EVALUATION OF PHARMACIST INTERVENTIONS ON TREATMENT OUTCOMES OF PULMONARY TUBERCULOSIS PATIENTS IN SECONDARY HEALTH FACILITIES ABUJA

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BY

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DECLARATION

I declare that the work in this dissertation titled "EVALUATION OF PHARMACIST INTERVENTIONS ON TREATMENT OUTCOMES OF PULMONARY TUBERCULOSIS PATIENTS SECONDARY HEALTH FACILITIES ABUJA NIGERIA" has been carried out by me in the Department of Clinical Pharmacy and Pharmacy Practice. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this dissertation was previously presented for another degree or diploma at this or any institution.

……. …….

Ruth Feyisayo AJAYI Date

CERTIFICATION

This dissertation entitled EVALUATION OF PHARMACIST INTERVENTIONS ON TREATMENT OUTCOMES OF PULMONARY TUBERCULOSIS PATIENTS IN SECONDARY HEALTH FACILITIES IN ABUJA, NIGERIA, by Ruth Feyisayo AJAYI meets the regulations governing the award of the degree of Master of Science, Clinical Pharmacy of Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

Prof. A.U. Zezi Chairman, Supervisory Committee	_____ Signature	_____ Date
Dr. J. Ya'u Member, Supervisory Committee	_____ Signature	_____ Date
Dr. S. Mohammed Head of Department	_____ Signature	_____ Date
Prof. S.Z. Abubakar Dean, School of Postgraduate Studies	_____ Signature	_____ Date

DEDICATION

This research is dedicated to Almighty God my Creator, my all in all for seeing me through this work.

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ABSTRACT

Tuberculosis is a chronic infection that still remains one of the major health problems in most developing countries. Poor treatment outcomes have serious consequences which include spread of the disease, morbidity and mortality. The world health organization (WHO) recommended minimum successful outcomes of 85%; this has not been achieved in most facilities rendering the services. The aim of the study was to evaluate the impact of Pharmacist Intervention on the treatment outcomes of pulmonary tuberculosis patients in secondary health facilities in Abuja. It has been found out that Pharmacists have not always been involved directly in the management of tuberculosis patients therefore this work was design to evaluate Pharmacist intervention on treatment outcomes of pulmonary tuberculosis through phone calls and text messages. Two health facilities under Federal Capital Territory Abuja which were Asokoro District Hospital and Nyanya General Hospital were used. A total of 110 pulmonary tuberculosis patients 60 from Nyanya General Hospital and 50 from Asokoro District Hospital accessing Directly Observed Therapy Short course (DOTS) were recruited for the research and divided into control and intervention groups. They were then given health education and medication adherence counseling. The intervention group was accompanied with phone calls and text messages till the completion of their treatment each lasted for six months. Questionnaires were distributed at baseline to measure their knowledge of disease and social behaviour. Proforma sheet was used to collect their treatment outcomes which includes successful (cured and treatment completed) and unsuccessful (Died, failure, defaulter, transfer out). Questionnaire were then administered to measure improvement on disease knowledge and social history medication adherence was measured from patient medication refill cards. 95% confidence was set with p value $p<0.05$ significant level. The data collected were presented using percentages, tables and charts

The study shows there were tremendous statistically significant difference ($p<0.05$) in medication adherence after interventions with more than 70% of participants having good adherence(100%), disease knowledge and social history in intervention group accompanied with phone calls and text messages as compared to control group. The study established successful treatment outcomes of tuberculosis of 87.5% in the intervention group as against 74.1% in the control group from the secondary healthcare facilities used for the research. Comparing Nyanya General Hospital to Asokoro district hospital, Nyanya General Hospital achieved successful treatment outcomes of 90% as against 84.5% in Asokoro District Hospital in the intervention group. While the control group had 80% and 66.7% in Nyanya and Asokoro Hospital respectively. It can be concluded that, the study showed that pharmacist intervention improves knowledge of tuberculosis disease, medication adherence with 87.5% successful treatment outcomes tuberculosis patients in the secondary healthcare facilities, Abuja.

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LISTS OF ABBREVATIONS/ACRONYMS

Acronyms	Meaning
ABU	Ahmadu Bello University
ADH	Asokoro District Hospital
AFB	Acid Fast Bacilli
AIDS	Acquired Immune Deficiency Syndrome
ART	Antiretroviral Therapy
CDC	Center for Disease Control and Prevention
CHEW	Community Health Extension Worker
CXR	Chest X- ray
DHRSA	Department of Health Republic of South Africa
DOTS	Directly Observed Therapy Short Course
DST	Drug Susceptibility Testing
EMO	Electronic Monitoring Devices
FCT	Federal Capital Territory
FCTA	Federal Capital Territory Administration
HIV	Human Immune Deficiency Virus

IUTLD	International Union Against Tuberculosis and Lung Disease
LED	Light Emitting Diode
MDR-TB	Multi Drug Resistant Tuberculosis
NGH	Nyanya General Hospital
NTBLCP	National Tuberculosis and Leprosy Control Program
RR-TB	Rifampicin Resistant Tuberculosis
SMS	Short Message Service
TB	Tuberculosis
WHO	World Health Organization

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Tuberculosis (TB) infection is caused by the bacillus *Mycobacterium tuberculosis*. It typically affects the lungs (pulmonary) but can affect other sites as well (extra pulmonary) (WHO, 2016a). Tuberculosis is a chronic infection that is present in all parts of the world. In most developing countries, it remains one of the major health problems (Babatunde *et al.*, 2013). There were an estimated 10 million new TB cases, 5.8 million among men, 3.2 million among women and 1.0 million among children in 2017 (WHO, 2018). There were also an estimated 1.3 million TB deaths among HIV negative and three hundred thousand (300,000) and HIV positive tuberculosis patients in 2017 (WHO, 2018). This number of deaths was extremely high based on the global TB target deadline to reduce prevalence and death due to TB by 90% in 2030 compared to 2015 (WHO, 2018). Nigeria is still among the eight countries that accounted for two-third of global TB cases in the world and is the second in Africa. (WHO, 2018)

Tuberculosis affects both adults and children age 15 and below (Paediatric TB). Some risks factors like HIV/AIDS, smoking and overcrowding further added to high burden of TB in the country. The disease can be transmitted through coughing, sneezing, talking and singing. Lagos, Kano and Oyo have the highest Tuberculosis prevalence in the Country (Nigeria TB Facts Sheet, 2010).

