# A STUDY ON KNOWLEDGE & AWARENESS OF TUBERCULOSIS AMONG UNDERGRADUATE STUDENTS OF PRIVATE UNIVERSITIES IN DHAKA

*This dissertation is submitted to the Department of Pharmacy, East West University in the partial fulfillment of the requirements for the Degree of Bachelor of Pharmacy*


**Submitted By**

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# Declaration by the Research Candidate

I, Towhida Akter Pushpo, ID-2013-1-70-071, hereby declare that the dissertation entitled **''A Study on Knowledge and Awareness of Tuberculosis among Undergraduate Students of Private Universities in Dhaka"** submitted by me to the Department of Pharmacy, East West University: in the partial fulfillment of the requirement for the award of the degree of Bachelor of Pharmacy, is a record of bonafide work carried out by me under the guidance and supervision of **Farah Shahjin,** Senior Lecturer, Department of Pharmacy, East West University. The matter embodied in this dissertation has not been submitted to any other University or Institution for the award of degree. This thesis is my original work and it has not been presented earlier in this manner. This information is purely for academic interest.

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# Certificate by the Supervisor

This is to certify that the dissertation entitled **''A Study on Knowledge and Awareness of Tuberculosis among Undergraduate Students of Private Universities in Dhaka"** submitted to the Department of Pharmacy, East West University for the partial fulfillment of the requirement for the award of the degree Bachelor of Pharmacy is a bonafied record of original and genuine research work carried out by **Towhida Akter Pushpo**, ID: 2013-1-70-071 under my supervision and guidance.

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## Certificate by the Chairperson

This is to certify that the dissertation entitled **''A Study on Knowledge and Awareness of Tuberculosis among Undergraduate Students of Private Universities in Dhaka"** submitted to the Department of Pharmacy, East West University for the partial fulfillment of the requirement for the award of the degree Bachelor of Pharmacy is a bonafied record of original and genuine research work carried out by **Towhida Akter Pushpo**, ID: 2013-1-70-071 under the supervision and guidance of **Farah Shahjin**, Senior Lecturer, Department of Pharmacy, East West University and no part of this project has been submitted to other degree.

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## Acknowledgement

At the outset, I would like to recall the pity and kindness of Almighty Allah and thank Him for showing me the right path of securing special knowledge in pharmacy science and for His mercy and blessings.

Later, I want to express my heartfelt gratitude to the learned guide and supervisor, **Farah Shahjin,** Senior Lecturer, Department of Pharmacy, East West University for his day to day supervision, constructive suggestions, adept analysis, and active encouragement to carry out this research.

It gives me immense pleasure to express sincere appreciation and gratefulness to **Tilka Fannana,** Senior Lecturer, Department of Pharmacy, East West University, for providing all possible help during the course of this research work.

I am profoundly indebted to **Dr. Shamsun Nahar Khan, Associate Professor and Chairperson,** Department of Pharmacy, East West University, for her encouragement and support in my study. She paid attention for the purpose of my research work and extending facilities to carry out my work when necessary.

I take this opportunity to express the profound gratitude from my deep heart to my beloved parents, my siblings for their love and continuous support-both spiritually and materially.

Finally, I would like to thank all my friends who gave me mental support throughout my work, those people who made this thesis possible and an unforgettable experience for me.

*I Dedicated*
*This Research Paper to*
*my Beloved Parents*

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## List of Abbreviation

**ADA**- Adenosine Deaminase

**AIDS**-Acquired Immunodeficiency Syndrome

**ARTI**- Annual Risk Tuberculosis Infection

**BCG** - Bacille Calmette–Guérin (vaccine)

**DOTS**- Directly Observed Treatment

**EMB**-Ethambutol

**EPTB-**Extra-pulmonary Tuberculosis

**ESR**- Erythrocyte Sedimentation Rate

**FDA**- Food and Drug Administration

**FDCs**- Fixed Dose Combinations

**GFATM**- Global Fund for TB, AIDS and Malaria

**HIV**-Human Immunodeficiency Virus

**IGRAs**- Interferon Gamma Release Assays

**INH**- Isoniazid

**IUATLD**-International Union Against Tuberculosis and Lung Diseases

**LAM**- Lipoarabinomannan

**LTBI**-Latent Tuberculosis Infection

**MDGs**- Millennium Development Goals

**MDR-TB**-Multidrug-resistant tuberculosis

**NTP**-National Tuberculosis Programme

**PASA**- Para-Amino Salicylic acid

**PCR**- Polymerase Chain Reaction

**PHC**-Primary Health Care

**PTB**- Pulmonary TB

**PZA**- Pyrazinamide

**QFT-GIT**- QuantiFERON®–TB Gold In-Tube test

**RBT**-Rifabutin

**RIF**-Rifampin

**RPT-**Rifapentine

**RR-TB**- Rifampicin Resistant TB

**SM**-Streptomycin

**SSC**-Short Course Chemotherapy

**SSM**- Sputum Smear Microscopy

**TB** –Tuberculosis

**TST**- Tuberculin Skin Test

**WHO**- World Health Organization

**XDR-TB**-Extensively drug-resistant TB

## Abstract

Tuberculosis (TB) is an infectious disease which is transmitted through the air. This disease damages the lungs and other organs in the human body. TB is highly contagious and spreads when TB patients cough, sneeze, spit and talk. Due to the ease of infection, anyone can contract the disease. Unfortunately, not many people are aware about TB. This lack of knowledge and awareness is a problem anywhere around the globe. Therefore, the study attempts to examine the awareness regarding this disease. The main objective of this study is to review the level of knowledge and awareness on TB among undergraduate students of private universities in Dhaka. A cross sectional survey was conducted on 300 undergraduate students of 6 private universities in Dhaka. Data was collected from universities of Dhaka from June 2016 to September 2016 using a standard 4 pages questionnaire. Data were analyzed using Microsoft Office Excel (version 2007). Among 300 students, male and female were 35.66% and 64.33% respectively. Majority of the students 96.33% had heard about TB. About 53.67% students responded to TB as a communicable disease, 85% students agreed that bacteria can cause TB, 55% students believed that TB is curable. About (60.66%) students were aware of the sign & symptoms of TB but remaining (39.33%) of had no idea about sign & symptoms of TB , (55%) of respondents had no knowledge about spread of TB and remaining (44.33%) respondents had knowledge about spread of TB. However students had poor knowledge about latent TB (65%), BCG vaccine (63.33%) and DOTs program (78.33%).About (61.33%) of students had idea about the way of TB curability, and 85.33% had idea about the place from where one can take treatment of TB. Most of the students (80%) had knowledge about precaution that should be taken by TB patients. Although our data showed insufficient general knowledge on tuberculosis among undergraduate students of private universities in Dhaka, this survey underlines the considerable need for improvement in knowledge about the disease, especially among students. In light of the scientific recommendations concerning knowledge about tuberculosis among students, progress of current health care curriculum must be aimed to develop students' skills in this field.



**Key Words:** Tuberculosis, TB symptoms, Stigma

# *Chapter-1*
# *Introduction*

## 1.1: Tuberculosis

Tuberculosis (TB) is a chronic infectious disease caused by a bacterium called *Mycobacterium tuberculosis*. It usually affects the lungs in 80% of cases with warning signs of cough, haemoptysis, and chest pain, shortness of breath, fever, weight loss, and drenching night sweat. TB is spread mainly through the air inform of droplets. When infectious people cough, sneeze, talk, laugh or spit, droplets containing *Mycobacterium tuberculosis* are sprayed into the air. People nearby may inhale the bacteria and become infected. (Desalu et al., 2013).

*Mycobacterium tuberculosis* can remain viable as airborne droplet suspended in the air for a long time or as part of house dust for weeks. However, transmission usually occurs only after substantial exposure to someone with active TB. A person can be infected by *Mycobacterium tuberculosis* for many years without getting sick or spreading the organism to other people. If the immune system is weakened by immunosuppressive disease like HIV infection, diabetes mellitus, malignancy, chronic kidney disease, extremes of ages, and immunosuppressive agent, latent TB infection can develop into active disease. If a person with active disease is left untreated, he or she will infect on the average between 10 and 15 people every year. TB accounts for 2.5% of the global burden of disease and is the commonest cause of death in young women, killing more women than all causes of maternal mortality combined. Ninety-five per cent of all cases and 99% of deaths occur in developing countries. It currently holds the seventh place in the global ranking of causes of death. Knowledge on TB disease, its diagnosis and treatment therefore is an important factor for the management and outcomes. Even when TB-services are accessed, the response of the health staff determines further actions. To improve case notification, there is a need to address the knowledge gaps related to care seeking, and inappropriate actions of care providers in their interactions with potential TB-cases.(Ramen, 2001).

## 1.2: Pathophysiology of Tuberculosis

### 1.2.1: *Mycobacterium tuberculosis*

Tuberculosis is an infection caused by the rod-shaped, non-spore-forming, aerobic bacterium *Mycobacterium tuberculosis***.** Mycobacteria commonly measure 0.5 μm by 3 μm, are classified as acid-fast bacilli, and have a unique cell wall structure crucial to their survival. The well-developed cell wall contains a considerable amount of a fatty acid, mycolic acid, covalently attached to the underlying peptidoglycan-bound polysaccharide arabinogalactan (Biopolymer

consisting of arabinose and galactose monosaccharides), providing an extraordinary lipid barrier. This barrier is responsible for many of the medically challenging physiological characteristics of tuberculosis, including resistance to antibiotics and host defense mechanisms. The composition and quantity of the cell wall components affect the bacteria's virulence and growth rate. The peptidoglycan polymer confers cell wall rigidity and is just external to the bacterial cell membrane, another contributor to the permeability barrier of mycobacteria. Another important component of the cell wall is lipoarabinomannan (Glycolipid and major virulence factor in the bacteria genus Mycobacterium), a carbohydrate structural antigen on the outside of the organism that is immunogenic and facilitates the survival of mycobacteria within macrophages. The cell wall is key to the survival of mycobacteria, and a more complete understanding of the biosynthetic pathways and gene functions and the development of antibiotics to prevent formation of the cell wall are areas of great interest. (Knechel, 2009).

### 1.2.2: Transmission of *Mycobacterium tuberculosis*

*Mycobacterium tuberculosis* is spread by small airborne droplets in most cases (97%), called droplet nuclei, generated by the coughing, sneezing, talking, or singing of a person with pulmonary or laryngeal tuberculosis. These virulent bacilli once inhaled will stay in the pulmonary alveoli, where they will be phagocytosed (to envelop and destroy bacteria and other foreign materials). It is the primary infection may be asymptomatic. Once infectious particles are aerosolized, they are spread throughout a room or building by air currents and can be inhaled by another individual. One droplet nuclei contains no more than 3 bacilli. Droplet nuclei are so small that they can remain air-borne for extended periods of time. The most infective droplet nuclei tend to have a diameter of 5um. Coughing generates about 3000 droplet nuclei. Talking for 5 minutes generates 3000 droplet nuclei but singing generates 3000 droplet nuclei in one minute. Sneezing generates the most droplet nuclei by far, which can spread to individuals up to 10 feet away. Tuberculosis begins when droplet nuclei reach the alveoli. When a person inhales air that contains droplets most of the larger droplets become lodged in the upper respiratory tract like nose and throat, where infection is unlikely to develop. Generally the number of bacilli in the droplets, the virulence of the bacilli, exposure of the bacilli to UV light, degree of ventilation, and occasions for aerosolization all influence transmission. Introduction of *M tuberculosis* into the lungs leads to infection of the respiratory system; however, the organisms can spread to other

organs, such as the lymphatics, pleura, bones/joints, or meninges, and cause extrapulmonary tuberculosis. (Smith, 2003).

### 1.2.3: Effects of *Mycobacterium tuberculosis* in the body

Once inhaled, the infectious droplets settle throughout the airways. The majority of the bacilli are trapped in the upper parts of the airways where the mucus-secreting goblet cells exist. The mucus produced catches foreign substances, and the cilia on the surface of the cells constantly beat the mucus and its entrapped particles upward for removal. This system provides the body with an initial physical defense that prevents infection in most persons exposed to tuberculosis. (Smith,2003).

Bacteria in droplets that bypass the mucociliary system and reach the alveoli are quickly surrounded and engulfed by alveolar macrophages, the most abundant immune effector cells present in alveolar spaces. These macrophages, the next line of host defense, are part of the innate immune system and provide an opportunity for the body to destroy the invading mycobacteria and prevent infection. Macrophages are readily available phagocytic cells that combat many pathogens without requiring previous exposure to the pathogens. Several mechanisms and macrophage receptors are involved in uptake of the mycobacteria. Macrophages are readily available phagocytic cells that combat many pathogens without requiring previous exposure to the pathogens. Several mechanisms and macrophage receptors are involved in uptake of the mycobacteria. The mycobacterial lipoarabinomannan is a key ligand for a macrophage receptor. The complement system also plays a role in the phagocytosis of the bacteria.The complement protein C3 binds to the cell wall and enhances recognition of the mycobacteria by macrophages. Opsonization (an immune process where particles such as bacteria are targeted for destruction by an immune cell known as a phagocyte) by C3 is rapid, even in the air spaces of a host with no previous exposure to *M tuberculosis*. The subsequent phagocytosis by macrophages initiates a cascade of events that results in either successful control of the infection, followed by latent tuberculosis, or progression to active disease, called primary progressive tuberculosis. (Smith ,2003)

After being ingested by macrophages, the mycobacteria continue to multiply slowly,[8] with bacterial cell division occurring every 25 to 32 hours. Regardless of whether the infection becomes controlled or progresses, initial development involves production of proteolytic enzymes and cytokines by macrophages in an attempt to degrade the bacteria. Released

cytokines attract T lymphocytes to the site, the cells that constitute cell-mediated immunity. Macrophages then present mycobacterial antigens on their surface to the T cells. This initial immune process continues for 2 to 12 weeks; the microorganisms continue to grow until they reach sufficient numbers to fully elicit the cell-mediated immune response, which can be detected by a skin test. (Niemi, 2014)

For persons with intact cell-mediated immunity, the next defensive step is formation of granulomas around the *M tuberculosis* organisms. These nodular-type lesions form from an accumulation of activated T lymphocytes and macrophages, which creates a micro-environment that limits replication and the spread of the mycobacteria. This environment destroys macrophages and produces early solid necrosis at the center of the lesion; however, the bacilli are able to adapt to survive. In fact, *M tuberculosis* organisms can change their phenotypic expression, such as protein regulation, to enhance survival. By 2 or 3 weeks, the necrotic environment resembles soft cheese, often referred to caseous necrosis, and is characterized by low oxygen levels, low pH, and limited nutrients. This condition restricts further growth and establishes latency. Lesions in persons with an adequate immune system generally undergo fibrosis and calcification, successfully controlling the infection so that the bacilli are contained in the dormant, healed lesions. Lesions in persons with less effective immune systems progress to primary progressive tuberculosis. (Niemi, 2014).

For less immunocompetent persons, granuloma formation is initiated yet ultimately is unsuccessful in containing the bacilli. The necrotic tissue undergoes liquefaction, and the fibrous wall loses structural integrity. The semi-liquid necrotic material can then drain into a bronchus or nearby blood vessel, leaving an air-filled cavity at the original site. In patients infected with *M. tuberculosis,* droplets can be coughed up from the bronchus and infect other persons. If discharge into a vessel occurs, occurrence of extra pulmonary tuberculosis is likely. (Smith, 2003).

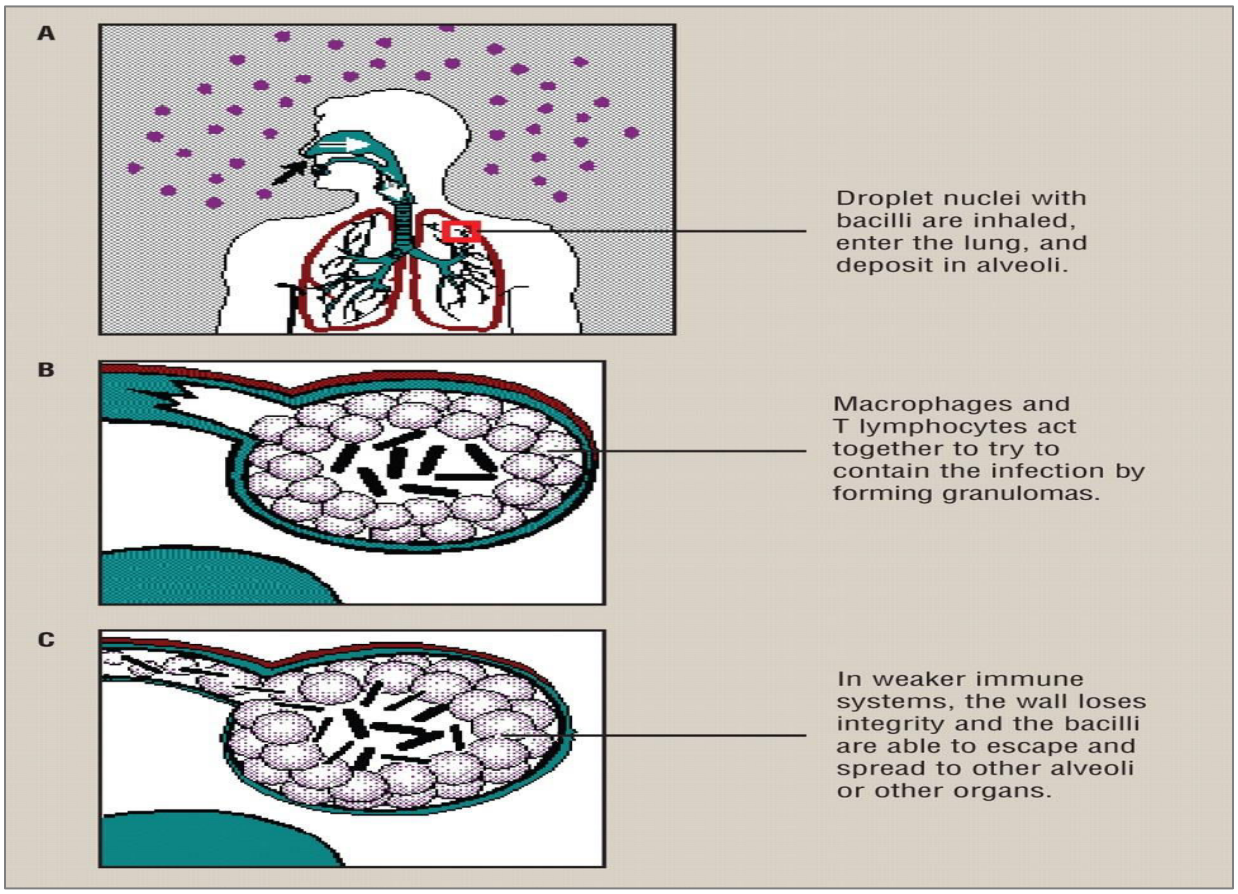


**Figure 1.1:** Pathophysiology of tuberculosis: inhalation of bacilli (A), containment in a granuloma (B), and breakdown of the granuloma in less immunocompetent individuals (C). (Knechel, 2009)

### 1.3: Risk Factors of Tuberculosis

Tb disease can develop soon after becoming infected (within weeks) before immune system can fight the TB bacteria. Some people may get sick years later, when their immune system becomes weak for another reason. (Narasimhan et al., 2013).

Overall, about 5 to 10% of infected persons who do not receive treatment for latent TB infection will develop TB disease at some time in their lives. For persons whose immune systems are weak, especially those with HIV infection, the risk of developing TB disease is much higher than for persons with normal immune systems. Certain factors can increase the risk of tuberculosis. These factors include:

### 1.3.1: Weakened immune system:

A healthy immune system often successfully fights TB bacteria, but body can't mount an effective defense if resistance is low. A number of diseases and medications can weaken immune system, including:

- HIV infection (the virus that causes AIDS)
- Diabetes
- Severe kidney disease
- Cancer treatment, such as chemotherapy
- Drugs to prevent rejection of transplanted organs
- Some drugs used to treat rheumatoid arthritis,
- Crohn's disease and psoriasis
- Malnutrition
- Very young or advanced age
- Low body weight (10% below ideal)
- Certain cancers (Head and neck cancer). (Ai et al., 2016)

### 1.3.2: Traveling or living in certain areas

The risk of contracting tuberculosis is higher for people who live in or travel to countries that have high rates of tuberculosis and drug-resistant tuberculosis, include:

- Africa
- Eastern Europe
- Asia
- Russia
- Latin America
- Caribbean Island (Ai et al., 2016)

### 1.3.3: Poverty and substance abuse

- **Lack of medical care:** If we receive a low or fixed income, live in a remote area, have recently immigrated to the United States, or are homeless, may lack access to the medical care needed to diagnose and treat TB.
- **Substance abuse:** IV drug use or alcohol abuse weakens immune system and makes more vulnerable to tuberculosis.
- **Tobacco use:** Using tobacco greatly increases the risk of getting TB and dying of it.

### 1.3.4. Place of work or living

- **Health care work:** Regular contact with people who are ill increases the chances of exposure to TB bacteria. Wearing a mask and frequent hand-washing greatly reduce the risk.
- **Living or working in a residential care facility:** People who live or work in prisons, immigration centers or nursing homes are all at a higher risk of tuberculosis. That's because the risk of the disease is higher anywhere there is overcrowding and poor ventilation.
- **Living in a refugee camp or shelter:** Weakened by poor nutrition and ill health and living in crowded, unsanitary conditions, refugees are at especially high risk of tuberculosis infection. (Ai et al., 2016).

## 1.4: Types of Tuberculosis

Tuberculosis is a dangerous and highly contagious disease caused by the bacterium Mycobacterium tuberculosis. While TB usually affects the lungs, it can also infect other parts of the body including the spine, brain and kidney. If proper medical attention is not received, TB can be fatal. The medical community divides this disease into two categories--pulmonary and extra pulmonary, which together cause 11 distinct types of tuberculosis. Pulmonary tuberculosis is responsible for four of these and extra pulmonary the remaining seven. Extra pulmonary tuberculosis occurs primarily in those with a compromised immune system.

### 1.4.1: Pulmonary Tuberculosis

TB disease most commonly affects the lungs; this is referred to as pulmonary TB. In 2011, 67% of TB cases in the United States were exclusively pulmonary. Patients with pulmonary TB usually have a cough and an abnormal chest radiograph, and may be infectious. Although the majority of TB cases are pulmonary, TB can occur in almost any anatomical site or as disseminated disease. Different types of pulmonary tuberculosis are given below:

#### 1.4.1.1: Laryngeal TB

Laryngeal TB occurs when the bacterium attacks the throat's vocal chords. This highly uncommon pulmonary TB is frequently confused with other throat diseases like chronic laryngitis and laryngeal carcinoma. (Iseman, 2016)

#### 1.4.1.2: Cavitary TB

Cavitary TB involves the upper lobes of the lung. The bacteria cause progressive lung

destruction by forming cavities, or enlarged air spaces. This type of TB occurs in reactivation disease. The upper lobes of the lung are affected because they are highly oxygenated (an environment in which (*M.tuberculosis* thrives).Symptoms include productive cough, night sweats, fever, weight loss, and weakness. There may be hemoptysis (coughing up blood). Occasionally, disease spreads into the pleural space and causes TB empyema (pus in the pleural fluid). (Iseman, 2016)

#### 1.4.1.3: Miliary TB

"Miliary" describes the appearance on chest X-ray of very small nodules throughout the lungs that look like millet seeds. Miliary TB can occur shortly after primary infection. The patient becomes acutely ill with high fever and is in danger of dying. The disease also may lead to chronic illness and slow decline. Symptoms may include fever, night sweats, and weight loss. It can be difficult to diagnose because the initial chest x-ray may be normal. Patients who are immunosuppressed and children who have been exposed to the bacteria are at high risk for developing miliary TB. (Iseman, 2016)

#### 1.4.1.4: TB Pleurisy

This usually develops soon after initial infection. A granuloma located at the edge of the lung ruptures into the pleural space, the space between the lungs and the chest wall. Once the bacterium invade the space, the amount of fluid increases dramatically and compresses the lung, causing shortness of breath (dyspnea) and sharp chest pain that worsens with a deep breath (pleurisy). Tuberculosis pleurisy generally resolves without treatment; however, two-thirds of patients with tuberculosis pleurisy develop active pulmonary TB within 5 years. (Iseman, 2016).

### 1.4.2: Extrapulmonary Tuberculosis

Extrapulmonary TB disease occurs in places other than the lungs, including the larynx, the lymph nodes, the pleura, the brain, the kidneys, or the bones and joints. Different types of extrapulmonary tuberculosis are following:

#### 1.4.2.1: Adrenal Tuberculosis

Adrenal TB is an extrapulmonary form of TB that affects the adrenal gland and the production of adrenal hormone. Patients with this form of TB often feel weak or faint due to insufficient adrenal gland production. (Manso et al., 2016).

#### 1.4.2.2: Lymph Node Disease

When the TB bacterium impacts the lymph nodes and causes them to become enlarged, lymph

node disease is diagnosed. This extrapulmonary TB can even cause the lymph nodes to become so large they rupture through the skin if not diagnosed in time. (Janssen, 1940)

#### 1.4.2.3: Osteal Tuberculosis

Osteal TB is an infection of the bones caused by the TB bacteria. This extrapulmonary form can lead to bone tissue weakening and even bone fractures depending on where the disease has spread in the body. While infection can occur in any bone, the spine is most usually attacked, which can lead to compression fractures and back deformity. (Janssen, 1940)

#### 1.4.2.4: TB Peritonitis

*Mycobacterium tuberculosis* can involve the outer linings of the intestines and the linings inside the abdominal wall, producing increased fluid, as in tuberculosis pleuritis. Increased fluid leads to abdominal distention and pain. Patients are moderately ill and have fever. (Janssen, 1940)

#### 1.4.2.5: Renal TB

When a patient has pyuria, or white blood cells in the urine, this can be an indication of renal TB. If renal TB spreads undetected, it can affect reproductive organs. In men, renal TB can lead to swelling of the tube that connects the testicles with the vas deferens, a condition known as epididymitis. (Hawes, 1939).

#### 1.4.2.6: TB Meningitis

Patients that show signs of a stroke or a brain tumor should be checked for the presence of the TB bacterium. If present, TB meningitis is diagnosed. This potentially fatal form of extrapulmonary tuberculosis infects the brain. (Thwaites, 2000).

#### 1.4.2.7: TB Pericarditis

Tuberculosis pericarditis occurs when excess fluid builds around the heart. When TB affects this area the ability of the heart to fill with blood and beat properly can be hampered.(Syed and Mayosi, 2007).

### 1.5: Symptoms of Tuberculosis

**1.5.1: Pulmonary TB Symptoms:** The main symptoms of pulmonary tuberculosis are:

- Persistent cough of 2 weeks or more or any duration if HIV positive
- Fever for more than 2 weeks
- Drenching night sweats
- Unexplained weight loss (more than 1.5 kg in a month)

A productive cough, often accompanied by systemic symptoms such as fever, night sweats or loss of weight, is the commonest presentation of pulmonary tuberculosis. Every patient with a positive symptom screen must be investigated appropriately. Not all those with TB will have a cough; therefore, a high index of suspicion is required, particularly in people who are HIV positive who may only have one of the above symptoms. Some patients may present with chest pains (due to pleurisy, muscle strain), breathlessness (due to extensive lung disease or concomitant pleural effusion), localized wheeze due to local tuberculous bronchitis, or because of external pressure on the bronchus by an enlarged lymph node. (Trenchard, 1945)

### 1.5.2. Physical signs

Physical signs may not be helpful in confirming the diagnosis, but it is important to examine the patient carefully. Some of the common signs are:

**Fever** – the body temperature may be high or irregular (greater than 38.5 degrees Celsius)

**Pulse** – the pulse rate may be raised because of fever

**Chest** – there may be no abnormal signs, crackles in the lung apices more pronounced on deep breathing; localized wheeze in local obstruction or pressure; dullness where there is effusion and in chronic disease there may be extensive fibrosis with the trachea pulled to one side. All individuals suspected of having pulmonary tuberculosis should have at least one sputum specimen examined for bacteriological confirmation of TB disease using the rapid diagnostic tests. (Trenchard, 1945)

### 1.5.3: Symptoms of Extrapulmonary TB

Symptoms of Extrapulmonary Tb vary, but can include:

- Persistently swollen glands
- Abdominal (tummy) pain
- Pain and loss of movement in an affected bone or joint
- Confusion
- Persistent headache
- Seizures (fits) (Trenchard, 1945).

## 1.6: Diagnosis of Tuberculosis

The diagnosis of TB depends on numerous factors namely; self-presentation of persons with TB symptoms to health care facility, high index of TB suspicion among health care professionals, TB screening practices in health facilities, sensitivity and specificity of diagnostic test used,

turnaround time for delivery of laboratory results, and the capacity to trace people with positive results and start them on treatment. (Purohit, 2015).

### 1.6.1: Diagnosing Active TB

Active TB disease can be difficult to diagnose, especially in children and those who have weakened immune systems, additional tests beyond medical examinations are required. The following tests may be used to determine if a patient has active TB disease:

1.6.1.1. Tuberculin Skin Test (TST)

1.6.1.2. Chest Radiograph (X-ray)

1.6.1.3.Sputum Smear Microscopy (SSM)

1.6.1.4. Culture

1.6.1.5. Polymerase Chain Reaction (PCR)

1.6.1.6: Ultrasound

1.6.1.7: Adenosine Deaminase (ADA)

1.6.1.8: Erythrocyte Sedimentation Rate (ESR)

1.6.1.9: TB LAM (lateral flow version) (Lange et al,2006)

#### 1.6.1.1: Tuberculin skin test

The TST has been in existence for over 100 years. The tuberculin test has limited value in clinical work, especially where TB is common. The test shows hypersensitivity to proteins of the TB bacillus, as a result either of infection with M. tuberculosis or induced by Bacille Calmette-Guérin (BCG) vaccination. A positive TST does not indicate TB disease, only infection. Infection is one of the criteria used in the diagnosis of TB in children. A negative result does not rule out the diagnosis of TB disease as various conditions, including HIV, may suppress the reaction.TST test is done by injecting small amount of liquid containing TB proteins into the lower part of the arm. The injection site is examined by a trained healthcare professional 2 – 3 days later. If the person has LTBI, the body recognizes the proteins that were injected and responds by forming a lump where the TB proteins were injected. (Meier and Enders, 2010).

The skin test result depends on the size of the raised, hard area or swelling. It also depends on the person's risk of being infected with TB bacteria and the progression to TB disease if infected.

- **Positive skin test:** This means the person's body was infected with TB bacteria. Additional tests are needed to determine if the person has latent TB infection or TB disease. A health care worker will then provide treatment as needed.

- **Negative skin test:** This means the person's body did not react to the test, and that latent TB infection or TB disease is not likely. (Bettag, 1997).

### 1.6.1.2: Chest-X-rays

Chest X-rays are used to check for lung abnormalities in people who have signs and symptoms of TB disease in the lungs. Although chest x-rays may suggest that TB disease is present, a chest X-ray alone cannot definitely diagnose a tuberculosis infection in the lungs or anywhere else in the body. Chest x-rays are necessary in patients who cannot produce sputum or who have negative expert results and are HIV positive, and where extra pulmonary TB (such as pleural effusions and pericardial TB) is suspected. While CXR is non-specific for TB, the presence of infiltrates, lymph nodes or cavities is highly suggestive of TB. The x-ray findings must be interpreted in the light of the patient's history and clinical findings. Other indications for the use of chest x-rays include:

- To assist in the diagnosis of suspected complications of TB disease such as pneumothorax, pleural effusion or patients with frequent or severe haemoptysis.
- To help in diagnosing other concomitant lung diseases such as lung cancer, bronchiectasis (abnormal widening of the bronchi or their branches, causing a risk of infection), lung abscess (bacterial infection that occurs in the lung tissue) and pneumoconiosis (a disease of the lungs due to inhalation of dust, characterized by inflammation, coughing, and fibrosis). (Fujikawa et al.,2014).

