Chapter 01: Introduction

Tuberculosis (TB) is a zoonotic disease which was declared as a worldwide public health problem by the WHO assembly resolution in 1991 (WHO, 1991). TB is a bacterial disease caused by Bacillus *Mycobacterium tuberculosis* and most commonly affects lungs. Infection mostly gets into human bodies with droplets as the result of the direct contact (Vīksna, 2011; Millet et al., 2012). In most infected persons, infection is contained by the immune system and bacteria become walled off in caseous granulomas or tubercles. In about 5% of infected cases, rapid progression to tuberculosis will occur within the first two years after infection (Narasimhan et al., 2013). About 10% of people with latent infection will reactivate, half within the first year and the remainder over their lifetime (Maher, 2009; Kwan and Ernst, 2011). It occurs mostly by reactivation of the dormant tubercle bacilli acquired from primary infection or less frequently by reinfection. Overall, about 10–15% of those infected go on to develop active disease at some stage later in life (Maher, 2009). Tuberculosis usually affects the lungs and it is transmitted from person to person via droplets, and over 90% of people infected with the tubercle bacillus will not develop TB disease (Osterberg and Blaschke, 2009).

In most cases the consequences of TB are measured by the direct expenses for the treatment of patients, including drugs and personnel (Tanimura et al., 2014). Due to the long duration of TB treatment, it tends to be more expensive on average than treatment of other illnesses. There are also indirect economic losses to the individual or his family members in regards to disability during the treatment period (Tanimura et al., 2014) or a lower productivity during outpatient care (Rajeswari et al., 2010). These types of losses mostly concern the able-bodied population, as TB most often affects the economically active (aged 15 – 54) peoples (Kim et al., 2007).

The importance of TB risk factors and risk conditions is confirmed by historical examples. In the second half of the 19th century and the first half of the 20th century, even before the discovery of TB medications, morbidity and mortality rates of TB in Europe were constantly decreasing due to not only the isolation of TB patients in sanatoriums and hospitals (Wilson, 2005), but also because of housing, hygiene and sanitation improvements, better diet and access to clean water (Lienhardt, 2001). Nowadays risk factors of TB mortality are being widely studied around the world, and we are aware of the range of possible risk factors. However, in each country there are different risk factors or their impact may be varied due to economic, social and cultural peculiarities. TB mortality risk factors are being demonstrated by epidemiologist and sociologist. Some scientists believe that both of these scientific branches deal with determinants of health, and that the boundaries between the social epidemiology and medical sociology are relative (Faresjö, 1992; Zielbertus & Kiemeney, 2001).

A person having TB annually infects 10 people; two out of them can develop active form of TB (Narasimhan et al., 2013). According to the World Health Organization (WHO) in 2019, 10 million people were infected with TB globally and 1.2 million people died (WHO, 2020a). TB is still remaining as second most important cause of death following HIV/AIDS. Ninety five percent (95%) of TB's deaths occur in low- and middle-income countries like Bangladesh. On the other hand, more than half of global TB deaths occurred in Southeast Asia. In 2019, an estimated 4.3 million people fell ill with TB and estimated 632 000 died (WHO, 2020b). In Bangladesh tuberculosis is a major public health problem having almost 300,000 new cases each

year and half of them are infectious (Hossain et al., 2019). The estimated incidence of TB per 100,000 is 221 in Bangladesh, with a mortality rate of 24 per 100,000 population (WHO, 2020a). Bangladesh remains among the top 20 high Multi drug resistant tuberculosis (MDR-TB) burden countries of the world. Bangladesh Government has adopted goals to end the era of TB, including targets for 90% reduction in TB cases and 95% reduction in TB deaths by 2035 (WHO, 2014).

Many new cases of TB are attributable to poverty, undernourishment, HIV infection, smoking, diabetes, and alcohol use, which are indicators in the Sustainable Development Goal (SDG) framework for TB (Kak et al., 2020). However, at the population level impact of this risk factor could vary depending on the local prevalence of the HIV. Diabetes, alcohol, malnutrition, tobacco smoke, and indoor air pollution are factors which impact a larger section of the population and accelerate progression to TB disease. In Bangladesh where TB-burden is high, all healthcare workers (HCWs) are at risk of TB exposure due to the presence of presumptive and or confirmed TB patients in the hospital (Islam et al., 2020; Nasreen et al., 2016). Public tertiary care hospitals often lack basic infection prevention and control (IPC) measures that make HCWs more vulnerable (Waheed et al., 2017). In low-and middle-income countries, the pooled prevalence of latent TB infection among HCWs was 47%, whereas in Bangladesh it was 54% (Nasreen et al., 2016).

To assess the risk of progression to infection and disease is essential for proper control measures of TB. The risk of infection following TB exposure is primarily governed by exogenous factors. It also determined by an intrinsic combination of the infectiousness of the source case, proximity to contact and social and behavioral risk

factors including smoking, alcohol, and indoor air pollution. In settings with increased chances of social mixing (together with overcrowding) transmission will be high. Similarly, conditions which prolong the length of exposure to an infectious patient include health system-related factor such as delay in diagnosis. Factors that increase the progression of infection to disease are primarily endogenous (host related). The National Tuberculosis Program (NTP) of Bangladesh adopted the Directly Observed Treatment Short course (DOTS) strategy. This research aims to summarize the risk factors which contribute to TB infection and disease among patients visited at a DOTS center in Chattogram, Bangladesh.

Objectives

1. To find out the socio-demographic profile of TB patients in Chattogram of Bangladesh
2. To find out the risk factors related to TB infections
3. To develop recommendations for reducing risk of TB infections

Chapter 02: Review of Literature

The understanding of the impact of risk factors and the risk conditions has an important role in the combat against TB and its prevention. Thus, in the framework of the thesis, the main TB morbidity influencing risk factors and risk conditions affecting them were intended to identified by reviewing previous literature.

TB as an organism

Mycobacterium tuberculosis is a human pathogen that has had a staggering global impact. Its origins are ancient. The emergence of *M. tuberculosis* as a human pathogen is not well understood, but it has been plausibly suggested that the domestication of cattle facilitated close contact to humans, resulting in transmission with eventual evolution of *M. bovis*, the bovine tuberculosis strain. The*M. tuberculosis* complex comprises at least nine species in the genus *Mycobacterium,* family Mycobacteriaceae, and order Actinomycetales that are causes of human TB and zoonotic disease. The *M. tuberculosis* complex species share 99.9% sequence identity and likely evolved from a single clonal ancestor. *M. tuberculosis* is an aerobic, non–spore-forming, nonmotile bacillus with a high cell wall content of high-molecular-weight lipids. Growth is slow, the generation time being 15 to 20 hours, compared with much less than 1 hour for most common bacterial pathogens, and visible growth takes from 3 to 8 weeks on solid media. The organism tends to grow in parallel groups, producing the colony characteristic of serpentine cording (John, 2020).

Transmission cycle of TB:

The success of any bacterial pathogen ultimately depends on its ability to multiply and infect new hosts. Many pathogenic bacteria interact with hosts by secreting virulence molecules like proteins and lipids. The tubercle bacillus is spread person-to-person almost exclusively by aerosolized particles. The size of infectious droplets ranges from 0.65 (small) to >7.0 μm (medium–large) (Fennelly 2004). These particles attached with alveolar macrophages or tissue dendritic cells. Subsequently, infected macrophages or dendritic cells migrate to draining lymph nodes, activate adaptive immunity and then return to the initial site of infection where a granuloma forms. Drainage of tuberculosis to local lymph nodes could result in lymphatic disease. If the particles are very small, they might bypass epithelial cells altogether and reach the terminal alveoli to be ingested by airway phagocytes. Thus, both inoculum dose and particle size could influence the outcome of disease such that individuals (Shiloh, 2016).