National Tuberculosis and Leprosy Control Program (NTBLCP) is responsible for the coordination and control of tuberculosis in Nigeria and is supported by STOP TB partnership initiatives whose aim is to eliminate tuberculosis in Nigeria (NTBLCP Manual, 2010). Monitoring the outcome of treatment using standardized approaches is essential in order to evaluate the

effectiveness of the interventions used in the management of tuberculosis because patients on anti-tuberculosis drugs need to take about four drugs daily for an intensive phase of two months and inappropriate treatment could lead to infectivity of people around and development of resistant. (WHO, 2005; MaHTAS, 2012)

Enhancing the quality of health care requires not only well-trained, available and motivated personnel but also the incorporation of Pharmacist into the health care system (Abrogoua, 2016). Pharmacists are currently involved in the pharmacotherapeutic aspect of care, due to extensive knowledge and training in Pharmaceutical care to identify and resolve drugs therapy problems. This pharmaceutical activity has given rise to patient-centered pharmaceutical practices, of which a vital element is the pharmaceutical interventions (Abrogoua, 2016). Pharmaceutical interventions have been reported to impact positively on morbidity, adverse drug effect (Gillespie *et al*., 2009; Schnipper *et al*., 2006) and the reduction of cost of treatment (Kausch *et al*., 2005). This study was carried out to evaluate the Pharmacist interventions on treatment outcomes of tuberculosis patients in secondary health facilities in Abuja.

1.2 Statement of the Problem

More than 90% of tuberculosis cases occur in developing countries due to poor resource setting environment (TB Facts Sheets, 2010). With the modes of transmission of TB, there was need for effective evaluations of treatment outcomes.

Abuja is the capital of the Federal Republic of Nigeria and it is centrally located. It is surrounded by satellite towns like Zuba, and Mararaba. These are towns that serve as a link or stop over to all travellers from every part of the country as such there are high influx of people in and out of Abuja on a daily basis leading to congestion and overcrowding which put the city at risks of tuberculosis.

The Hospitals chosen for this study are strategically located between Zuba and Mararaba which make them health facilities where people from these places visit for medical care. Improper treatment outcome monitoring can lead to emergence of multi-drug resistance tuberculosis which is already in the Country. This poses a threat to the Country which has only four reference laboratories for treating multi-drug resistance TB. This may undermine the previous efforts in controlling TB (TB Facts Sheet, 2010).

Considering the risky behaviour of these drivers like smoking, overcrowding and even passengers staying overnight, it gives an avenue for easy spread of the disease and Abuja is a rapidly growing city. Also, due to the ignorance of the public to the risks and burden of tuberculosis, prevalence and different modes of transmission, there is prevailing inappropriate care seeking behaviour which can subsequently lead to poor treatment outcomes. (Dupas, 2011)

Unsuccessful treatment outcome is a problem due to poor adherence and this can lead to infectivity and resistance. With the re-emergence of tuberculosis as a major public health concern in Nigeria and with the advent of some unsuccessful treatment and multi-drug resistant TB, it is important to evaluate the treatment outcome of tuberculosis. (Dudala, 2013; WHO, 2018)

1.3 Justification of the Study

In a study of impact of Pharmacist intervention to improve outcome of tuberculosis treatment in a tertiary institution in Nigeria, the intervention group shows a success rate of 87.3% as against control group that elicit a success rate of 62.4% (Ojieabu and Erah, 2011). This showed that the presence of Pharmacists improved tuberculosis treatment outcome.

In a study conducted in South Western Nigeria on Treatment Outcome of tuberculosis patients at DOTS centre in Ogbomoso, the cure rate is 33.3%, completed treatment is 52.2%, failure rate is 0.01%, transferred out 3.94%, and death is 9.52% (Sunday *et al.*, 2014).

Pulmonary tuberculosis is airborne chronic infection transmitted through droplets nuclei when coughing, sneezing or talking and strategic nature of the Federal Capital Territory, as well as the important role Pharmacist played in the management of patients management, there was need for this study using a standardized approach by World Health Organization and International Union Against Tuberculosis and Lung Disease (IUATLD). This will make it possible to recognize and amend any failures arising from managing the disease in order to prevent resistant development, improve successful treatment outcomes and to achieve the recommended target of 90% reduction in the absolute number death due of tuberculosis by 2030 (WHO,2018)

Tuberculosis is almost curable if patient take their drugs regularly as prescribed. In many cases seen, successful treatment outcome to antituberculosis therapy is poor and as result of some factors like age, little or lack of knowledge of disease and other disease states e.g. HIV, forgetfulness, and distance to health facility. These, if good health education, counseling and follow up are adequately carried out could improve treatment outcome.(Ojieabu and Erah, 2011)

Treatment outcome of TB patients and Pharmacist interventions have not been assessed during the period under research in these Hospitals. This research aimed at evaluating treatment outcomes of the patients, baseline knowledge of the disease transmission before and after Pharmacist interventions for six months duration of treatments

1.4 Aims and Objectives of Study

1.4.1 Aim

The aim of this study was to evaluate Pharmacist interventions on the treatment outcome of pulmonary tuberculosis patients in secondary Health facilities in Federal Capital Territory, Abuja.

1.4.2 Specific Objectives

1. To determine the distribution of pulmonary tuberculosis among new smear positive patients.

2. To determine patients knowledge of disease transmission before and after Pharmacist interventions

3. To determine the percentage of patients' medication adherence between control and Pharmacists interventions groups

4. To assess impact of Pharmacist interventions on treatment outcomes. (Successful and unsuccessful)

1.6 Research Hypothesis

Pharmacist interventions with text messages after counseling and health educations will significantly improve treatment outcomes of patients with pulmonary tuberculosis.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 History of Tuberculosis

Tuberculosis historically known as "wasting disease, consumption, and white plague" has affected humans for centuries. The first known case of pulmonary tuberculosis occurred between 668-626 BC which was found in the record of the king Assurbanipal of Assyria (Harms, 1997).