### 1.6.1.3: Sputum Smear Microscopy (SSM):

This is a simple laboratory test that examines sputum for bacteria using a microscope. Since some other non-TB bacteria appear similar to *Mycobacterium tuberculosis*, it cannot always distinguish between TB and other infections. It is commonly used to diagnose active TB disease because it can quickly determine if a person is infected. However, it sometimes gives a negative result even in people with TB disease so a negative result cannot be relied upon. (Gandhi et al., 2012)

**Table 1.1: Methods of obtaining a sputum sample** (Takahashi, 1975)

| **Method** | **Description** | **Advantage** | **Disadvantage** |
|---|---|---|---|
| Sputum sample | Patient coughs up sputum into sterile container | Easy to perform | ✓ Patient may not be able to cough up sputum<br>✓ Education and supervision of the patient is required |
| Nebulisation/ Sputum induction | Patient inhales a saline mist which causes them to cough. | Used to obtain Sputum in patients with non productive Cough. | ✓ Specimen may be watery and confused with saliva.<br>✓ May cause bronchospasm |
| Gastric washing/ aspirate | A tube is inserted into the stomach through the patients mouth or nose to obtain swallowed sputum. | Used to obtain sputum in children who do not cough up sputum | ✓ Must be done early morning before eating<br>✓ Patient may need to be hospitalized |
| Bronchoscopy | A scope is passed through the mouth or nose to the diseased part of the lung to obtain sputum or lung tissue | Used to obtain sputum when the patient cannot cough and gastric aspirate cannot be done. | ✓ Requires special equipment<br>✓ Must be done in a hospital by a specialist |

### 1.6.1.5: Culture

Culture techniques are used to grow live TB bacteria in a laboratory. This is a reliable method for detecting active TB disease as long as a suitable sample containing the TB bacteria can be obtained. TB can be cultured from a variety of specimens. This test can also provide information on which antibiotics would be effective in treating the infection. A major drawback of this test is the length of time it takes to obtain the results (2-6 weeks). (Takahashi,1975).

### 1.6.1.6: Polymerase chain reaction (PCR)

These tests detect the presence of genetic material in bacteria. PCR can detect small amounts of genetic material. However, to be effective, the samples still have to contain a certain number of TB bacteria. It is sometimes difficult to obtain a good sample so people with TB disease may give a negative PCR result. The test is also quite complicated and can be expensive. (Mehta et al.,2012).

### 1.6.1.7: Ultrasound

The ultrasound can be used as a supplementary investigation in the diagnosis of extrapulmonary TB particularly abdominal and pericardial TB. (Vijayaraghavan, 2010).

### 1.6.1.8: Adenosine Deaminase (ADA)

ADA is an enzyme found in most cells, it is elevated in TB effusions (>30µl). This test may therefore be useful in confirming the cause of an effusion when it doubt. (Salmanzadeh et al., 2015)

### 1.6.1.9: Erythrocyte Sedimentation Rate (ESR)

This test is not a confirmatory test for TB. A number of infections and diseases result in elevated ESR, therefore low specificity for TB. (Naidoo et al., 2014).

### 1.6.1.10: TB LAM (lateral flow version)

This assay detects lipoarabinomannan (LAM) antigens in urine. LAM is a component of the mycobacterial outer cell wall that is shed from metabolically active or degrading cells and is cleared by the kidney and detectable in urine. It has been reported to have good sensitivity in HIV-infected patients with low CD4 (<50cells/mm3) cell counts. In a clinical setting this test may have a role in diagnosis if used in combination with other tests to support a diagnosis of TB in patients with advanced immunosuppression. Further studies are required to determine the role of this test in programmatic settings. (Peter et al.,2015).

### 1.6.2: Diagnosis of Latent TB Infection

Latent TB Infection (LTBI) can convert to active disease, especially in people with a weakened immune system that may be unable to control the latent infection. It is therefore important to identify those people with LTBI and treat them before they convert to active TB disease and pass it onto others. Risk groups are with higher rates of conversion to active disease include children, the elderly, transplant patients, people who are HIV positive, and those being treated for rheumatoid arthritis. (Ahmadinejad et al., 2012).

#### 1.6.2.1. TB blood tests or TB Interferon Gamma Release Assays (IGRAs)

TB blood tests (also called Interferon-Gamma Release Assays or IGRAs) are a new type of more accurate TB test. This test is used to measure how the immune system reacts to the bacteria that cause TB. The immune system produces some special molecules called cytokines. These TB tests work by detecting a cytokine called the interferon gamma cytokine.

Two IGRAs are approved by the U.S. Food and Drug Administration (FDA) and are available in the United States:

1. QuantiFERON®–TB Gold In-Tube test (QFT-GIT)
2. T-SPOT®.TB test (T-Spot)

The advantages of an IGRA TB test include the fact that it only requires a single patient visit to carry out the TB test. Results can be available within 24 hours, and prior BCG vaccination does not cause a false positive result. Disadvantages include the fact that the blood sample must be processed fairly quickly, laboratory facilities are required, and the test is for latent TB. It is also thought that the IGRAs may not be as accurate in people who have HIV. In low prevalence resource rich settings, IGRAs are beginning to be used in place of the TB skin test. (Nsangi et al., 2011).

### 1.7: Current Anti-TB Drugs

Currently, there are 10 drugs approved by the U.S. Food and Drug Administration (FDA) for the treatment of TB disease. In addition, the fluoroquinolones (levofloxacin, moxifloxacin, and gatifloxacin), although not approved by the FDA for TB disease, are commonly used to treat TB disease caused by drug-resistant organisms or for patients who are intolerant of some first-line drugs. Rifabutin, approved for use in preventing Mycobacterium avium complex disease in patients with HIV infection but not approved for TB disease, is useful for treating TB disease in patients concurrently taking drugs that interact with rifampin (e.g., certain antiretroviral drugs).

Amikacin and kanamycin, nearly identical aminoglycoside drugs used in treating patients with TB disease caused by drug-resistant organisms, are not approved by the FDA for treatment of TB. Of the approved drugs, isoniazid (INH), rifampin (RIF), ethambutol (EMB), and pyrazinamide (PZA) are considered first-line anti-TB drugs and form the core of standard treatment regimens. Rifabutin (RBT) and rifapentine (RPT) may also be considered firstline drugs under certain circumstances. RBT is used as a substitute for RIF in the treatment of all forms of TB caused by organisms that are known or presumed to be susceptible to this agent.

RBT is generally reserved for patients for whom drug-drug interactions preclude the use of rifampin. Streptomycin (SM) was formerly considered to be a first-line drug and, in some instances, is still used in the initial treatment regimen. However, an increasing prevalence of resistance to SM in many parts of the world has decreased its overall usefulness. The remaining drugs are reserved for special situations such as drug intolerance or resistance. (Boahen, 2014)

**Table 1.2: Currently Used anti-TB Drugs** (Boahen, 2014)

| **Drugs classes** | **Anti-Tb Drugs** | **Comments** |
|---|---|---|
| First-line drugs | Isoniazid (INH)<br>Rifampin (RIF)<br>Pyrazinamide (PZA)<br>Ethambutol (EMB) | INH, RIF, PZA, and EMB form the core of initial treatment regimen. |
| | Rifabutin (RBT) | May be used as a substitute for RIF in the treatment of all forms of TB caused by organisms that are known or presumed to be susceptible to this agent. |

**Table 1.2: Currently Used anti-TB Drugs** (Boahen, 2014)

| **Drugs classes** | **Anti-Tb Drugs** | **Comments** |
|---|---|---|
| | Rifapentine (RPT) | May be used once weekly with INH in the continuation phase of treatment for HIV-negative patients with noncavitary, drug-susceptible pulmonary TB who have negative sputum smears at completion of the initial phase of treatment. |
| Second line drugs | Streptomycin (SM) | SM was formerly considered to be a first-line drug and in some instances, is still used in initial treatment. Increasing prevalence of resistance to SM in many parts of the world has decreased its overall usefulness. |
| | Cycloserine, Terizodine, Ofloxacin, Levofloxacin, Ethionamide, Moxifloxacin,Gatifloxacin,Amikacin, Kanamycin | These drugs are reserved for special situations such as drug intolerance or resistance. |

## 1.8: TB Disease Treatment Regimens:

There are four basic treatment regimens recommended for treating adults with TB disease caused by organisms that are known or presumed to be susceptible to INH, RIF, PZA, and EMB. Each treatment regimen consists of an initial 2-month treatment phase followed by a continuation phase of either 4 or 7 months. The 4-month continuation phase is used for the majority of patients. Although these regimens are broadly applicable, there are modifications that should be made under specified circumstances.

### 1.8.1: Initial Phase

The initial phase of treatment is crucial for preventing the emergence of drug resistance and determining the ultimate outcome of the regimen. Four drugs—INH, RIF, PZA, and EMB—should be included in the initial treatment regimen until the results of drug-susceptibility tests are available. Each of the drugs in the initial regimen plays an important role. INH and RIF allow for short-course regimens with high cure rates. PZA has potent sterilizing activity, which allows further shortening of the regimen from 9 to 6 months. EMB helps to prevent the emergence of RIF resistance when primary INH resistance is present. If drug-susceptibility test results are known and the organisms are fully susceptible, EMB need not be included. For children whose clarity or sharpness of vision cannot be monitored, EMB is usually not recommended except when the risk of drug resistance is high or for children who have “adult-type” (upper lobe infiltration, cavity formation) TB disease.

### 1.8.2: Continuation Phase

If the *Mycobacterium tuberculosis* isolate is sensitive to isoniazid, rifampicin, and pyrazinamide, then isoniazid and rifampicin are given for 4 months in the continuation phase (i.e., 6 months of total treatment).

Total therapy for 9 months is considered for patients with extensive skeletal TB, especially when large joints are involved with slow clinical response. Patients with CNS TB receive 7 to 10 months of continuation phase therapy (9 to 12 months total). Patients with MDR TB should have their final regimen based on the results of drug-susceptibility testing, in consultation with an expert.(Leibert and Rom, 2010)

**Table 1.3: Dosage Recommendations for the Treatment of TB in Adults and Children** (Principi et al., 2015)

| **Dose in mg/kg (maximum dosage in parentheses)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Drug** | **Adults/Children** | | | **Daily** | **1 time/week** | **2times/week** | **3 times/week** |
| INH | Adults | | | 5mg/kg (300 mg) | 15mg/kg (900 mg) | 15mg/kg (900 mg) | 15 mg/kg (900 mg) |
| | Children | | | 10–15 mg/kg (300 mg) | | 20–30 mg/kg (900 mg) | |
| RIF | Adults | | | 10mg/kg (600 mg) | | 10mg/kg (600 mg) | 10 mg/kg (600 mg) |
| | Children | | | 10–20 mg/kg (600 mg) | | 10–20 mg/kg (600 mg) | |
| RBT | Adults | | | 5mg/kg (300 mg) | | 5mg/kg (300 mg) | 5 mg/kg (300 mg) |
| | Children | Appropriate dosing for children unknown | | | | | |
| RPT | Adults | | | | 10mg/kg (600mg) (continuation phase) | | |
| | Children | This drug is not approved for use in children | | | | | |
| PZA | Adults | weight | 40–55 kg | 18.2–25 mg/kg(1000 mg) | | 36.4–50 mg/kg(2000 mg) | 27.3–37.5 mg/kg(1500 mg) |
| | | | 56–75 kg | 20– 26.8 mg/kg(1500 mg) | | 40– 53.6 mg/kg(3000 mg) | 33.3– 44.6 (2500 mg) |
| | | | 76–90 kg | 22.2– 26.3 mg/kg(2000 mg) | | 44.4–52.6 mg/kg(4000 mg) | 33.3–39.5 mg/kg(3000 mg) |
| PZA | Children | | | 15-30 mg/kg | | 50 mg/kg | |

**Table 1.3: Dosage Recommendations for the Treatment of TB in Adults and Children** (Principi et al., 2015)

| **Drug** | **Adults/ Children** | | | **Daily** | **1 time/week** | **2times/week** | **3 times/week** |
|---|---|---|---|---|---|---|---|
| EMB | Adults | weight | 40–55 kg | 14.5–20 mg/kg(800 mg) | | 36.4–50 mg/kg(2000 mg) | 21.8–30 mg/kg(1200 mg) |
| | | | 56-75 kg | 16–21.4 mg/kg (1200 mg) | | 37.3–50 mg/kg(2800 mg) | 26.7–35.7 mg/kg(2000 mg) |
| | | | 76–90 kg | 17.8–21.1 mg/kg(1600 mg) | | 44.4–52.6 mg/kg(4000 mg) | 26.7–31.6 mg/kg(2400 mg) |
| | Children | | | 15–20 mg/kg(1000 mg) | | 50 mg/kg(2500 mg) | |

*INH= isoniazid, RIF= rifampin ,RBT= rifabutin ,RPT= rifapentine , PZA= pyrazinamide, EMB= ethambutol

**Table 1.4: Dosage of Second-line Agent Anti-Tb Drugs** (Van der Boogaard et al., 2008)

| Drug | Daily Dose (Maximum dose) |
|---|---|
| Capreomycin | 15 - 30 mg/kg (1 g) |
| Kanamycin | 15 - 30 mg/kg (1 g) |
| Ethionamide | 15 - 20 mg/kg (1 g) |
| Para-aminosalicylic acid (PAS) | 150 mg/kg (16 g) |
| Cycloserine | 15 - 20 mg/kg (1 g) |
| Ciprofloxacin | 750 - 1500 mg/day |
| Ofloxacin | 600 - 800 mg/day |
| Levofloxacin | 500 mg/day |
| Clofazimine | 100 - 300 mg/day |

## 1.9: Treatment for Extra pulmonary TB

Six months treatment is as effective in extra-pulmonary as in pulmonary disease. In some instances of severe or complicated disease (meningitis, TB bones/joints, miliary TB) treatment may need to be extended to nine months. The intensive phase remains two months and the continuation phase is prolonged to seven months-2(RHZE)/7(HR) that means the duration of the initial phase is 2 months and drug treatment is daily, with rifampicin (R), isoniazid (H), pyrazinamide (Z) and ethambutol (E). The continuation phase is 7 (RH). The duration is 7 months, with rifampicin (R) and isoniazid (H) three times per week.(Rockwood, 2007).

## 1.10: Adjunctive treatment

### 1.10.1: Pyridoxine (Vitamin B6)

The use of Pyridoxine is recommended for all adults patients started on TB treatment to prevent peripheral neuropathy most commonly caused by Isoniazid.

**Dose of Pyridoxine**: 25mg daily if patient develops peripheral neuropathy at any stage during TB treatment, the dose can be increased to 50 – 75mg (up to maximum of 200mg) until the symptoms subside, then reduce to 25mg daily.(Boahen, 2014)

### 1.10.2: Steroids

The use of corticosteroids is recommended in extra-pulmonary tuberculosis, particularly for tb meningitis and pericarditis. High dose steroid treatment for 2-4 weeks and the taper off gradually over several weeks depending on clinical progress is recommended. The response to treatment is assessed clinically. (Boahen, 2014).

## 1.11: Different Treatment Strategies

Various treatment strategies are employed for treatment of TB. Initially the treatment consisted of single drugs. But on administration of single drugs to patient having infection with sensitive and resistant organisms, the sensitive organisms got killed, while the resistant ones proliferated and developed greater resistance to the drugs. Hence double or triple drug therapy was initiated in the treatment of TB to obtain complete eradication of all bacteria. Between (1948-1952), short course chemotherapy (SSC) was introduced with combinations of streptomycin and Para amino salicylic acid. But still problem of patient compliance and missed doses remained, for which the World Health Organization (WHO) introduced Fixed Dose Combinations (FDCs). Further Directly Observed Treatment (DOTS) was also implemented with the purpose of direct monitoring of the administration of Anti-TB drugs. (Ray and Gulati, 2007)

### 1.11.1: Fixed Dose Combinations (FDC) Of Anti-TB Drugs

Currently the use of standardized regimen for the treatment of Tb is the fundamental strategy of World Health Organization (WHO) and International Union against Tuberculosis and Lung Diseases (IUATLD). Deviations from such regimen result in increased risk of side effects, or decreased chance of cure or both. One of the best ways of ensuring compliance with such regimens is to physically combine the requisite drugs into simple FDC products. FDC formulation is a combination of two or more first line anti-TB drugs (rifampicin ,pyrazinamide, isoniazid, etambutol) into a fixed proportion. WHO and IUATLD also advocate use of FDCs of two, three or four anti-TB drugs even in DOTS programme. Use of FDCs as a routine therapeutic regimen, simplifies TB treatment thereby increasing patients adherence to the therapy. (Ray and Gulati, 2007)

**Table 1.5: Number of Single Drug and FDC Tablets to Be Taken Daily in the Intensive Phase of TB Treatment** (Ray and Gulati, 2007)

| Dosage Form and Dose | Number of Tablets |
|---|---|
| **Single Drug Tablets** | |
| Rifampicin (R)-50mg | 3 |
| Isoniazid (H)-300mg | 1 |
| Pyrazinamide (Z)-400mg | 3 |
| Ethambutol (E)-400mg | 2 |
| **FDC Tablets** | |
| R+H+Z+E (150mg+75mg+400mg+275mg) | |

### 1.11.2: Directly Observed Therapy (DOT)

DOT is a component of case management that helps ensure patients adhere to therapy. It is the method whereby a trained health-care worker or another trained designated person watches a patient swallow each dose of anti-TB drugs and documents it. DOT is the preferred core management strategy recommended for treatment of TB disease and, if resources allow, for latent tuberculosis infection (LTBI) treatment. DOT can reduce the development of drug resistance, treatment failure, or relapse after the end of treatment. Good case management, which includes establishing a relationship with the patient and addressing barriers to adherence, facilitates successful DOT. Nearly all the treatment regimens for drug-susceptible TB disease can be given intermittently if they are directly observed. Using intermittent regimens reduces the total number of doses a patient must take, as well as the total number of encounters with the health-care provider or outreach worker, making these regimens more cost-effective. Drug-resistant TB disease should always be treated with a daily regimen and under direct observation. There are no intermittent regimens for treatment of multidrug-resistant (MDR) TB. If anti-TB drugs for the treatment of MDR TB need to be given twice daily, then DOT should be provided twice daily as well.(Morse,1996).

## 1.12: Drug resistant Tuberculosis (MDR-TB & XDR-TB)

The bacteria that cause TB can develop resistance to the antimicrobial drugs used to cure the disease. Multidrug-resistant TB (MDR-TB) is TB that does not respond to at least isoniazid and rifampicin, the two most powerful anti-TB drugs. The reasons why multidrug resistance continues to emerge and spread are mismanagement of TB treatment and person-to-person transmission. Most people with TB are cured by a strictly followed, six-month drug regimen that is provided to patients with support and supervision. Inappropriate or incorrect use of antimicrobial drugs, or use of ineffective formulations of drugs (e.g. use of single drugs, poor quality medicines or bad storage conditions), and premature treatment interruption can cause drug resistance, which can then be transmitted, especially in crowded settings such as prisons and hospitals. In some countries, it is becoming increasingly difficult to treat MDR-TB. Treatment options are limited and expensive, recommended medicines are not always available, and patients experience many adverse effects from the drugs. In some cases even more severe drug-resistant TB may develop. Extensively drug-resistant TB, XDR-TB, is a form of multidrug-resistant TB with additional resistance to more anti-TB drugs that therefore responds to even fewer available medicines. It has been reported in 105 countries worldwide. In 2014, an estimated 480 000 people worldwide developed MDR-TB. It is estimated that about 9.7% of these cases were XDR-TB (Extensively drug-resistant TB). Factors contributing to MDR-TB are as followings:

- Management of drug supply.
- Patient management, including prescription errors.
- Poor relationships between patients and health care personnel due to the uncaring staff attitudes, showing little empathy for patients, being paternalistic and failing to adopt a problem solving approach to help resolve issues all contribute to poor adherence.
- Inadequate counseling of patients resulting in low knowledge levels, poor understanding of what is expected of them and of the importance of completing treatment and monitoring the response to treatment also contribute to poor adherence to first line regimens.
- Ineffective systems, including lack of support for directly observed therapy and unsupervised patients; poor record keeping, follow-up of patients and referral.

- Staffing issues including frequent staff changes, poor staff morale, lack of regular support and supervision and low accountability of staff for programme outcomes.
- Insufficient contact tracing and follow-up of MDR cases also contributes to the spread of MDR-TB. (Field, 2013).

### 1.12.1: XDR-TB

XDR-TB is extremely difficult and expensive to treat. It has very high mortality, with rates of over 90% recorded amongst HIV co-infected XDR patients. Prevention is key to the control of XDR- TB. Just as good case management of new and retreatment cases will prevent MDR-TB, good case management of MDR-TB will prevent XDR-TB. There is probably no difference in the spread of XDR-TB to any other form of TB.

By the time confirmation of XDR-TB is made these patients would ideally be on MDR-TB treatment. However, XDR-TB requires an individualized approach to treatment regimes, based on the previous history of drug use and the results of drug susceptibility testing. The duration of stay in the hospital may vary from patient to patient depending on the clinical response to treatment, on average it is six months. On discharge these patients are followed up at the clinic or at home with monthly assessments conducted at the MDR-TB site. (Jaramillo, 2007).

**Table 1.6.Second-Line Drugs for Treating Drug-Resistant TB** (Giffin and Robinson, 2009)

| Drug | Activity | Dosage (daily) | | |
|---|---|---|---|---|
| | | Average | Minimum | Maximim |
| **Aminoglycosides** | | | | |
| Streptomycin | Bactericidal | 15mg/kg | 750 mg | 1000 mg |
| Kanamycin | | 15mg/kg | 750 mg | 1000 mg |
| Amikacin | | 15mg/kg | 750 mg | 1000 mg |

**Table 1.6.Second-Line Drugs for Treating Drug-Resistant TB** (Giffin and Robinson, 2009)

| **Drug Average** | **Activity** | **Average** | **Maximum** | **Minimum** |
|---|---|---|---|---|
| Capreomycin | | 15mg/ kg | 750 mg | 1000 mg |
| Thioamides | | | | |
| Ethionamide | Bacteriostatic | 15-20 mg/Kg | 500 mg | 750 mg |
| Prothionamide | | 15-20 mg/kg | 500 mg | 750 mg |
| Pyrazenamide | Bactericidal | 20-30 mg/kg | 1200 mg | 1600mg |
| **Fluoroquinolones** | | | | |
| Levofloxacin | Weakly bactericidal | 7.5-10 mg/kg | 750 mg | 1000mg |
| Moxifloxacin | | 400mg | 400 mg | 400 mg |

**Table 1.7: Drug resistant TB patient categories** (Giffin and Robinson, 2009)

Patients with drug resistant TB are categorized by the resistance pattern of strains isolated in their sputum or other specimen.

| | |
|---|---|
| Rifampicin Resistant TB (RR-TB) | Resistance to rifampicin, with or without resistance to other TB medicines. This maybe mono, poly, multi or extensive drug resistance**.** |
| Multi Drug Resistant TB (MDR-TB) | Resistance to at least both rifampicin and isoniazid. |
| Extensive Drug Resistant TB | Resistance to any fluoroquinolone and to at least one of the three second line injectable drugs (capreomycin, kanamycin and amikacin), in addition to multi drug resistance. |
| Mono resistance | Resistance to one of the first line TB medicines (rifampicin, isoniazid, pyrazinamide or ethambutol). |
| Poly Drug Resistant TB | Resistance to more than one first line TB medicines. This excludes resistance to both rifampicin and isoniazid. |

### 1.12.2: Treating Mono and Poly-Resistance

Patients with mono and poly-resistance must be referred to the MDR-TB hospital for assessment and initiation of treatment but should not be admitted in the hospital. The PHC (Primary Health Care) facility must then monitor the patient throughout the treatment period and the treatment outcomes must be reported to the MDR-TB Treatment initiation site. (Melzer,2002).

## 1.13: Management of the Common Side Effects of TB medicines

### 1.13.1: Monitoring side effects

The clinical monitoring of all TB patients for side effects during treatment is important. At every follow up visit, the patients must be asked about the following symptoms;

- Burning, numbness and tingling sensation in the feet
- Joint pains
- Anorexia
- Nausea
- Abdominal pains
- Skin rash with/ without itching
- Impaired vision
- Confusion

When the patient has minor side effects they can be reassured and treated symptomatically at the clinic. When they present with major side effects they must be referred to next appropriate level of care hospital immediately.

**Table1.8: Common side effects of TB drugs** (Dyer, 2010)

| **Side effects** | **Drugs responsible** |
|---|---|
| **Minor** | |
| Anorexia, nausea, abdominal pains | Rifampicin |
| Joint pains Burning sensation in feet | Pyrazinamide |
| Orange/ red coloured urine | Isoniazid |
| **Major** | |
| Skin itching/ rash | Streptomycin, Rifampicin, Isonazid |
| Deafness (no wax on otoscopy) | Streptomycin |
| Dizziness (vertigo, nystagmus) | Streptomycin |
| Jaundice (other causes excluded) Vomiting, | Isoniazid, Rifampicin, Pyrazinamide |
| confusion | Isoniazid, Rifampicin, Pyrazinamide |
| Visual impairment/ loss | Ethambutol |
| Generalised purpura, shock and purpura | Rifampicin |
| Toxicity - auditory , vestibular , renal | Capreomycin, Kanamycin, Amikacin |

**Table1.8: Common side effects of TB drugs** (Dyer, 2010)

| Side effects | Drugs responsible |
|---|---|
| Psychosis, Convulsions , Depression, Headaches Rash ,Drug interactions | Cycloserine |
| GI upset ,Hypersensitivity ,Hepatotoxicity | Para-aminosalicylic acid (PAS) |
| GI upset , Dizziness, Hypersensitivity ,Drug interactions ,Headaches, Restlessness | Ciprofloxacin, Ofloxacin, Levofloxacin |

## 1.14: Strategies for TB Prevention

TB prevention consists of two main parts. The first part of TB prevention is to stop the transmission of TB from one adult to another. This is done through firstly, identifying people with active TB, and then curing them through the provision of drug treatment. With proper TB treatment someone with TB will very quickly not be infectious and so can no longer spread the disease to others. The second main part of TB prevention is to prevent people with latent TB from developing active, and infectious, TB disease. Anything which increases the number of infectious people, such as the presence of TB and HIV infection together, or which increases the number of people infected by each infectious person, such as ineffective treatment because of drug resistant TB, reduces the overall effect of the main TB prevention efforts. As a result it is then more likely that globally the number of people developing active TB will increase rather than decrease. There is a vaccine for TB, but it makes only a small contribution to TB prevention, as it does little to interrupt the transmission of TB among adults. (Sable et al., 2011)

### 1.14.1: BCG Vaccine

BCG vaccines are live vaccines derived from a strain of *Mycobacterium bovis*. BCG is used in many countries with a high prevalence of TB to prevent childhood tuberculous meningitis and miliary disease. However, BCG is not generally recommended for use because of the low risk of infection with *Mycobacterium tuberculosis*, the variable effectiveness of the vaccine against adult pulmonary TB, and the vaccine's potential interference with tuberculin skin test reactivity. TSTs and TB blood tests to detect TB infection are not contraindicated for persons who have been vaccinated with BCG. Evaluation of TST reactions in persons vaccinated with BCG should be interpreted using the same criteria for those not BCG-vaccinated. Unlike the TST, TB blood

tests do not detect the presence of BCG and are less likely to give a false-positive result.

### 1.14.2: Patient Education

Educating patients about TB disease helps ensure their successful completion of therapy. Health-care providers must take the time to explain clearly to patients what medication should be taken, how much, how often, and when. Patients should be clearly informed about possible adverse reactions to the medications they are taking and when to seek necessary medical attention. Providing patients with the knowledge they need regarding the consequences of not taking their medicine correctly is very important. In addition, patients should be educated about infection control measures and potential need for isolation. HIV testing and counseling is recommended for all patients with TB disease in all health-care settings. The patient must first be notified that testing will be performed. The patient has the right to decline HIV testing and counseling (opt-out screening). (Sable et al., 2011).

## 1.15: Statistics on Global Epidemiology of Tuberculosis

Roughly one-third of the world's population has been infected with *M. tuberculosis*, and new infections occur at a rate of one per second. However, not all infections with *M. tuberculosis* cause tuberculosis disease and many infections are asymptomatic. In 2007, there were an estimated 13.7 million chronic active cases, and in 2010 there were 8.8 million new cases, and 1.45 million deaths, mostly in developing countries. 0.35 million of these deaths occur in those co-infected with HIV.

In 2009, it was estimated that there were over 9 million new cases of TB across the world resulting in an estimated prevalence of over 14 million cases. There were also an estimated 1.3 million deaths among HIV-negative cases and an additional 0.4 million deaths among co-infected patients with TB and HIV in 2009. In 2014, 1.2 million people died of HIV and this includes the 0.4 million TB deaths among HIV positive people. People, who have both TB and HIV when they die, are internationally classified as having died from HIV. There were an estimated 9.6 million new cases of TB in 2014.There were an estimated 3.2 million cases and 480,000 TB deaths among women. There were also an estimated 1.0 million cases of TB in children and 140,000 deaths. In 2014, an estimated 480,000 new cases of MDR-TB and an estimated 190,000 people died of MDR-TB. Due to its vast public health implications, it is one of the three communicable diseases specifically mentioned under the Millennium Development Goals (MDGs). This has contributed to structured efforts on a global scale with notable

improvements in National TB Programmes (NTPs) worldwide. In spite of this though, TB remains a public health challenge globally.(Rom and Garay, 1996)

**Table 1.9: Estimated WHO Regional TB statistics** (Rom and Garay, 1996)

The WHO figures for the estimated incidence, prevalence and number of deaths from TB in each WHO region are given below.

| **Region** | **TB Mortality** | **HIV Positive TB Mortality** | **Prevalence** | **Incidence** | **Population** |
|---|---|---|---|---|---|
| Africa | 450,000 | 310,000 | 3,200,000 | 2,700,000 | 963,361,000 |
| America | 17,000 | 6,000 | 350,000 | 280,000 | 981,613,000 |
| Eastern Mediterranean | 88,000 | 3,200 | 1,000,000 | 740,000 | 635,745,000 |
| Europe | 33,000 | 3,200 | 440,000 | 340,000 | 907,279,000 |
| South-East Asia | 460,000 | 62,000 | 5,400,000 | 4,000,000 | 1,906,087,000 |
| Global Total | 1,100,000 | 390,000 | 13,000,000 | 9,600,000 | 7,239,269 |

**Table 1.10: TB statistics for 'high burden' countries** (Rom and Garay, 1996)

| Region | TB Mortality | HIV Positive TB Mortality | Prevalence | Incidence | Population |
|---|---|---|---|---|---|
| Afghanistan | 14,000 | 100 | 110,000 | 60,000 | 31,628,000 |
| Philippines | 10,000 | 100 | 410,000 | 290,000 | 99,139,000 |
| Bangladesh | 81,000 | 200 | 640,000 | 360,000 | 159,078,000 |
| Pakistan | 48,000 | 1,300 | 630,000 | 500,000 | 185,044,000 |
| India | 220,000 | 31,000 | 2,500,000 | 2,200,000 | 1,295,292,000 |
| Myanmar | 28,000 | 4,100 | 240,000 | 200,000 | 53,437,000 |
| South Africa | 24,000 | 72,000 | 380,000 | 450,000 | 53,969,000 |
| Viet Nam | 17,000 | 1,900 | 180,000 | 130,000 | 92,423,000 |

## 1.16: Tuberculosis in Bangladesh

TB continues to be a major public health problem in Bangladesh. The actual extent of the tuberculosis problem in Bangladesh is not known precisely, due to the lack of adequate epidemiological data on prevalence, incidence and mortality. The WHO estimate of prevalence was estimated with a very large uncertainty at 434/100,000 population for all types of TB. Two-third of the TB patients detected in 2012 had new smear-positive pulmonary TB (PTB), while 15% had smear-negative PTB and 19% had extra pulmonary TB (EPTB). Three percent of the TB-cases were diagnosed in children. The proportion of retreatment cases was 4.6% among all cases notified in 2012. The prevalence of multi drug resistance (MDR) cases among new cases was 1.4 % (0.7-2.5%), and among retreatment cases 29% (24-34%).Prevalence estimates obtained from surveys in Bangladesh varied widely. The available epidemiological data from the surveys in 1964-66 and in 1987-88 were reanalyzed in 1997 in an attempt to reconcile the estimates of TB-prevalence. This resulted in an estimated prevalence of smear positive TB of 220/100,000 population in 1964-66 survey and 527/100,000 population in 1987-88 survey. Similarly, the prevalence of infection estimates remained unclear in Bangladesh. The only tuberculin survey was conducted along with the 1964-66 prevalence survey, and provided an estimation of annual risk of tuberculosis infection (ARTI) of 2.3%. It is this estimate which formed the basis of the yearly WHO estimates of the burden of TB in Bangladesh.