Health

Nowadays health is one of the fundamental values for the individual and society. It not only affects person's material status, but also social status and well-being. Deterioration of public health may be a threat to social stability and social development. In 1968, Ottawa Charter for Health Promotion elaborated on the definition adopted in 1948, emphasizing that health means "to reach a state of complete physical mental and social well-being, an individual or group must be able to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment. Good health is a major resource for social, economic and personal development and an important dimension of quality of life" (WHO, 1986). É. Durkheim, T. Parsons and E. Goffman were pioneers of sociological research. One

of the first theoretical conceptions that included concepts of health and disease is Émile David Durkheim's deviance theory according to which any society with existing social norms has to face violations of these social norms – deviances.

Sociologist Talcott Parsons, a representative of USA's structural functionalism, author of Role theory, treats health as "the optimum capacity of an individual for the effective performance of the roles and tasks he has been socialized", whereas disease is application of the sick role (Parsons, 1975). In the case of not performing, one's duties, individual's behaviour is seen as being deviant, but in contradiction to Durkheim, Parsons does not consider disease itself as a deviance, but the individual's behaviour that does not correspond to the sick role. Robert King Merton also believes that not all individuals with health problems should be considered as deviant, but only the ones who do not engage in 5 ways of adaptation which help to achieve the goal set by the society – good health – conformity, innovation, ritualism, retreatism and rebellion. Retreatism and rebellion are often regarded as deviations. Another group of sociologists view disease as a risk. The term risk was introduced in sociology from the social risk theory. Risks were closely studied by sociologists Anthony Giddens and Ulrich Beck.

Getting ill, including development of TB, may be regarded as a social risk, as it characterized by all the four aforementioned basic criteria – the probability of the occurrence of an event – a person may or may not become ill in his lifetime; negative consequences for the individual or society – physical deterioration, pain, physical function limitations, etc.; necessary actions to reduce the social risk – strengthening immunity, compliance with doctor's recommendations, etc., but at the macro level it is maintenance of health institutes, implementation of health

promotion programs etc.; the presence of influencing factors – health influencing factors can increase an individual's risk of a disease, therefore there is a need for disease risk control programs (Ivanovs, 2016).

Health Models

To define health and analyze health related processes two models are mostly used. The biomedical model is the currently most used model by doctors for disease diagnostics. According to this model, "health constitutes the freedom from disease, pain, or defect" (Annandale, 1998). This model prescribes direct treatment of a disease – clinical diagnostics and medical intervention to treat symptoms, whereas disease prevention and health promotion are of secondary importance (Shi & Singh, 2013). The biopsychosocial model studies three aspects of health – physical, psychological and social factors that determine health and disease treatments. In 1948 Constitution of the WHO adopted a definition for the concept of health that may be attributed to this model. Health is defined "as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1948).

Health Determinants

Evaluation of morbidity risk and disease risk factors has nowadays become one of the main topics in medical sociology and public health (Gabe, et al., 2004). Nowadays the most prevalent diseases may more or less be linked to the individual's lifestyle – bad habits and unhealthy diet increase the risk of chronic diseases. WHO recognizes that the person's health is affected by genetic, environmental, social and economic factors which are related to the person's well-being, living conditions,

income, family life, education, quality of life, and to a lesser extent – medical help (WHO, 2005). The importance of social and economic factors in regards to health has been stated in the Ottawa Charter for Health Promotion "Prerequisites for health are peace, shelter, education, food, income, a stable eco-system, sustainable resources, social justice, and equity" (WHO, 1986). Medical sociologists also study the impact of various social factors on the health of the individual and disease risk. The British medical sociologist William Cockerham is convinced that social class or socioeconomic status of the individual "is one of the strongest predictors of health, disease causation, and longevity", also in interaction with other factors (Cockerham, 2007). According to Giddens (2009), individuals belonging to a higher social status are healthier, stronger and live longer.

Sociologists attribute the differences in disease risk between different social strata to the existing inequality. According to the theory of unequal distribution of resources, two individuals with the same health indicators may have a different disease risk

The aforementioned theory is closely connected to *the Theory of Class Distinction* and allows to study health depending on the individual's or group's social position. The French sociologist Pierre Bourdieu claims that the social structure, by determining individual's social position, is largely connected to health and well-being (Bourdieu, 1986). In the context of risk, TB may be characterized as a consequence of social inequality or structural violence against individual's rights and health (De Maio, 2010). This connection may be explained by individual's behaviour models, stating that individuals who belong to lower social class, are more likely to exhibit health damaging behaviour (Giddens, 2009). At the same time individual's choice is affected by structural and social conditions and factors influencing individual's behaviour (Nettleton, 2006).

It needs to be emphasized that both individuals characterizing influencing factors – lifestyle, behaviour, diet and culture, as well as the structural influencing factors – income levels and poverty have an important role in explaining the social origins of health and disease. In the case of health influencing risk factors, it is more accurate to use the narrower term health determinant instead of influencing factor. Health determinant is a range of factors and conditions, which directly affects individual's health by strengthening or deteriorating it (Shi & Singh, 2013).

Health determinants can leave both negative and positive impact on health. Protective factors have a positive impact – they strengthen human health, increase the body's defenses. Risk factors impact health in a negative way – they worsen human health, thereby increasing the risk of disease or even provoking premature death. Risk factor is one of the most important terms in both medical sociology and epidemiology. "A risk factor is any attribute, characteristic or exposure of an individual that increases the likelihood of developing a disease or injury" (WHO, 2009). A risk factor does not necessarily cause the disease, but only increases the probability or risk of developing a disease

Approaches of health determinants analysis

Nowadays there are three main health promoting approaches that analyze health determinants from three different viewpoints:

- Medical (traditional) approach analysis health as a non-existence of a disease.
- Behavioural (Lifestyle) approach analysis health as the result of individual's chosen lifestyle.

Socio-Environmental (Structural) approach: It analyze health as the result of

interactions and impact between social, economic and environmental factors

Each of the approaches has its advantages and disadvantages, they all indicate different health determinants, and each has its own explanation for the cause of a disease, nevertheless these three approaches have a significant role in health promotion.

Medical approach: According to the medical approach, health is defined as a non-existence of a disease or disability and health determinants are connected to the potential cause of the disease – infection, low BMI, weak immune system, high blood pressure or cholesterol level etc. Healthcare related activities are mostly carried out in a doctor's practice, out-patient clinics or hospitals and the main actors are doctors, nurses and other healthcare workers who mostly dedicate their efforts to the treatment of a disease instead of preventative care (Labonte, 1993). In the medical approach preventative healthcare means fighting causes of a specific disease – trying to prevent, foresee and timely diagnose it instead of improving one's general health. This is the biggest drawback of the medical approach – the fact that it concentrates on particular diseases and does not analyse the human body as a single system.

Nevertheless, the preventative measures prescribed by the medical approach are beneficial to the individual. For example, regular blood pressure and cholesterol tests help to timely diagnose cardiovascular and other disease risks. Early cancer diagnostics help to avoid the last stages of the disease.

Behavioural approach: In the framework of behavioural approach individual's lifestyle is viewed as conscious choice, therefore mass campaigns were launched to

promote healthy lifestyle (Birse, 1998). Health determinants became synonymous with healthy lifestyle. The fact that individual's health depends not only on healthcare but also on the behaviour of the person was emphasized (Labonte, 1993). The most common lifestyle factors include diet, physical activity, smoking, alcohol abuse, drug abuse, unjustified use of medication and others (Birse, 1998).

The first attempt to include lifestyle factors in health promotion at a state level was in 1974 when Marc Lalolde published his vision in the Health Field Concept on the necessary reform in healthcare system and concluded that the previously used healthcare approach was erroneous and health needed to be viewed from a broader perspective. In addition to medical care Lalonde also mentions individual responsibility for one's health, stating that all health determinants should be classified into four large fields – healthcare system, human biology, environment and lifestyle (Lalonde, 1974).

