebei Province. Data on TB-registered cases between 2009 and 2014, in addition to social-economic factors, were collected for each district/county in Beijing, Tianjin and Hebei, a region characterized by an aging population and disparities in social-economic development. A Bayesian space–time hierarchy model (BSTHM) was used to reveal spatio-temporal variation in the incidence of TB among the elderly in this region between 2009 to 2014. Geo Detector was applied to measure the determinant power (q statistic) of risk factors for TB among the elderly. The incidence of TB among the elderly exhibited geographical spatial heterogeneity, with a higher incidence in underdeveloped rural areas compared with that in urban areas. Hotspots of TB incidence risk among the elderly were mostly located in north-eastern and southern areas in the study region, far from metropolitan areas. Areas with low risk were distributed mainly in the Beijing-Tianjin metropolitan

areas. Social-economic factors had a non-linear influence on elderly TB incidence, with the dominant factors among rural populations being income (q=0.20) and medical conditions (q=0.17). These factors had a non-linear interactive effect on the incidence of TB among the elderly, with medical conditions and the level of economic development having the strongest effect (q=0.54).

A Cohort Study on Pulmonary Tuberculosis Incidence and Risk Factors in Rural Areas of China examined TB incidence and relative risk factors in rural areas of China. Participants (n=177,529) were recruited in Xiangtan County (in the central area of China) and in Danyang County (in the eastern area of China) in 2009 and a followed-up study was conducted for one year. The incidence density of pulmonary TB and smear-positive TB were 91.6 (95% CI) per 100,000 person-year and 36.7 (95% CI) per 100,000 person-year respectively in Xiangtan, and 47.3 (95% CI: 38.2, 57.5) per 100,000 person- year and 22.7 (95% CI: 16.5, 30.8) per 100,000 person-year in Danyang. The medical history of TB was associated with TB, with the relative risk (RR) of 7.00 (95% CI) in Xiangtan and that of 31.08 (95% CI) in Danyang. The association between TB and per capita living space over median was found in Xiangtan, with the RR of 1.86 (95% cl). No association was found between TB and the insurance status, the contact history with TB, the history of diabetes, smoking, or per capita annual income. The host genetic susceptibility, and social factors such as education and income could be considered in future studies.

To determine the prevalence and risk factors for MDR-TB in Georgia a population-based study was carried out between July 2005 and May 2006. Of 1314 patients with acid-fast bacilli smear- and culture-positive pulmonary tuberculosis (TB), 799 (60.8%) were newly diagnosed patients and 515 (39.2%) had been treated previously. Overall, 733 (56%) patients had resistance to at least one anti-tuberculosis drug and 195 (15%) had MDR-TB. Patients who had been treated previously for TB were significantly more likely to have MDR-TB than newly diagnosed patients (141/515). In multivariate analysis, previous TB treatment (aOR 5.47, 95%CI 3.87–7.74) and female sex (aOR 1.58, 95%CI 1.02–2.32) were independent risk factors for the presence of MDR-TB. Drug-resistant TB, including MDR- TB, has emerged as a major public health problem in Georgia.

To study the prevalence of tuberculosis infection among children in household contact with adults having pulmonary tuberculosis, and identify the possible risk factors, a

prospective, hospital based, descriptive study was conducted over a period of 18 months, on children who were contacts of 100 consecutive ''sputum smear positive'' and 100 consecutive ''sputum smear negative'' adults with pulmonary tuberculosis diagnosed. Children under the age of 5 years who were in household contact with 200 consecutive adults with pulmonary tuberculosis underwent tuberculin skin testing. Transverse induration of greater than 10 mm was defined as positive tuberculin test suggestive of tubercular infection. Infected children underwent chest radiography and analysis of gastric lavage fluid or induced sputum for detection of acid fast bacilli. Tuberculin test was positive in 95 of 281 contacts (33.8%), of which 65 were contacts of sputum positive patients, while 30 were contacts of sputum negative patients. Nine of these children were diagnosed as having tuberculosis based on clinical features and/or recovery of acid fast bacilli; seven were in contact with sputum positive adults. The important risk factors for transmission of infection were younger age, severe malnutrition, and absence of BCG vaccination, contact with an adult who was sputum positive, and exposure to environmental tobacco smoke. The prevalence of tuberculosis infection and clinical disease among children in household contact with adult patients was higher than in the general population, and risk is significantly increased by contact with sputum positive adults.

Chapter 03
Methodology

3.1: Research Design

A prospective, cross-sectional study was conducted with investigating 531 patients to assess and evaluate the prevalence and risk factors of pulmonary Tuberculosis.