The social face of TB in Bangladesh is still complex and puzzling. For example, the difference in TB notifications between men and women appears to be relatively large in the country. It is debated if this difference is a result of differences in exposure, accessibility to services, cough production, or smoking habits. Also the role of stigma might have a differential effect on men and women. Studies in Bangladesh suggest that stigma is more prominent in women than men, precluding adequate identification in the former. One of the reasons for providing DOTS free of cost is that everyone with the disease can access treatment when needed, particularly the poorer sections of the population. Case notification data segregated by socio economic strata is not available in Bangladesh but inequities in accessing services in other sectors of the health services suggest that inequity in service utilization might also be a challenging issue for the TB control programme. It has been recognized that TB control needs to focus beyond therapeutic strategies to include poverty and tackling the social determinants of TB. There is a need to obtain better information on socio-economical factor influencing access to TB-services in Bangladesh. The current DOTS program in Bangladesh depends on passive case finding for TB treatment. The estimated case notification proportion of new smear positive PTB (Pulmonary tuberculosis) of around 70% since 2006 suggests that a substantial portion of cases still remains outside DOTS and is probably being treated in the private sector or not accessing care at all. Passive case finding is influenced by patient's awareness, accessibility and availability of health services.

### 1.16.1: TB control in Bangladesh

In the pre-DOTS era, TB control in Bangladesh was vertical and based in a limited number of large hospitals in different districts of the country. In 1993, the government of Bangladesh adopted the DOTS strategy for TB control and started to implement its components throughout the country. This occurred initially in rural areas and was only from 2003 onwards scaled-up to the urban areas. One important feature in expanding TB services was including NGOs in TB-control activities from the beginning. The government commitment continued with subsequent annual development plans. TB-control activities were further strengthened with the availability of funding support from Global Fund for TB, AIDS and Malaria (GFATM) since 2003. (Zafar Ullah et al., 2010)

# *Chapter-2*
# *Literature Review*

## 2.1: Awareness regarding Tuberculosis among patients attending general dispensaries in South Delhi

This hospital based cross sectional descriptive study was planned to find out awareness regarding causation, signs, symptoms and management aspects of tuberculosis like investigations, preventive measures and treatment among patients attending general dispensaries of South Delhi. A total of 1000 patients were included in the study. Sixty-nine percent of the people were aware that cough more than 3 weeks is a symptom of tuberculosis. Only 18% of the study population was aware that tuberculosis is caused by an infectious agent. Sixty-two of the participants mentioned sputum investigation as an initial diagnostic test. Only 67% of the participants believed that the disease is curable. Only 57% of the participants were aware of correct duration of treatment. It is important to create awareness and educate the community through community based awareness campaign. It is also important to conduct surveys at regular intervals for assessment of impact of information, education and communication provided. (Khalid *et al*., 2012)

## 2.2: Assessment of knowledge regarding tuberculosis among non-medical university students in Bangladesh: a cross-sectional study

The study was conducted to assess the knowledge about TB among non-medical university students in Bangladesh. A cross-sectional survey was performed on 839 non-medical university students. Data were collected from University of Rajshahi from March to August 2013 using a standard semi-structured questionnaire. Chi-square test was utilized to find the factors which are associated with student's knowledge about TB.

Among 839 students, males and female were 68.2 % and 31.8 % respectively. Most of the students (94.4 %) were informed about the term TB, among them 50 % got information from electronic media. More than 50 % students believed that TB is a communicable disease, 42.8 % students agreed that bacteria is an agent for TB, most of the subjects (93 %) had the knowledge about the vaccination against TB and 97.6 % students believed that TB is curable. However, students had poor knowledge about latent TB (13.7 %) and DOTs program (28.5 %).In this study demonstrated that the level of general knowledge about TB was insufficient among non-medical university students. Consequently, health education program is needed to improve the knowledge among university students regarding TB. (Rana *et al*., 2015)

### 2.3: Public awareness of tuberculosis in China: a national survey of 69 253 subjects

This study was conducted to investigate the level of awareness about tuberculosis (TB) in the public and associated factors in China. Participants were recruited from 60 counties in 19 provinces and interviewed using a structured questionnaire. Questions asked covered the areas are-overall TB awareness, signs/symptoms of TB, mode of TB transmission, TB dispensaries, free TB detection/treatment policy, TB curability and stigma attached to TB. Factors associated with TB awareness were examined using logistic regression.

A total of 69 253 respondents aged 12–65 years were interviewed, revealing an overall TB awareness rate of 89.0%. The awareness rates for TB symptoms, TB dispensaries and the free TB detection/treatment policy were respectively 15.1%, 41.9% and 44.7%. Approximately 71.9% had some extent of stigma towards patients with TB. People in the farming industry and those with low educational levels had poorer knowledge of all aspects of TB knowledge and were more likely to stigmatism TB. Future TB control programs in China should emphasized TB symptoms, TB dispensaries and its free TB detection/treatment policy to increase public TB awareness, and should target farm workers and people with low educational levels. (Lu *et al.,* 2009)

### 2.4: Factors associated with poor knowledge among adults on tuberculosis in Bangladesh: results from a nationwide survey

The main objective of this study was to describe knowledge of TB among newly diagnosed TB cases and community controls to assess factors associated with poor knowledge in order to identify programmatic implications for control measures. Embedded in TB prevalence survey 2007–2009, 240 TB cases from the TB registers and 240 persons ≥ 15 years of age randomly selected from the households where the survey was implemented. All participants were interviewed using a structured, pre-tested questionnaire to evaluate their TB knowledge. Regression analyses were done to assess associations with poor knowledge of TB.

Based on the number of correct answers to the questionnaires, community controls showed significantly poorer knowledge than the TB cases in the domains of TB transmission (80% vs. 88%), mode of transmission (67% vs. 82%), knowing ≥ 1 suggestive symptoms including cough (78% vs. 89%), curability of TB (90% vs. 98%) and availability of free treatment (75% vs. 95%). Community controls were more likely to have poor knowledge of TB issues compared to the TB

cases even after controlling for other factors such as education and occupation in a multivariate model. (Hossain *et al.,* 2015)

### 2.5: Knowledge and Awareness of Tuberculosis among High School Students of Mysore City

This cross sectional study was carried out to assess the knowledge about tuberculosis among 129 students studying in 9th- 10th standard of two high Schools in Mysore city selected by cluster sampling. 81% students knew TB was caused by bacteria, 85% mentioned it spreads from person to person, 78%, 72% and 54% knew cough as the main symptom, sputum test as the diagnostic test and that treatment was for 6-9 months respectively. 54% students mentioned television as main source of information. (Renuka & Dhar, 2016)

### 2.6: Knowledge and Attitude towards Tuberculosis among sandstone quarry workers in desert parts of Rajasthan

This study was conducted to test the knowledge and attitude of sand-stone quarry workers of Jodhpur on tuberculosis. Nineteen sand-stone quarry sites were selected randomly in Jodhpur district from which 376 quarry workers were interviewed who consented to participate in the study.

Their literacy rate was 28.5%. More than half (50.5%) had heard about tuberculosis from neighbours followed by friends (42.6%) and family members (37.2%). Only 1.6% knew that tuberculosis was caused by germs and 45.2% respondents had misconception that TB was a hereditary disease. Literates were more aware than illiterates about symptoms of tuberculosis. Only 6.9% knew about the need of treatment for 6-8 months and 0.8% knew about the use of BCG vaccine for prevention of tuberculosis. Tendency to discriminate TB patients was evident as 72.6% respondents concluded to isolate TB patients from the family and 80.6% said to avoid sharing food with these patients. (Haldiya *et al.,* 2005)

### 2.7: Patient's Knowledge and Attitude towards Tuberculosis in an Urban Setting

This study conducted during March to August 2008 in selected DOTS centers of Dhaka metropolitan city. From the list of 73 centers providing DOTS service 27 were selected according to convenience and accessibility. Male and female distribution was 55.6% and 44.4%, respectively.

Among them 89.9% people mentioned night fever as most common symptoms of Tb and 56% were aware that it could spread through sneezing/coughing. Television was mentioned as a

source of information about TB. The majority expressed a helping attitude towards other TB patients. Although most of them were positive about getting family support, 46.6% mentioned discrimination of separate utensils for food or drink. About 50.5% expressed increased sadness, 39.8% had fear of loss of job/wedges, and 21.4% felt socially neglected. (Tasnim *et al.,* 2012)

## 2.8: Knowledge and awareness of tuberculosis among Roma population in Belgrade: a qualitative study

This study was considered to be appropriate for investigating knowledge and beliefs about TB. A total of 24 Roma people aged 19-55 years participated in three focus-group discussions.

All participants knew of TB as a pulmonary disease and could be contagious. Saliva was found to be the most commonly mentioned mode of transmission. Some individuals thought, albeit hesitantly, that TB could be transmitted by shaking hands with an infected individual. Of factors contributing to TB, participants mentioned bad living conditions, low quality and lack of food, and stress. Participants quoted chest pain, cough, haemoptysis, loss of appetite, loss of weight, weakness and sweating as basic symptoms of TB. Participants believed that effective treatment should include resting, taking prescribed medicines, inhaling fresh air and eating "strong" food such as bacon and pork. In addition, participants mentioned that they use some folk medicines. Relatives and friends, and to a lesser extent television, were the main sources of information about TB. Participants most appreciate personal contact with doctors as a source of information. (Vukovic & Nagorni-Obradovic, 2011)

## 2.9: Awareness of the Warning Signs, Risk Factors, and Treatment for Tuberculosis among Urban Nigerians

The aim of the study was to determine the awareness of the warning signs, risk factors, and treatment of tuberculosis among urban Nigerians. This was a cross-sectional survey among 574 adults in Ilorin, Nigeria. Semi structured questionnaire was administered by trained interviewers to obtain information about awareness of tuberculosis warning signs, risk factors, and treatment.

Majority of the people (71.4%) were aware of at least one warning sign of tuberculosis. Cough (66.2%), weight loss (38.0%), and haemoptysis (30.7%) were the most identified warning signs. The predictors of awareness of warning sign were increasing age (r+0112), higher family income (r+0.10), higher level of education (r+0.10) and belonging to Christian faith(r+0.11). Awareness of risk factors for tuberculosis was higher for tobacco smokers (77.0%) and history of contact with a case of TB (76.0%). Less than half were aware of HIV infection (49.8%), alcohol

consumption (42.5%), chronic kidney disease (40.4%), extremes of ages (39.4%), cancers (36.9%), and diabetes mellitus (27.5%) as risk factors for TB. Tuberculosis was reported to be curable by 74.6% of the subjects and 67.9% knew that there are medications for treatment of tuberculosis, while 11.5% knew the duration of treatment.(Desalu *et al.,* 2013)

## 2.10: Knowledge about tuberculosis among undergraduate health care students in 15 Italian universities: a cross-sectional study

The main purpose of this multicentre study was to evaluate undergraduate health care student's knowledge of tuberculosis and tuberculosis control measures in Italy. In October 2012–June 2013, a sample of medical and nursing students from 15 Italian universities were enrolled on a voluntary basis and asked to complete an anonymous questionnaire investigating both general knowledge of tuberculosis (aetiology, clinical presentation, outcome, screening methods) and personal experiences and practices related to tuberculosis prevention.

The sample consisted of 2,220 students in nursing (72.6%) and medicine (27.4%) courses. These findings clearly showed that medical students had a better knowledge of tuberculosis than did nursing students. Although the vast majority of the sample (up to 95%) answered questions about tuberculosis etiology correctly, only 60% of the students gave the correct responses regarding clinical aspects and vaccine details. Overall, 66.9% of the students had been screened for tuberculosis, but less than 20% of those with a negative result on the tuberculin skin test were vaccinated. (Montagna *et al.,* 2014)

# *Aims and Objective of the study*

## Aims and Objective of the Study

The lack of awareness and knowledge about Tuberculosis is a major problem around the globe. The study attempts to examine the level of student's awareness regarding this disease and proposes a more effective approach to address the issue of insufficient communication of information. Especially this study has 4 main objectives:

1. To review the level of awareness on TB among undergraduate students of private universities in Dhaka.
2. To identify the best strategy to improve TB awareness among students.
3. To examine the relationship among demographic characteristics with knowledge and attitude of people towards TB.
4. To assess misconception regarding TB.

# *Significance Of the study*

## Significance of the study

Tuberculosis (TB) is primarily a lung infection caused by the bacterium *Mycobacterium tuberculosis*, which can penetrate lung tissue causing inflammation and the development of tubercles (encapsulated bacterial cells). These tubercles may rupture allowing the infection to spread to the surrounding tissue, the circulatory and lymphatic systems, and consequently to other parts of the body. They may also lie dormant, reactivating years later. It can also affect intestine, meninges, bones and joints, lymph glands, skin and other tissues of the body. The disease is usually chronic with cardinal features like persistent cough with or without expectoration, intermittent fever, loss of appetite, weight loss, and chest pain.

About one-third of the world's population is currently infected with the TB bacillus. 5-10% of people who are infected with TB bacilli (but who are not infected with HIV) become sick or infectious at some time during their life. People with HIV and TB infection are much more likely to develop TB. The risk for developing TB disease is also higher in persons with diabetes, other chronic debilitating disease leading to immune-compromise, poor living conditions, tobacco smokers etc. So the knowledge on TB disease, its diagnosis and treatment therefore is an important factor for the management and outcomes. However, lack of TB awareness, along with delay in early diagnosis and insufficient health service resources, has been associated with low TB detection rates and the interruption of TB treatment, as well as delays in early TB diagnosis. In contrast, better public awareness of TB could promote patient detection, early diagnosis and treatment completion. This study will be helpful to increase the knowledge and awareness of TB among students, as they can play a unique role in near future in the society. Thus, the result of the study is expected to increase their perception and knowledge which ultimately will help to improve the disease management process.

# *Chapter-3*
# *Methodology*

## 3.1. Type of Study

This research was a cross-sectional survey assessing TB-related knowledge and awareness among undergraduate students of private universities in Dhaka.

## 3.2. Study Area

The study was done in 6 private universities including (North South University, American International University Bangladesh, Stamford University, Eastern University, South East University, and Green University) in Dhaka city.

## 3.3. Study Population

The study was conducted over a period of 4 months, from June 2016 to September 2016. The target sample size of this survey was 300 undergraduate students of private universities.

## 3.4. Inclusion Criteria

Respondents aged 15 years and above, both male and female candidates were included in the study.

## 3.5. Exclusion Criteria

Respondents aged below 15 and above 26 years were excluded from the study.

## 3.6. Study Tool

In response to evaluate the Knowledge and Awareness of TB among students, a questionnaire was established in April 2016. Through this questionnaire, student's demographic information was collected along with some questions regarding knowledge and awareness, source, signs and symptoms, causes, misconception regarding TB.

## 3.7. Questionnaire Development

The questionnaire was developed based on some common questions regarding TB disease that would help us to link to the relationship among demographic information with knowledge and attitude of students towards TB. The questionnaire was developed from the prospect of Bangladesh so that maximal statistical data was collected from the survey.

### 3.8. Data Analysis

After the collection of data, all the filled questionnaires were checked in order to correct inconsistency in information. Data were analyzed using Microsoft Office Excel (version 2007).

### 3.9. Ethics

The study was done without conflict any ethical issues. Ethical consideration was checked by the research supervisor with the research policy of East West University.

# *Chapter-4*
# *Result*

## 4.1: Gender distribution of respondents

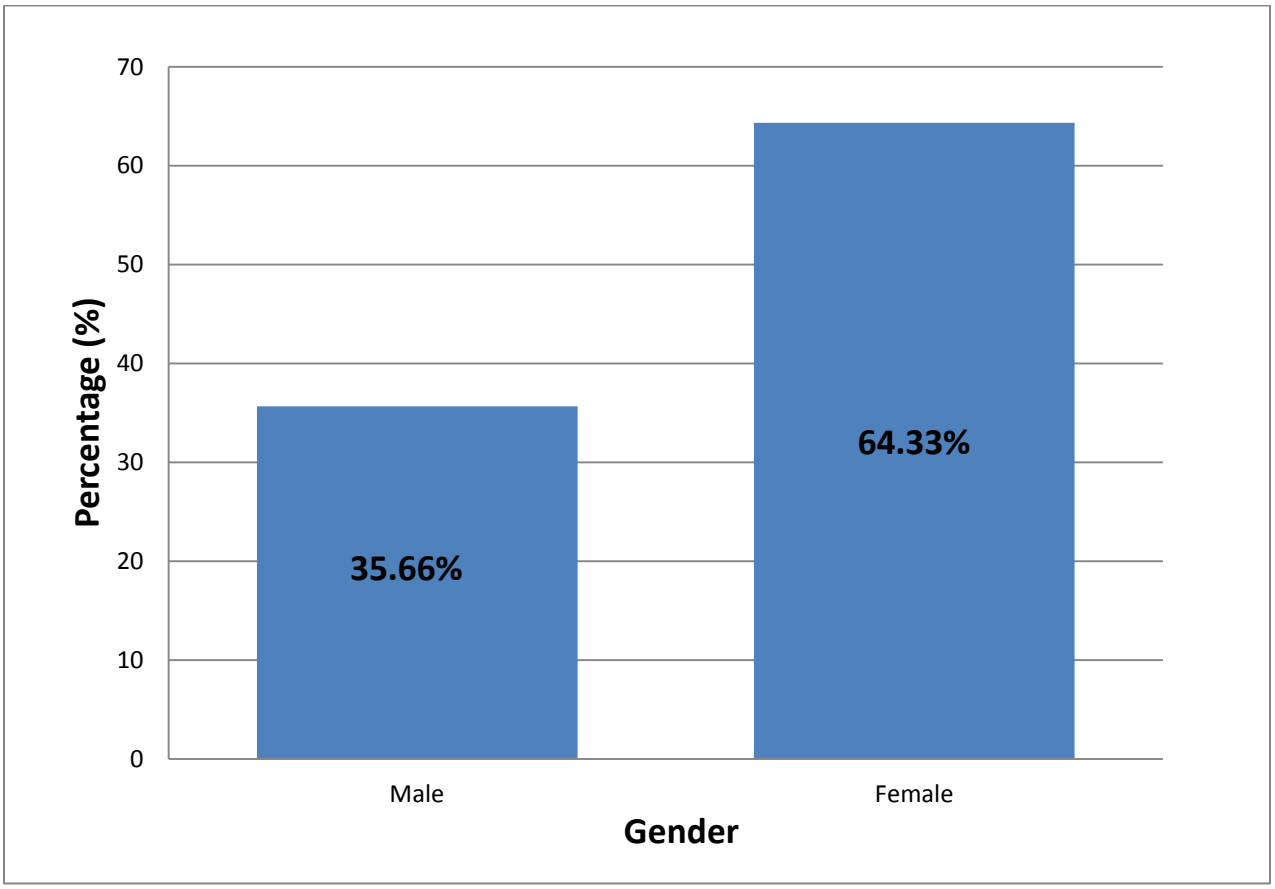


**Figure 4.1: Gender distribution of respondents**

According to the survey conducted among 300 undergraduate students of private universities, 35.66% respondents were males and 64.33% were females.

## 4.2: Age distribution of respondents

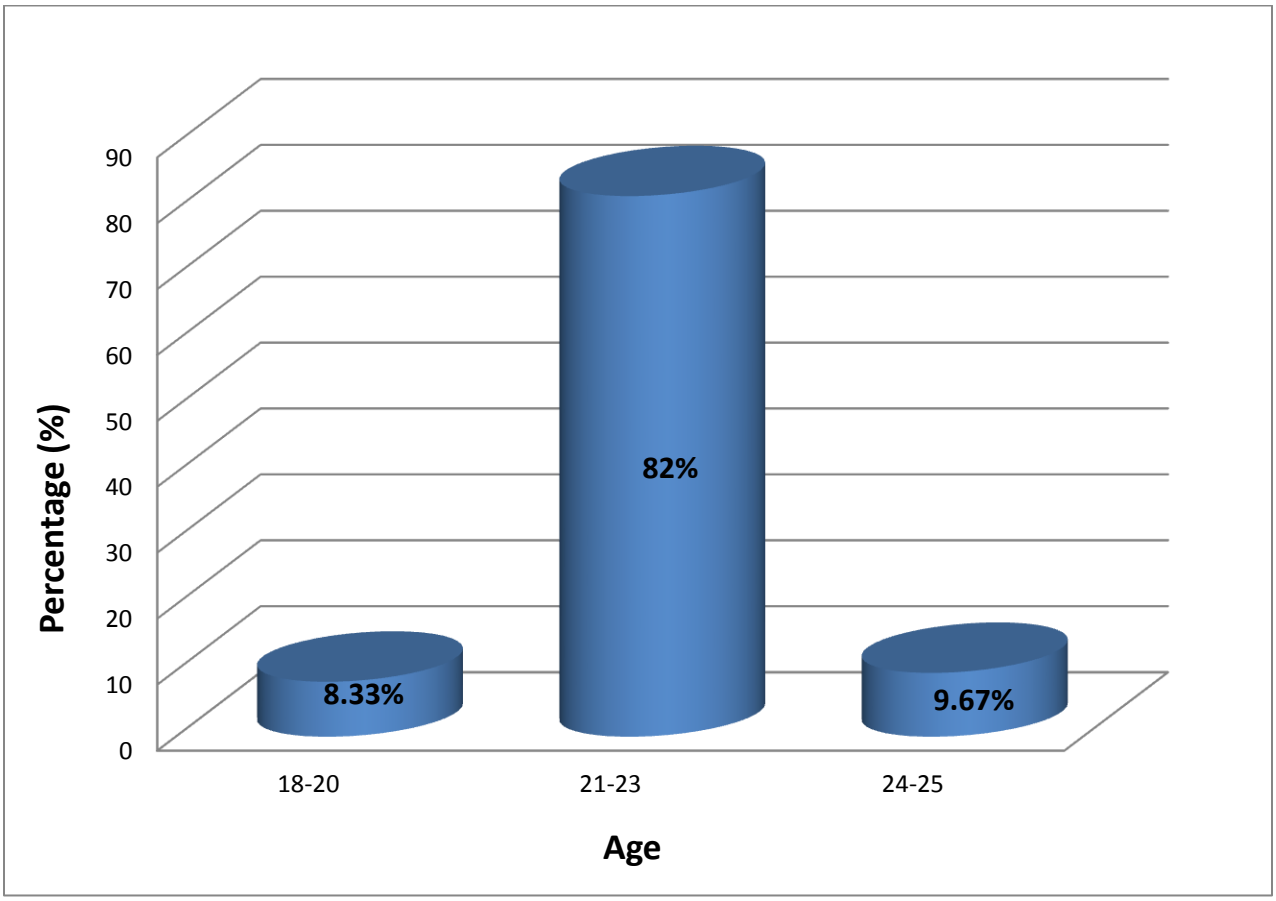


**Figure 4.2: Age distribution of respondents**

Majority of the respondents, (82%) were in the age-group of 21-23 years, while remaining respondents were in the age range of 24-25 years (9.67%) and 18-20 years (8.33%).

## 4.3. Religion distribution of respondents

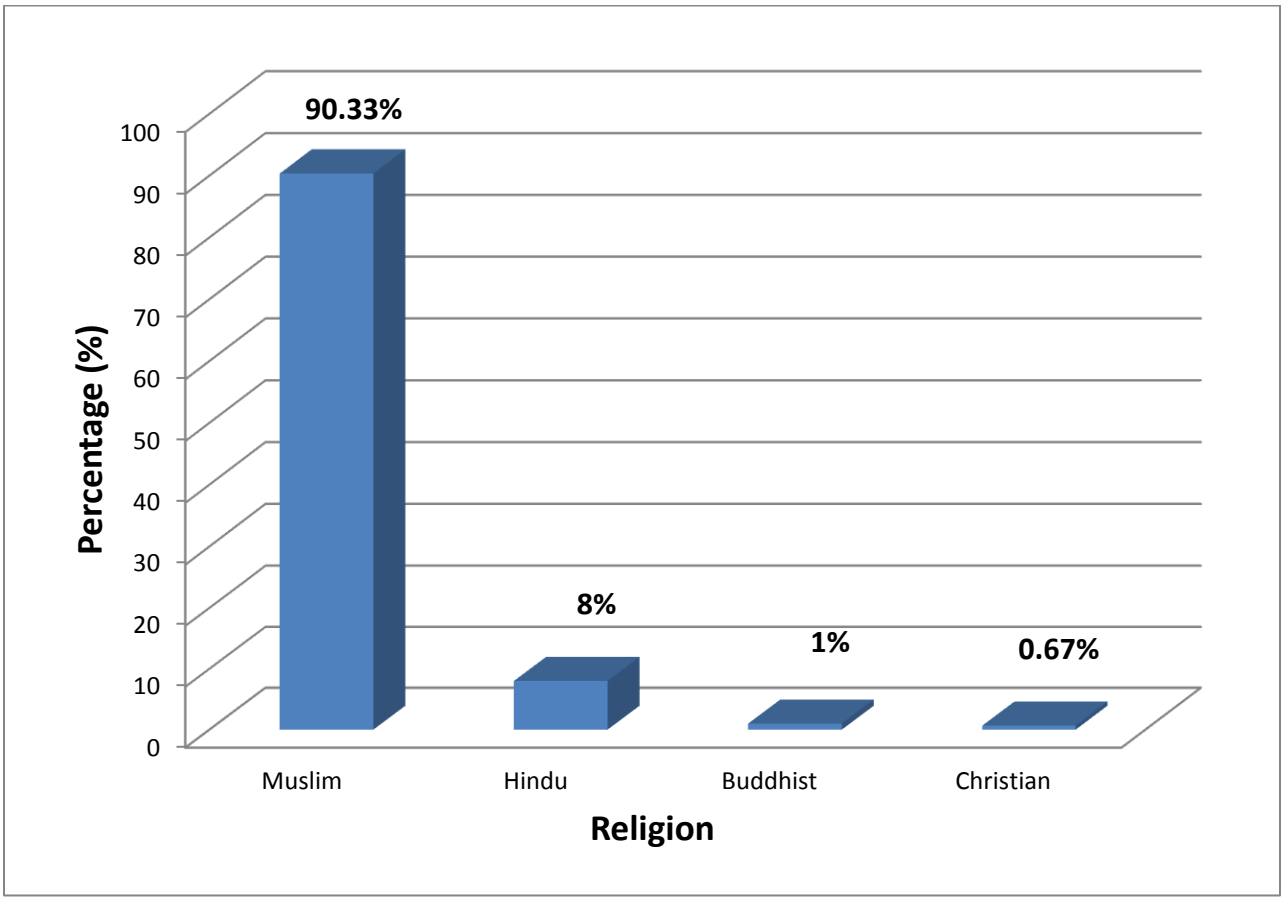


**Figure 4.3. Religion distribution of respondents**

In this survey majority of the respondents were Muslim (93.33%), (8%) students were Hindus, (1%) were Buddhists and only (0.67%) were Christians.

## 4.4. Type of respondents family

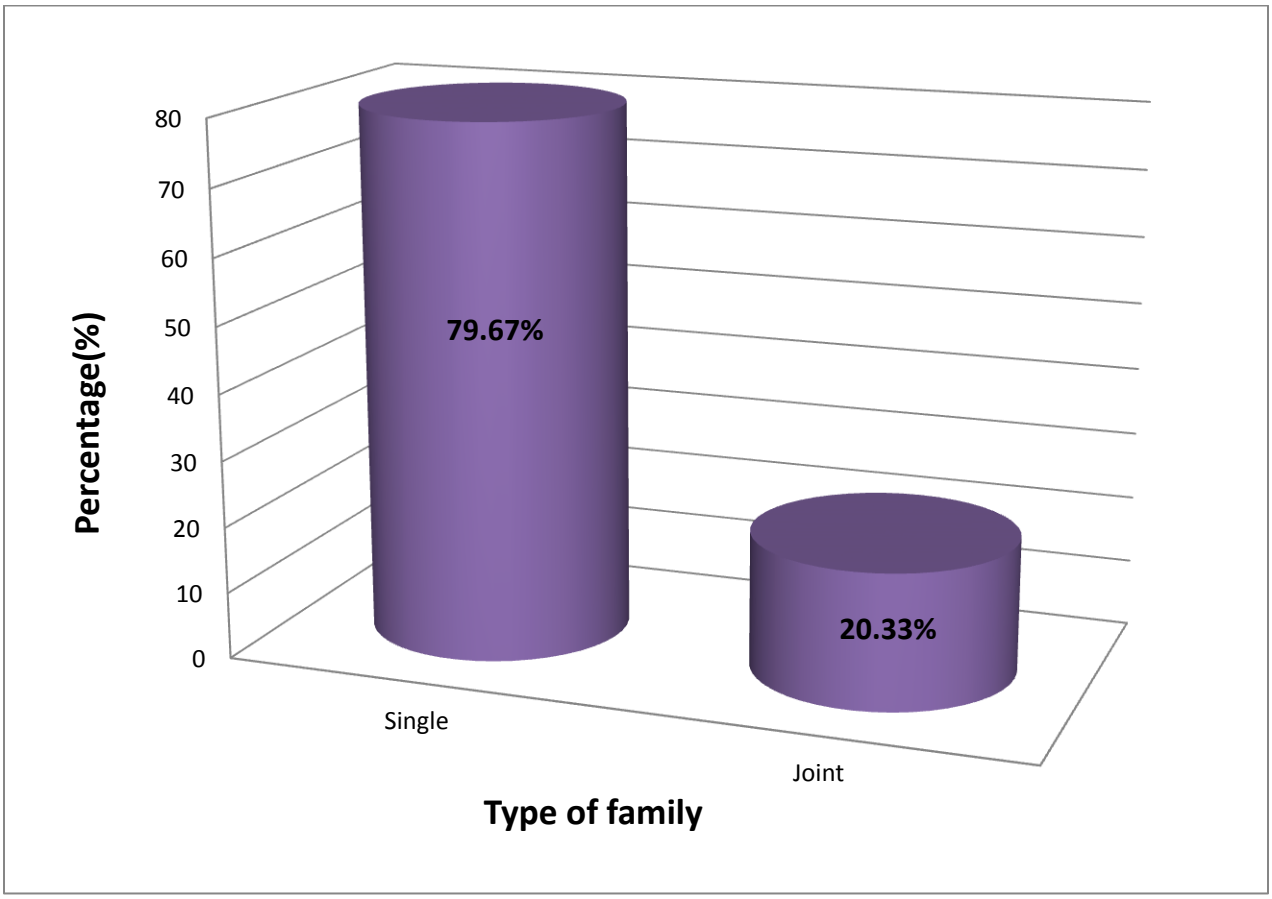


**Figure 4.4: Type of respondents family**

Majority of the students, (79.67%) came from single family and remaining (20.33%) students came from joint family.