Socio-Environmental approach: In the 1970s health promotion transitioned into Socio-Environmental approach by adding environmental and structural factors to the health determinants due to the fact that promotion of healthy lifestyle mostly affected the educated part of the society and was less likely to leave an impact on those who were less educated and poor (Labonte, 1993). This confirmed that the lifestyle of an individual does not depend only on the individual itself, but also on socio-environmental conditions that indirectly affect individual's health (VanLeeuwen et al., 1999).

In the framework of the Socio-Environmental approach various health determinant models were developed. Henrik L. Blum's model Environment of Health (later renamed Paradigms) is considered as one of the most important ones. The Force

Field and Well-Being Paradigms of Health characterizes health as physical, psychological and social well-being. In his model Blum showed that the impact of health determinants should be viewed by both the direct impact when a risk factor increases risk of morbidity, and through indirect or immediate impact. Proximate risk factors are the physical, social and mental risk factors that directly increase the impact of a disease and the risk of getting ill (Lönnroth et al., 2009). The intensity of proximate risk factors is affected by risk events. Risk conditions do not affect human health directly, but indirectly cause an emergence of risk factors, therefore influencing the risk of getting.

A distinction between two concepts should be made – latent TB where someone is infected with *M. tuberculosis*, but does not have TB disease (no losses are caused), and active TB when bacteria overcome the defenses of the immune system, resulting in the progression from latent TB infection to TB disease. Around 1/3 of the world's population has latent TB (WHO, 2013), but the ratio of the infected people varies between countries. In African countries this ratio may even be 95%, whereas in Europe it is up to 5%. About 5 to 10% of infected persons will develop TB disease at some time in their lives due to the TB risk factors. If the impact of the risk factors is decreased, so is the risk of morbidity. Therefore, in order to decrease the direct and indirect losses caused by a high prevalence of TB both for the individual and the state, it is necessary do develop and implement a comprehensive program for combating TB, taking into consideration both the micro and macro-TB risk factors and their influencing risk conditions

Big hopes of combatting TB were pinned to BCG vaccine discovered in 1921, nevertheless the protective effect was proven to be limited. In 1943 the first anti-TB drug *streptomycin* was discovered, in 1950's chemotherapy was introduced, and as a

result TB become a curable disease, raising hopes of its complete eradication (Lönnroth et al., 2009). Anti-TB drugs undoubtedly helped to decrease TB morbidity at a faster rate in the 1950's and 1960's, nevertheless we should take into consideration that during this period people's well-being considerably increased, as well as economy improved, resulting in better housing, better nutrition and work conditions. Therefore, the progress in combatting TB can be attributed to medical breakthroughs, as well as improvements in public health, economy and social sphere (Navarro, et al., 2006).

Four-layer model of health determinants

In the current study most important determinants of TB were identified and classified by summarizing information about most important disease risk factors and risk conditions, as well by exploiting the Four-layer model of health determinants:

First level: General socioeconomic conditions of the society, culture and environment

1. Gross domestic product: TB morbidity rates are higher in countries with a lower GDP per capita (Millet, et al., 2012). It was found that there is a very close linear relationship between the GDP per capita and TB morbidity and mortality rates (Arinaminpathy & Dye, 2010).
2. Immigration process: In developed countries where there are a lot immigrants, TB morbidity rates are not decreasing due to immigrants from Asian, African and Latin American countries. In Europe 25% – 50% of all TB cases are attributable to immigrants (Millet, et al., 2012).
3. Urbanization: If urban planning principles, social reforms and

environment protection are not taken into consideration and there is lack of a well-organized healthcare system, it constitutes ideal conditions to the spread of TB (Lönnroth et al., 2009).

4. Incidence of TB in the country: It determines the risks involved for a healthy person to meet someone who has TB and get infected from that person.

Second level: Living and working conditions

1. Poverty (socioeconomic status): TB is more characteristic to people with lower incomes (Lienhardt, 2001), because they more often live-in narrow dwellings with inadequate ventilation, are more likely to smoke and consume alcohol, more often have contact with TB patients, are more likely to work in worse conditions, are not able to provide quality nutrition, have a limited access to healthcare, and are less likely to have a healthy lifestyle (Lönnroth et al., 2009).
2. Employment (unemployment): The unemployed are more likely to suffer from TB, as person's income, acquaintances, job prestige and social status depend on employment (Coker et al., 2006).
3. Housing conditions (overcrowding): Low quality of housing, overcrowding related to poverty, non-existence of ventilation, and mold aggravate respiratory health and increases risk of TB morbidity (Canadian TB Committee, 2007).
4. Homelessness: Bad living conditions contribute to the spread of TB – poverty, contact with other TB patients, experience of i-

mprisonment. The characteristics of homeless people do not accelerate TB recovery – they tend to have a weak character, low intelligence and poor physical development and exhibit asocial behaviour.

5. Imprisonment: High density of prisoners, suppressed psyche, bad sanitary conditions, poor diet, the length of isolation, belated discovery of source of infection. The situation is also aggravated by subjective factors – smoking, alcoholism and low level of education (Narasimhan et al., 2013).

Third level: Psychosocial risk factors

Psychosocial risk factors are of a dual effect – they may weaken immunity or they can occur as a consequence of long-term treatment of TB and being in an out-patient clinic, which contributes to the deterioration of psychological health.

1. Social exclusion: Condition of social isolation leaves a negative impact on the immune system, therefore increasing the morbidity risk.
2. Depression: Depression and stress negatively affect the immune system, therefore also increasing morbidity risk (Pachi et al., 2013).

Fourth level: Individual lifestyle risk factors

1. Smoking: The proportion of smokers among the TB patients differs in various studies varying from 45% to 85% (Yach, 2000). Smoking increases TB morbidity risk and mortality rates (Slama et al., 2007), as it leaves a negative impact on lungs and immunity.
2. Alcohol abuse: It may cause changes in the immune system and lead

to immunodeficiency, resulting in susceptibility to pneumonia, TB and other infectious diseases. (Narasimhan et al., 2013). The proportion of alcoholics among the TB patients is 10% to 50% (Lönnroth et al., 2008).

3. Drug use: The negative effects are associated with the detrimental impact on the immune system. Drug use or even trying them once (both injectable and not) has been recognized as a serious disease risk factor in several studies (Coker et al., 2006).
4. Malnutrition: It has an adverse impact on immunity as well. TB patients are more likely to have lower contents of protein and fat in their diets. Moreover, TB causes loss of weight and appetite, accelerates protein metabolism, as well as causes immune dysfunction (Narasimhan et al., 2013).

   BMI: Individuals with low BMI have a higher TB morbidity (Lönnroth, et al., 2010), because one's body constitution may affect susceptibility to TB due to differences in lung mechanics. BMI is more often linked to genetics than diet.

Core human's biological risk factors:

1. Gender: TB patients are mostly men (Millet, et al., 2012). The difference between genders is thought to lie in different immune system reactions due to different sex hormones (Kolappan et al., 2007), as well as differences in social roles and economic activity (Lienhardt, 2001).
2. Age: The immune system weakens with age (Lienhardt, 2001),

nevertheless the effect of age on a disease is not linear, but U-shaped, and as the most affected are those aged 35 to 55.

3. HIV is the most influential TB risk factor (more significant than drug use) (Millet et al., 2012) due to its devastating effect on the human immune system. According to the estimations of WHO, people with HIV have 21 – 34 times higher TB morbidity risk (WHO, 2011).
4. Diabetes: Diabetes impairs innate and adaptive immunity, therefore accelerating the spread of TB.

Morbidity of TB is mostly developed by individual immunity disorders – due to low immunity level and sleeping" mycobacteria reactivate, or after contact with TB patient in active phase reinfection occurs, resulting in mycobacterial stress in body that cannot be tackled by the organism's immune system. Immune system disorders are caused by a number of risk factors of the third, the fourth and the core level of the Determinant model – psychosocial risk factors (social exclusion and state of depression), individual lifestyle risk factors (addictions, malnutrition and BMI), as well as biological risk factors (gender, age, HIV and diabetes).