3.2: Aim and Objective.

Present study is aimed to assess the prevalence and identify the risk factors associated with pulmonary tuberculosis among Population of DG Khan.

3.3: Study Tool

A questionnaire was prepared keeping in view the prevalence and risk factors of pulmonary tuberculosis. The questionnaire was composed of socio-economic and demographic factors, educational details and risk factors of Pulmonary Tuberculosis. The questionnaire was prepared in English and it took 05-08 minutes for the observer to interview each patient and fill the Questionnaire form. The questions related to risk factors were in "Yes" or "No" format.

3.4: Study design.

A cross section study was conducted this method is beneficial to reduce the errors and bias among the participants.

3.4: Development of questionnaire.

The questionnaire was composed of socio-economic and demographic factors, educational details and risk factors of Pulmonary Tuberculosis. The questionnaire was prepared in English and it took 05-08 minutes for the observer to interview each patient and fill the Questionnaire form. The questions related to risk factors were in "Yes" or "No" format.

3.5: Study population and sample size.

The targeted sample for this study was the population of DG Khan.

Participants of this study were taken from the DHQ Hospital DG Khan.

3.6: Inclusion criteria.

The approved questionnaire was distributed among the patients of hospital in DG Khan. All the patients actively participated in the study. The contestant assigned knowledgeable assent type proceeding towards the study, which was approved by my supervisor.

3.6.1: Inclusion criteria were as follows:

Only those patients were included in the study that ;

- Were the residents of DG Khan
- must have answered all questions
- Must had the T.B.(active or latent)
- Were receiving medications according to the protocols

3.7: Exclusion criteria.

- Were not the residents of DG Khan
- Didn't properly answered all the questions
- Not co-operative with Observer
- Improper patient data

3.8: Data analysis.

The collected data were reviewed, coded, verified and statistically examine using the IBM Statistical package for social sciences (SPSS) software version 20.

Chapter 04: Results

Total 510 patients were recoded. The prevalence was higher in females as compared to males and in rural areas compared to urban areas **(Table. No. 01).** The laborers and housewives shows greater prevalence while students and farmers shows low prevalence **(Table No. 02).** A higher prevalence was observed in age group 36-45 leading by age group 46-55 while a sudden decrease in prevalence was seen in age group 56-75**(Table No. 03).** Highest prevalence was seen in uneducated and persons with inadequate health care. Smoking also shows the major risk factor for prevalence as compared to other factors. Exposure to certain risk factors like close contact with TB patients, family history about TB, living in sub-standard conditions and pre-existing medical conditions were also the major risk factors for developing PTB. **(Table No. 05)**

Table No.01: (Socio-economic Variables)

variable	Category	Number	Percentage(%)
Gender	Male	208	40.78 %
	Female	302	59.22 %
Marital Status	Single	80	15.69 %
	Married	357	70 %
	Widowed	73	14.31 %
Residency	Rural	396	77.64 %
	Urban	114	22.36 %

Table No.02: (Work related factors *n=510)*

occupation	Numbers	Percent(%)
Labourer	167	32.74 %
Health Care Worker	21	4.11 %
Driver	23	4.50 %
Farmer	66	12.94 %
Housewife	174	34.11 %
Student	59	11.56 %
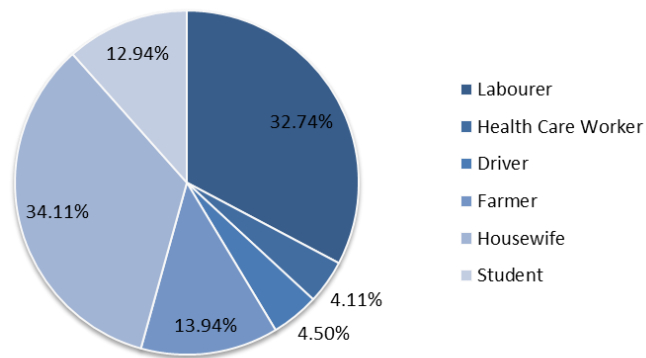
Figure no. 2