Even earlier, are records of another form of TB such as *Mycobacterium bovis* which commonly affects cows (Harms, 1997). Research suggests that *M. bovis* was the first to start causing the disease in humans after the farming of cattle began around 8000 – 4000 BC (Harms, 1997). It has been hypothesized that tuberculosis adapted itself to humans from the *M. bovis* strain (Harms, 1997). In the 17th century Sylvius recorded anatomical descriptions of TB, he also noted that the lungs underwent distinct changes and even noted tubercles which were consistent to TB patients (Harms, 1997).

After the turn of the 18th Century, a physician in England, Benjamin Marten postulated that the disease was caused by "minute living creatures" and further postulated that the disease may be contagious (Harms, 1997). Confirmation to Martens speculation came later in 1865 when Jean-Antoine Villemin, a French surgeon, discovered that TB was contagious (Harms, 1997; CDC, 2008). Up till the mid-1800 it was assumed that tuberculosis was hereditary. People did not realize that it could spread from person to person through the air.

In 1882 Robert Koch, a German scientist discovered the bacterium that causes TB (Koch, 1882). Half a century passed before drugs were discovered for the treatment of the disease. Prior to this discovery, many people with the disease were sent to sanatoriums and special rest homes, where

they followed prescribed daily routines. There was no scientific evidence to know if the sanatoriums really helped people, even with the establishment of the sanatorium, many people couldn't afford going to a sanatorium so they died at home (CDC, 2008).

Until the 1940s and 1950s there was no antibiotic treatment for tuberculosis. A diagnosis with the disease often meant a slow death sentence (CDC, 2008). A breakthrough came in 1943 when an American scientist, Selman Waksman and one of his assistants, Albert Schatz, discovered a drug (Streptomycin) which could kill the TB bacteria. Between 1943 and 1952, two more drugs were found. After these discoveries many people with TB were treated and the number of people that contracted the disease declined (CDC, 2008).

2.2 Types of Tuberculosis

Tuberculosis can be classified into two categories: active and latent infection. Active tuberculosis is further divided into pulmonary and extra pulmonary tuberculosis (Iseman, 2013).

2.2.1 Active tuberculosis

In active tuberculosis the bacteria are rapidly multiplying and invading different organs of the body (Iseman, 2013). The typical symptoms of active tuberculosis include cough, fever, night sweats, weight loss for a period of over one month, chills, fatigue and loss of appetite. This may be mild or severe. People with TB symptoms can infect many people around them (WHO, 2014).

2.2.1 Types of active tuberculosis

There are two types of active tuberculosis: pulmonary (occurring within lung) and extra pulmonary (occurring outside the lungs) (Iseman, 2013).

2.2.1.1 Pulmonary tuberculosis

The types of pulmonary tuberculosis include:

Primary tuberculosis pneumonia: This is an uncommon type of tuberculosis which presents as pneumonia and is very contagious. Patients have high fever and productive cough. It occurs most commonly in extremely young children and elderly. It can also be seen in patients that are immuno-compromised e.g. people with HIV/AIDS, and patients on long-term corticosteroid therapy (Swierzewski, 2015)

Tuberculosis pleurisy: This often times 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). Usually, a couple of tablespoons of fluid can be found in the pleural space. Once the bacteria invades the space, the amount of fluid increases rapidly and compresses the lungs, causing shortness of breath (dyspnea) and sharp chest pain that worsens with a deep breath (pleurisy). A chest X-ray reveals a significant amount of fluid. Mild or low grade fever is usually present. Tuberculosis pleurisy generally abates without treatment; however, two-thirds of patients with tuberculosis pleurisy develop active pulmonary TB within 5 years (Swierzewski, 2015).

***Cavitary tuberculosis*:** Cavitary tuberculosis affects the upper lobes of the lungs. The bacteria cause progressive lungs destruction by forming cavities. They affect the upper lobes of the lungs because they are highly oxygenated (an environment that highly favours the growth of *M. tuberculosis*). Cavitary tuberculosis occurs rarely soon after primary infection (Swierzewski, 2015). Symptoms include productive cough, night sweats, fever, weight loss, and weakness. There may be hemoptysis (coughing up blood). Patients with cavitary tuberculosis are highly contagious. On rare occasions, diseases spread into the pleural space and causes TB emphysema (pus in the pleural fluid) (Swierzewski, 2015).

Miliary tuberculosis: Miliary tuberculosis is a rare form of active disease that occurs when tuberculosis bacteria find their way into the bloodstream. In this form bacteria quickly migrates all over the body in tiny nodules and invade multiple organs at once. This form of tuberculosis can be rapidly fatal (Iseman, 2013). Symptoms may include fever, night sweats, and weight loss. It may be difficult to diagnose because initial chest X-ray may be normal. Patients who are immunosuppressed and children who have been exposed to the bacteria stand a chance of developing miliary tuberculosis (Swierzewski, 2015).

2.2. 1.2 *Extra pulmonary tuberculosis*

This type of tuberculosis occurs primarily in immunocompromised patients. They include:

***Lymph node disease*:** Lymph nodes contain macrophages that engulf bacteria. Any lymph node can habour uncontrolled replication of bacteria, which causes the lymph node to become enlarged. The infection may contain a fistula (passage way) from the lymph node to the skin (Swierzewski, 2015).

***Tuberculosis peritonitis*:** *M. tuberculosis* can invade the outer linings of the intestine and the linings inside the abdominal wall, causing accumulation of fluid, as in tuberculosis pleuritis. Increased fluid leads to abdominal distention and pain. Patients are moderately ill and have fever (Swierzewski, 2015).