Prevalence of TB risk factors is affected by individual's living and working conditions (the second level) – low socioeconomic status, poverty, low-skilled job or lack of employment, poor housing conditions and imprisonment or homelessness. Risk conditions on the first level impact factors of the societal level – gross domestic product, immigration processes, urbanization rate and TB incidence in the society. TB patients are characterized by a lower level of education ($p < 0.001$) than the general population. Previous studies (Lienhardt, 2001; Narasimhan, et al., 2013) show results,

indicating that the TB patients have lower levels of education. Housing conditions of the TB patients are generally worse. They live in older ($p < 0.001$) and smaller housings ($p = 0.005$), with a smaller number of rooms ($p < 0.001$) and the total housing area ($p = 0.015$). Their housing is less likely to be equipped with a central sewerage, hot and cold-water supply, toilet with a water pipe and bathroom or shower ($p < 0.001$). TB patients have more often reported that their housing is dark ($p = 0.001$) (Andrejs Ivanovs, 2016).

If a person lives in a dwelling, where one family member has < 15 m^2, his risk of developing TB is 1.8 times higher than for a person living in a more spacious housing (Canadian TB Committee, 2007; Lienhardt, 2001; Clark et al., 2002). By defining low BMI as a TB risk factor, we can calculate that a person who is underweight has a 12 times higher risk of developing TB than someone having normal weight or being overweight. In comparison with the results of the Estonian research (Tekkel, et al., 2002), in which insufficient weight increases TB morbidity risk by only 2 times.

Biological risk factors

There is a higher prevalence of HIV among the TB patients (11.4%) than in the general population (0.3%, $p < 0.001$). HIV-positive people are 40.1 times more likely to get infected with TB than people without this virus. This is the highest result out of all risk conditions and risk factors included in the analysis (Lienhardt, 2001 & WHO, 2011). Risk calculation also shows that diabetes is not an important TB risk factor (Narasimhan et al., 2013; Jurcev-Savicevic et al., 2013; Coker et al., 2006; Lönnroth et al., 2009).

Many times, an individual's disease risk is higher due to the impact of the particular risk condition or risk factor. The most significant TB morbidity predictor is one of the core risks factors – presence of HIV – an HIV-positive person has a 40.1 times greater risk of developing TB than a person without the virus. The second strongest predictor is the 2 level risk conditions – homelessness – a person without a home is 28.7 times more likely to get infected with TB. A very close third place can be attributed to the two levels risk condition – experience of imprisonment, which increases TB morbidity risk by 27.6 times. The fourth strongest risk factor is the 4th level risk factor – being underweight. Persons with a low BMI (< 18.5) have a 12 times higher risk of developing TB than people who have normal weight or are overweight (Andrejs Ivanovs, 2016).

The importance of risk conditions and risk factors on the level of society is shown by another indicator – Population attributable fraction (PAF), which demonstrates the importance of a risk factor in the society. PAF indicator is calculated by taking into account the risk factor prevalence in the society and its significance (OR) at the individual level. PAF indicator has reduced the importance of the following risk factors – HIV, homelessness and imprisonment due to their low prevalence, making smoking the most important risk factor for TB. It means that 59.3% of TB morbidity cases should be attributed to smoking. The second most important risk condition is the person's income per family member – 53.1% of the TB morbidity cases are related to insufficient income. The third most important risk factor is gender (male) – 44.9% of the TB morbidity cases (Andrejs Ivanovs, 2016).

Biological risk factors could not be impacted by any risk conditions, but psychosocial and individual lifestyle risk factors are impacted by risk conditions of the first and second level – living and working conditions (socio economic

status, imprisonment, housing, employment, homelessness) and general risk conditions (incidence of TB, immigration, urbanization, GPD).

Psychosocial risk factors

In addition to the financial losses TB also causes psychological and social issues. The importance of psychosocial risk factors was emphasized by Ronald Labonte. According to the Socioenvironmental model, individuals who experience the impact of negative risk conditions, feel less social support from their loved ones or the society, exhibit self-isolating behaviour, are unhappy, tend to blame themselves and more often experience helplessness. These individuals are also characterized by health damaging behaviour which they use to cope with the stress (Labonte, 1993). During the lengthy treatment, TB patients are separated from their families and relatives or they can lose their job. TB is seen as a disease of the poor and homeless by the general public. This type of discrimination may lead to depression and decreased quality of life. Information on the psychological health of TB patients during the treatment, as well psychosocial risk factors has been gathered and analyzed in this thesis for the first time. In Latvia no researches on the psychological state of TB patients before or after getting ill has been conducted. The thesis is also the first attempt to estimate the importance of psychosocial factors in developing TB. Multifactor analysis has shown that individual's mental state before the illness is worth researching. Psychological health is most affected by the employment (unemployment) – the psychological health of the unemployed is worse. There is also a weak impact by income and education. The regression analysis showed no statistically significant impact of experience of imprisonment and homelessness on one's psychological health.

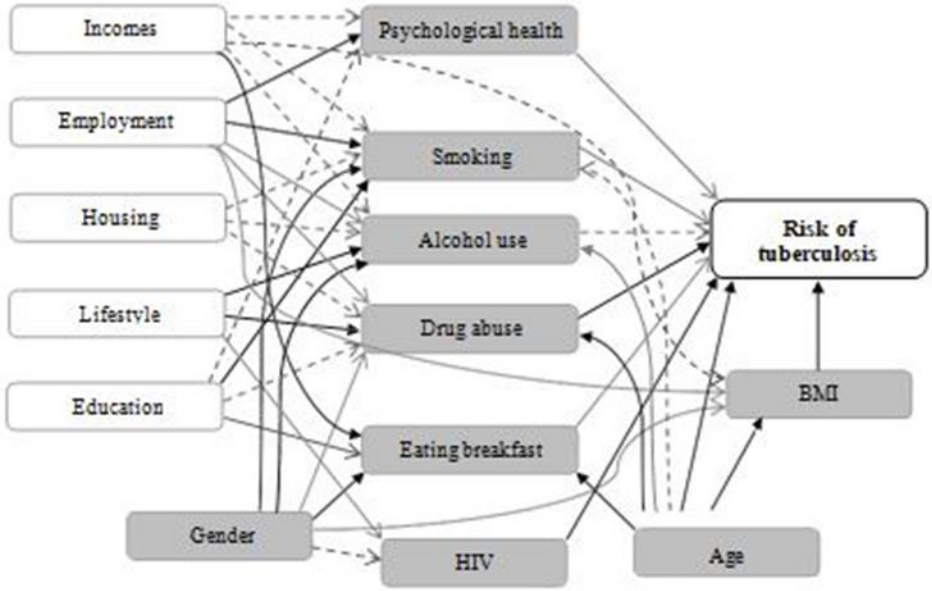

Figure 1. Scheme of TB risk factors and risk conditions

Direct risk factors

Tuberculosis is directly affected by 8 risk factors and mediately affected by 5 risk conditions.

BMI: The strongest impact on morbidity risk is left by BMI, and its contribution in increasing the risk of disease is extremely powerful. The results of the thesis suggest that BMI is also of biological nature, as in the regression analysis it was demonstrated that BMI influencing predictors have a very small role in BMI changes. BMI is mostly affected by age and gender, but the only social risk condition that may impact it is unemployment. Employed individuals have a higher BMI, and there is also a weak impact of income. Nutrition has a very weak or non-existent impact on BMI, moreover the regression analysis did not demonstrate any impact of physical fitness and the intensity of physical exercises on BMI. A weak connection between the self-evaluation of one's physical fitness and BMI was found – individuals subjectively

link their physical fitness with BMI, but in fact there is no objective statistically significant relationship between the two. Therefore, it should be concluded that BMI should not just be analysed as a result of individual's lifestyle choices, but as a biological risk factor as well. Consequently, TB control programs should pay special attention to individuals with low BMI, regardless of their lifestyle (Kirenga et al., 2015).