## 4.5. Marital status of respondents

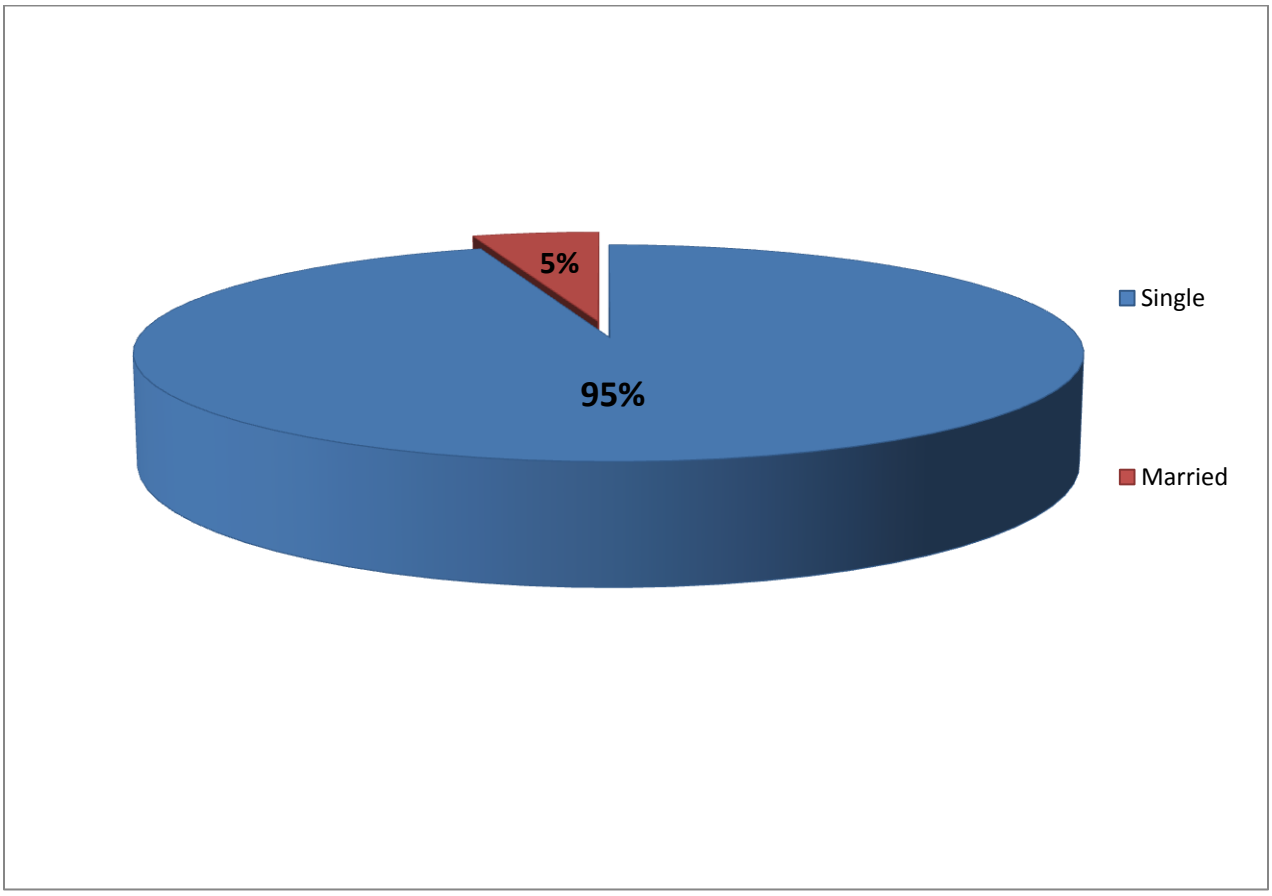


**Figure 4.5: Marital status of respondents**

Among the total respondents, maximum populations about (95%) were single whereas only few students about (5%) were married.

## 4.6. University distribution of respondents

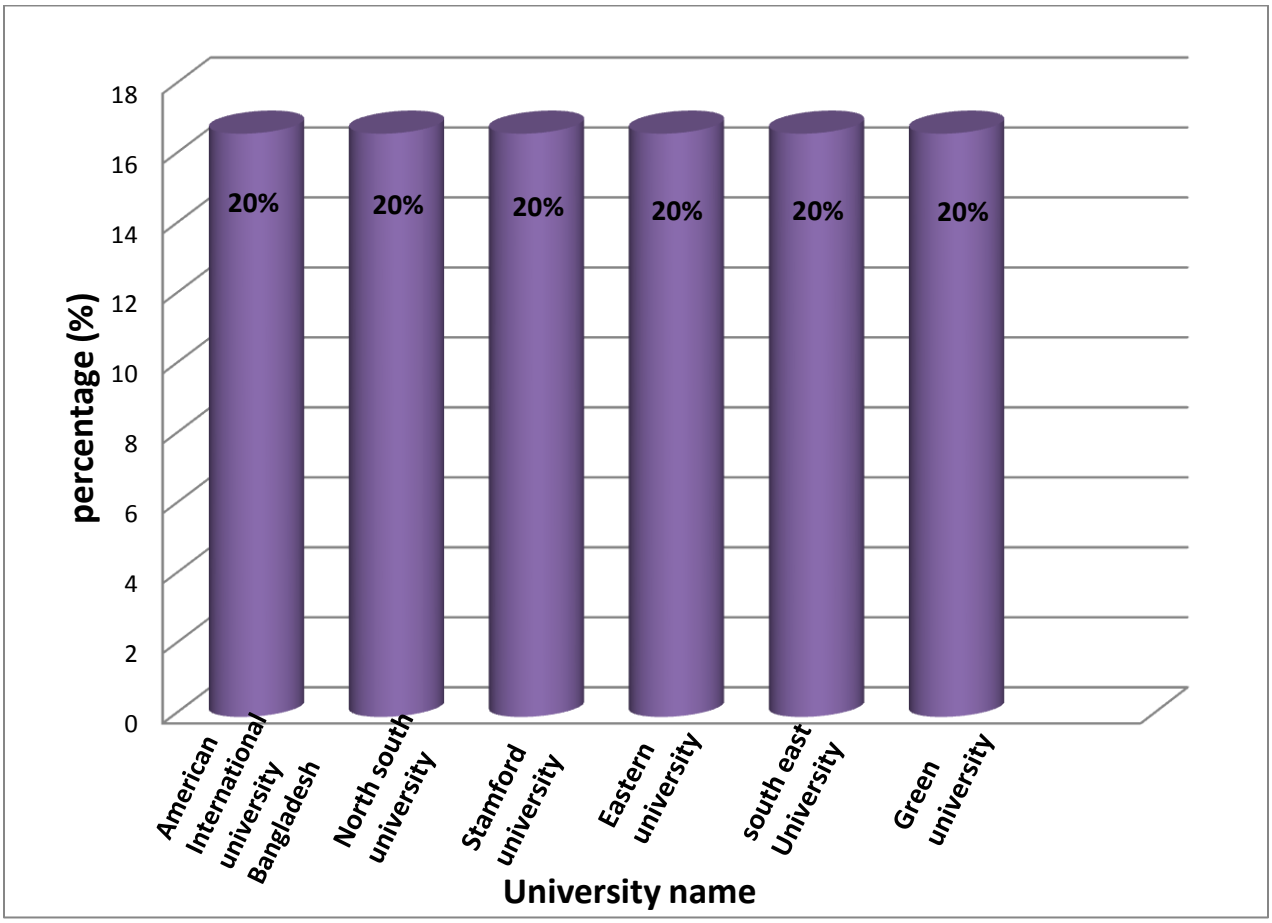


**Figure 4.6. University distribution of respondents**

In this study, the numbers of surveyed students were same (20%) from the American International University Bangladesh, North South University, Stamford University, Eastern University, South East University and Green University.

## 4.7: Department distribution of respondents

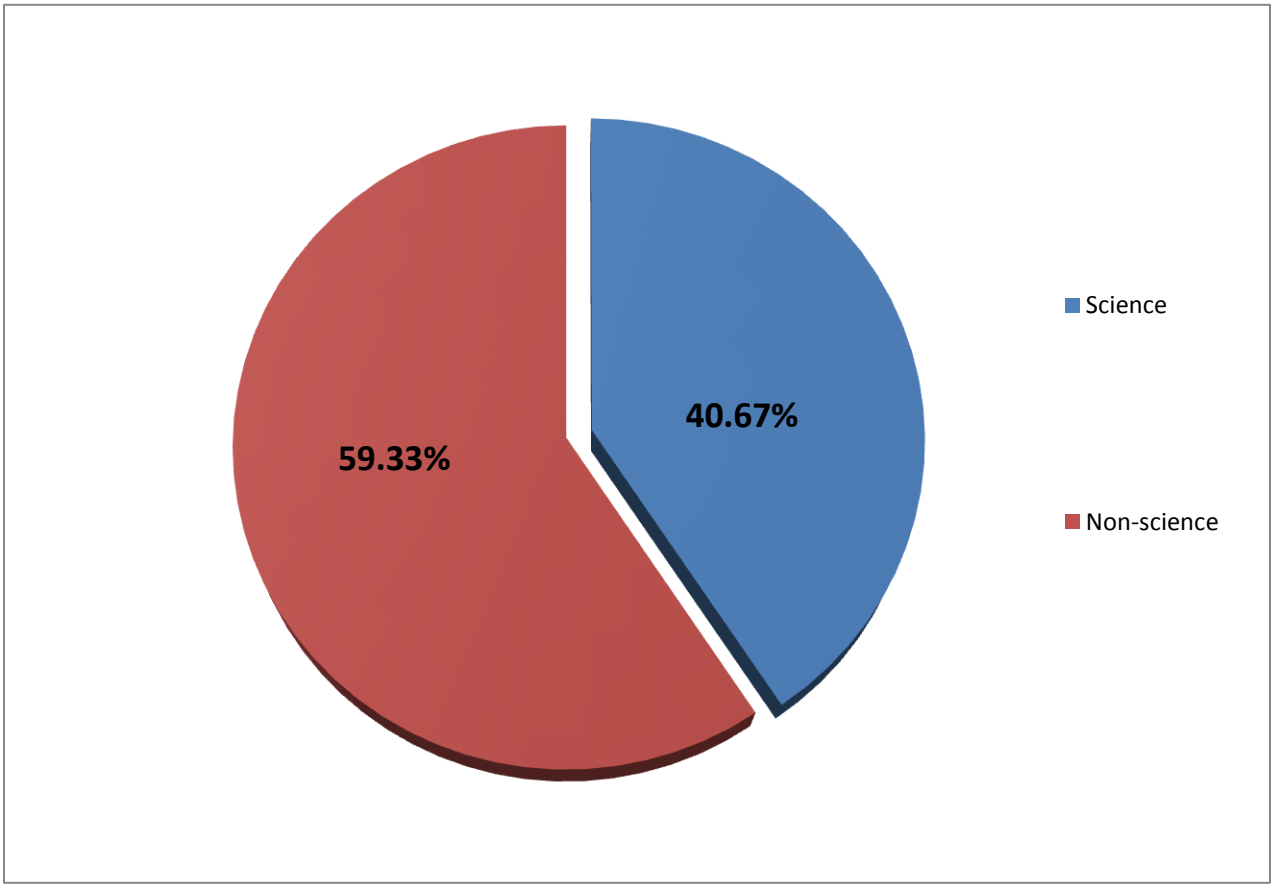


**Figure 4.7: Department distribution of respondents**

Among the total respondents, majority of the students were from non-science background (59.33%) and 40.67% students were from science background.

## 4.8: Year of study distribution of respondents

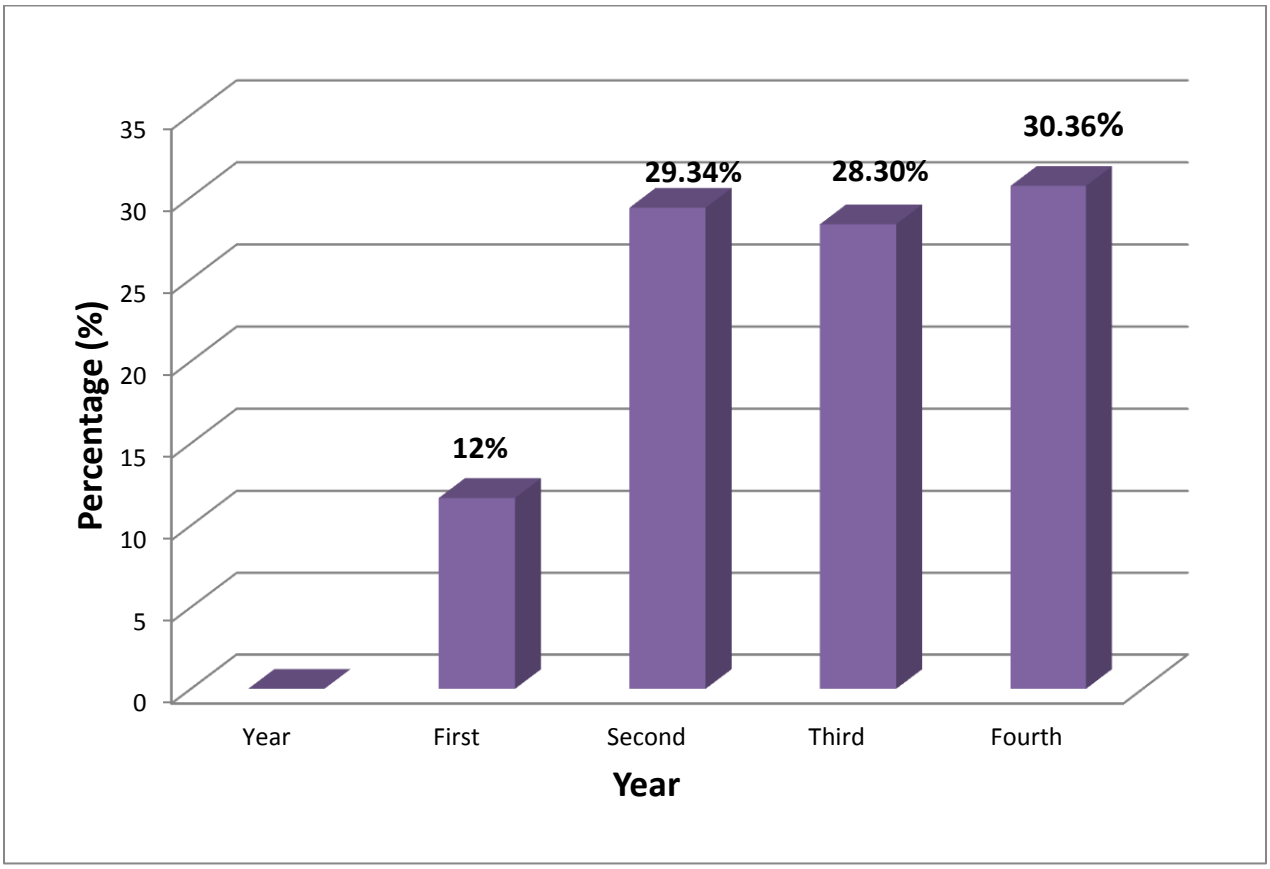


**Figure 4.8: Year of study distribution of respondents**

In this study, about 12% students were from first year, 29.34% from 2nd year, 28.34% from 3rd year and 30.36% were from 4th year.

## 4.9. Employment status of respondents

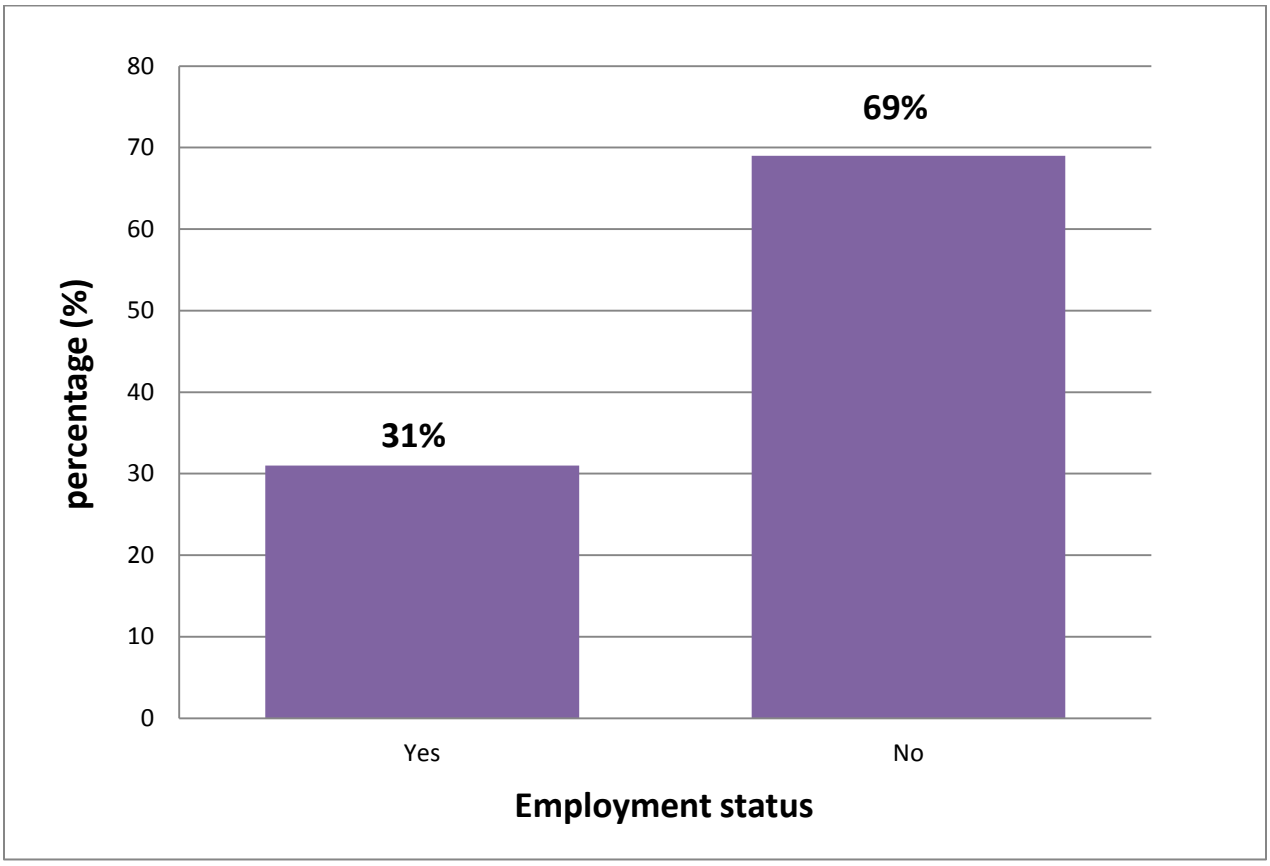


**Figure 4.9. Employment status of respondents**

Among the students who responded to this study, only 31% were employed while the remaining 69% respondents did not do any job.

## 4.10: Occupation distribution of respondents

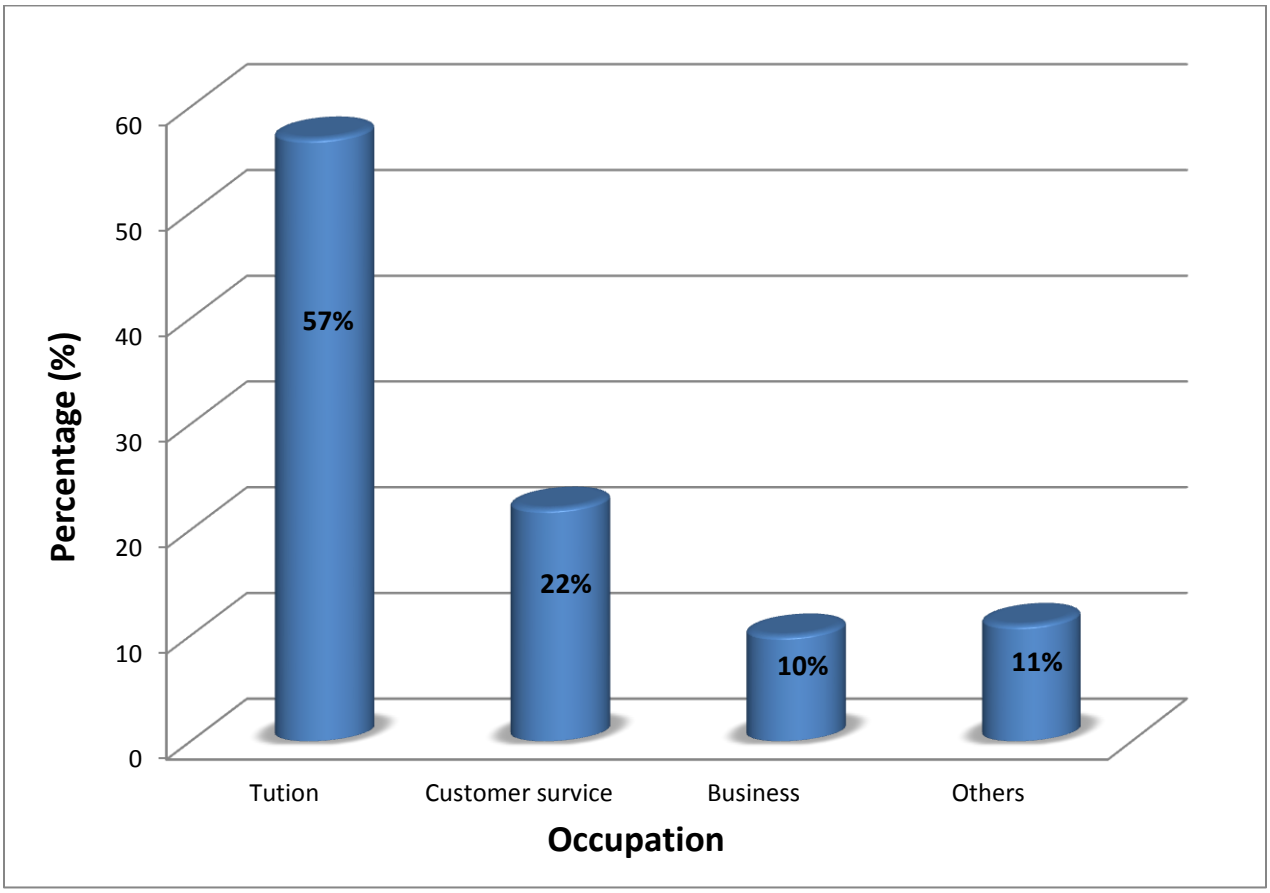


**Figure 4.10: Occupation distribution of respondents**

Among the total respondents, majority of the students (57%) were giving tution, 22% students provided customer service, (10%) students were doing business and remaining (11%) students responded to others.

## 4.11: Income distribution of respondents

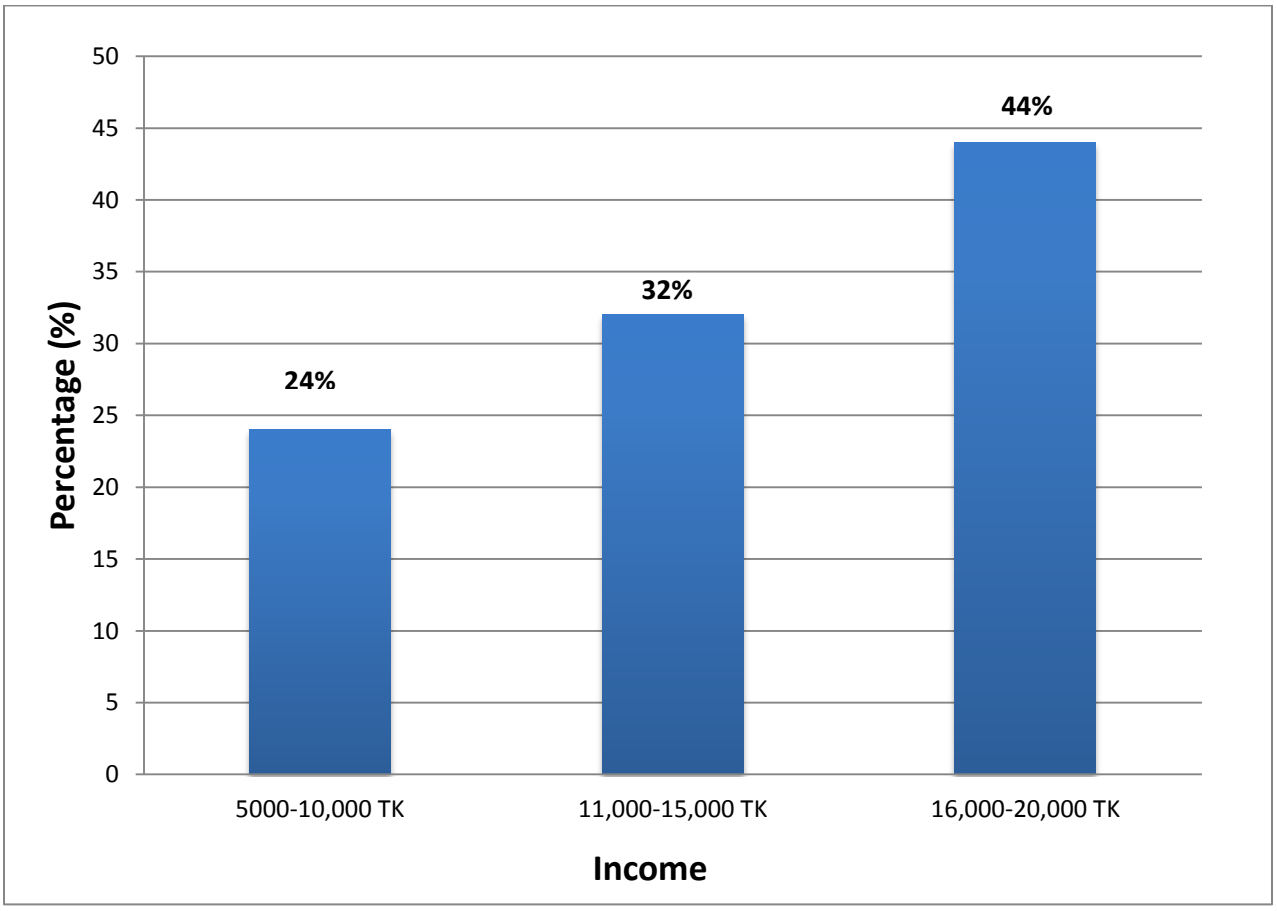


**Figure 4.11: Income distribution of respondents**

Of the total respondents, the monthly income of (44%) students was TK. 16,000-20, 000. (32%) students earned TK. 11,000-15,000 and (24%) students earned monthly income of TK. 5000-10,000

## 4.12: Parents education distribution of respondents

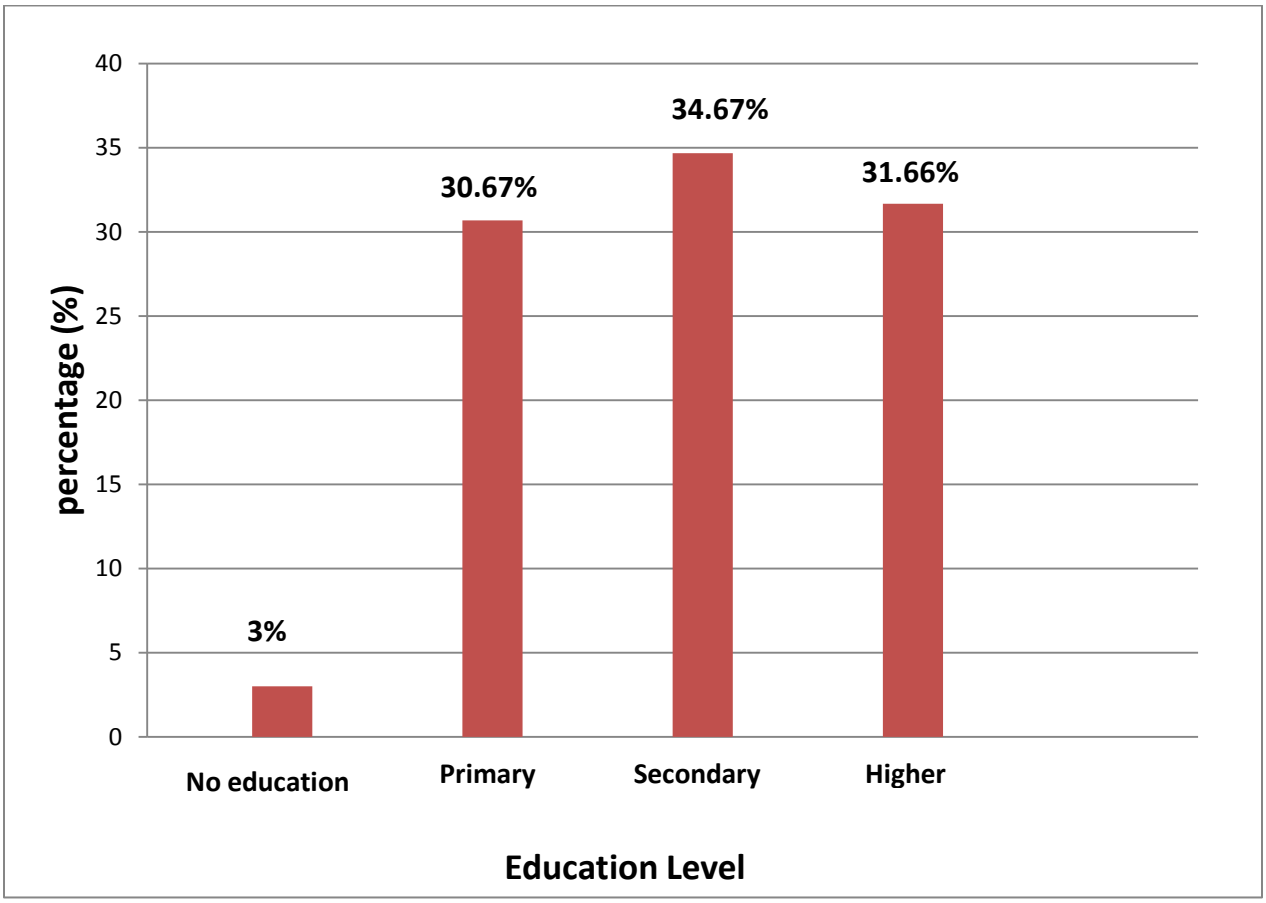


**Figure 4.12: Parents education distribution of respondents**

In this study, parents of maximum students (51.67%) were educated at secondary level, (31.66 %) were highly educated, (30.67%) parents were educated at primary level remaining parents of (3%) student's were not educated.

## 4.13: Habit of respondents

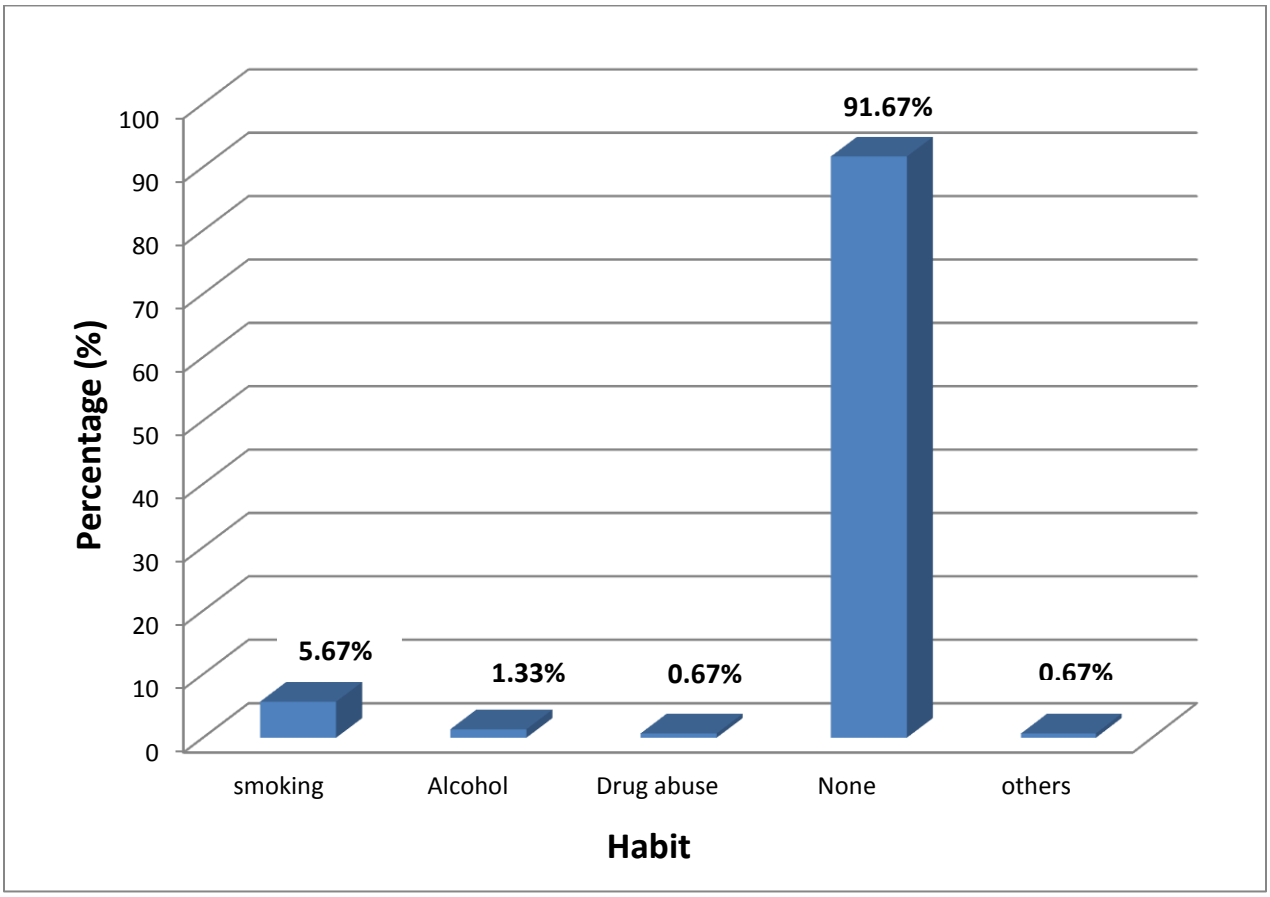


**Figure 4.13: Habit of respondents**

In this study, majority of the students (91.67%) had no bad habits, (5.67) % of respondents were smoker, (1.33%) consumed alcohol, (0.67%) were drug abuser, and remaining (0.67%) responded to others.