Tuberculosis pericarditis: The pericardium, which is a membrane surrounding the heart, is affected in this condition. This result in the space between the pericardium and heart to be filled with fluid, impeding the hearts ability to function (fill with blood and beat) efficiently (Swierzewski, 2015).

Osteal tuberculosis: Infection of any bone can occur, but the most common sites of infection is the spine. Spinal infection can lead to compression fractures and deformity of the back (Swierzewski, 2015).

Renal tuberculosis: This may result in asymptomatic pyruria, which is the presence of white blood cells in the urine, and can spread to the reproductive organs and affect reproduction. Epididymitis (inflammation of the epididymis) may occur in men (Swierzewski, 2015).

Adrenal tuberculosis: Tuberculosis in the adrenal glands may lead to adrenal insufficiency; which is the inability of the adrenal glands to produce sufficient steroid in times of stress, causing weakness and collapse (Swierzewski, 2015).

Tuberculosis meningitis: The meninges, which is the membrane surrounding the brain and spinal cord, may become affected by *M. tuberculosis* and this may be very devastating, leading to permanent impairment and death. It is difficult to distinguish between brain tumour and TB meningitis because the latter presents itself as a focal mass in the brain with focal neurological signs. Headache, sleepiness and coma are typical signs (Swierzewski, 2015).

2.2.2 Latent tuberculosis

Many people affected with TB do not develop overt disease. They are asymptomatic and their chest X-ray is normal. The only confirmation to this infection may be reaction to the tuberculin skin test (TST) or interferon gamma release assay (IGRA). However, there is a risk that latent infection may escalate to active disease. The risk is increased by illnesses such as HIV or medications which suppresses the immune system. To prevent latent TB from escalating to active TB in this category of people (e.g. HIV) a strategy of preventive therapy by the use of isoniazid tablets or treatment of latent TB is employed (Iseman, 2013).

2.3 Transmission

Mycobacteria are members of the bacterial family which cause a number of diseases. Mycobacteria that cause tuberculosis are called tuberculous e.g. *M. tuberculosis*, which is the major causative agent of tuberculosis, and some other ones such as *M. bovis, M. africanum, M. microti,* and *M. canetti*. Mycobacteria that do not cause tuberculosis are called nontuberculous and are usually not spread from person to person e.g. *M. avium* complex (CDC, 2008).

Tuberculosis is spread from person to person through the air. When a person with infected TB coughs, sneezes, speaks, or sings, tiny particles containing *M. tuberculosis* are released into the air. These particles, called droplet nuclei, are about 1 to 5 microns in diameter – less than 1/5000 of an inch. The droplet nuclei can remain suspended in the air for several hours, depending on the environment. If another person inhales air contaminated with these droplet nuclei, transmission may occur (CDC, 2008).

Not everyone exposed to an infectious TB patient gets infected with the disease. The probability of infection is dependent on four factors (CDC, 2008).The degree of infection of the TB patient depends on; the kind of environment in which the exposure occurs, the time of exposure and the virulence of the tubercle bacilli. People who have close contact with TB patients (e.g. family members, roommates, friends, coworkers etc.) are at higher risk of being infected than those who have less contact with them (CDC, 2008). The best way to stop transmission is to isolate infectious patients and begin standard TB treatment on them as soon as possible. The length of time required for a TB patient to become noninfectious after beginning TB therapy varies. However once the standard TB therapy is initiated and the patient complies with it, the infectiousness of TB patient rapidly declines (CDC, 2008).

2.4 Drugs used in the Treatment of Tuberculosis

The first combination therapy for the treatment of TB was a product of years of research in two concurrent lines of inquiry (Kerantzas and Jacobs, 2017). The first line of inquiry was the development of antibiotics from the first antibiotic (penicillin) to the first antibiotic used successfully in the treatment of tuberculosis (Streptomycin) (Schatz and Waksman, 1944; Fleming, 1929). The second line of inquiry was the development of antimicrobial chemotherapy from the first synthetic antimicrobial drug (the antisyphilis agent arsphenamine [salvarsan]) to the first antimicrobial therapy used successfully in the treatment of tuberculosis (para-aminosylic acid [PAS] (Lehmann, 1946). Consequently, the first combination antimicrobial regimen for the treatment of TB comprised of Streptomycin and PAS and all other regimens came about by an addition or modification of this regimen as new drugs were discovered (British Medical Journal, 1950; Fox *et al.*, 1999).

2.4.1 Streptomycin

Streptomycin was discovered in 1943. It was the first antibiotic discovered that was effective against TB. It is usually added to first line TB medicine in patients that have previously been treated for TB. This is because patients that have previously been treated for TB are most likely to have develop some form of resistance to the drugs used in treatment like rifampicin and isoniazid (TBCAB, 2011a).

2.4.1.1 Mechanism of action

Streptomycin is a bacteriocidal antibiotic derived from the actinobacterium *Streptomyces griseus*. It prevents protein synthesis which results in the death of microbial cells. It is a useful broad-spectrum antibiotic (TBCAB, 2011a).

2.4.1.2 Side effects

Streptomycin can cause hearing impediment, which can become permanent if treatment levels are continued. The risk of hearing loss is higher in patients with kidney damage. Streptomycin can worsen kidney damage, although this is generally reversible if treatment is stopped. Streptomycin can also cause dizziness, vertigo, impaired coordination, rashes, fevers, yeast infections and oral thrush. Streptomycin should be avoided during pregnancy as it may cause birth defects including deafness in the foetus. Streptomycin should only be used during pregnancy when benefits outweigh the risks. Streptomycin is secreted in breast milk but it is not contra-indicated during breast feeding (TBCAB, 2011a).