Drug use: The second strongest risk factor increasing the disease risk is drug use**.** This result is not surprising, as drugs leave a devastating effect on the immune system. It also corresponds with common stereotypes that TB is the disease of individuals with deviant lifestyle. Both the impact of risk factors and the risk conditions that impact the risk factors is associated with deviant behaviour – the biggest contributor to the drug use is experience of imprisonment and to a lesser extent – homelessness, unemployment, low level of education, as well as the impact on biological risk factors – age and gender, as drugs are mostly used by young men. In order to reduce the impact of risk factors on the disease risk, it is necessary to take into account that potential TB patients are younger men with an experience of imprisonment (W et al., 2015).

Alcohol use: The impact of alcohol use was not statistically proven by the multifactor analysis. The regression analysis shows that the same predictors that contribute to the drug use also increase the risk of alcohol abuse. Thus, if TB control programs paid particular attention to persons with imprisonment experience, it would be possible to achieve a reduction in the disease risk, as well as mediately affect drug and alcohol abuse (Narasimhan et al., 2013).

Smoking: Third risk factor related to bad habits – smoking – has different influencing risk conditions than drug and alcohol use. In addition to usual factors like age and gender, it is more affected by risk conditions non-related to deviant behaviour – education and employment. Smokers tend to have a lower education and are more likely to be unemployed. Education is the strongest contributing risk condition, and it is through smoking when this risk condition affects the disease risk the most. Therefore, by increasing the level of education in society, or at least through awareness campaigns, it is possible to reduce an individual's risk of disease, by reducing the prevalence of smoking (L and NL, 2004).

Eating breakfast: The last lifestyle risk factor influencing individual's risk of disease is the habit of eating breakfast. In addition to age and gender, this risk factor is primarily affected by the individual's income and to a lesser extent by the level of education – individuals with higher incomes and higher level of education eat breakfast frequently, thereby having a better diet. Thus, higher level of education not only lowers the prevalence of smoking, but also positively impacts the habit of breakfast eating, thereby reducing the risk of TB. Although the risk condition of income has a weak impact on a number of risk factors (psychological health, smoking, alcohol abuse, BMI), it strongly affects breakfast eating habits. This phenomenon should be further explored by using qualitative methods in order to find out more about this connection, as employment does not affect the habit of eating breakfast in a statistically significant way, despite the fact that income and employment do have a statistically significant relationship. This could be explained that the income is a stronger predictor than having a job (Narasimhan et al., 2013).

Employment (unemployment): It is a risk condition with the strongest impact on morbidity. It also affects a number of unrelated psychosocial and lifestyle risk factors,

through which one can see employment's mediated effect of on the disease risk. Unemployment primarily leaves a negative impact on one's psychological health and increases the prevalence of smoking, but secondarily it increases alcohol and drug use, and even reduces BMI, which in turn, has a stronger effect on the risk of disease. Thus, an increase in the number of unemployed in the country, may worsen the psychological health of the population, increase the spread of bad habits, and even a slight decline in BMI, which in turn can increase the overall incidence of TB in the country (Hossain et al., 2019).

The experience of imprisonment: The impact of the second most important risk condition – the experience of imprisonment – primarily manifests itself through deviant behaviour – excessive use of alcohol and drugs and secondarily through HIV, which also has features of deviant behaviour. It is not surprising, because the fact that an individual has been imprisoned already shows his past deviant behaviour, therefore having a connection with risk factors of deviant behaviour (Hirpa et al., 2013).

Low-income level of an individual, which is often subjectively linked to a high risk of morbidity, is only the third strongest risk condition that primarily affects the habit of eating breakfast, and also has a weak impact on one's psychological health, smoking and drinking habits. Given that the impact of low income is not statistically significant in multifactor analysis one can deduce that individual's income might not be as important as it is generally believed. The situation is similar in regards to homelessness. This risk condition is often linked to an increased risk of morbidity by the society. The regression analysis demonstrated a statistically significant impact, nevertheless its impact can be seen through a weak impact on risk factors related to bad habits, but homelessness does not have a statistically significant impact on the rest of the risk factors (Joshi et al., 2006).

Education: The impact of the fifth most important risk condition – education primarily manifests itself through smoking and secondarily through eating breakfast. Education also has a weak impact on psychological health and drug use.

This study will fill the gap of previous knowledge and added updated information regarding the risk of Tb infection in an area where the information is severely scarce. Moreover, the TB control measures, in order to achieve the maximum efficiency, should take into consideration the results obtained by the research of the thesis (Narasimhan et al., 2013).

Chapter 03: Materials and Methods

Study area

This study was conducted in Chattogram city which is the 2nd most populous city of Bangladesh after capital Dhaka. Due to intense industrialization, over population, and air pollution the city residents are under risk of developing tuberculosis. Chittagong medical college is the tertiary care health facility located in the city where government approved DOTS center (Directly Observed Treatment Short course) has established to monitor TB patients. This study collected data from patients in this DONTS center during their routine visit.

Questionnaire design

A pre-tested, semi structured questionnaire was used for data collection which contains three big parts. Part one possessed sociodemographic questions, part two had lifestyle related questions and part three included questions on clinical aspect of patients. The questionnaire was built in English but translated in Bengali during the interview (Annex 01).

Sample size

Study period was 1st January 2020 to 30th June 2021. The required sample size for the study has been calculated by using following formula-

$$N = Z^2pq/ d^2$$

Where N is the sample size, z 2 was standard value normal distribution at 95% confidence level (1.96), proportion (p) = 0.50 was considered as the actual data for the

study area is unknown, d2 was acceptable maximum sample error (5%). The total sample size became 385 respondents.

Data Collection

Data collection was conducted in government approved DOTS centers located in Chittagong medical college hospital. Due to COVID lockdown data collection was hampered resume after lockdown which leads to more time to collect the required amount of data. Initial data collection was started in January 2020 and finally ended in March 2021. Study population: Patients pre-diagnose as confirmed TB case by the hospital and register under National Tuberculosis Control Program for receiving anti-TB drugs from the DOTS center was the target participants in this study. Interview was held face to face mode when patients visited the DOTS center for follow up.

Data analysis

We entered all the data into Microsoft Office Excel for cleaning and management. Then the final data were transferred and analyzed using the software STATA/IC-13 (Stata Corp, 4905, Lakeway Drive, College Station, Texas 77845, USA). Descriptive analyses of the TB patients such as percentage of different variables has presented in the graphs. We performed chi-square test for each variable of the patients and the level of significance was considered for risk factors, when $p<0.05$

Ethical Approval

Ethical approval for the study protocol was obtained from the Chattogram Veterinary and Animal sciences University Ethics Review Committee with memo no-CVASU/Dir(R&E)EC/2019/126(6). Oral informed consent was obtained from each participant. No incentives were given to any patients for participating in this study.

Chapter 04: Results

Descriptive analysis depicted that around half (49.48%) of patients were between 21 to 40 years old and small number of patients (6.92%) were above 60 years of age. The number of male (53.04) and female (46.96) patients were close to each other. Among total patients 67.09% were married followed by 32.08% unmarried. Of total occupation groups 28.54% was housewife, 22.83% was students, and the lowest number was unemployed participants. The highest number (89.1%) of our participants had 4-7 members in their family. More than half (52.62%) of patients lived in a multi-unit building whereas, 38.57% were from single houses. Most of their houses were building (54.72%) and semi paka (36.48%) and possessed two bed rooms (81.34). The source of the drinking water of most of the TB cases were WASA supply line (53.68%) and shallow tube well (30.32%). A number of participants also acknowledged that they were smoking daily (31.37%) however, 62.95% had no smoking history. Figure 1 represents the percentage of different variables of the study.