## 4.14. Respondents who are aware of the terminology 'TB'

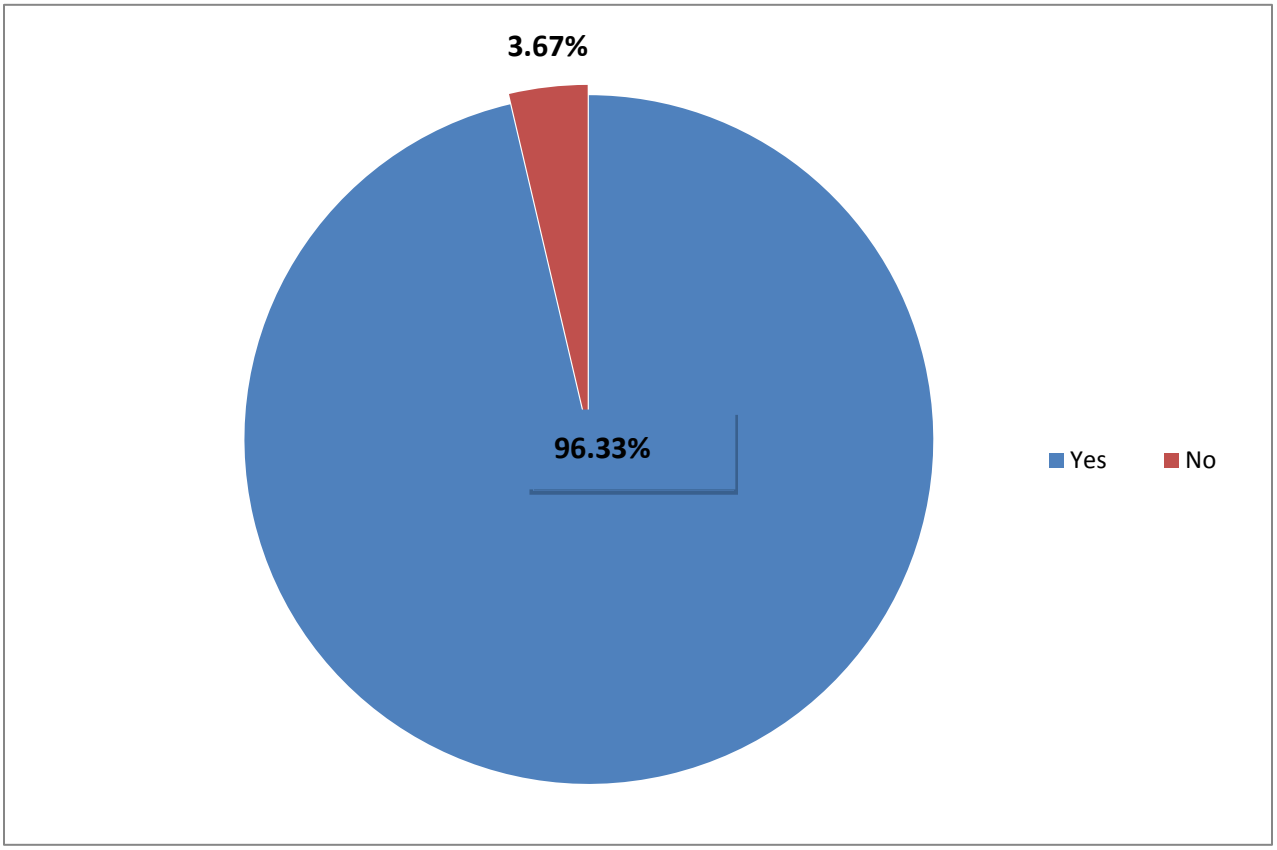


**Figure 4.14. Respondents who are aware of the terminology 'TB'**

In this study, majority of respondents (96.33%) confirmed that they had heard about TB whereas 2% respondents had not heard about TB.

## 4.15: Knowledge of TB as communicable disease

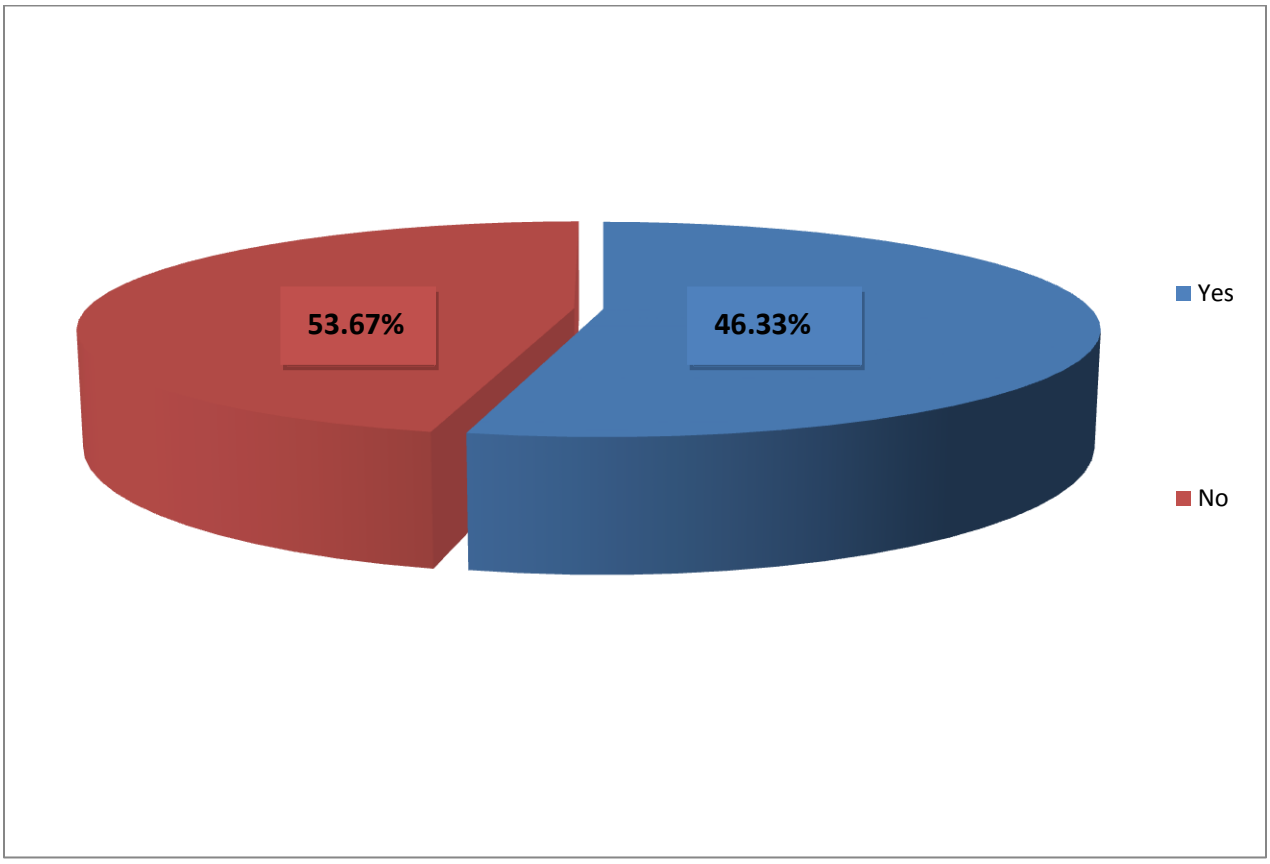


**Figure 4.15: Knowledge of TB as communicable disease**

Among the respondents, (53.67%) students responded to as TB a communicable disease whereas (46.33%) students had no idea about the term communicable and non-communicable diseases regarding TB.

## 4.16: Knowledge about latent TB

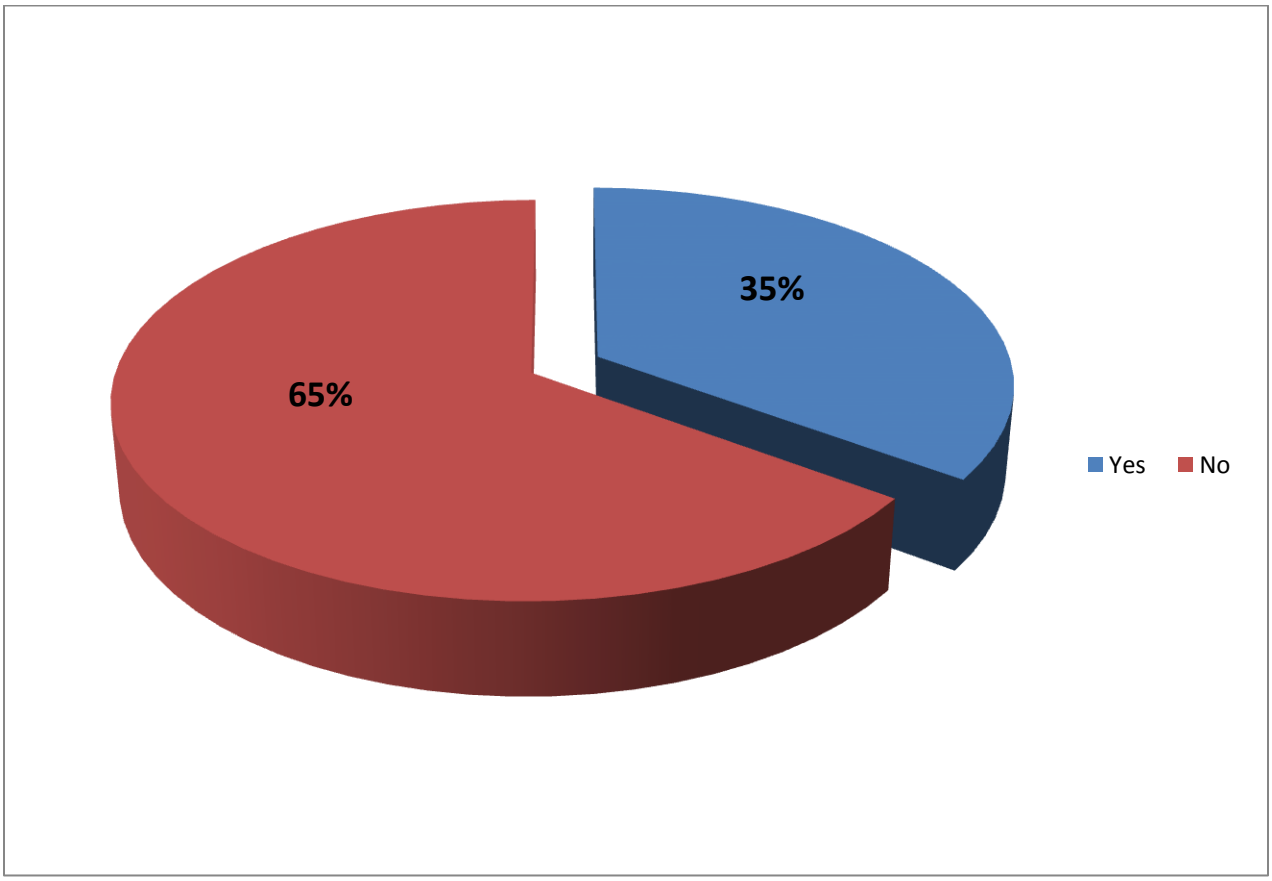


**Figure 4.16: Knowledge about latent TB**

In this study, majority of the respondents (65%) had no idea about latent TB whereas (35%) respondents had knowledge about latent TB.

## 4.17: Knowledge about TB as a major health problem in Bangladesh

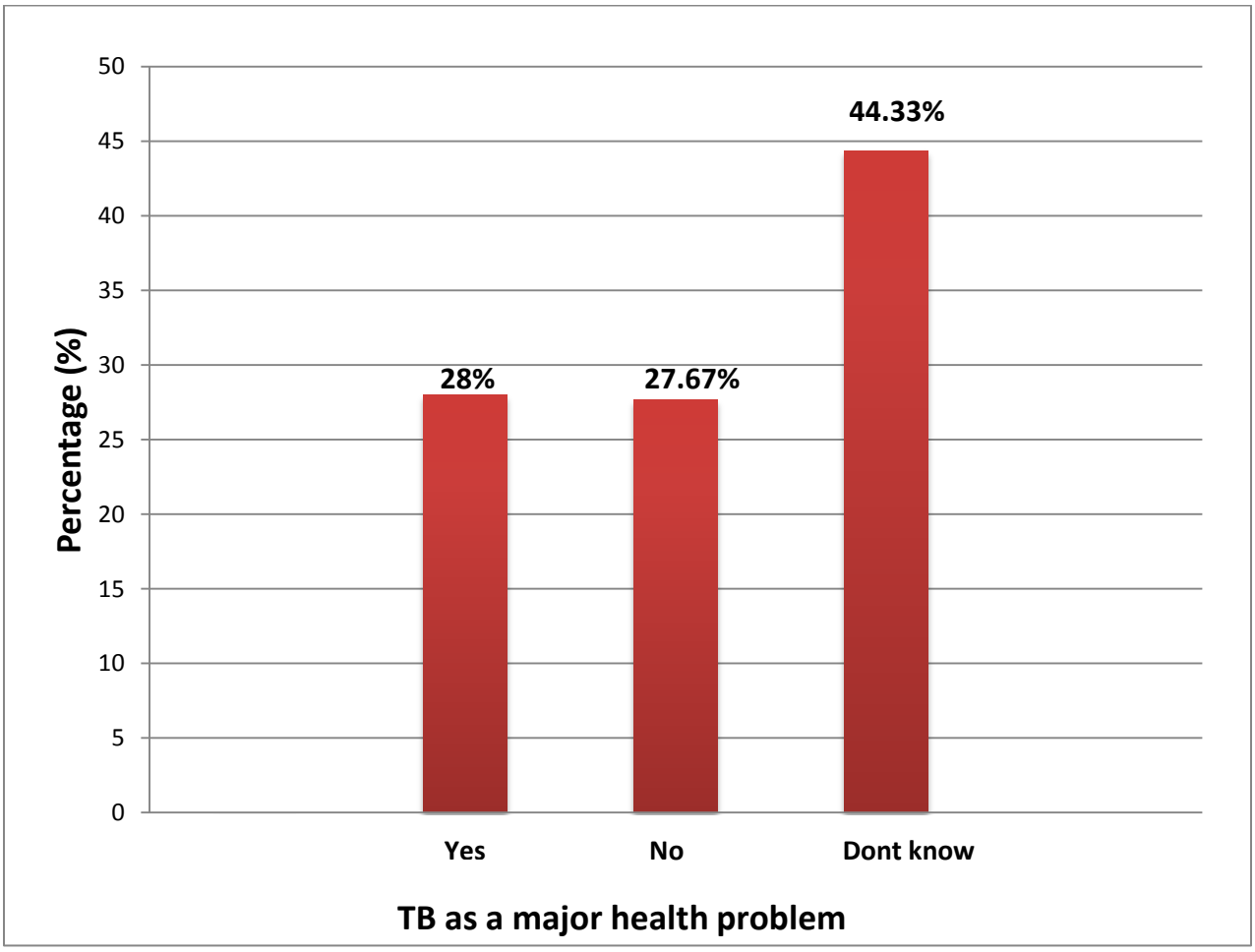


**Figure 4.17: 4.17: Knowledge about TB as a major health problem in Bangladesh**

When respondents were asked about whether TB as a major health problem or not, majority of the students about (44.33%) responded didn't know, (28%) of students considered TB as a major health problem in Bangladesh, (27.67%) of students had not idea about this.

## 4.18: Knowledge about causes of TB

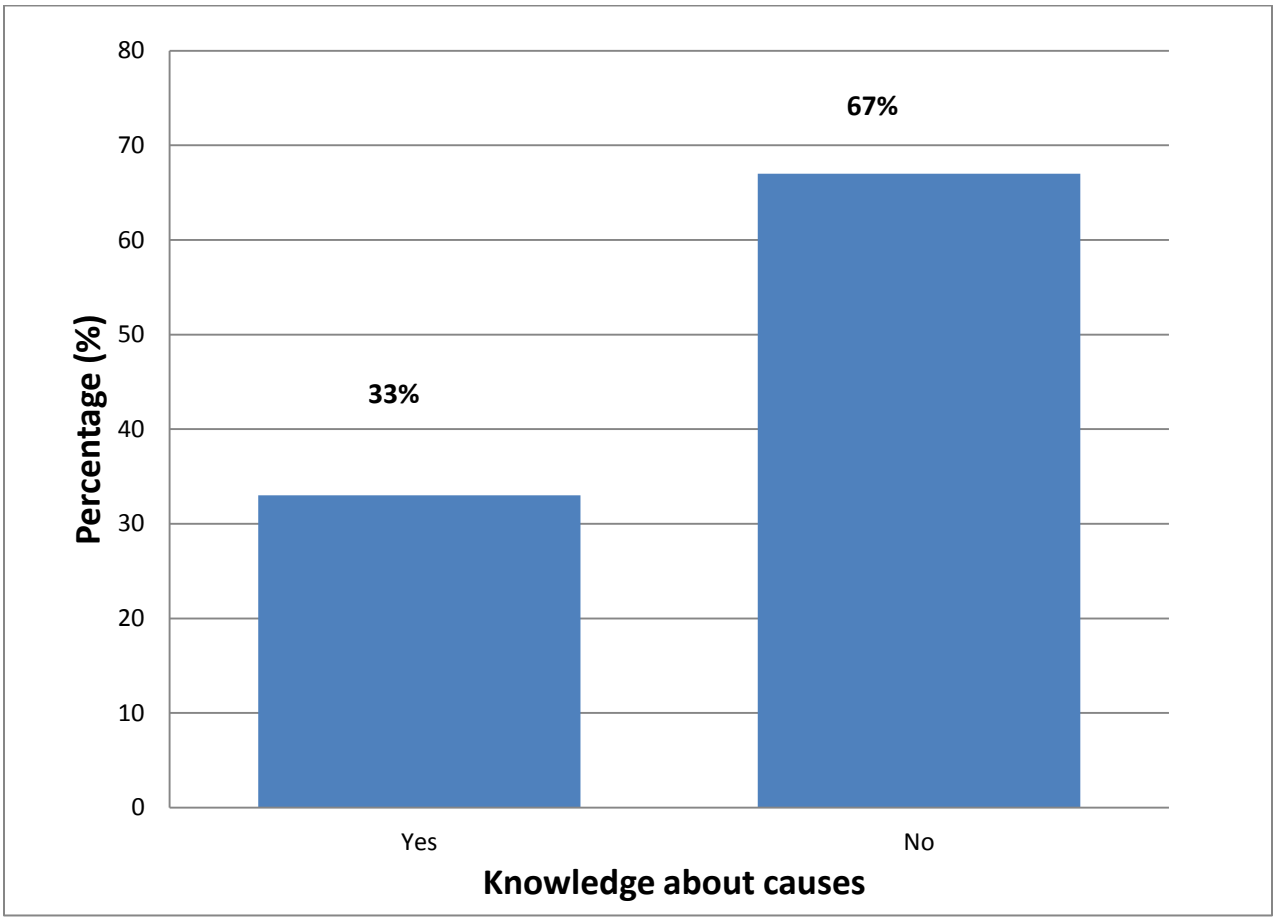


**Figure 4.18: Knowledge about causes of TB**

In this study, only (33%) of the respondents had knowledge about the causes of TB whereas maximum students (67%) had no idea about the causes of TB.

## 4.19. Causes of TB

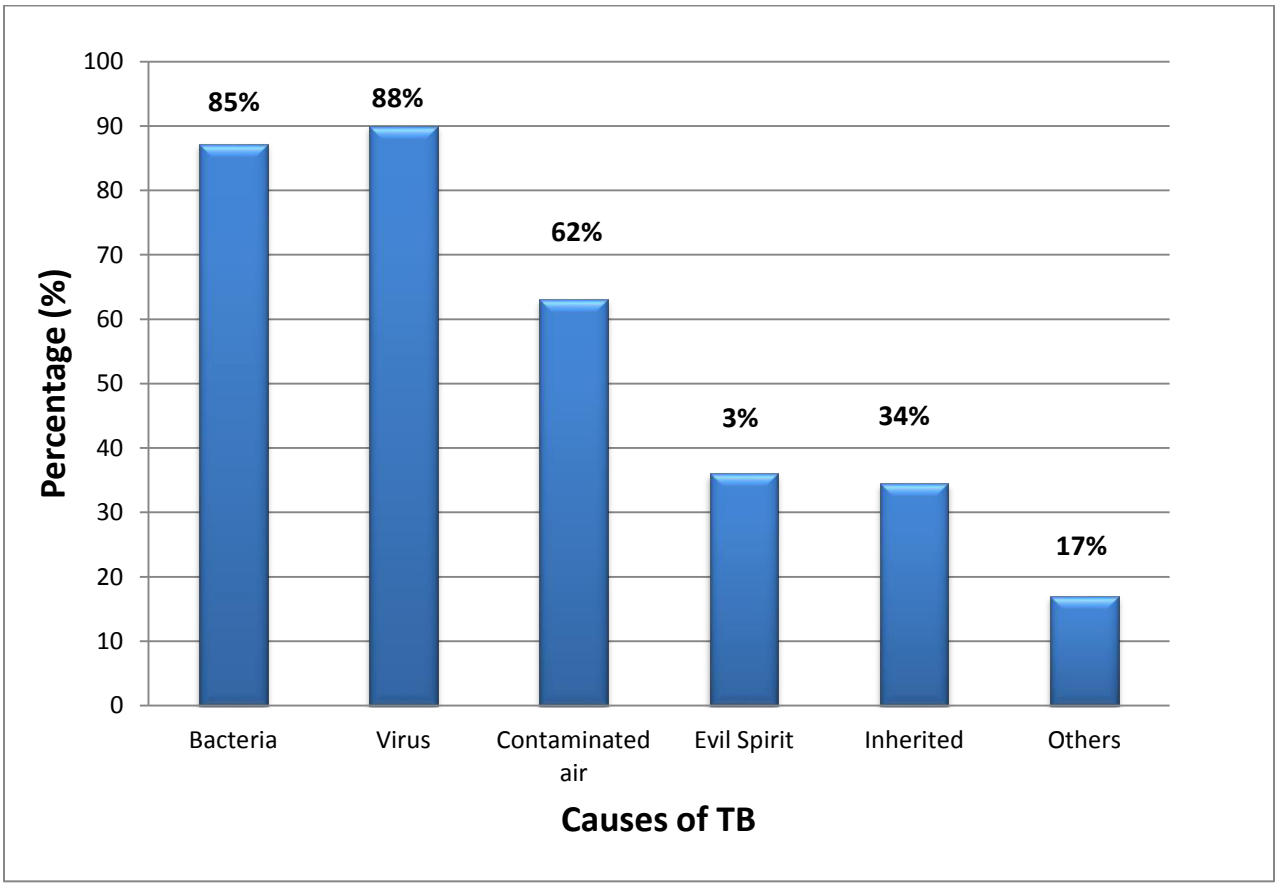


**Figure 4.19. Causes of TB**

Among the total respondents, majority of the students about (88%) claimed that virus can cause TB followed by (85%) of students responded that bacteria, (62%) contaminated air, (34%) inherited disease, (17%) thought others factor and remaining (3%) believed evil spirit can cause TB.

## 4.20. Knowledge about sign & symptoms of TB

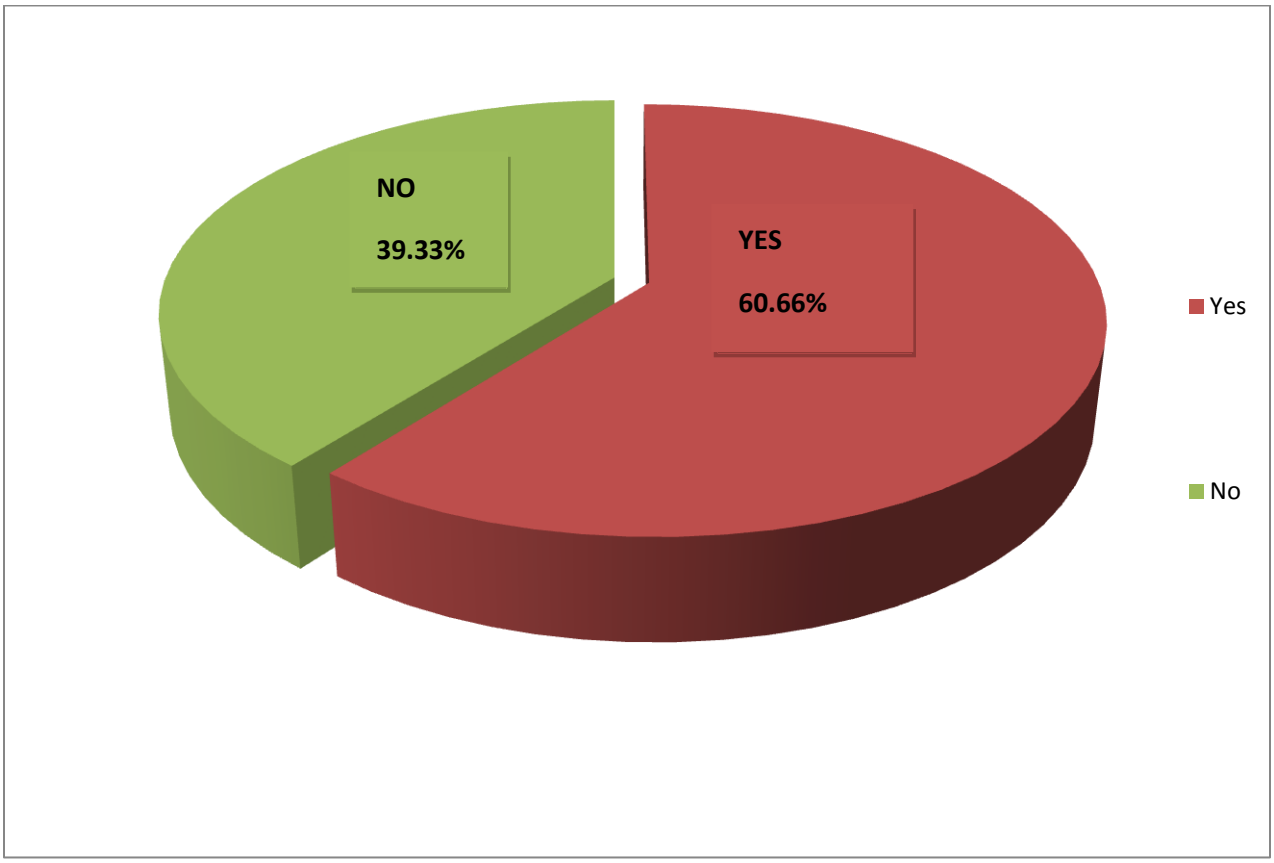


**Figure 4.20. Knowledge about sign & symptoms of TB**

In this study, about (60.66%) students were aware of the sign & symptoms of TB but remaining (39.33%) of had no idea about sign & symptoms of TB.

## 4.21: Awareness of sign & symptoms of TB

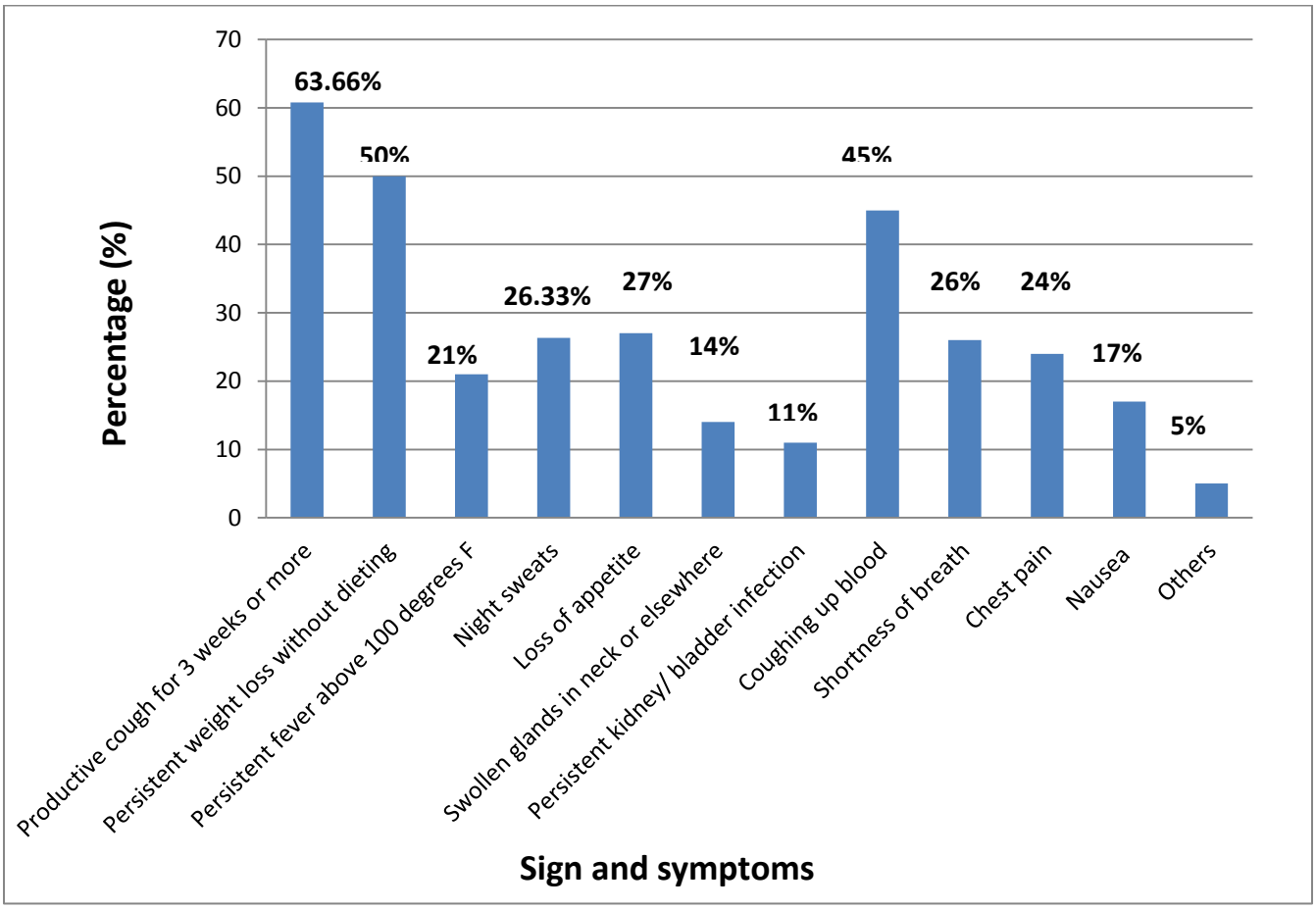


**Figure 4.21: Awareness of sign & symptoms of TB**

Among the total respondents, (63.66%) students were aware of productive cough for 3 weeks or more as TB warning sign, (50%) of students were aware of persistent weight loss without dieting as TB warning sign,( 45%) of students were aware of coughing up blood as a TB sign. Also (27%) mentioned loss of appetite, (26.33%) mentioned night sweats, (26%) mentioned shortness of breath, (24%) mentioned chest pain, (21%) mentioned persistent fever above 100 degrees F, (17%) mentioned nausea, (14%) mentioned swollen glands in neck or elsewhere, (11%) mentioned persistent kidney/ bladder infection and remaining (5%) mentioned other factors as sign & symptoms of TB.