2.4.2 Isoniazid

Isoniazid is an organic compound that was synthesized in the early 20th century. Its activity against TB was discovered in the 1950s. It is one of the four drugs taken as first line treatment regimen recommended by World Health organization recommended. Isoniazid is also used to prevent latent TB from progressing to active TB. This use is called Isoniazid Preventive Therapy (IPT) (TBCAB, 2011b). This is still currently employed in HIV positive patients and close family relation of TB patients as preventive measure

2.4.2.1 Mechanism of action

Isoniazid is a prodrug and must be activated by a bacterial enzyme. By a biochemical complex the isoniazid inhibits the synthesis of mycolic acid, which is required for the mycobacterial cell wall. It is bacteriocidal, It is also bacteriostatic, meaning that it stops TB from growing, hence the use as a preventive therapy. (TBCAB, 2011b).

2.4.2.2 Side effects

Isoniazid may cause fevers, rashes and peripheral neuropathy. HIV positive patients are more likely to develop isoniazid related peripheral neuropathy. Isoniazid may cause neurotoxicity (damage to the nervous tissue) and hepatotoxicity (hepatitis). Neurotoxicity can be avoided with a low dose of pyridoxine (vitamin B6). Liver damage is usually reversible if isoniazid is stopped. Rare side effects include psychosis, jaundice and convulsions (TBCAB, 2011b).

2.4.3 Rifampicin

Rifampicin is one of the four drugs taken as part of a standard treatment regimen for TB recommended by World Health Organization. Rifampicin, discovered in 1957, remains one of the strongest medications available for TB treatment (TBCAB, 2011c).

2.4.3.1 Mechanism of action

Rifampicin is a bacteriocidal antibiotic drug derived from a compound *Amycolatopsis rifamycinica*.It inhibits DNA-dependent RNA polymerase, thus inhibiting transcription to RNA, causing inhibition of important proteins in the bacterium (TBCAB, 2011c).

2.4.3.2 Side effects and interactions

Rifampicin can cause hepatitis (inflammation of the liver), anorexia, nausea, mild abdominal pain, vomiting and itching. When taken intermittently, rifampicin can also cause flu-like symptoms such as fever, chills, malaise, headaches and bone pains. Rifampicin colour body secretion (tears, sweat, semen and urine) orange or red (TBCAB, 2011c).

Rifampicin reduces the effectiveness of oral contraceptives. Patients may need to be given a higher dose of oral contraceptive or switched to a different method of contraception, such as condoms (TBCAB, 2011c).

Rifampicin can reduce the concentration of the following antiretrovirals in the body: nevirapine, efavirenz, lopinovir and ritonavir (TBCAB, 2011c).

2.4.4 Pyrazinamide

Pyrazinamide was discovered in 1952 and is one of four drugs taken as part of a standard treatment regimen to treat TB. Pyrazinamide can also be used as part of a treatment regimen to treat multi-drug resistant TB (patients resistant to both rifampicin and isoniazid are said to have MDR TB) usually involving five drugs (TBCAB, 2011d).

2.4.4.1 Mechanism of action

Pyrazinamide is a chemically synthesized bacteriocidal antibiotic. It converts a special enzyme to the active form which prevents the synthesis of fatty acids; this disrupts the normal functioning of the cell membrane and deactivates energy production which is essential for the survival of the TB bacteria (TBCAB, 2011d).

2.4.4.2 Side effects

Pyrazinamide can cause nausea, vomiting, joint pain and jaundice. Pyrazinamide is contraindicated in patients with severe liver disease (TBCAB, 2011d).

Due to lack of safety data, pyrazinamide is not recommended by the Center for Disease Control and Prevention (CDC) during pregnancy. However, it is nevertheless routinely used during pregnancy and no significant adverse events have been reported (TBCAB, 2011d).

2.4.5 Ethambutol

Ethambutol is an antimycobacterial agent which was discovered in 1961. More than forty years later ethambutol continues to be used as part of a standard treatment regimen for TB (Lewis, 1998;

TBCAB, 2011e). It is also used as part of a combination regimen in the therapy of *Mycobacterium avium* complex (MAC) infections in patients with or without concomitant infection with human immunodeficiency virus (HIV) (Lewis, 1998).

2.4.5.1 *Mechanism of action*

Ethambutol is a chemically synthesized bacteriostatic antibiotic. It works against TB by inhibiting the formation of the cell wall (TBCAB, 2011e).

2.4.5.2 Side effects

Ethambutol can cause retrobular neuritis (inflammation of the optic nerve) characterised by vision impairment. Vision usually return to normal once the drug is stopped, but permanent damage can occur if the drug is continued (TBCAB, 2011e).

Other common side effects include appetite loss, nausea, vomiting, stomach pain, dizziness and headaches (TBCAB, 2011e).

2.5 Standard Regimen used in the Treatment of New and previously treated Tuberculosis Patients (2[HRZE] / 4[HR])

The standard regimen for the treatment of tuberculosis is made up of two phases (table 2.1): The intensive phase which lasts for 2 months and the continuation phase which lasts for 4 months. During the intensive phase 4 drugs (Isoniazid [H], Rifampicin [R], Pyrazinamide [Z] and Ethambutol [E]) are used to rapidly kill the tubercle bacilli. Infectious patients become less infectious approximately 10 – 14 days after commencement of treatment and symptoms abate. However, majority of patients with continuous phase 2 drugs (Isoniazid and Rifampicin) are used over a period of 4 months. During this period the sterilizing effect of the drugs gets rid of the

remaining bacilli and prevents subsequent relapse (DHRSA, 2014). sputum smear-positive tuberculosis become smear-negative within two months. In the

Six months treatment is as effective in extra-pulmonary as in pulmonary disease. However 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.

Table 2.1: Regimen for Adults and Children Weighing More Than 30 kg

Pre-treatment body weight	Intensive phase 7days a week for 2 months	Continuation phase 7days a week for 4 months	
	RHZE (150, 75,400,275mg)	RH (150, 75mg)	RH (300,150mg)
30-37 kg	2 tabs	2 tabs	
38-54 kg	2 tabs	3 tabs	
55-70 kg	4 tabs		2 tabs
>70 kg	5 tabs		2 tabs

Source: Department of Health Republic of South Africa, NTBLCP 2010

2.6 Direct Observed Therapy Short Course (DOTS)

DOTS (Direct Observed Therapy Short Course) was launched in 1995 by WHO and has been recommended as the most effective way to combat tuberculosis. It is a comprehensive strategy that ensures the cure of most people with tuberculosis presenting to primary health care services (WHO, 2005; MaHTAS, 2012).