Table No 03 (Age group *n=510)*

Age Group (Years)	Numbers	Percent(%)
Less than 05	21	4.15 %
05-15	39	7.64 %
16-25	37	7.25 %
26-35	73	14.31 %
36-45	115	22.55 %
46-55	125	24.50 %
56-65	63	12.35 %
66-75	37	7.25 %
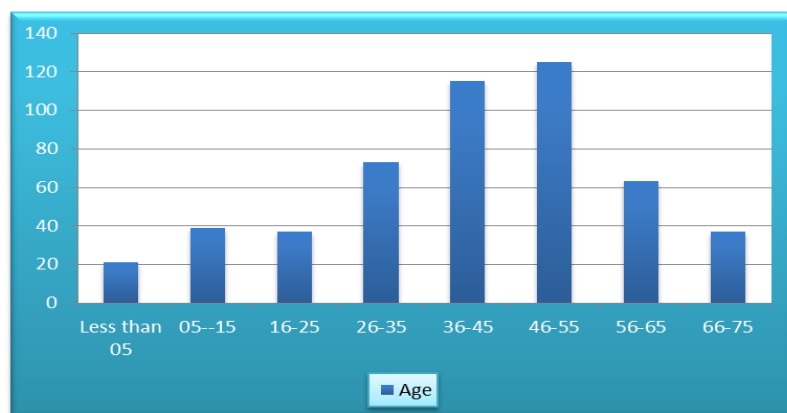
Figure No. 3

Table No 04: (Education level *n=510*)

Education	Number	Percent (%)
Below Primary	287	56.27 %
Primary	112	21.96 %
Secondary	73	14.32 %
Higher Secondary	25	4.90 %
Graduation	13	2.55 %
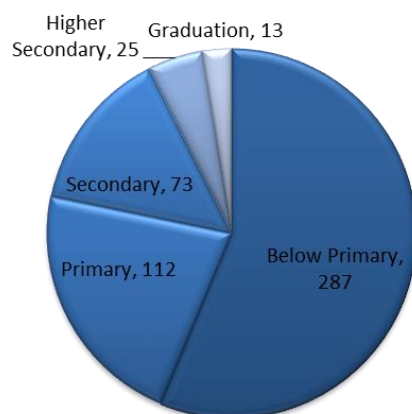
Figure no. 4 (Education)

Table No 05: (Risk factors and Prevalence *n=510*)

Risk Factors	Numbers
Close contact with active T.B. Patients	123
Immunocompromised	23
Lacking adequate Health Care	263
Living in sub-standard conditions	287
Pre-existing medical conditions	247
Institutionalization	13
Immigrants from countries with higher incidence of T.B.	04
Health care worker	13
Smoking	291
Children less than five years	21
Malnutrition	40
Homeless or prisoner	26
Family history about T.B.	156