## 4.22. Knowledge about spread of TB

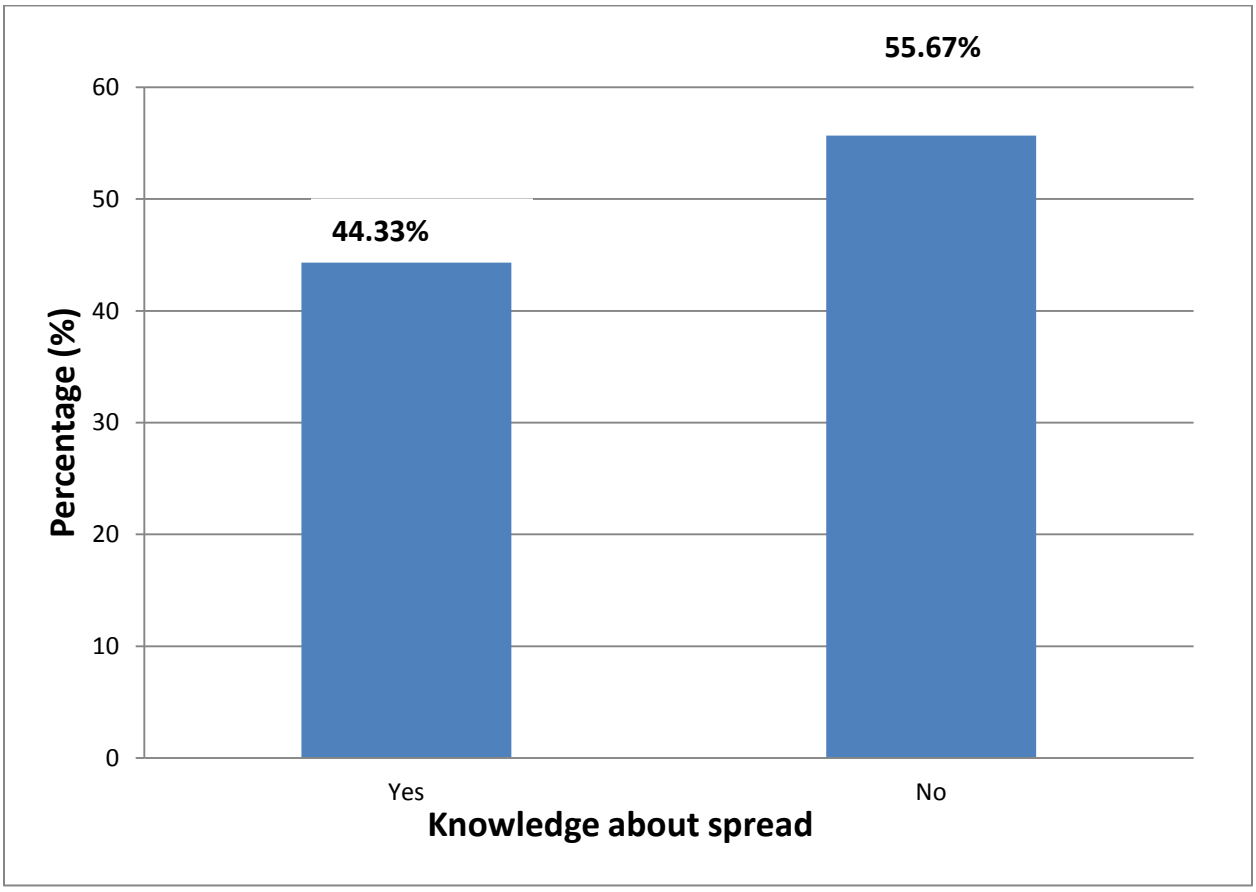


**Figure 4.22. Knowledge about spread of TB**

In this study, (55%) of respondents had no knowledge about spread of TB and remaining (44.33%) respondents had knowledge about spread of TB.

## 4.23: Awareness of mode of spread of TB

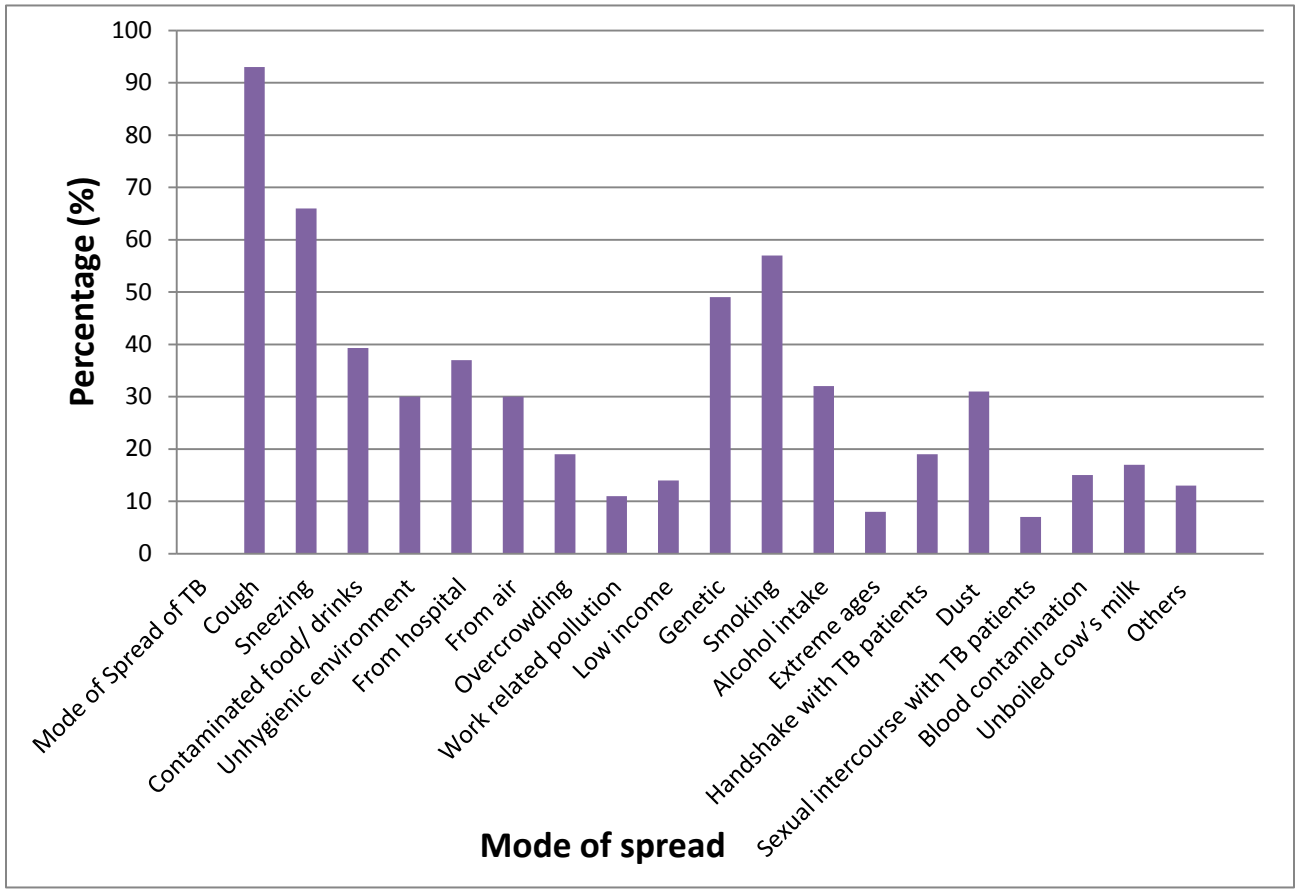


**Figure 4.23: Awareness of mode of spread of TB**

Among the total respondents, ( 93% ) agreed that TB disease can spread through cough, 66% knew that TB is spread through sneezing, (57%) believed it can be spread via smoking, 49% claimed TB can be spread genetically. Also contaminated food/ drinks (39.33%), (37%) from hospital,(32%) alcohol intake, (31%) dust, (30%) unhygienic environment, (30%) from air, (19%) overcrowding, (19%) handshake with TB patients, (17%) unboiled cow's milk, (15%) blood contamination, (14%) low income, (13%) other factors, (11%) work related pollution, (8%) extreme ages, (7%) sexual intercourse with TB patients have believed as modes of spread of TB.

## 4.24: Knowledge about TB affected organ

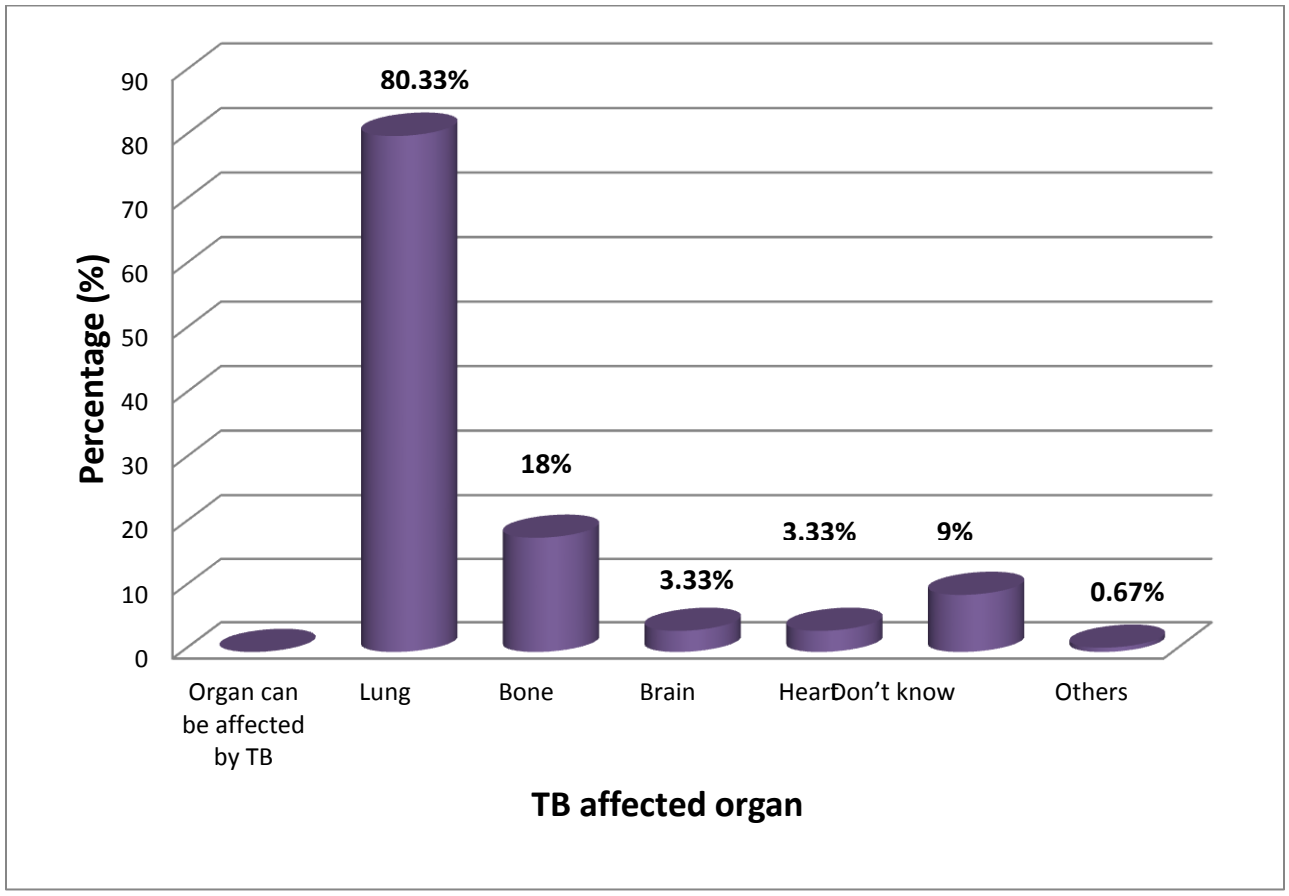


**Figure 4.24: Knowledge about TB affected organ**

In this study, (80.33%) of students responded that lung can be affected by TB, followed by (18%) bone, (9%) had no idea, heart (3.33%), (3.33%) brain, (0.67%) other organ had been mentioned that can be affected by TB.

## 4.25: Tb Affected people

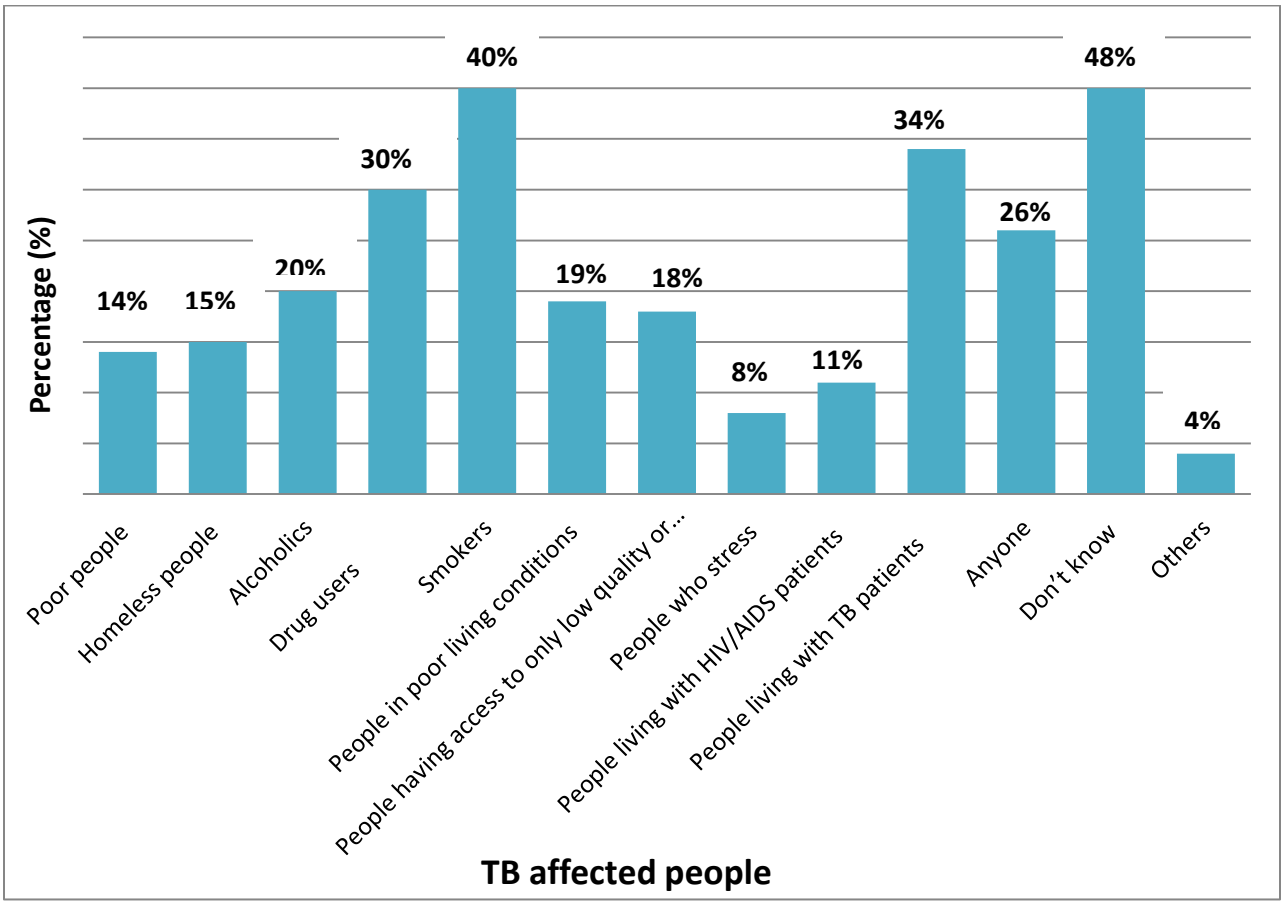


**Figure 4.25: TB Affected people**

In this study, (52%) students had idea that which type of people can be affected by TB and (48%) students had no idea that which type of people can be affected by TB. Among 52% of students, (40%) believed that smokers can be affected by TB followed by (34%) people living with TB patients, (30%) mentioned drug users, (26%) perceived that anyone can be affected, (20%) alcoholics, (19%) people in poor living conditions, (18%) people having access to only low quality or lack of food, (15%) homeless people,(14%) poor people, (11%) people living with HIV/AIDS patients, (8%) people who stress and (4%) responded to others.

## 4.26: Knowledge about curability of TB disease

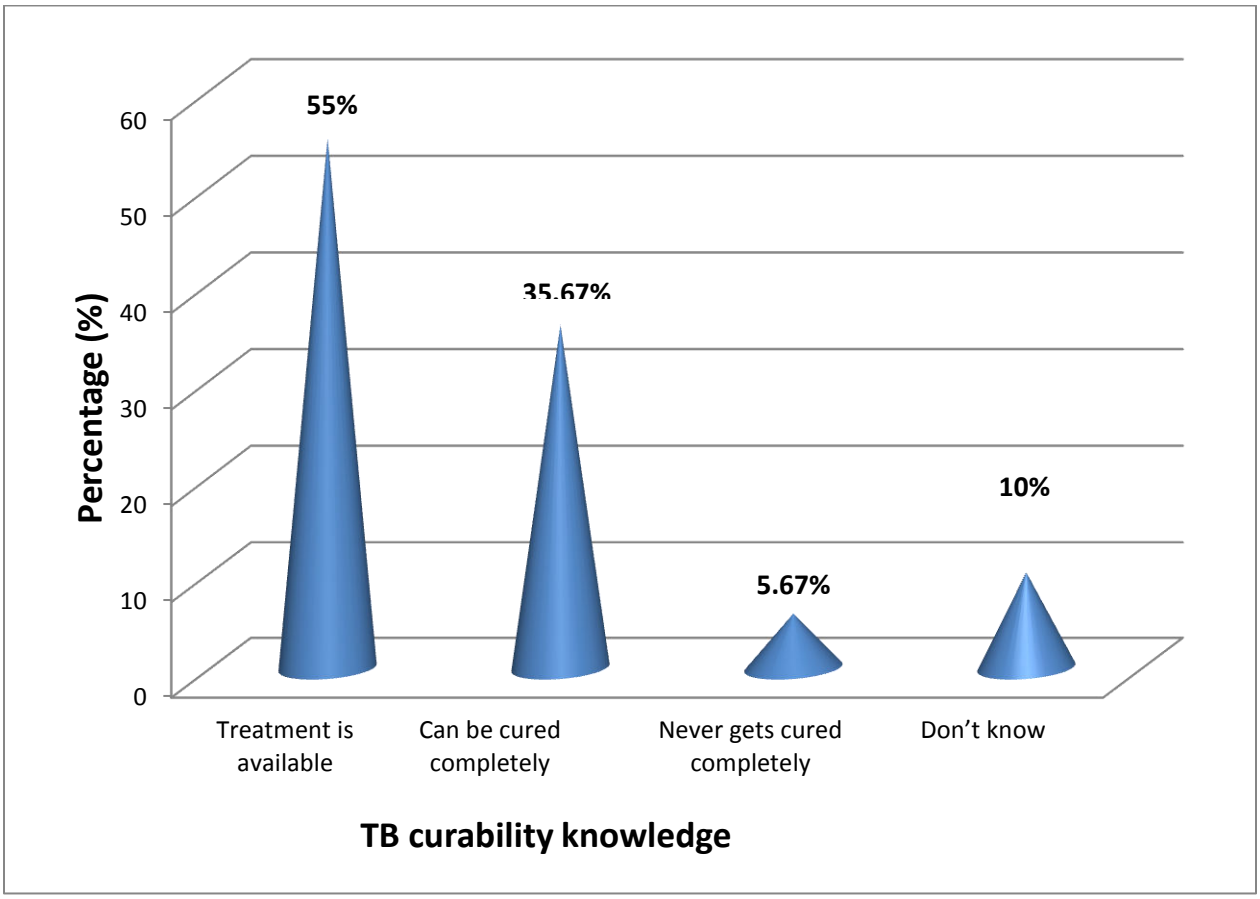


**Figure 4.26: Knowledge about curability of TB disease**

Of the respondents, majority (55%) students believed that treatment of TB is available, (35.67%) students believed that TB can be cured completely, (10%) of students had no idea about it and remaining (5.67%) believed that TB can never be cured completely.

## 4.27: Knowledge about whether TB causes death or not

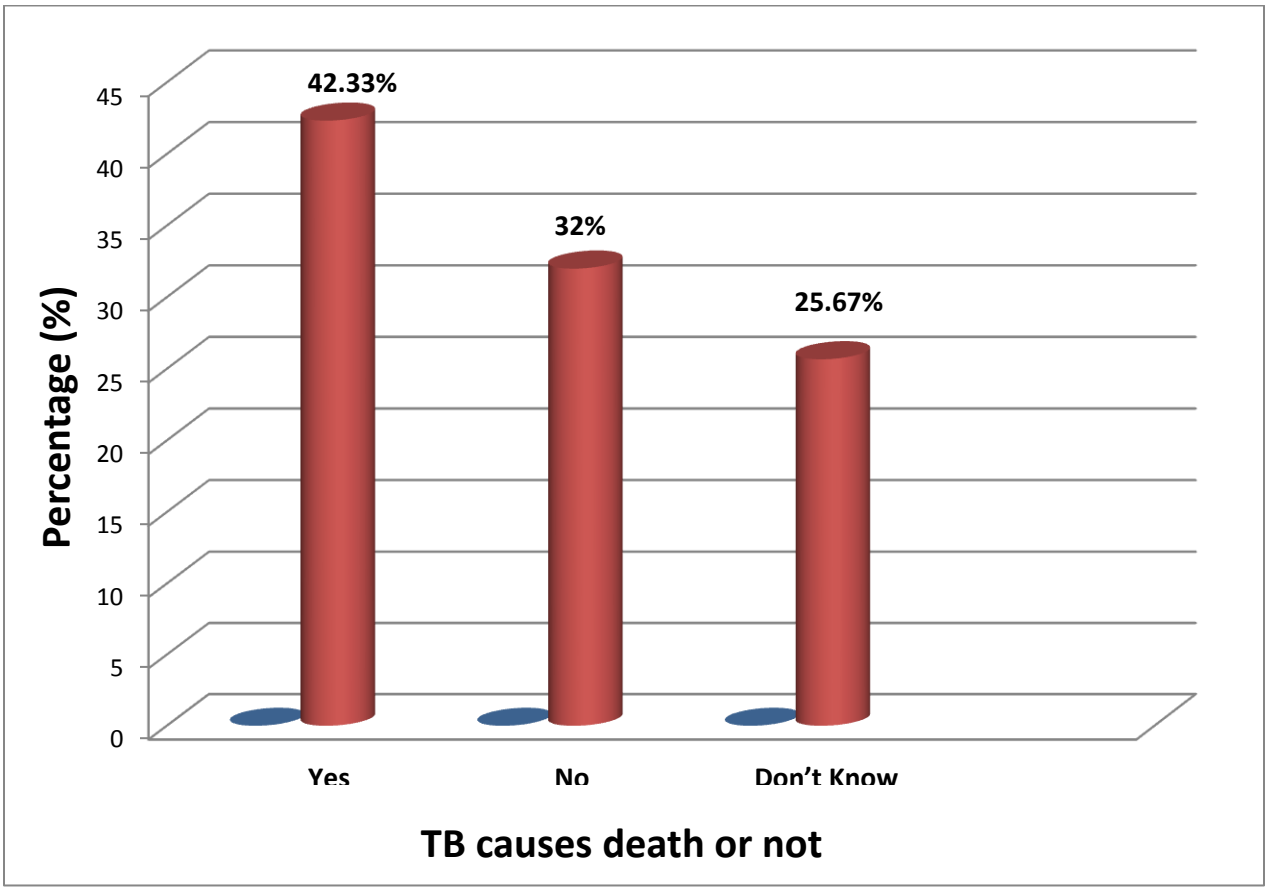


**Figure 4.27: Knowledge about whether TB causes death or not**

In this study, majority of the students (42.33%) reported that TB can cause death, (32%) students thought that TB doesn't cause death and remaining (25.67%) of students had no idea whether TB causes death or not.

## 4.28: Awareness of BCG vaccine

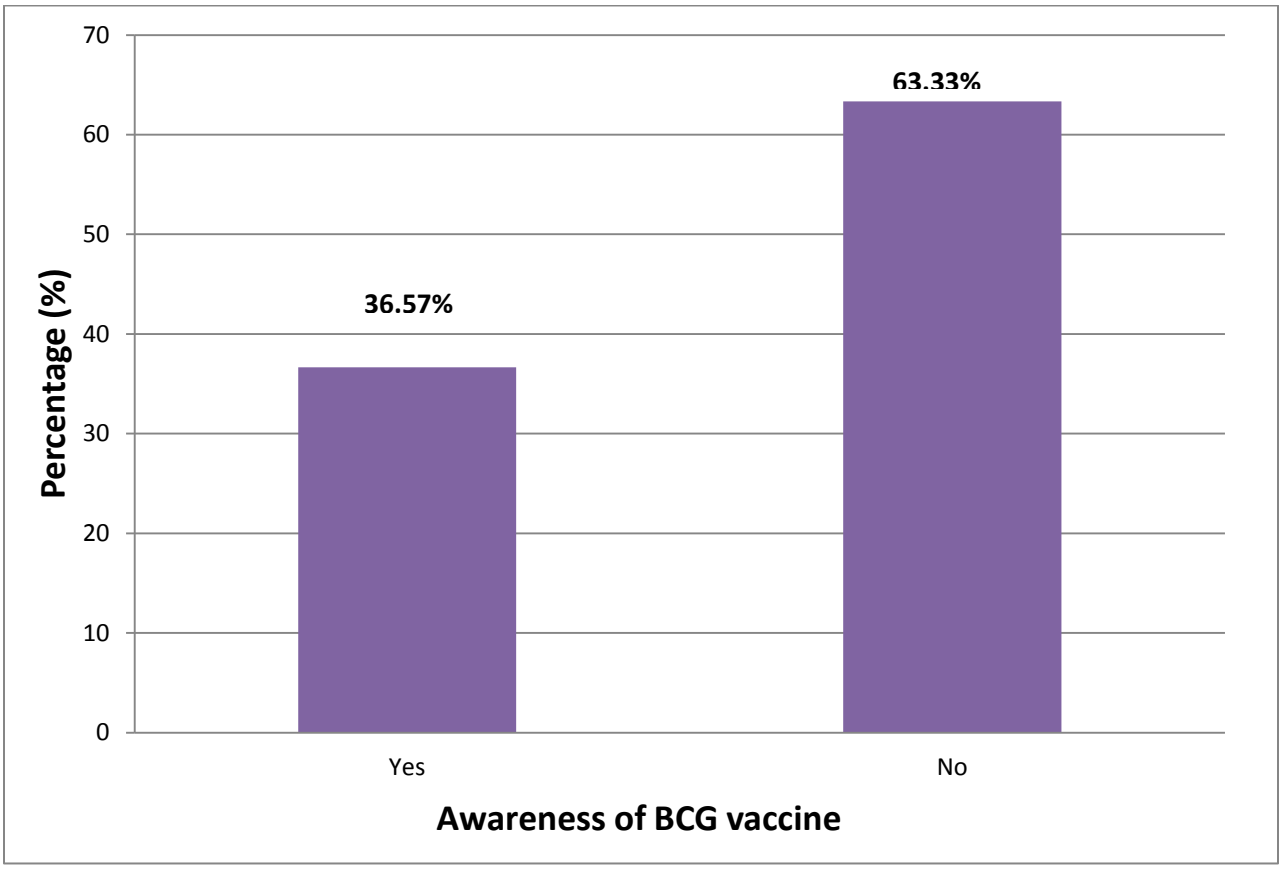


**Figure 4.28: Awareness of BCG vaccine**

In this study, maximum respondents (63.33%) had no idea about BCG vaccine against TB while remaining (36.57%) of students heard about BCG vaccine against TB.

## 4.29: Knowledge about cost of TB diagnosis & treatment in this country

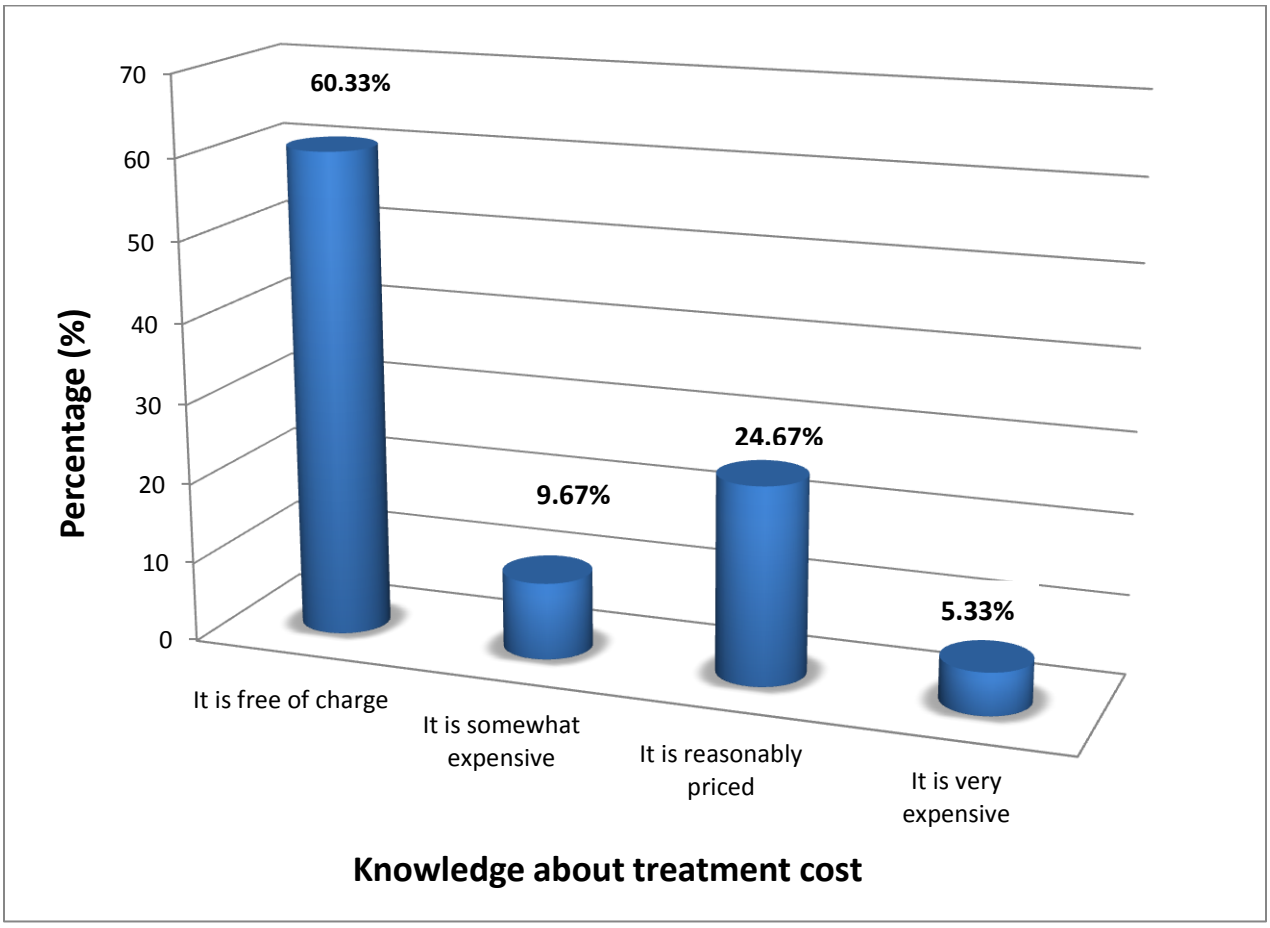


**Figure 4.29: Knowledge about cost of TB diagnosis & treatment in this country**

In this study, majority of the respondents (60.33%) believed that treatment of TB is free of charge, (24.67%) respondents mentioned that treatment of TB is reasonably priced,(9.67%) of students thought that it is somewhat expensive and remaining (5.33%) of students responded that it is very expensive.