The main components of the strategy are:

(i) Political commitment with long-term planning, adequate human resources and expanded and sustainable financing to reach the targets set by the World Health Assembly and the Millennium Development Goals.

(ii) Case detection through bacteriology (microscopy first and then culture and drug susceptibility testing) and strengthening the laboratory network to facilitate detection of tuberculosis cases that are sputum smear–positive and –negative, drug-resistant and multi-drug-resistant.

(iii) Standardized treatment, under proper case management conditions, including DOTS to reduce the risk of acquiring drug resistance, and patient support to increase adherence and the chance of cure.

(iv) Effective and regular drug supply system, including improving drug management capacity.

(v) An efficient monitoring system for supervising and evaluating programs, including measuring impact (WHO, IUATLD and RNTA, 2001; WHO, 2005).

Other components of the strategy include:

(i) Addressing TB/HIV, multi-drug-resistant TB and other special challenges by scaling up TB/HIV joint activities, DOTS Plus and other relevant approaches.

(ii) Contributing to strengthening health systems by collaborating with other health programs and general services in, for example, mobilizing the necessary human and financial resources for implementation and evaluating impact and by sharing and applying the achievements of TB control.

(iii) Engaging all care providers, public, nongovernmental and private, by scaling up public-private mix approaches to ensure adherence to the international standards of TB care, with a focus on the providers for the poorest people.

(iv) Empowering patients and communities by scaling up community TB care and creating demand through context-specific advocacy, communication and social mobilization

(v) Enabling and promoting research to improve program performance and for developing new drugs, diagnostics and vaccines (WHO, 2005).

2.7 Laboratory Tests for Tuberculosis

2.7.1 Microscopy (Acid Fast Bacilli [AFB])

The principle used in the microscopy of mycobacteria is based on the fact that they are easily distinguished from other microorganisms because they possess thick lipid-containing cell walls that retain biochemical stains despite discoloration by acid-containing reagents (so called "acid-fastness"). Two stains, Ziehl-Neelsen (ZN) and Auramine-phenol are used in the microscopy of mycobacteria (DHRSA, 2014).

The advantages of microscopy of sputum smear is that, it is simple and inexpensive, it quickly detects infectious cases of pulmonary TB; Sputum from patients with pulmonary TB – especially those with cavitary cases – usually contain sufficiently large amount of bacilli to be easily detected by microscopy (WHO, 1998a). The disadvantages include**:** Direct smear microscopy is relatively insensitive and requires about 5000 bacilli per millilitre of sputum for a positive result. Sensitivity further reduces in patients with extra pulmonary cases, HIV co infection, and those with disease due to nontuberculous mycobacteria (NTM) (WHO, 1998a).

The limitations include: Microscopy for acid fast bacilli cannot distinguish between tuberculosis mycobacteria and nontuberculous mycobacteria (NTM), viable from non-viable organism, or drug susceptible from drug-resistant strains (WHO, 1998a).

2.7.1.1 Conventional light microscopy

This method uses the conventional tungsten lamp as light. The sensitivity of this method is low in dictating mycobacteria (WHO, 1998a).

2.7.1.2 Conventional fluorescent microscopy

Conventional fluorescent microscopy uses quartz-halogen or high pressure mercury vapour lamps as light sources. A lower magnification objective is used to scan smears, this allows a much larger area of the smear to be viewed and therefore taking less time than the convectional light microscopy. The conventional fluorescent microscopy is on the average 10% more sensitive than the conventional light microscopy, but requires considerable expertise (WHO, 1998a).

2.7.1.3 Light Emitting Diode (LED) fluorescent microscopy

The LED fluorescent microscopy makes provision of a fluorescent light source that is relatively cheaper than that of the conventional fluorescent microscopy. LED bulbs are more energy efficient, can run on batteries, have a long-life, and release less toxic compounds when broken. Recent WHO evaluation confirmed the diagnostic accuracy of LED microscopy compared to conventional fluorescent microscopy, and superior efficiency of LED over conventional light microscopy (WHO, 1998a; WHO, 2010a).

2.7.2 Culture

In this method the suspected specimen is cultured in appropriate media and observed for mycobacteria manifestations.

The advantages include: culture is a more sensitive method in detecting TB than smear microscopy, detecting a higher proportion of cases among patients with symptoms. Further identification is usually performed on positive cultures to detect Tuberculous from Non-Tuberculous Mycobacteria (NTM). Culture is an important diagnostic tool in patients with paucibacillary tuberculosis, such as HIV patients with smear negative pulmonary tuberculosis and children (DHRSA, 2014). The disadvantages include: It is an expensive and slow diagnosis not available to some patients. Time to positive result is usually about 4 weeks in most cases; however a culture is not considered negative until after the end of 6 weeks incubation (DHRSA, 2014).

The main limitation of culture method is that specimens have to be decontaminated prior to being cultured to prevent overgrowth by other micro-organisms. All decontamination procedures are to some extent damaging to mycobacterium and is therefore not 100% sensitive (WHO, 1998b).

Traditionally, culture is done using a solid medium such as coagulated egg (e.g. Löwenstein-Jensen) or agar (e.g. Middlebrook 7H10) as a base. Solid media are simple and cost effective to use. Disadvantages include slow bacterial growth (3-4 weeks) and errors due to manual reading of results. The development of more sensitive liquid medium culture techniques, has provided for the more rapid detection of TB bacilli, within 7 to 14 days. Automated systems are used to culture mycobacteria in liquid media. These systems use specialized vials/ tubes which are inoculated with the patients specimens. Liquid culture is more prone to contamination than solid culture (DHRSA, 2014).