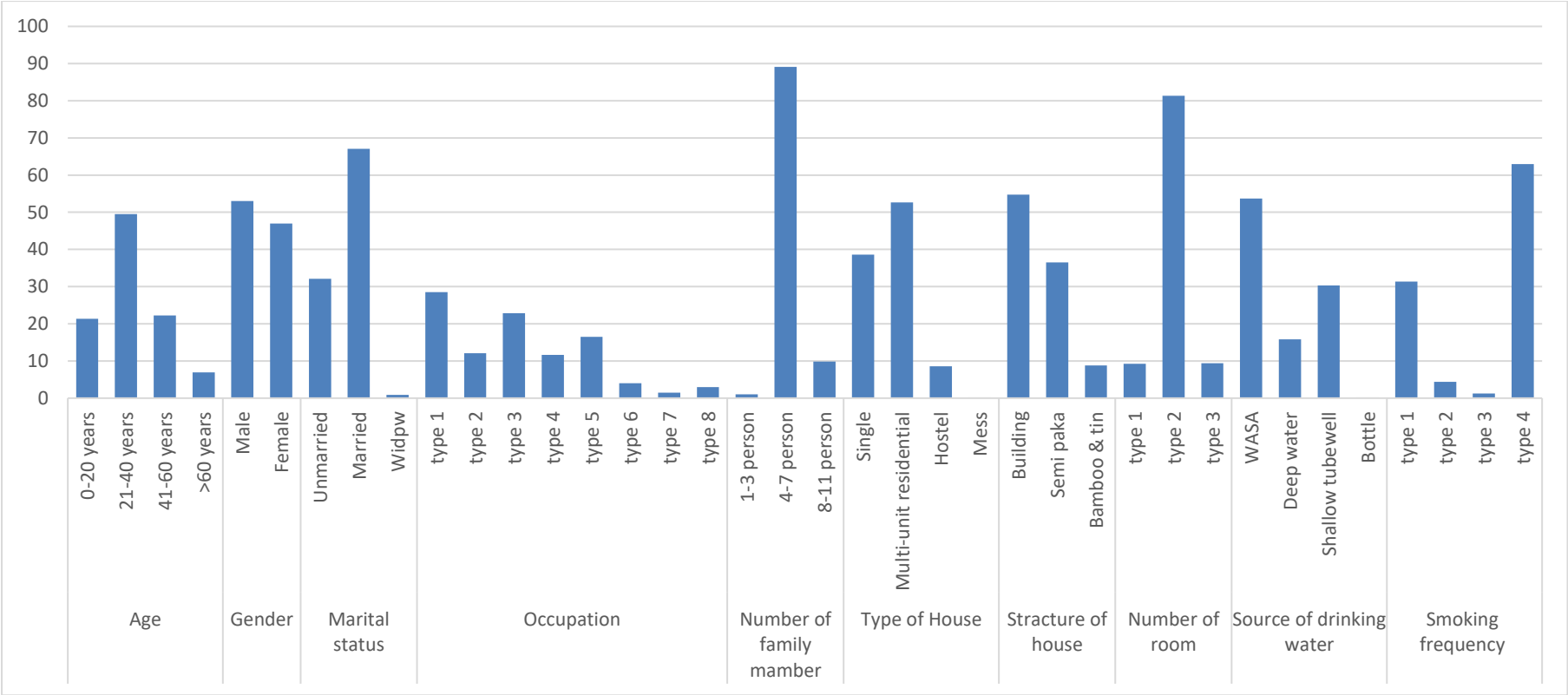

Figure 2: Descriptive analysis of the demographic information of the TB patient

Figure 2 shows the type of occupations and activities of patients performed throughout the last one year. Higher number of participants (28.03%) were engaged in household activities, followed by 20.55% were unemployed and maintained sedentary lifestyle. On the other hand, 22.43% were involved in study. It also presents that 11.95% worked heavy and 4.4% did light works.

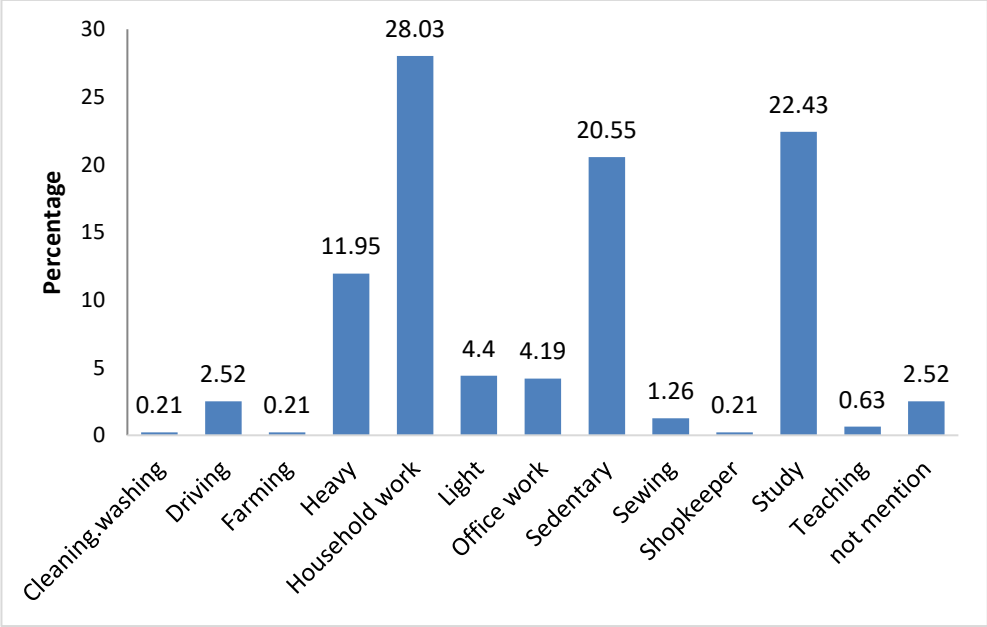

Figure 3: Activities performed by the patients in the last 12 month

Study investigated different types of tuberculosis based on the location in various parts of human body (See Figure 3). The most recorded types were pulmonary (58%), gland (22%), and intestine (8%). Other less frequently found types were breast (7%) and bone (5%).