Figure no. 5

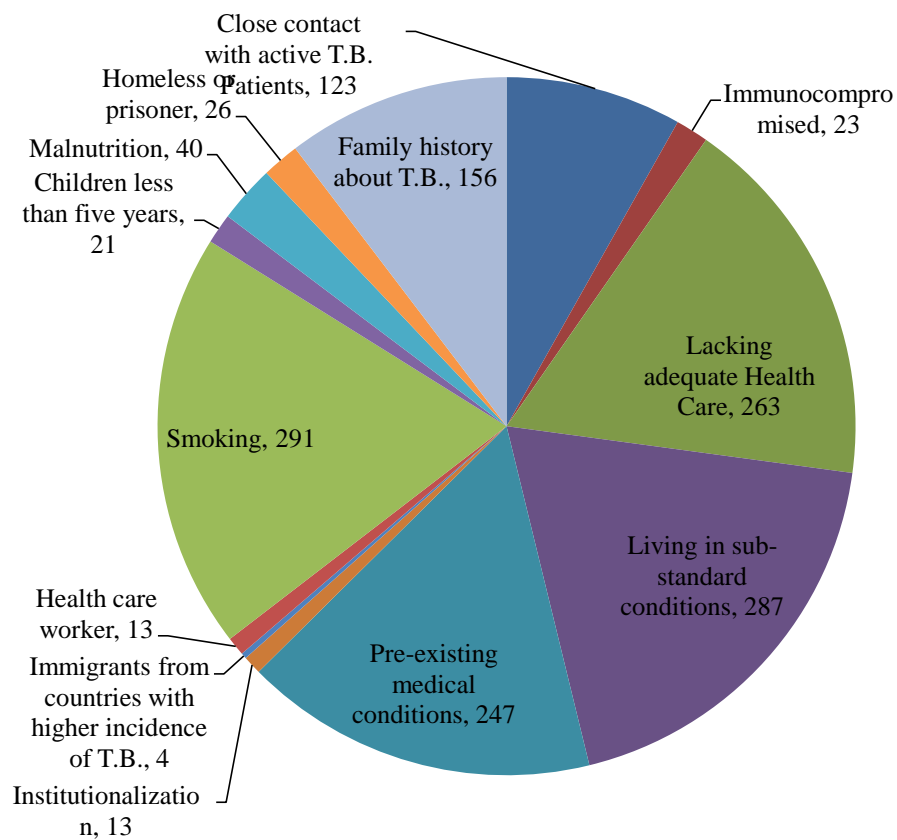|	Close contact with active e...	Immunoc ompromi sed	Lacking adequ ate Heal th Care	Living in sub- stan dard co...	Pre- exist ing medi cal cond iti...	Institutio naliz ation	Imm igra nts from coun tries wi...	Heal th care wor ker	Smo king	Chil dren less than five year s	Mal nutri tion	Hom eless or priso ner	Fam ily histo ry abou t T.B.
Series1	123	23	263	287	247	13	4	13	291	21	40	26	156
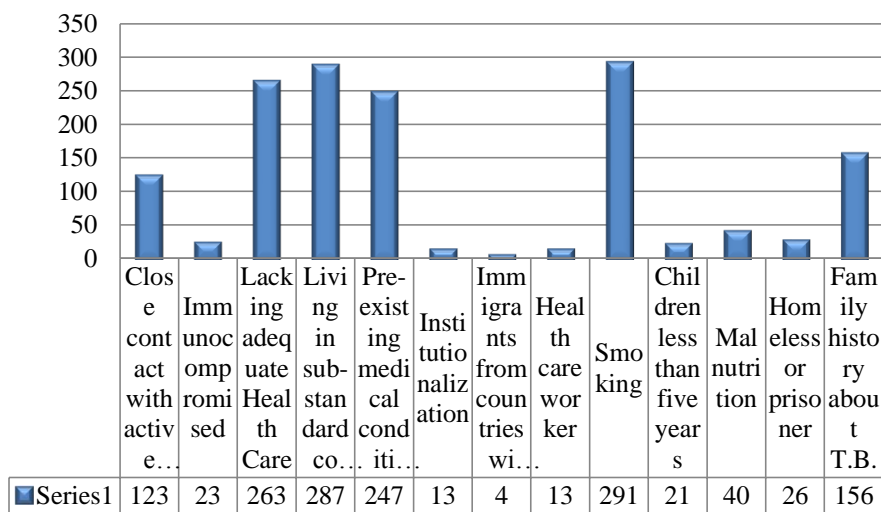
Table No. 06. (Multiple Risk Factors)

Risk Factors	Numbers
Lacking adequate Health care Smoking	157
Lacking adequate health care Living in substandard conditions	98
Lacking adequate health care Close contact with T.B. Patient	87
Living in substandard conditions Family history about T.B.	76
Lacking adequate Health care Smoking Pre-existing medical conditions	93
Smoking Family history about T.B.	54
Living in substandard conditions Pre-existing medical conditions	58

Chapter 05: Discussion

The present study is the first study of its types conducted in DG khan city to investigate the role of various hosts, environmental, demographic and socioeconomic risk factors involved in the increasing risk of infection of TB in the population. Tuberculosis is one of the most contagious disease infected those people who live in crowded. Ill-ventilated places and those who are ill-fitted to conflict tuberculosis in term of their immune status or whose nutrition level is so low that they easily capitulated to tuberculosis. According to the Global TB Report in 2008, World Health Organization revealed that Pakistan is on 9th positions among the twenty-two high-burden tuberculosis countries worldwide, where approximately 280.000 people develop TB primarily adults in their creative years. Similar to other growing countries, the high risk groups for tuberculosis infection in Pakistan, may comprise individuals with diabetes, people with hepatitis, other respiratory tract infected people or people suffered from cancer, those individuals who have been contacting with active tuberculosis patients, residents of homeless shelters, the malnourished, poor and present or former prisoners.