2.7.3 Drug susceptibility testing (DST)

Drug Susceptibility Testing (DST) provides a definitive diagnosis of drug resistant TB. A number of different DST techniques and can be grouped into:

(i) Phenotypic methods involve culturing of *M. tuberculosis* in the presence of anti-TB drugs to detect growth (indicating drug resistance) or inhibition of growth (indicating drug susceptibility).
(ii) Genotypic methods target specific molecular mutations associated with resistance against individual drugs.

Phenotypic DST methods are performed as direct or indirect tests on solid or liquid media. In direct testing, a set of drug-containing and drug-free media is inoculated directly with a concentrated specimen. Indirect testing involves inoculation of drug-containing media with a pure culture grown from the original specimen. Indirect phenotypic tests have been extensively validated and are currently regarded as the gold standard. Three methods are commonly used: proportion, absolute concentration, and resistance ratio. DST results do not differ significantly between the three methods for first line anti-TB drugs (WHO, 2008).

The disadvantages of this method include: the methods are suitable for use at central/national reference laboratory level only, given the need for appropriate laboratory infrastructure (particularly biosafety) and the technical complexity of available technologies/methods (WHO, 2008).

The limitations of this method include: the accuracy of DST varies with the drug tested. For both first- and second-line DST, formal links with one of the laboratories in the Supranational Reference Laboratory (SRL) network is recommended to ensure adequate expert input on laboratory design, specimen and process flow, biosafety, standard operating procedures, maintenance of equipment and external quality assurance (WHO, 2008).

2.7.4 Molecular Testing

Molecular testing involves the use of Nucleic Acid Amplification Techniques (NAT) in the rapid and more specific detection of mycobacterium. One of the most used NAT for the detection of tuberculosis is the GeneXpert test (WHO, 2011a). The GeneXpert was developed by the Foundation for innovative New Diagnostics (FIND) (WHO, 2011a). The GeneXpert system was launched in 2004, and the development of the GeneXpert test, based on the GeneXpert platform, was completed in 2008 (WHO, 2008; WHO, 2011b). The test detects the DNA in bacteria using sputum sample and can give a result in less than 2 hours. It can also detect the genetic mutations associated with resistance to the drug Rifampicin (Cepheid International, 2011).

WHO recommended that the test should be used as the initial diagnosis test in individuals with multi-drug resistant TB (MDR TB) and HIV associated TB. They also suggested that it could be used as a follow up on the test to microscopy in the settings where MDR TB and/or HIV is of a lesser concern, especially in cases of smear negative specimens, because of the lack of accuracy of smear microscopy. They however recognized the major resource implication in using it in the second way (WHO, 2010b).

WHO also emphasized that the test does not eliminate the need for conventional microscopy culture and drug sensitivity testing, as these are still required to monitor treatment progress and also detect other types of drug resistance. The Genexpert MTB/RIF cannot be used for treatment monitoring as it detects both live and dead bacteria (WHO, 2011c; WHO, 2011d).

The major advantages are:

It is a more reliable means of diagnosis when compared to sputum microscopy. Although sputum microscopy is both quick and cheap, it is often unreliable. It is particularly unreliable when people are HIV positive. Another advantage is the speed of getting result faster compared to culture. Although culture gives a definitive diagnosis, to get the result usually takes weeks rather than the hours of the GeneXpert test.

In addition, it has the main advantage in respect of identifying rifampicin resistance, which is again the matter of speed. Normally to get any drug resistance result takes weeks rather than hours (WHO, 2010b).

There are a number of disadvantages which include:

The shelf life of the cartridges is only 18 months, very stable electricity supply is required, the instrument needs to be recalibrated annually, the test is very costly and the temperature ceiling is critical hence needs for twenty four hour temperature monitoring (Trebucq, 2011).

2.8 Radiological Testing

Radiography makes use of X-rays to visualize the internal structures of a patient. X-rays are forms of electromagnetic radiation produced by an X-ray tube. X-rays pass through the body and are captured behind the patient by a film or a digital detector (WHO, 2016).

Chest X-ray (CXR) is a rapid imaging technique that allows lung abnormalities to be identified. CXR is used to diagnose conditions of the thoracic cavity, including airways, ribs, lungs, heart, and diaphragm. Historically CXR has been one of the techniques used in detecting TB, especially pulmonary TB. CXR has high sensitivity for pulmonary TB and thus is a valuable tool in identifying TB as a differential diagnosis for patients, especially when the X-ray is read to identify any abnormality that is consistent with TB. However, CRX has low specificity; although some CXR abnormalities are specific for pulmonary TB (for example, cavities), many CXR abnormalities that are consistent with pulmonary TB are also similar to those of other pathological conditions of the lungs; therefore, they are not only indicative of TB but also of other lung pathologies. Moreover, there is significant intra- and inter-observer variation in the reading of CXRs. Relying only on CXR diagnosis may lead to over diagnosis as well as under diagnosis (WHO, 2016b).

2.9 Treatment Outcomes of Tuberculosis

The recent treatment outcome definitions make a clear distinction between two types of patients (WHO, 2013). Patients treated for drug-susceptible TB (Table 2.2) and Patients treated for drug resistant TB using second line treatment (defined as combination chemotherapy for drug-resistant tuberculosis which includes drugs other than first line drugs (Table 2.3).

The two groups are mutually exclusive. Any patient found with drug resistant TB placed on second-line treatment is removed from the drug-susceptible TB outcome cohort (WHO, 2013).

Table 2.2 Treatment Outcomes for Tuberculosis Patients (Excluding Patients Treated for Rifampicin-Resistant TB [RR-TB] or Multidrug Resistant TB [MDR]

Outcome	Definition
Cured	A pulmonary TB patient with bacteriologically confirmed TB at the beginning of treatment who was smear- or culture-negative in the last month of treatment and on at least one previous occasion.
Treatment completed	A TB patient who completed treatment without evidence of failure BUT with no record to show that sputum smear or culture results in the last month of treatment and on at least one previous occasion were negative, either because tests were not done or because results are unavailable.
Treatment failed	A TB patient whose sputum smear or culture is positive at month 5 or later during treatment.
Died	A TB patient who dies for any reason before starting or during the course of treatment.
Lost to follow-up	A TB patient who did not start treatment or whose treatment was interrupted for 2 consecutive months or more.
Not evaluated	A TB patient for whom no treatment outcome is assigned. This includes cases "transferred out" to another treatment unit as well as cases for whom the treatment outcome is unknown to the reporting unit.
Treatment success	The sum of cured and treatment completed.