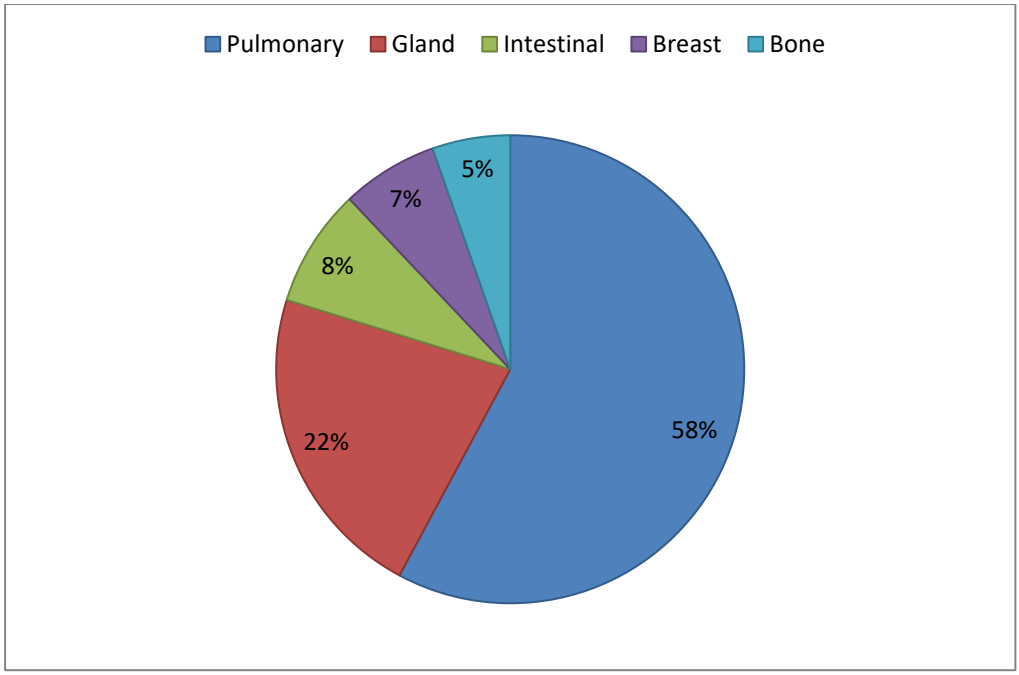

Figure 4: Percentage of tuberculosis in different locations of body

Association of different types of tuberculosis with the socio-demographic factors of patients has represented in the Table 1. Among different variables age, gender, marital status, smoking habit and diabetes had significant effect on the occurrence of tuberculosis in various organs. On the other hand, number of family member, structure of house, source of drinking water, and livestock rearing etc. had no significant relation with the types of tuberculosis. Bone TB were rare among young age groups but 22.6% found in over 60 years aged participants. Glandular TB highly recorded (31.7%) among participant below 20 years old. Pulmonary TB was mostly reported in both male (65.2%) and female (49.8%) groups of participants. Among female, 26.7% found gland TB and 10.9% had breast TB.

Table 1: Univariate association between variables and different types of Tuberculosis

Variables	Categories	Types of Tuberculosis n (%)					P value
		Pulmonary	Glandular	Breast	Intestinal	Bone	
Age	0-20 y (101)	59 (58.4)	32 (31.7)	4 (3.9)	4 (3.9)	2 (1.9)	<0.001*
	21-40 y (229)	133 (58.1)	56 (24.5)	14 (6.1)	21 (9.2)	5 (2.2)	
	41-60 y (104)	60 (57.7)	11 (10.6)	11 (10.6)	11 (10.6)	11 (10.6)	
	>60 y (31)	17 (54.8)	3 (9.7)	2 (6.5)	2 (6.5)	7 (22.6)	
Gender	Male (244)	159 (65.2)	43 (17.6)	7 (2.8)	20 (8.2)	15 (6.2)	<0.001*
	Female (221)	110 (49.8)	59 (26.7)	24 (10.9)	18 (8.1)	10 (4.5)	
Marital status	Unmarried (149)	91 (61.1)	45 (30.2)	3 (2)	7 (4.7)	3 (2)	0.002*
	Married (312)	175 (56.1)	56 (17.9)	28 (8.9)	31 (9.9)	22 (7.1)	
	Widow (4)	3 (75)	1 (25)	0	0	0	
Number of Family	1-3 (133)	4 (80)	1 (20)	0	0	0	0.162
	4-7 (55)	236 (57)	94 (22.7)	31 (7.5)	34 (8.2)	19 (4.6)	

member	8-11 (106)	29 (63)	7 (15.2)	0	4 (8.7)	6 (13)	
Structure of house	Building (253)	140 (55.3)	60 (23.7)	17 (6.7)	22 (8.7)	14 (5.5)	0.918
	Semi paka (171)	105 (61.4)	34 (19.9)	12 (7.0)	11 (6.4)	9 (5.3)	
	Bamboo & Tin (41)	24 (58.5)	8 (19.5)	2 (4.9)	5 (12.2)	2 (4.9)	
Source of drinking water	WASA (245)	144 (58.8)	57 (23.3)	17 (6.9)	16 (6.5)	11 (4.5)	0.834
	Deep tube well (73)	38 (52)	16 (21.9)	5 (6.9)	9 (12.3)	5 (6.8)	
	Shallow tube well (144)	84 (58.3)	29 (20.1)	9 (6.3)	13 (9.0)	9 (6.3)	
Smoking frequency	Daily (143)	93 (65.0)	23 (16.1)	4 (2.8)	13 (9.1)	10 (6.9)	0.043*
	Weekly (20)	13 (65)	3 (15)	0	4 (20)	0	
	Rarely (6)	4 (66.7)	1 (16.7)	0	1 (16.7)	0	
	No (294)	157 (53.4)	75 (25.5)	27 (9.2)	20 (6.8)	15 (5.1)	
Frequency of drinking	Occasionally (6)	3 (50)	1 (16.7)	1 (16.7)	0	1 (16.7)	0.436
	Rarely (60)	42 (70)	9 (15)	2 (3.3)	5 (8.3)	2 (3.3)	

alcohol	No (385)	215 (55.8)	90 (23.4)	27 (7.0)	32 (8.3)	21 (5.5)	
Livestock rearing	No (369)	221 (59.9)	81 (21.9)	20 (5.4)	27 (7.3)	20 (5.4)	0.133
	Yes (96)	48 (50)	21 (21.9)	11 (11.5)	11 (11.5)	5 (5.2)	
Diabetics	No (395)	234 (60.6)	91 (23.6)	19 (4.9)	28 (7.3)	14 (3.6)	<0.001*
	Yes (82)	35 (44.3)	11 (13.9)	12 (15.2)	10 (12.7)	11 (13.9)	
Family member/ relative having TB	No	245 (57.2)	93 (21.7)	30 (7.0)	35 (8.2)	25 (5.8)	0.469
	Yes	24 (64.9)	9 (24.3)	1 (2.7)	3 (8.1)	0	

Chapter 05: Discussion

This study analyzed data associated with different types of TB and associated risk factors among TB patients in Chattogram, Bangladesh. Study found higher number of participants affected with pulmonary TB which was supported by the literature stated that approximately 80% of all TB cases in Bangladesh are pulmonary TB (WHO, 2019). A study in India showed the prevalence of bacteriologically positive pulmonary TB 255.3 per 100,000 population (Rao et al., 2012). Another systematic review stated the range of prevalence of pulmonary tuberculosis ranged from 24.5 to 1518/100,000 population with the pooled prevalence of 295.9/100,000 population (Sathiyamoorthy et al., 2020).

TB affects the young and economically active age group of people in the community. The study shows half of the patient's age was between 21 to 40 years and the significant association of age with the occurrence of TB in different organs. The finding was supported by previous studies in different countries. Previous literature on the socio-demographic characteristics of the study participants indicated that 45.8% (Shimeles et al., 2019a) or 54.9% (Wondemagegn et al., 2015) of cases were in the 26–45 years of age whereas another study at Addis Ababa, showed that 29.9% of TB patients were placed within the age group 26–45 (Hirpa et al., 2013). Generally, the finding is consistent with other studies reported a rapid rise in TB morbidity and mortality among this young adult population mostly between 15–44 years of age (Matteo et al., 2013). High risk of infection in the young age group could be due to having a higher number of social contacts of them in the community (Middelkoop et al., 2011). Young people possess a big part of Bangladesh's total population.

Therefore, higher prevalence of TB among the youth is alarming for the future prosperity of the country.

However, studies also reported that children are at higher risk of contracting TB infection and disease. This study found around one fifth of patients were below 20 years old. Literature proved that children having less than two years of age get infected from the household source whereas, majority of them with more than two years of age, became infected in the community (Narasimhan et al., 2013). Household sputum positive source case is the single most important risk factor for children and remained an important contributor to infection up to 5–10 years of age (Marais et al., 2004). Children with primary infection before 2 years or after 10 years of age were at increased risk for disease development (Migliori and Huggett, 2009). The highest risk for TB-related mortality following primary infection occurred during infancy.