## 4.30 Knowledge about TB treatment

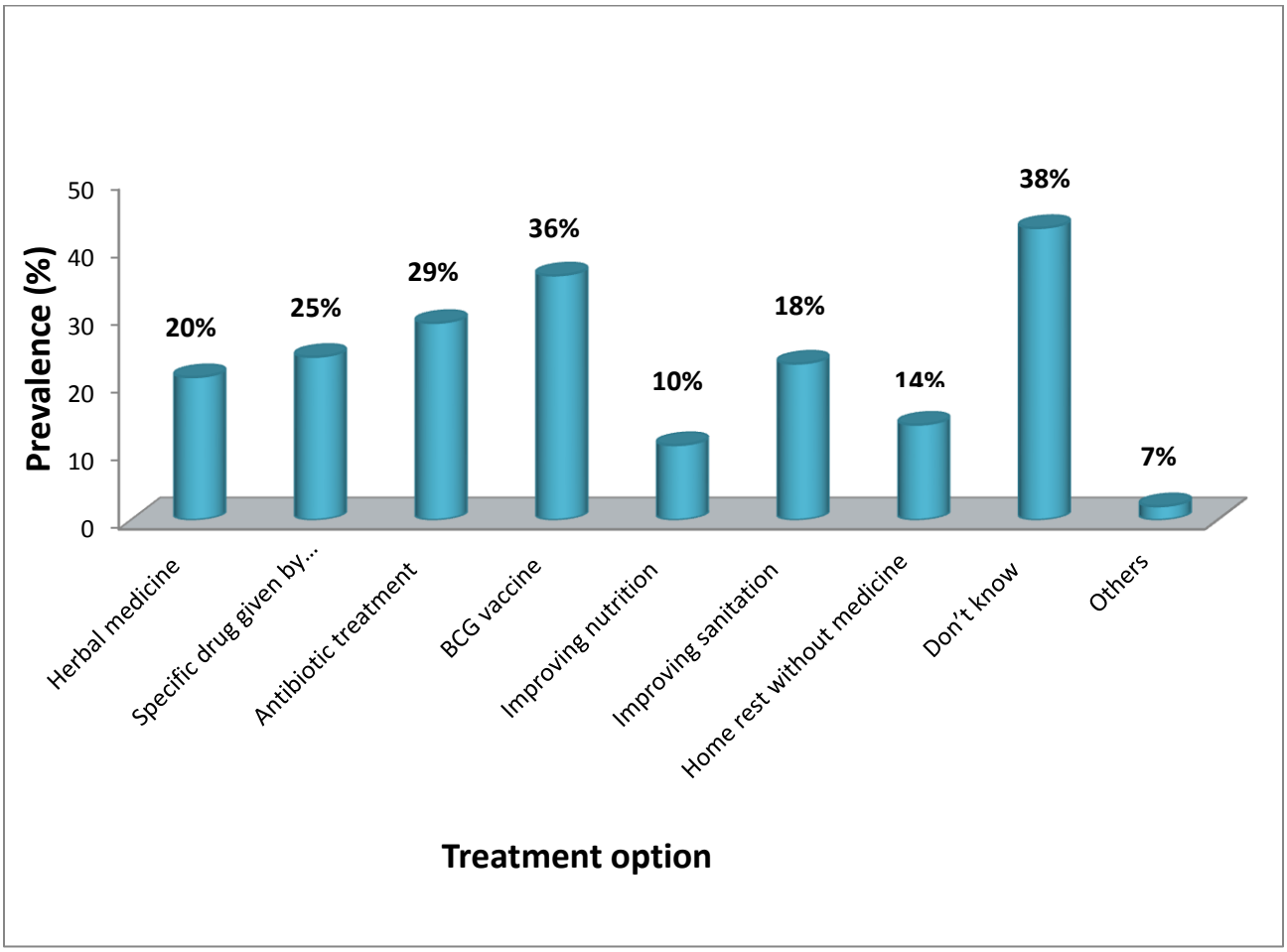


**Figure 4.30: Knowledge about TB treatment**

In this study, 116 (38.57%) of students had no idea about how TB can be cured. Among the 184 (61.33%) of students who had idea about the way of TB curability, 25% mentioned that it can be cured by specific drug given by healthcare provider, 20% said that TB can be cured by herbal medicine, 36% believed that it can be prevented by BCG vaccine, 29% mentioned that antibiotic treatment can completely cured TB. 18%, 14%,10% students believed that TB can be cured by improving sanitation, home rest without medicine, improving nutrition respectively and 7% respondents thought that other options can be applied for the treatment of TB.

## 4.31: Awareness of DOTs (Directly Observed Treatment)

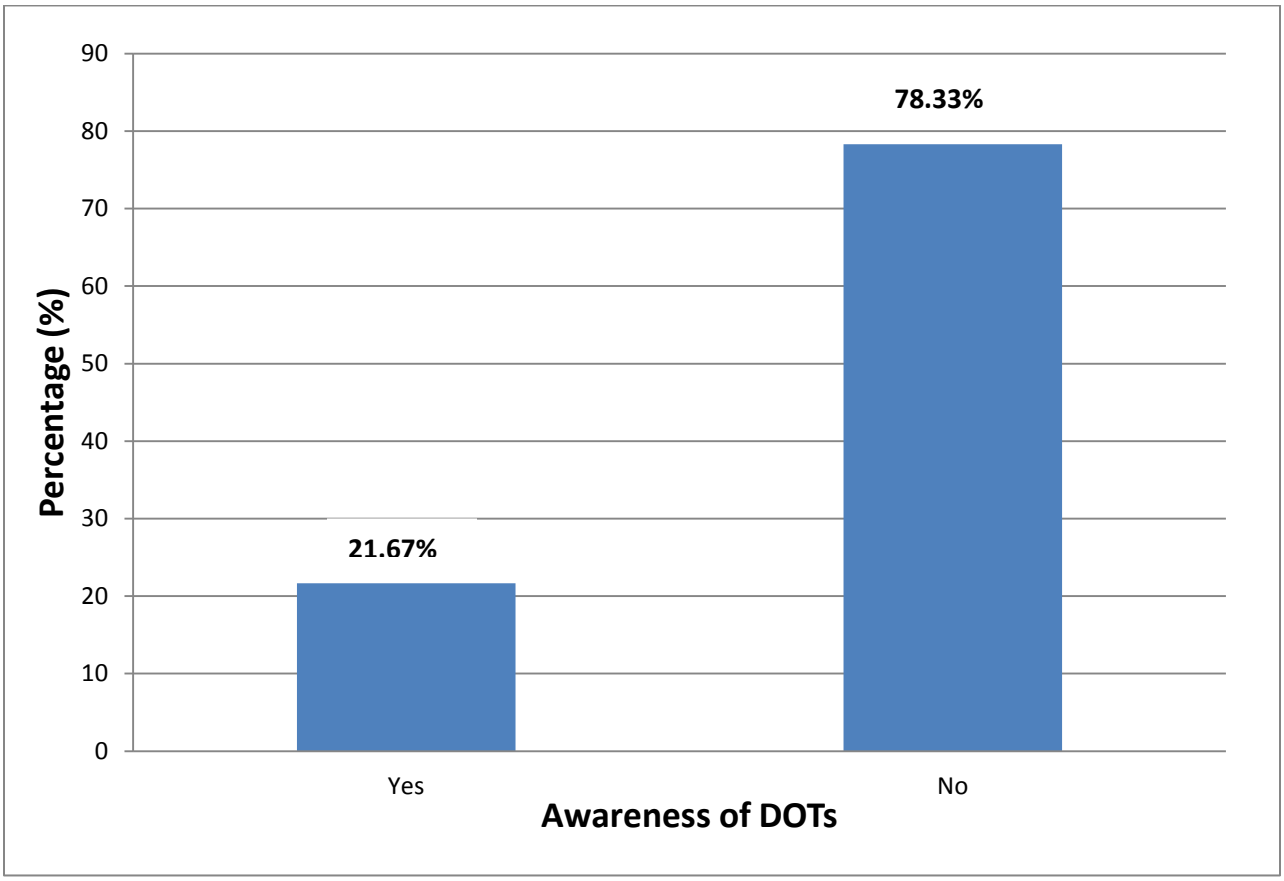


**Figure 4.31: Awareness of DOTs (Directly Observed Treatment)**

Majority of the students (78.33%) in this study were not aware of DOTs (Directly Observed Treatment) and resulting students (21.67%) were aware of DOTs.

## 4.32: Initial investigation for TB patient

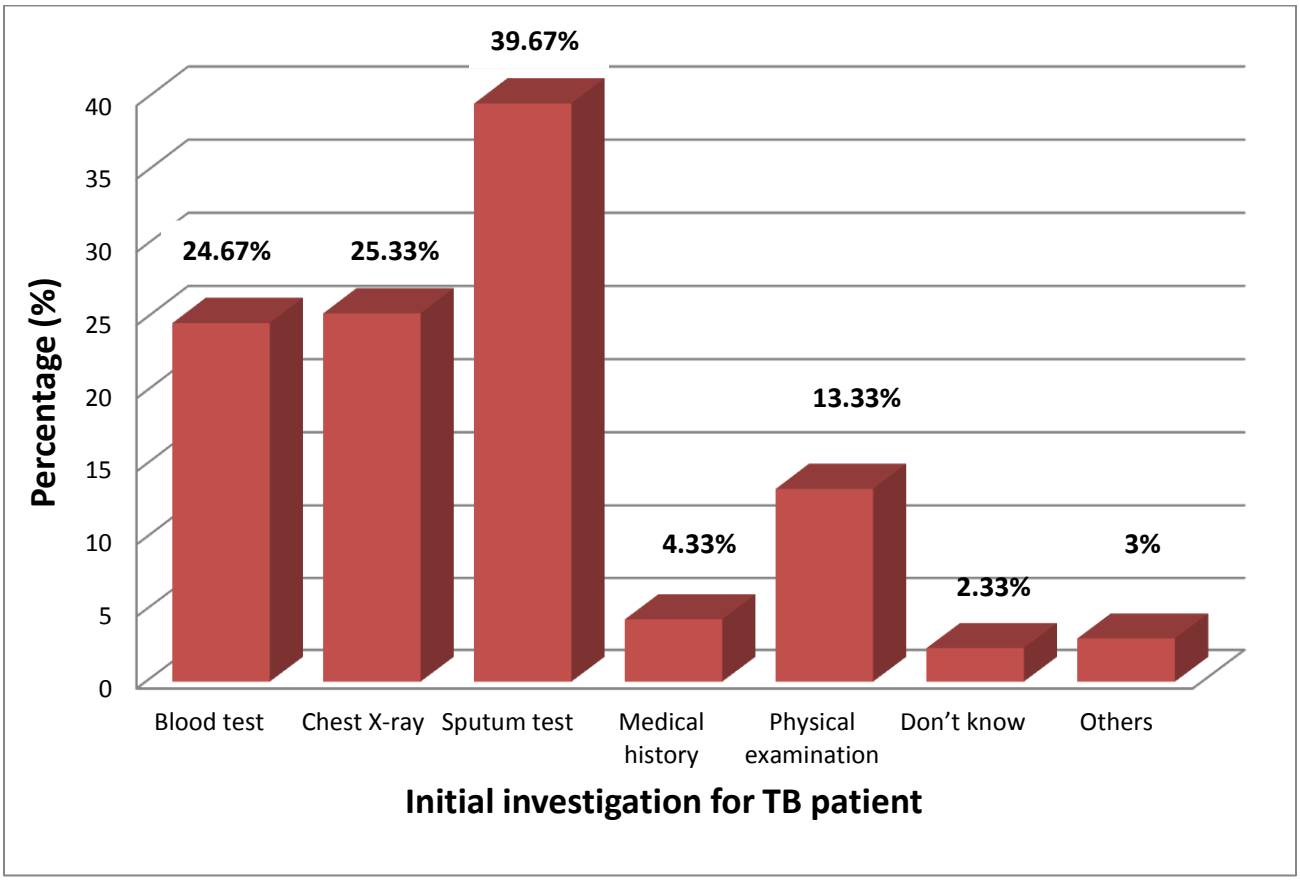


**Figure 4.32: Initial investigation for TB patient**

Among the respondents, (39.67%) stated sputum test should be done as initial investigation for TB patients followed by (25.33%) chest X-ray, (24.67%) blood test, (13.33%) physical examination, (4.33%) medical history and remaining (3%) thought TB can be investigated by other methods and the remaining.

## 4.33: Knowledge about place of TB treatment

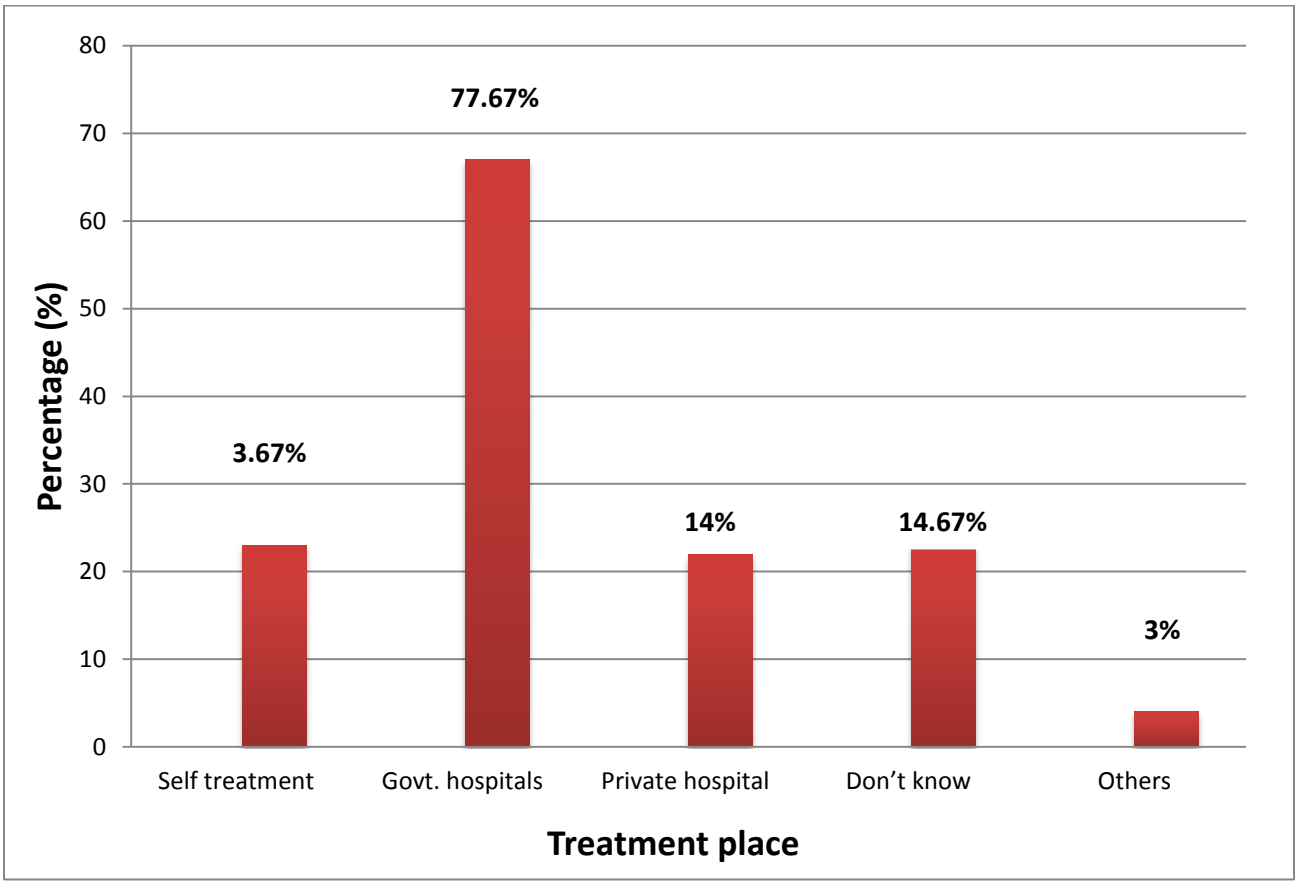


**Figure 4.33: Knowledge about place of TB treatment**

In this study, 44 (14.67%) of students had no idea about the place from where one can take treatment of TB and remaining students 256 (85.33%) had idea about this. Among the (85.33%) of students, majority of the students (77.67%) believed one can take treatment from govt. hospitals, followed by (14%) private hospitals, (3.67%) self treatment and only (3%) stated that treatment can be taken from other place.

## 4.34: Knowledge about duration of TB treatment

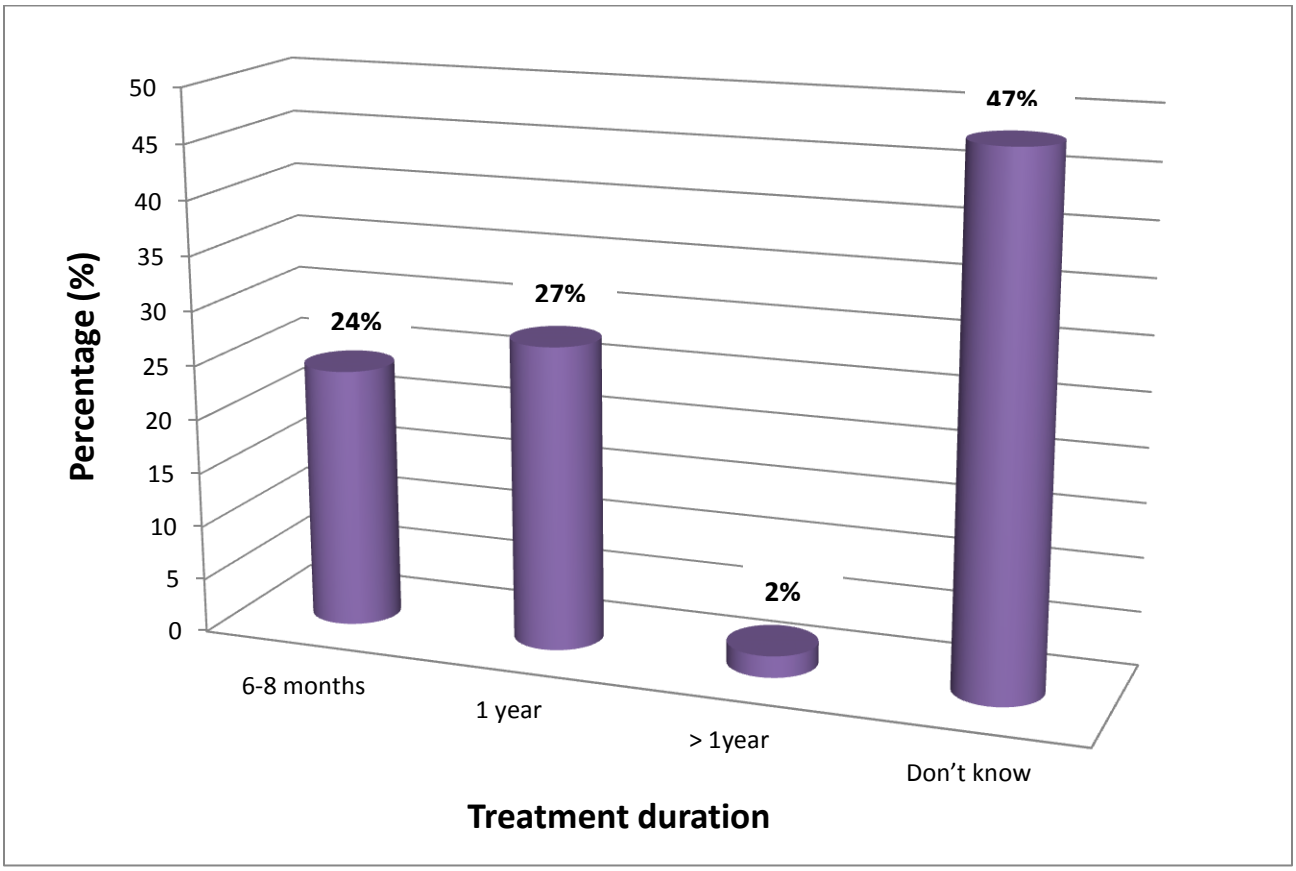


**Figure 4.34: Knowledge about duration of TB treatment**

In this study, majority of respondents (47%) were not aware of duration of TB treatment. 27% stated treatment duration is 1 year, (24%) of students were aware about the duration of treatment of TB as 6-8 months, and (2%) mentioned treatment duration is more than 1 year.

## 4.35: Respondents who are affected by TB

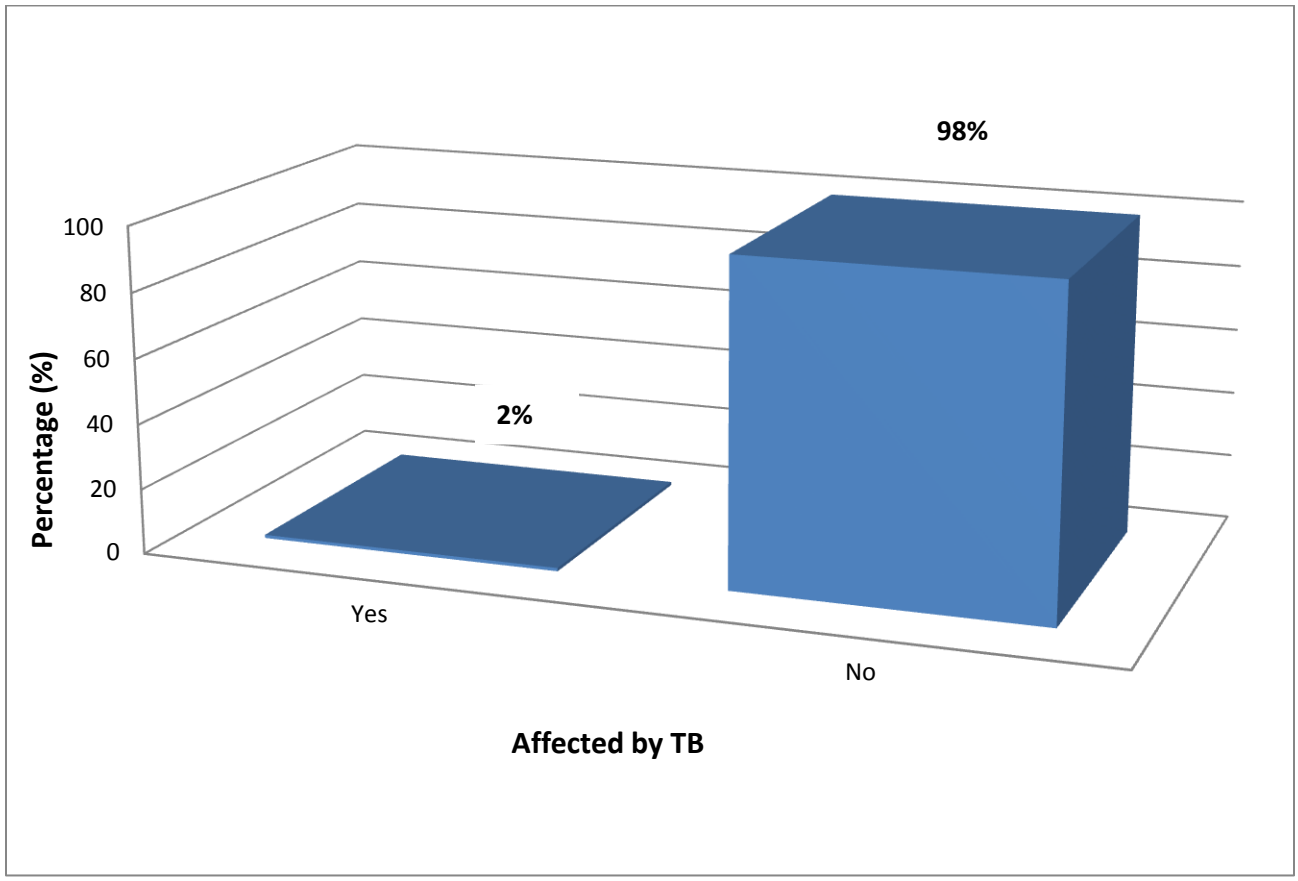


**Figure 4.35: Respondents who are affected by TB**

In this study, (98%) of students were not affected by TB and only (2%) of students were affected by TB.

## 4.36: Perception on being a TB patient

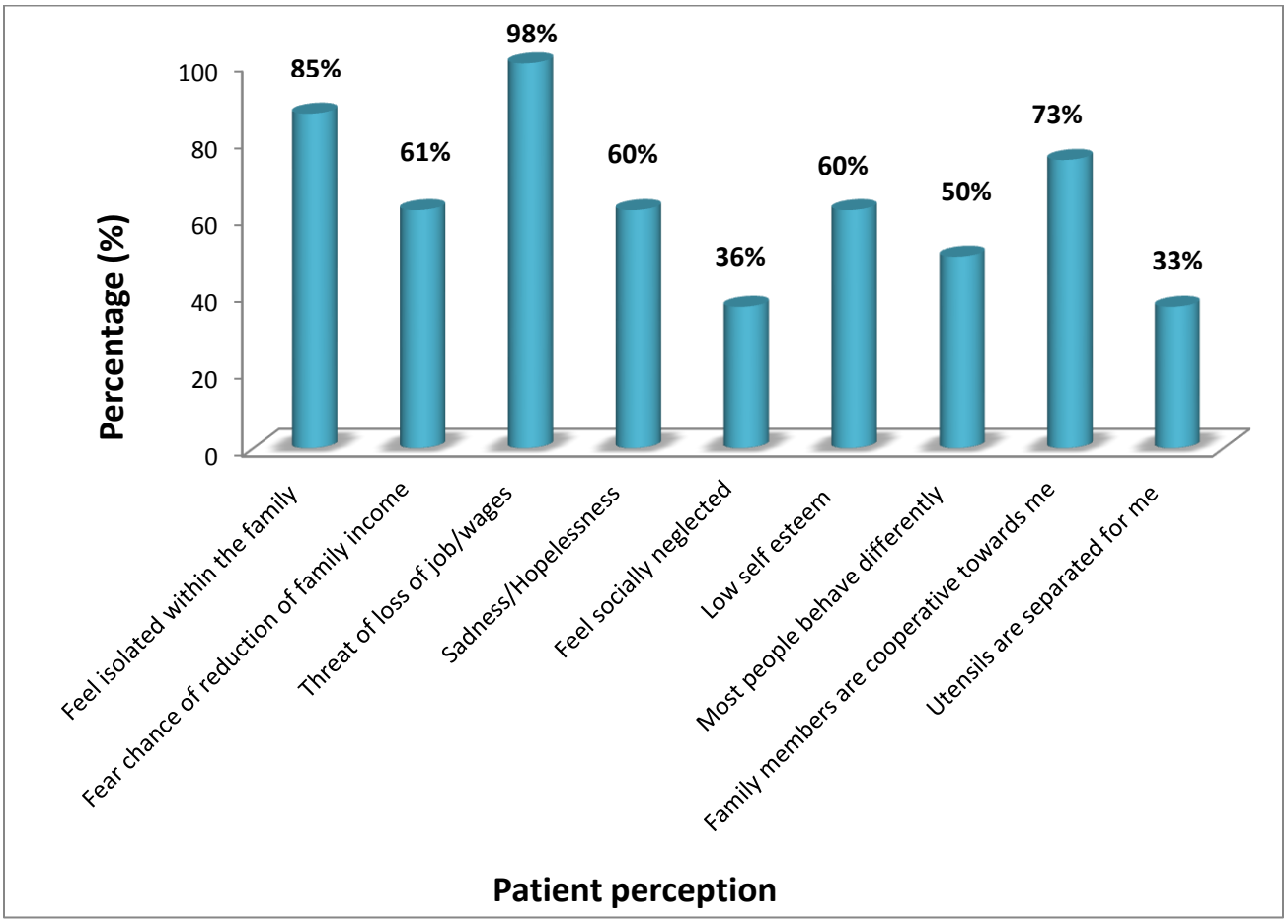


**Figure 4.36: Perception on being a TB patient**

In this study, only 2% respondents were affected by TB. Among them (98%) said they felt threat of loss of job/wages followed by (85%) felt isolated within the family, (61%) felt fear to chances of reduction of family income, (73%) said family members were cooperative toward them, (60%) felt sad/hopeless, (60%) low self esteem, (50%) said most people behaved with them differently, (36%) stated that they socially neglected, respectively, (33%) stated that utensils were separated for them.

## 4.37: When should one get tested for TB

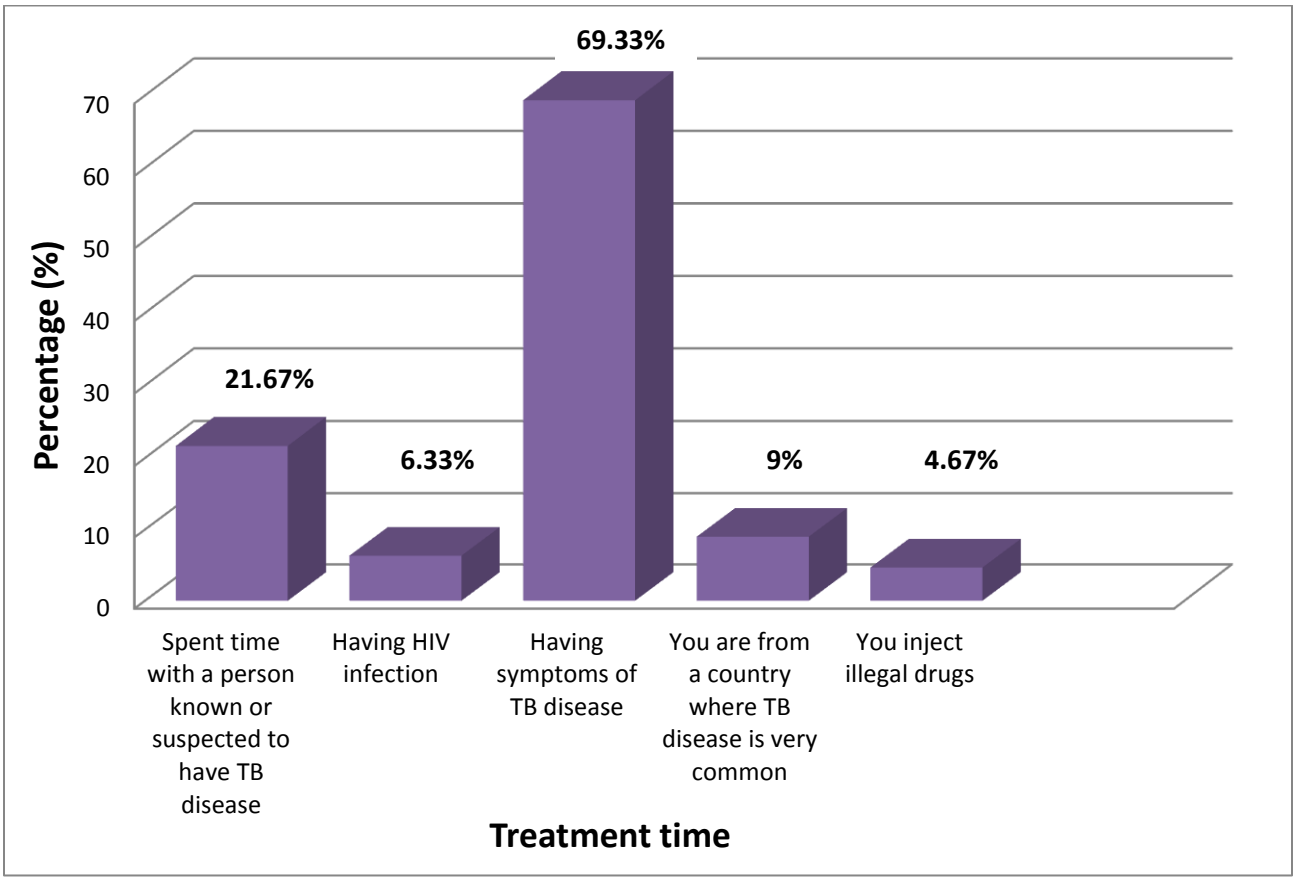


**Figure 4.37: When should one get tested for TB**

Among the respondents, 40% didn't know about the situation of when one should get tested for TB and 60% knew about it. Among the 60%, majority (21.67%) of respondents said spent time with a person known or suspected to have TB disease followed by (6.33%) having HIV infection, (9%) stated being from a country where TB disease is very common, (4.67%) stated that they should get tested TB if they take any illegal drugs.