The highest percentage of patients with prevalence of PTB in age group of 46-55 were 24.50%, age group 36-45 contributed as 22.5%. The highest prevalence was found in age between 36-55 years while these values were comparatively less than in young age (7.25%). Several researchers showed that tuberculosis is more prevalent in old stages mostly in old men due to their suppressive immune system using various drugs, smoking, and alcohol which may lead to disease development at a high rate. The prevalence of PTB was high in married (70%) as compared to um-married (15.69%) and widowed (14.31%). The maximum percentage was reported in female patients with observed value of 59.22% while 40.78% of patients recorded were male. Our study results are similar to other studies that reported a high rate of tuberculosis prevalence in the female population as compared to male. Females are more susceptible to disease development as compare to males because of extra immune deficient and some hormonal changes in their reproductive years which may lead to at a higher level of disease progression. In Hong Kong study reported the highest rate of tuberculosis prevalence in women community observed in their reproductive ages and due to missing of anti-TR medication. Geographically, the present study shows the highest prevalence rate of TB in the rural population of district DG Khan which is 77.64% while thus rate of prevalence is lower in the urban community which is 22.36%. Mainly the rural areas suffered to poverty, poor diagnosis, non-availability of qualified staff, insufficient education rate, and unsatisfactory coverage of immunization.

The higher incidence of transmission of infection with exposure to environmental tobacco smoke is an interesting observation; a possible explanation is that cigarette smoke impairs pulmonary defence mechanisms, making airways more susceptible to infection. Another possible explanation is that this actually reflects poorer health

related habits and sociocultural behavior that may independently increase risk of infection, including tuberculosis. However, in our study, contacts of sputum positive smokers had a higher infection rate than sputum positive non-smokers, suggesting that there may be a real link between the two factors. Active smoking was found to significantly increase the risk of infection in this study where the observed value for incidence of PTB in smokers was 291 out of 510 patients. Malnutrition was another profound risk for the TB in this study (40 patients). As it affects cell-mediated immunity (CMI) which is the principal host defense against TB.

The disease progresses rapidly in malnourished and immune compromised individuals. Various studies have shown that risk of progression of primary or latent infection to the active disease increases significantly in malnourished individual. In a report on Nutrition and health, the US Surgeon General summarized the potential impact of malnutrition on the global incidence of TB suggesting that malnutrition is an important factor of acquired immune system dysfunction throughout the world. People co-infected with diabetes or other immune compromised/ respiratory infectious diseases or any pre-existing medical condition are at a higher risk of the disease where the observed value in this study shows that 270 patients were of pre-existing medical conditions. Several studies have reported the association between diabetes and tuberculosis and found that people with diabetes are 2.5 times more likely to develop TB particularly in developing countries. It has been observed that with increasing the no. of people in the household specially adults in a house doubles the risk of TB increased which has been justified by many studies. In poorly maintained housing conditions with closed house types, less no. of rooms and windows/room and poor material used in the construction are also significant risk factors of increasing the TB incidence because it results in overcrowding and poor ventilation. These results are supported by various studies that showed that crowding, ventilation and housing conditions are markers of increased susceptibility of getting the infection.

TB is known as the disease of poverty. Social risk factors for infectious diseases have long been reported to be associated with one another. We found that increased incidence of cases are associated with unemployment, lack of education and migration which are all because of poverty, a marker of socio economic status. The numbers of patients with lack of adequate health care were 263 patients, living in sub-standard conditions were 287, with family history about T.B were 156 and with closed contact with active T.B. patients were 123. According to this study the most affected persons from PTB were housewives, laborers and then farmers with observed value of 34.11%, 32.74% & 12.94% respectively. These values indicate the higher prevalence of PTB that may be due to the lack of nutrition, poor hygienic conditions and lack of education, lack of health care services.

The patients that were exposed to the multiple risk factors were at higher risk of developing PTB as compared to the patients who were exposed to any single risk factor. The number of patients with exposed to multiple risk factors i.e.; smokers lacking adequate health care and with pre-existing medical conditions (RTI, Diabetes) were at greater risk of developing PTB than smokers with better health care, patients lacking adequate health care and living in sub-standard conditions were more likely to get infected with PTB, Persons with family T.B. history and living in sub-standard conditions were more prone to developing PTB.

Chapter 06: Conclusion

This study conducted at DHQ DG Khan shows that the higher prevalence of PTB was recorded in females as compared to males, in uneducated persons, in housewives and laborers. While in patients of age group between 36-55 higher prevalence of PTB was observed and in persons of age group 55-65 the prevalence of PTB was low. People from rural areas and with pre-existing medical conditions were at higher risk of developing the PTB. Persons with family history of TB and living in sub-standard conditions with inadequate health care were at greater risk of developing and prevailing the PTB. Our study shows that the smokers with pre-existing medical conditions or with family history of TB were also at higher risk of developing PTB. Hence this study provides useful information for association of risk factors with infection and disease that can be used to control the infection in DG Khan by reducing or eliminating the potential risk factors. It is also concluded from this study that people should be educated and facilitated with proper health care and medical facility and their living condition should be improved so that, the chance of infection could be reduced to stop TB.