The study revealed the significant effect of gender on different types of TB. The number of males was slightly higher (53.04) than female (46.96) patients which was concordant with the findings of other studies. A study in Ethiopia found 55.8% were males and 44.2% were females. Similar finding was observed in another studies where 57.5% (Wondemagegn et al., 2015) of participants were males. On the other hand, some studies revealed the lower percentage of male patients (43.3%) (Kirenga et al., 2015), however most studies in Bangladesh and India reported very high percentage of male: 70.0 to 71.1% (Hoque et al., 2017; Sethi et al., 2013) . Globally the male: female ratio was reported to be consistently higher like 1.7, 1.6, and 1.7 (WHO, 2017; WHO, 2016). Male populations are more vulnerable for TB as they have more chance to contact with the carriers due to their outdoor social activities. One of the underlying causes for high rate of MDR-TB among males is believed to be

the reduced adherence of males to treatment compared to females and males are more exposed to external environment as they are earning member of a family. Another possible reason might be male had the poor attitude to anti TB therapy than female

Literature shows people having TB case in family, care givers, and health care workers (Joshi et al., 2006) are at a higher risk of becoming infected with *Mycobacterium tuberculosis* and development of primary active tuberculosis. However, this study did not find significant effect of TB positive cases within family members or relatives. The probability of TB among household contacts with family history of TB were 8 times higher than that of individuals who did not have family history of TB (Nair 2016; Meseret 2017). It is also in support of the WHO report which stated that there was greater occurrence of TB when the contact lived with more than one TB case (WHO, 2014). It might be due to increased expelled bacilli that maximize the exposure within households

It is estimated that currently 70% of people with diabetes (DM) live in low- and middle-income countries (Organization, 2010), and the rates are steadily increasing in areas where TB is endemic, including India and sub-Saharan Africa (Sarah et al., 2004). Diabetes has been shown to increase the risk of active TB disease (Alisjahbana et al., 2006). A systematic review comparing 13 studies examining the association between diabetes and TB found that diabetic patients had about a threefold increased risk of developing TB when compared to those without diabetes (Jeon and Murray, 2008). Another review on treatment outcomes among patients with DM and TB found that the risk of death was 1.89 times higher compared to those without diabetes. Study found that patients with TB and DM had a 22.2% smear-positive culture rate at the end of treatment compared to only 6.9% of those without diabetes (Alisjahbana et al.,

2007). Biological evidence supports the theory that diabetes directly impairs the innate and adaptive immune response and thus accelerating the proliferation of TB. Increasing rates of diabetes in Bangladesh could pose a great challenge for TB control in the future.

Smoking has been a risk factor for TB infection and the association between smoking and TB has been studied in several studies (Lidia and Neal, 2004; Mohan et al., 2007). The effect of frequency of smoking has found significant ($P<0.043$) in this study that was similar to previous studies which also stated statistically significant effects (Bigwan et al., 2014). Literature identified smoking as important risk factor for developing TB by AOR (adjusted odds ratio) = 4.43 (Shimeles et al., 2019b) and AOR = 3.90 (Tulu et al., 2014). A meta-analysis of 24 studies on the effects of smoking on TB, showed that the relative risk of TB disease (RR = 2.3–2.7) was high among smokers in comparison to nonsmokers and that there was clear evidence that, with additional risk of death in persons with active TB (Michael et al., 2007). Smoking results in histological changes in the lower respiratory tract, including peri-bronchial inflammation, fibrosis, vascular intimal thickening, and destruction of alveoli. This leads to alterations in the epithelial function, such as reduced ciliary activity, decreased clearance of inhaled substances, and abnormal vascular and epithelial permeability (Mohan, 2002) decrease in the immune response and/or CD4 + lymphopenia due to the nicotine in the cigarettes (Wang et al., 2002) have been given as reasons for increased susceptibility to pulmonary tuberculosis (Lidia and Neal, 2004).

Therefore, pulmonary tuberculosis is the commonest type of tuberculosis in the study area. A considerable number of females were also reported breast tuberculosis. Young

people (21 to 40 years) have possessed half of the total patients which raise concern. Moreover, student and household workers were mostly infected by TB. The results of the thesis revealed the characteristics of TB patients, risk groups, and risk factors in a region of Bangladesh. A detailed and extended work should be conducted to develop a more comprehensive national action plan in order to reduce TB morbidity and its socio- economic burden.

One of the strengths of this study was the number of participants. However, study possessed several limitations. During selecting participants randomization did not followed. Since this was a cross-sectional study, these results cannot be interpreted as clear evidence of a causal association between the significant risk factor and an increased risk of TB. Other than that, there was a chance of recall biases with this study.

Conclusions

Proper identification of potential risk factors responsible for occurrence and transmission of tuberculosis is crucial for the successful control strategies. This study was intended to reveal sociodemographic characteristics of TB patients living in Chattogram, Bangladesh. The most recorded types of TB were pulmonary (58%) TB. Bone TB were mostly found in more than 60 years old participants while glandular TB highly recorded (31.7%) among young participants below 20 years old. Among different variables age, gender, marital status, smoking habit, and diabetes had significant effect on the occurrence of tuberculosis. The study recommended the revision of TB control programs of Bangladesh focusing on the significant risk factors. The study could also use as baseline for future extended research throughout the country.

Recommendation

- A large-scale case control study should be conducted to identified more specific risk factors and their impact on the occurrence of TB.
- The existing TB control program of the country should be revised based on findings of the study especially targeting the high risk group

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Annex 01: Questionnaire

A Descriptive Study on Socio-demographic Profile and Associated Risk Factors of Tuberculosis Patients in Chattogram

SL NO: Date:

Part 1: <u>Socio-demographic information</u>

1. Name Age:
2. Gender: Marital status:
3. Detail address of patient:
4. What is your highest education? ……..
5. What is your occupation? ……..
6. Average monthly income……
7. What kind of work do you do within last 12 months?

(Write "No" if you had no work) ……..

8. How many hours you were work per day……..
9. Number of your family members living in your house…….
10. Type of house: single multi-unit residential Hostel other……
11. Structure of house: Building semi-paka bamboo & tin Mud other……..
12. Number of rooms in your house: Bed room……..other room……..Balcony……. Number of window…….
13. Source of drinking water: deep water WASA supply water Pond/lake Shallow tube well Tank bottle water

other……

14. What you used for cooking? Wood/straw charcoal electricity gas other…

Part 2: Habit/lifestyle related questions

15. How frequently you smoked? daily twice per week weekly monthly rarely
16. In case of smoking, how old were you when started smoking? …….
17. How old were you when you stopped smoking? ……Still continuing
18. On average, how many cigarettes did/do you smoke per day? ……
19. How often do you drink any alcoholic beverage? daily twice per week weekly Monthly rarely
20. In case of drinking, at what age did you first started? .....
21. How old were you when you stopped drinking? ..... Still continue to drink
22. What kind of alcoholic beverage do you most often drink? ……
23. On average, how many bottles/glasses do you consume per day? .....
24. Do you rear any livestock? Yes No
25. What species: cattle goat poultry other……

Part 3: Health/disease related questions

26. Vitamin A deficiency: Night blindness Bitot's spots Corneal xerosis Corneal ulcer Keratomalacia Diabetes
27. Have you ever been diagnosed with diabetes? Yes No

28. If yes, what is your average glucose level…….

29. Body mass index: Height……..cm Weight…… kg

30. Have you previously vaccinated to BCG? Yes No

31. History of coughing or any chronic illness:

Yes (name)…… No

32. History of any family member/relative having TB?

Yes (relation)……. No

33. Type of tuberculosis: pulmonary gland breast intestinal bone

…….

Signature of the data collector

Brief bio-data of the author

DR. Taznuba Tahreen passed the Secondary School Certificate Examination in 2001 followed by Higher Secondary Certificate Examination in 2003. She obtained her MBBS Degree in 2009 from Chittagong Medical College, Bangladesh. Now, she is a Candidate for the degree of Masters in Public Health (One Health) under the One Health Institute, CVASU. She published two scientific articles in international peer- reviewed journals. She has immense interest to continue research on AMR, food safety and infectious disease epidemiology through One Health approach.