## 4.38: Possibility of TB sufferer going back to work

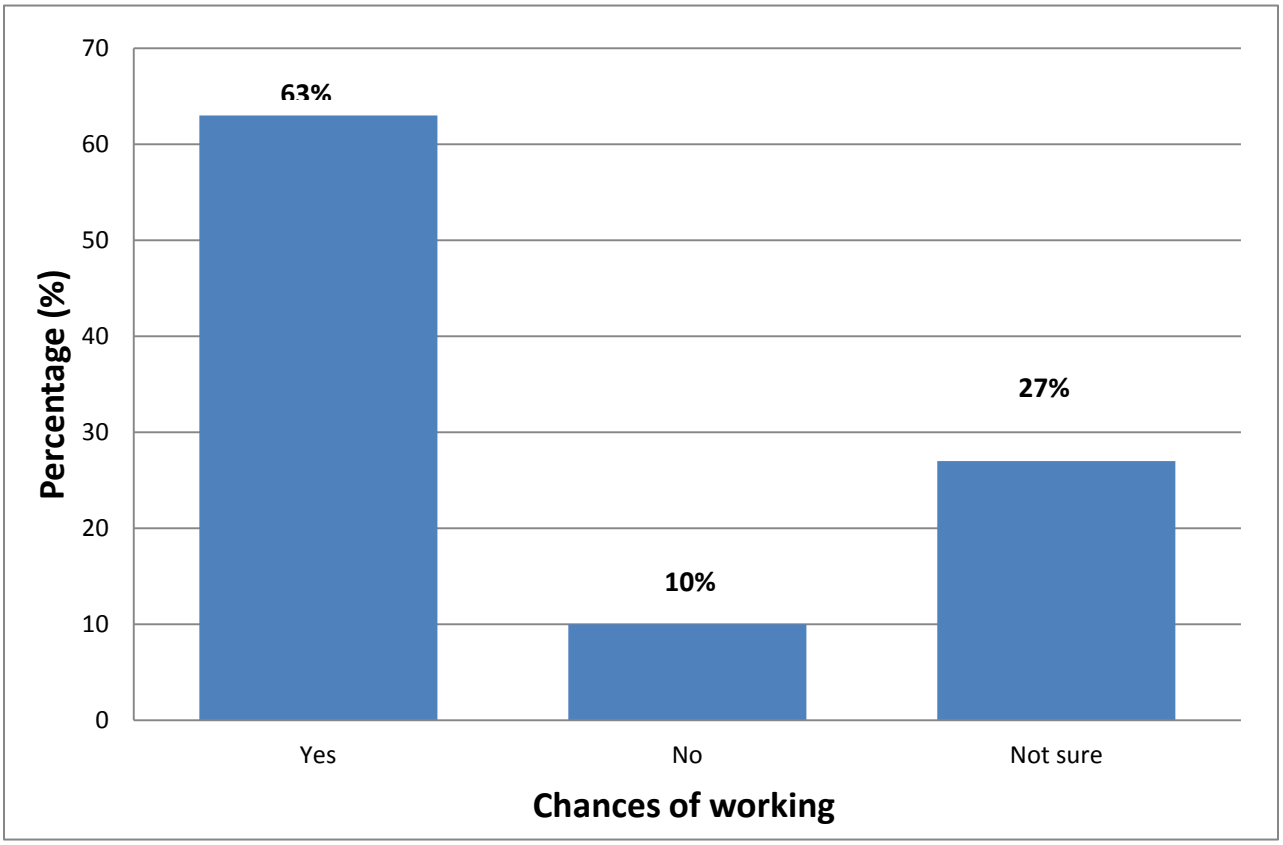


**Figure 4.38: Possibility of TB sufferer going back to work**

Among the respondents, (63%) of students said that a TB sufferer who is taking TB drugs can go back to work, (27%) of students were not sure whether a TB sufferer can go back to work or not and (10%) of students had no idea about it.

## 4.39: Precautions to be taken by a TB Patient

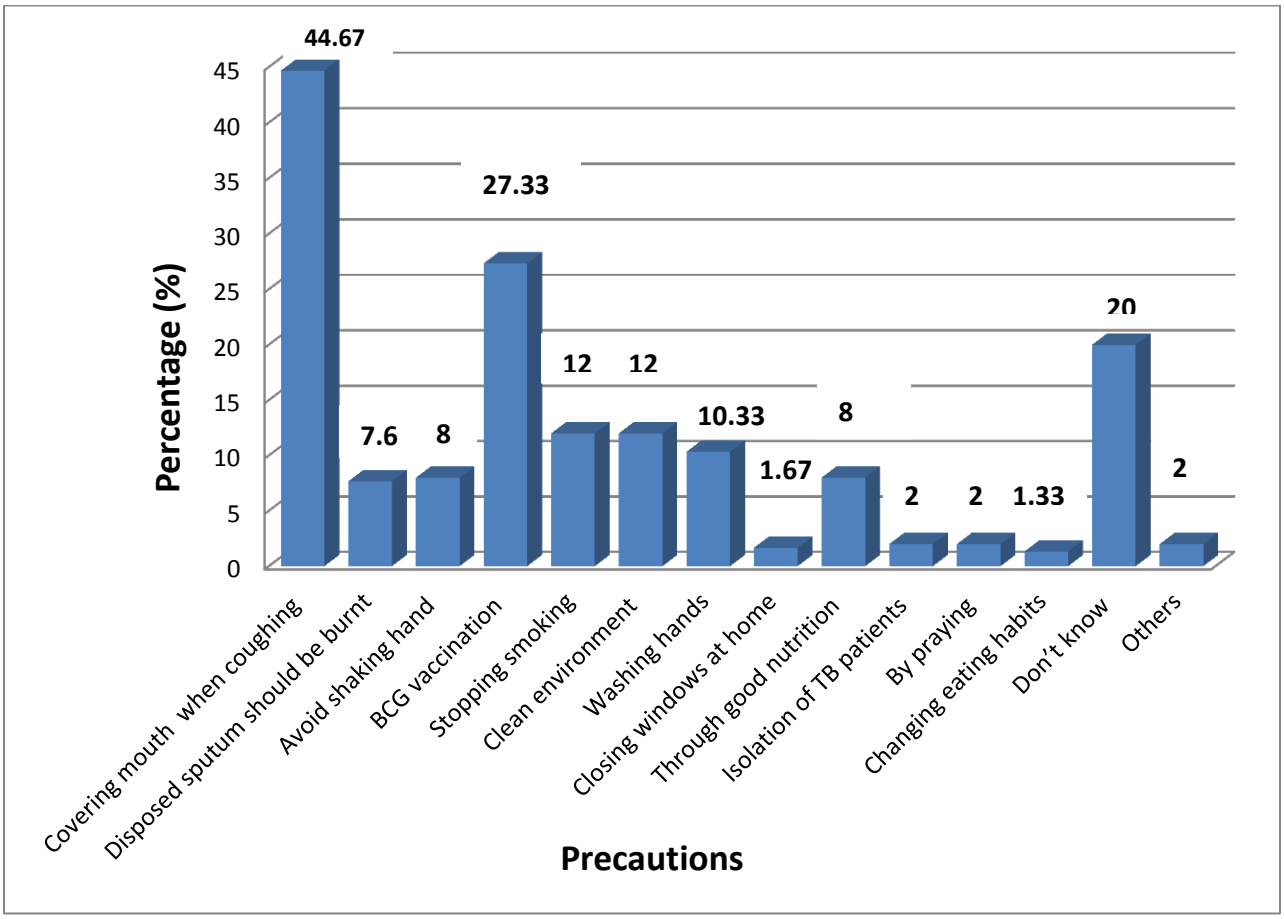


**Figure 4.39: Precautions to be taken by a TB Patient**

Among the total respondents, 20% had no idea about precaution that should be taken by Tb affected patients. Majority (44.67%) said that TB patients should cover mouth or nose during coughing or sneezing followed by BCG vaccination (27.33%), stopping smoking (12%), being in a clean environment (12%), (10.33%) should wash their hands after touching items in public places, avoid shaking hands (8%), through good nutrition (8%), Disposed sputum should be burnt or boil (7.67%), isolation of TB patients (2%), by praying (2%), changing eating habits (1.33%), others precautions (2%) ,patient closing windows at home (1.67%) had been considered that should be taken by TB.

## 4.40: Perception towards TB Patients

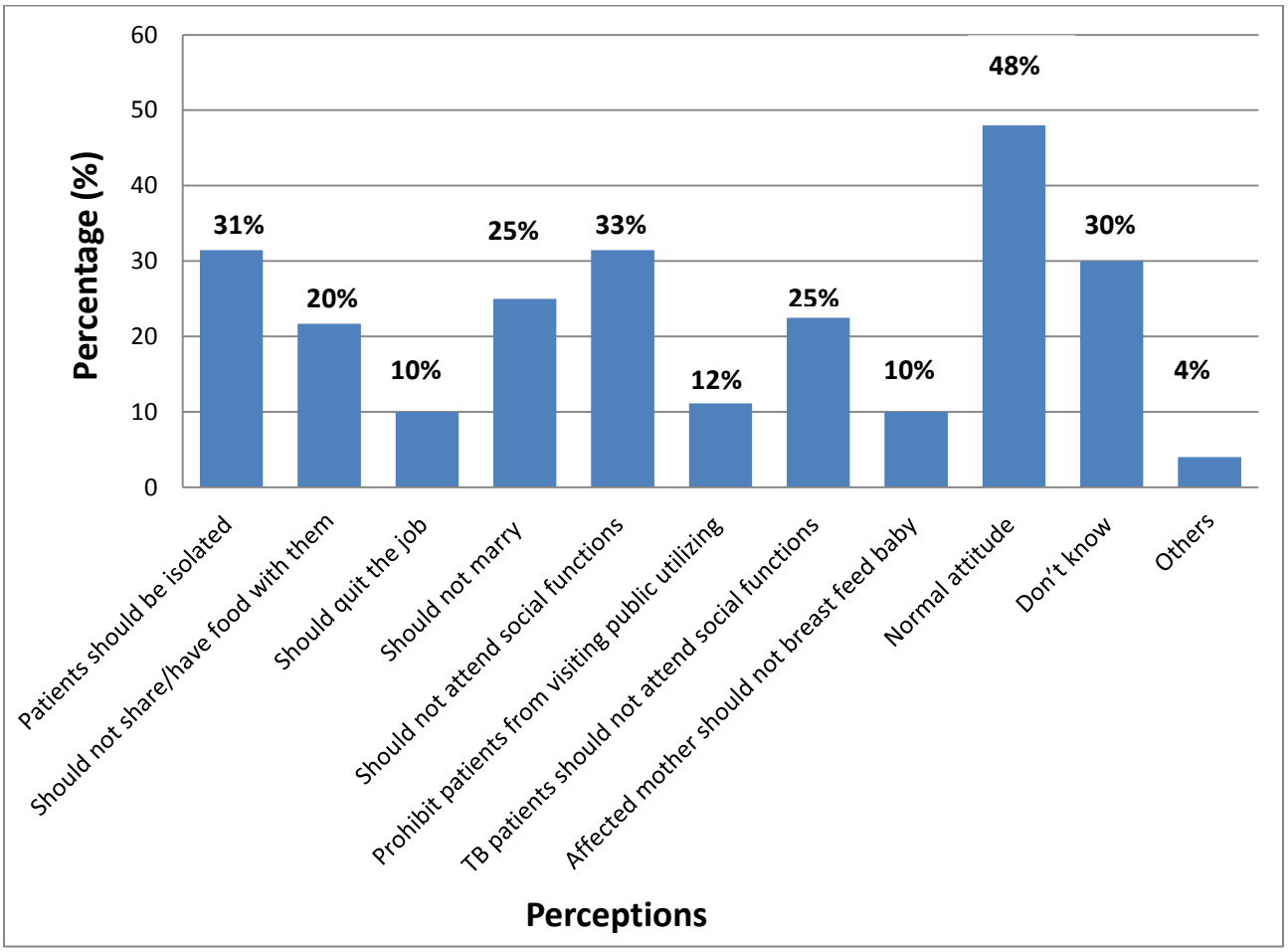


**Figure 4.40: Perception towards TB patients**

When respondents were asked about their perception towards TB patients, (48%) showed normal attitude, (33%) stated should not attend social functions, (31%) stated that patients should be isolated , (25%) said that TB patients should not attend social functions, should not marry (25%), should not share/have food with them (20%), prohibit patients from visiting public utilizing (cinema hall, club) (12%), should quit the job (10%), affected mother should not breast feed baby (10%), & (4%) said they had other perceptions. Out of 300 respondents, 144 (48%) had no idea about it.

## 4.41: Major sources of information on TB

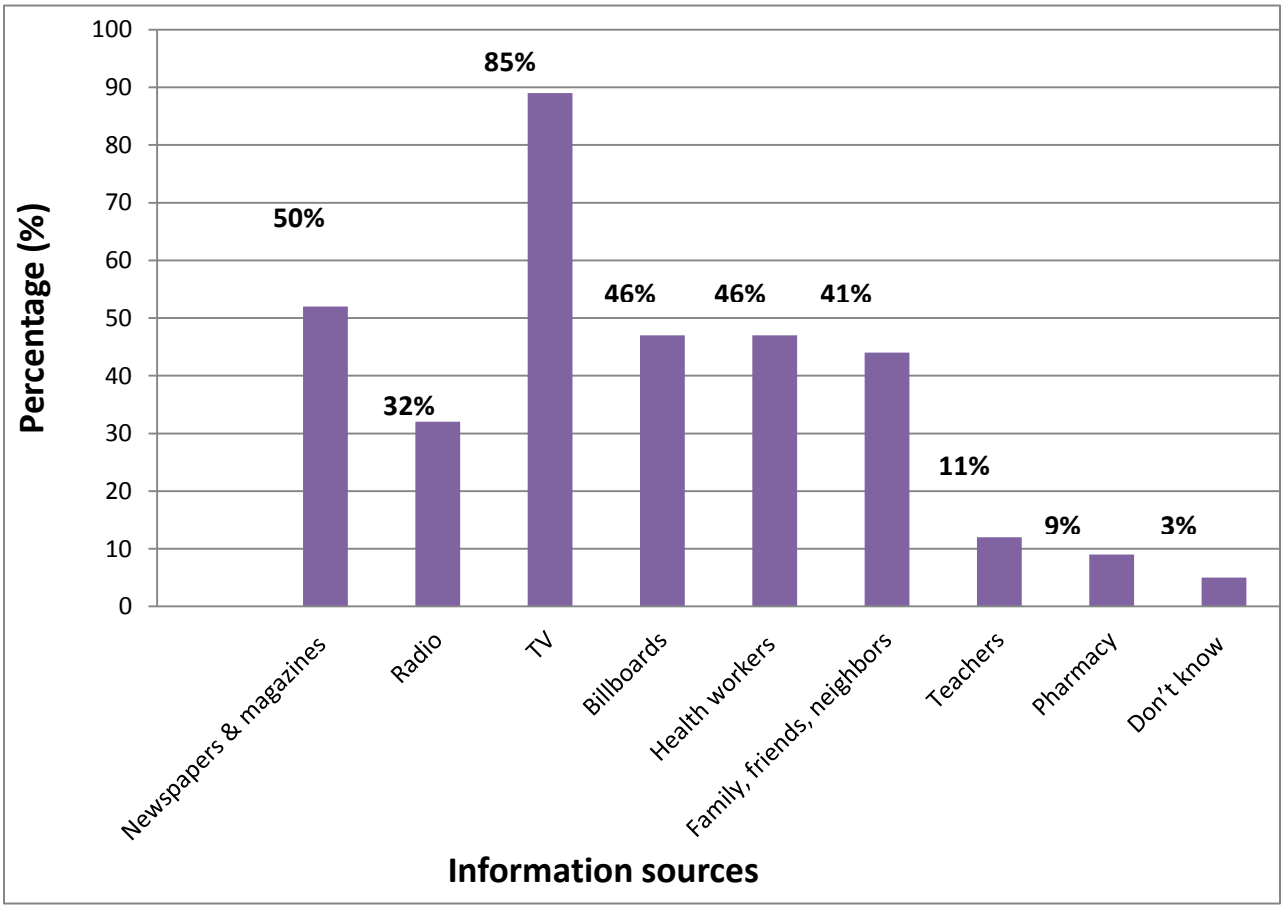


**Figure 4.41: Major sources of information on TB**

Among the total respondents, 85% stated they were informed about TB through TV followed by 50% from newspapers & magazines, 46% from billboards, 46% from health workers, 41% from family, friends and neighbors, 32%, 11%, 9%, 3% were informed from radio, teachers, pharmacy and had no idea respectively.

# *Chapter-5*
# *Discussion and Conclusion*

## 5.1: Discussion

In this study, 300 undergraduate students of 6 private universities in Dhaka (East West University, North South University, American International University, Green University, Stamford University, South East University, and Northern University) were surveyed, especially their knowledge about TB, communicable or non-communicable, sign and symptoms, causative agent of TB, mode of spread, protective estimation etc and established the association between the knowledge about TB and some selected socio-economic and demographic factors. This study also analyzed the knowledge of respondents of TB as a major public health problem.

In the present study, it was found majority of the respondents (82%) were in the age-group of 21-23 years, while remaining respondents were in the age range of 24-25 years (9.67%) and 18-20 years (8.33%).About (93.33%) respondents were Muslims, (8%) were Hindus,1% were Buddhists and only (0.67%) were Christians. About (64.33%) were females and (35.66%) were males. Among 300 respondents, majority (79.67%) of them were from single family and remaining (20.33%) from joint family. Majority of the students (59.33%) were from non-science background and (40.67%) were from science background and about (30.36%) students were from 4$^{th}$ year, (28.30%) were from 3$^{rd}$ year, (29.34%) from 2$^{nd}$ year and remaining (12%) from 1$^{st}$ year. In this study, parents of maximum (34.67%) students were educated at secondary level. Among the respondents (91.67%) had no bad habits, (5.67%) were smoker, (1.33%) consumed alcohol, (0.67%) were drug abuser.

This study shows about (96.33%) of students said that they had heard about TB. In another study by (Sah et al., 2016) on 'Knowledge on Tuberculosis among students of Higher Secondary School, Lalitpur, Nepal' it showed that all of the respondents had heard about the term Tuberculosis, which was close to our value. (Sah et al., 2016)

Despite (96.33%) students hearing about the term TB, maximum (46.33%) students had no idea about the term communicable and non-communicable diseases regarding TB. Another study by (Rana et al., 2015) on "Assessment of knowledge regarding tuberculosis among non-medical university students in Bangladesh" was performed on 839 non-medical university students in Bangladesh and it was found that (33.9%) respondents had no idea about the term communicable and non-communicable diseases regarding TB, which was quite close to our value. In our study, we found majority of the respondents (65%) did not have idea about latent TB, whereas (Rana et

al., 2015) found that (86.3%) respondents had no idea about latent TB, which was far different from our value. (Rana et al., 2015)

In our study, we found only (33%) of respondents had knowledge about causes of TB whereas maximum students (67%) had no idea about it. Among the respondents (33%), (85%) responded that bacteria can cause TB, whereas another study by (Renuka & Dhar, 2012) on 'Knowledge and Awareness of Tuberculosis among High School Students of Mysore City' was performed on 129 students studying in 9th- 10th standard of two high Schools in Mysore city and it was found that 81% knew TB was caused by bacteria, which was close to our value. (Renuka & Dhar, 2012).

Regarding symptoms of TB we found, maximum respondents gave correct answer about sign & symptoms of TB like- productive cough for 3 weeks or more (63.66%), coughing up blood (45%), shortness of breath (26%), persistent fever above 100 degrees F(21%), chest pain (24%), nausea (17%).However, one of study conducted by (Tasnim et al., 2012) on 'Patient's Knowledge and Attitude towards Tuberculosis in an Urban Setting' performed on 762 adult TB patients were interviewed at selected DOTS centre of Dhaka city Regarding symptoms of TB (89.9%) mentioned that night fever, tiredness (86.5%), productive cough (80.6%), and (61.6%) mentioned cough more than 3 weeks, which was close to our value. (Tasnim et al., 2012)

Among the total respondents, we found (93%) of respondents said TB disease can spread through cough, (66%) sneezing, (57%) via smoking, (49%) genetically, (39.33%) through contaminated food or drinks that were some of the main mode of transmission of TB. Another study conducted by (Tasnim et al., 2012) on 'Patient's Knowledge and Attitude towards Tuberculosis in an Urban Setting' performed on 762 adult TB patients found regarding mode of transmission of disease 22.9% were ignorant, 56% thought sneezing and cough, smoking 5.4%, and 2.2% mentioned TB is a familial disease, which was far different from our value. It seemed we had a higher population of correct knowledge of mode of spread of TB. About (85%) respondents stated were informed about TB through TV, (50%) from newspapers and magazines, (46%) from billboards and health workers, (41%) from family, friends and neighbors whereas, (Tasnim et al., 2012) conducted survey reported television as the main sources of information of TB (46.8%), (87%) mentioned about bill boards. (Tasnim et al., 2012)

In our survey we found, (36.57%) of students heard about BCG vaccine against TB. Maximum students (78.33%) were not aware of DOTs (Directly Observed Treatment) and remaining

(21.67%) were aware about it. In another study by, (Rana et al., 2015) on ‘Assessment of knowledge regarding tuberculosis among non-medical university students in Bangladesh: a cross-sectional study and it was found more than (90%) of students knew about DOTs while (8.6%) did not have knowledge about treatment system through DOTs. (Rana et al., 2015)

With regards to tuberculosis therapy, approximately 55% of the respondents reported that TB is curable, and only 24% knew the 6–8 months duration of treatment and maximum students (48%) had no idea about the duration. Another study by (Khayyam et al., 2012) on ‘Awareness Regarding Tuberculosis among patients attending general dispensaries in south Delhi’ that found only (57%) of the participants were aware of the correct duration of treatment others either were not aware of it or mentioned it wrongly, which was far different from our value. (Khayyam et al., 2012)

We found in our study, (20%) of total respondents had no idea about precaution that should be taken by TB affected patients. (44.67%) said TB patients should cover mouth or nose during coughing or sneezing, (27.33%) BCG vaccination, (10.33%) TB patient should wash their hands after touching items in public places, (8%) avoid shaking hands. On the other hand, (Orrett & Shurland, 2001) conducted a study on “Knowledge and Awareness of Tuberculosis among Pre-university students in Trinidad’ that found, (78%) of respondents were aware of precaution regarding TB. Our population had less knowledge about precaution regarding TB patients. (Orrett & Shurland, 2001)

## 5.2. Conclusion

In this study, we can conclude that participant's knowledge about mode of transmission of TB, precautions is satisfactory, whereas participant's knowledge of TB is inadequate in most viewpoints e.g. Latent TB, diagnosis, Place of TB treatment, duration of TB treatment, DOTs, BCG vaccine, perception towards Tb patients although there are misconceptions about TB as well. So, it is important to create awareness and properly educate the students and to remove misconceptions associated with ignorance through community based educational or awareness campaign. It is also important that similar surveys regarding TB knowledge and perceptions should be conducted at regular intervals for assessment of the impact of the education, information and communication provided. Mass media can be utilized to increase knowledge and remove misconceptions regarding TB disease. Student's skills can also be developed by promoting an integrated, multidisciplinary study programme focused on problem-oriented learning and active learning strategies (e.g. like seminars). By adopting these strategies, the knowledge and awareness among students regarding TB can be increased to some extent which will ultimately help to improve the disease management process.

# *Bibliography*

## Bibliography:

Ahmadinejad, Z., Azmoudeh Ardalan, F., Razzaqi, M., Davoudi, S. and Jafarian, A. (2012) QuantiFERON-TB Gold In-Tube test for diagnosis of latent tuberculosis (TB) infection in solid organ transplant candidates: a single-center study in an area endemic for TB.*Transplant InfectiousDisease*.[Online]15(1),p.90-95.Availablefrom: http://www.ncbi.nlm.nih.gov/pubmed/23173720 . [Accessed: 23 May 2016].

Anon (2013) *TB (Tuberculosis) Skin Test (Mantoux) - Minnesota Dept. of Health.* [Online]. Available from: http://www.health.state.mn.us/divs/idepc/diseases/tb/factsheets/tst.html. [Accessed: 10 January 2016].

Boahen, E. (2014) *Logistic Model In Reliability Of Tb Drugs*. Saarbrücken: LAP LAMBERT Academic Publishing.

Desalu, O., Adeoti, A., Fadeyi, A., Salami, A., Fawibe, A. & Oyedepo, O. (2013) Awareness of the Warning Signs, Risk Factors, and Treatment for Tuberculosis among Urban Nigerians. *Tuberculosis Research and Treatment*. [Online] 2013.p.1-5.Available from: http://www.hindawi.com/journals/trt/2013/369717/. [Accessed: 30 May 2016].

Dyer, C. (2010) *Tuberculosis*. Santa Barbara, Calif.: Greenwood.

Gandhi, M., Kumar, A., Toshniwal, M., Reddy, R., Oeltmann, J., Nair, S., Satyanarayana, S., Dewan, P. & Mannan, S. (2012). Sputum Smear Microscopy at Two Months into Continuation-Phase: Should It Be Done in All Patients with Sputum Smear-Positive Tuberculosis?. *PLoS ONE*. [Online] 7 (6). p. e39296. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3705651/. [Accessed: 16 March 2016].

Giffin, R. and Robinson, S. (2009) *Addressing the threat of drug-resistant tuberculosis*. Washington, D.C.: National Academies Press.

Haldiya, K., Sachdev, R., Mathur, M. & Saiyed, H. (2005) Knowledge, Attitude and Practices Related to Occupational Health Problems among Salt Workers Working in the Desert of Rajasthan, India. *Journal of Occupational Health*. [Online] 47 (1). p. 85-88. Available from: http://www.ncbi.nlm.nih.gov/pubmed/15703458 . [Accessed: 12 May 2016].

Hawes, G.A., (1939) Tuberculous meningitis following nephrectomy for renal tuberculosis: Three case reports. *The American Journal of Surgery*, *45*(2), pp.282-287.Available from: http://www.sciencedirect.com/science/article/pii/S0002961039904149. [Accessed: 10 May 2016].

Hossain, S., Zaman, K., Quaiyum, A., Banu, S., Husain, A., Islam, A., Borgdorff, M. & van Leth, F. (2015) Factors associated with poor knowledge among adults on tuberculosis in Bangladesh: results from a nationwide survey. *J Health Popul Nutr*.[Online] 34 (1).Available from: http://link.springer.com/article/10.1186/s41043-015-0002-4. [Accessed: 10 May 2016].

Janssen, T. (1940) *Manual of the international list of causes of death as adopted for use in the United States*. Washington: U.S. Govt. Print. Off.

Khayyam, K.U., Patra, S., Sarin, R. and Behera, D. (2012) Awareness regarding tuberculosis among patients attending general dispensaries in South Delhi. *Age (Years)*. [Online] *60*(51), p.5-1. Available from: http://medind.nic.in/ibl/t12/i2/iblt12i2p202.pdf . [Accessed: 30 March 2016].

Knechel, N. (2009). Tuberculosis: Pathophysiology, Clinical Features, and Diagnosis. *Critical Care Nurse*. 29 (2). pp. 34-43. Available from: http://ccn.aacnjournals.org/content/29/2/34.short. [Accessed: 5 June 2016].

Lu, S.H., Tian, B.C., Kang, X.P., Zhang, W., Meng, X.P., Zhang, J.B. and Lo, S.K., (2009) Public awareness of tuberculosis in China: a national survey of 69 253 subjects.*The International Journal of Tuberculosis and Lung Disease*.[Online] *13*(12). p.1493-1499. Available from: http://www.ingentaconnect.com/content/iuatld/ijtld/2009/00000013/00000012/art00009?crawler=true. [Accessed: 28 February 2016].

Manso, M., Rodeia, S., Rodrigues, S. and Domingos, R. (2016) Synchronous presentation of two rare forms of extrapulmonary tuberculosis. *BMJ Case Reports*, p.bcr2015212917.

Montagna, M.T., Napoli, C., Tafuri, S., Agodi, A., Auxilia, F., Casini, B., Coscia, M.F., D'Errico, M.M., Ferrante, M., Fortunato, A. and Germinario, C., (2014) Knowledge about tuberculosis among undergraduate health care students in 15 Italian universities: a cross-sectional study. *BMC public health*. [Online] *14*(1), p.1. Available from: http://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-14-970 . [Accessed: 28 March 2016].

Nsangi, B., Risser, J., Graviss, E., Hwang, L., Joloba, M., Kapadia, A., Kekitiinwa, A. and Kline, M. (2011) *Evaluation of the T-SPOT TB test in the diagnosis of latent tuberculosis infection in HIV-infected children in Uganda*.

Orrett Fitzroy A., Shurland Simone M. (2001) Knowledge and Awareness of Tuberculosis Among Pre-University Students in Trinidad. *Journal of Community Health*. [Online] 26(6), p.479-485.Available from: http://link.springer.com/article/10.1023%2FA%3A1012563508763. [Accessed: 23 March 2016].

Rana, M., Sayem, A., Karim, R., Islam, N., Islam, R., Zaman, T. & Hossain, G. (2015) Assessment of knowledge regarding tuberculosis among non-medical university students in Bangladesh: a cross-sectional study. *BMC Public Health*. [Online] 15 (1). Available from: http://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-015-2071-0. [Accessed: 25 February 2016].

Ray, A. and Gulati, K. (2007) *Current trends in pharmacology*. New Delhi: I.K. International Pub. House.

Sah BK, Sah JP, Shah SK, KCA (2016) Knowledge on Tuberculosis among Students of Higher Seconadary School, Lalitpur, Nepal.*MOJ Public Health*.4(5): 00091.

Salmanzadeh, S., Tavakkol, H., Bavieh, K. and Alavi, S. (2015) Diagnostic Value of Serum Adenosine Deaminase (ADA) Level for Pulmonary Tuberculosis. *Jundishapur J Microbiol*, 8(3).

Smolovic, M., Pesut, D., Bulajic, M. and Simic, M., (2012) Knowledge and attitudes towards tuberculosis in non medical students University of Belgrade. *Pneumologia*,[Online] *61*(2), p.88-91.Available from: http://www.ncbi.nlm.nih.gov/pubmed/22783598 .[Accessed:12 April 2016].

Syed, F. and Mayosi, B. (2007) A Modern Approach to Tuberculous Pericarditis. *Progress in Cardiovascular Diseases*, 50(3), p.218-236.

Tasnim, S., Rahman, A. & Hoque, F. (2012) Patient's Knowledge and Attitude towards Tuberculosis in an Urban Setting. *Pulmonary Medicine*.[Online] 2012. p. 1-5.Available from: http://www.hindawi.com/journals/pm/2012/352850/. [Accessed: 22 March 2016].

Thwaites, G., Chau, T.T.H., Mai, N.T.H., Drobniewski, F., McAdam, K. and Farrar, J., 2000. Tuberculous meningitis. *Journal of Neurology, Neurosurgery & Psychiatry*, *68*(3), pp.289-299.Available from: http://jnnp.bmj.com/content/68/3/289.short . [Accessed: 12 March 2016].

Vidhani, M. & Vadgam, P. (2012) Awareness Regarding Pulmonary Tuberculosis - A Study among Patient Taking Treatment of Tuberculosis in Rural Surat, Gujarat. *Natl J Med Res*, [Online] 2 (4), p.452-455.Available from: http://www.scopemed.org/?mno=30976. [Accessed: 12 March 2016].

Vukovic, D. & Nagorni-Obradovic, L. (2011) Knowledge and awareness of tuberculosis among Roma population in Belgrade: a qualitative study. *BMC Infect Dis*. [Online] 11 (1). p. 284.Available from: http://bmcinfectdis.biomedcentral.com/articles/10.1186/1471-2334-11-284. [Accessed: 23 March 2016].

Zafar Ullah, A., Huque, R., Begum, V., Newell, J. and Gerein, N. (2010) Public-Private Partnership for TB Control in Bangladesh: Role of Private Medical Practitioners in the Management of TB Patients. *World Medical & Health Policy*. [Online] 2(1), p.210-227.Available from: http://onlinelibrary.wiley.com/doi/10.2202/1948-4682.1029/abstract. [Accessed: 16 March 2016].