Chapter 07: References

1. *World Health Organization. (2020). Global Tuberculosis Report 2020. Geneva: World Health Organization.*

2. *Government of Pakistan. (2019). National Tuberculosis Control Programme Annual Report 2019. Islamabad: Ministry of National Health Services, Regulations & Coordination.*

3. *Khan, M. U., & Rehman, A. U. (2017). Risk factors for tuberculosis in Pakistan: A systematic review and meta-analysis. BMC Infectious Diseases, 17(1), 628.*

4. *World Health Organization. (2021). Global Tuberculosis Report 2021. Retrieved from https://www.who.int/tb/publications/global_report/en/*

5. *National TB Control Programme. (2022). About Us. Retrieved from https://ntp.gov.pk/about-us/*

6. *Lien LT, Hang NTL, Kobayashi N, Yanai H, Toyota E, et al. (2009) Prevalence and Risk Factors for Tuberculosis Infection among Hospital Workers in Hanoi, Viet Nam. PLoS ONE 4(8): e6798. doi:10.1371/journal.pone.0006798*

7. *Chen W, Shu W, Wang M, Hou Y, Xia Y, et al. (2013) Pulmonary Tuberculosis Incidence and Risk Factors in Rural Areas of China: A Cohort Study. PLoS ONE 8(3): e58171. doi:10.1371/journal.pone.0058171*

8. *DhanarajB,PapannaMK,AdinarayananS, VedachalamC,SundaramV,ShanmugamS,etal. (2015)PrevalenceandRiskFactorsforAdult PulmonaryTuberculosisinaMetropolitanCityof SouthIndia.PLoSONE10(4):e0124260. doi:10.1371/journal.pone.0124260*

9. *Kia NS , Nassaji Zavareh M, Sarkheil E, Ghods E. Prevalence of biologic, behavioral and psychosocial determinant of tuberculosis in tuberculosis patients of Semnan city; a five- year cross-sectional study. J Prev Epidemiol. 2020;5(2):e24. doi: 10.34172/jpe.2020.24.*

10. *El-Masry OS, Muzaheed. Incidence and assessment of demography-related risk factors associated with pulmonary tuberculosis in Saudi Arabia: A retrospective analysis. Pak J Med Sci. 2022;38(4):850-854. doi: https://doi.org/10.12669/pjms.38.4.5087*

11. Rathi S, K., S. Akhtar, H. Rahbar M, and I. Azam S. "Prevalence and risk factors associated with tuberculin skin test positivity among household contacts of smear-positive pulmonary tuberculosis cases in Umerkot, Pakistan." *The International Journal of Tuberculosis and Lung Disease* 6, no. 10 (2002): 851-857.

12. Lomtadze, N., R. Aspindzelashvili, M. Janjgava, V. Mirtskhulava, A. Wright, H. M. Blumberg, and A. Salakaia. "Prevalence and risk factors for multidrug-resistant tuberculosis in the Republic of Georgia: a population-based study." *The International journal of tuberculosis and lung disease* 13, no. 1 (2009): 68-73.

13. Romaszko, J., A. Buciński, R. Wasiński, A. Rosłan, and K. Bednarski. "Incidence and risk factors for pulmonary tuberculosis among the poor in the northern region of Poland." *The International Journal of Tuberculosis and Lung Disease* 12, no. 4 (2008): 430-435.

14. Wang, Li, Chengdong Xu, Maogui Hu, Jiajun Qiao, Wei Chen, Tao Li, Songbo Qian, and Mingtao Yan. "Spatio-temporal variation in tuberculosis incidence and risk factors for the disease in a region of unbalanced socio-economic development." *BMC Public Health* 21 (2021): 1-11.

15. Silva, Denise Rossato, Marcela Muñoz-Torrico, Raquel Duarte, Tatiana Galvão, Eduardo Henrique Bonini, Flávio Ferlin Arbex, Marcos Abdo Arbex, Valéria Maria Augusto, Marcelo Fouad Rabahi, and Fernanda Carvalho de Queiroz Mello. "Risk factors for tuberculosis: diabetes, smoking, alcohol use, and the use of other drugs." *Jornal Brasileiro de Pneumologia* 44 (2018): 145-152.

16. Singh, M., M. L. Mynak, L. Kumar, J. L. Mathew, and S. K. Jindal. "Prevalence and risk factors for transmission of infection among children in household contact with adults having pulmonary tuberculosis." *Archives of disease in childhood* 90, no. 6 (2005): 624-628.