Adapted from WHO (2013)

Table 2.3 Outcome for Rifampicin-Resistant Tuberculosis (RR-TB) / Multidrug-) / Resistant TB (MDR –TB)/Extensive drug-resistant TB (XDR-TB)

Outcome	Definition
Cured	Treatment completed as recommended by the national policy without evidence of failure AND three or more consecutive cultures taken at least 30 days apart are negative after the intensive phase.
Treatment completed	Treatment completed as recommended by the national policy without evidence of failure BUT no record that three or more consecutive cultures taken at least 30 days apart are negative after the intensive phase.
Treatment failed	Treatment terminated or need for permanent regimen change of at least two anti-TB drugs because of: - lack of conversion by the end of the intensive phase, or - bacteriological reversion in the continuation phase after conversion to negative, or − evidence of additional acquired resistance to fluoroquinolones or second-line injectable drugs, or − adverse drug reactions (ADRs).
Died	TB patient who dies for any reason before starting or during the course of treatment.
Lost to follow-up	A TB patient who did not start treatment or whose treatment was interrupted for 2 consecutive months or more.
Not evaluated	A TB patient for whom no treatment outcome is assigned. This includes cases "transferred out" to another treatment unit as well as cases for whom the treatment outcome is unknown to the reporting unit.
Treatment success	The sum of cured and treatment completed.

Adapted from WHO (2013)

2.10 Drug-resistant Tuberculosis (DR-TB)

Drug-resistant TB occurs when the drugs that are normally used (1st line drugs) to treat tuberculosis can no longer kill *Mycobacterium tuberculosis*. When this occur the bacteria is said to have developed resistance (CDC, 2008).

2.10.1 Types of drug-resistant tuberculosis (DR-TB)

The types of drug resistant TB include:

Mono-resistant: This occurs if the tubercule bacilli are resistant to any one TB treatment drug;

Poly-resistant: occurs when the tubercule bacilli are resistant to at least two TB drugs (but not both isoniazid and rifampin).

Multidrug-resistant tuberculosis (MDR TB): occurs when the tubercle bacilli are resistant to at least isoniazid and rifampin, the two best first-line TB treatment drugs.

Extensively drug-resistant tuberculosis (XDR TB): occurs when tubercle bacilli are resistant to isoniazid and rifampin, plus resistant to any fluoroquinolone and at least one of three injectable second-line drugs (such as amikacin, kanamycin, or capreomycin) (CDC, 2008).

2.10.2 Transmission of drug-resistant tuberculosis

Drug-resistant TB is transmitted in the same way as drug-susceptible TB. However, drug-resistant TB is more difficult to treat since it can survive in a patient's body even after treatment with the first-line drugs is started. Also, since it takes longer to diagnose drug-resistant TB, these patients may be infectious for a longer period of time. This may result in more people being infected (CDC, 2008).

2.10.3 Causes of drug-resistant tuberculosis

Drug resistant TB can be caused in two different ways: **primary** and **secondary** (acquired). Primary resistance is caused by person-to-person transmission of drug-resistant organisms. Secondary resistance develops during TB treatment, either because the patient was not treated with the appropriate treatment regimen or because the patient did not follow the treatment regimen as prescribed, the patient could develop secondary drug-resistant TB (CDC, 2008). Development of drug resistance in *Mycobacterium tuberculosis* (*Mtb*) has been ascribed to inadequate treatment, insufficient dose or dosing frequency, non-adherence to the regimen, and pharmacokinetic (PK) variability (Srivastava, 2011).

2.10.4. Management of drug resistant tuberculosis

Before the development of new drugs, the best hopes still lies in a more rational approach to managing existing agents. The WHO currently insists on the practice of direct observation therapy (DOT), which is supervised swallowing of the medication in the presence of health care provider. This should not only cure the patient, but will also prevent development of drug-resistance disease, since the patient will have no opportunity to give him/herself monotherapy. WHO however declares that DOT is only a part of a five strategy, the other being government commitment to provide resources, use of drugs with proven bioavailability, meticulous record keeping and reliable microscopy smear services. No DOTS programme is complete without all five components (Davies, 2001).

2.10.5 Incidence of drug resistance tuberculosis

In 2015 the WHO reported that, there were an estimated 480 000 new cases of multidrug-resistant TB (MDR-TB) and an additional 100 000 people with rifampicin-resistant TB (RR-TB) who were also newly eligible for MDR-TB treatment. Drug resistance surveillance data show that 3.9% of

new and 21% of previously treated TB cases was estimated to have had rifampicin- or multidrug-resistant tuberculosis cases. MDR/RR-TB caused 250 000 deaths in 2015. Most cases and deaths occurred in Asia. About 9.5% of MDR-TB cases have additional drug-resistance, extensively drug resistant TB (XDR-TB). To date, 117 countries worldwide have reported at least one XDR-TB case (WHO, 2016).

Studies by Lukoye *et al.* (2015) in sub-Saharan African showed that the estimated prevalence of DR-TB among new cases was 12.6% while that for MDR-TB was 1.5% among previously treated patients, these were 27.2% and 10.3% respectively.

The WHO (2011e) reported that Nigeria has an estimated MDR-TB rate of 2.2% and 9.4% among new and re-treatment TB cases, respectively, and is therefore ranked 15th among the 27 High Burden Countries for MDR-TB.

Lawson *et al.* (2010) carried out a pilot investigation on 117 diagnosed cases in Abuja, Nigeria and it was reported that (31%) of 32 culture-positive patients were resistant to at least one drug and four (13%) out of the 32 culture positive were resistant to all of the four drugs tested (Rifampicin, Ethambutol, Streptomycin and Isoniazid).

2.11 The Goals of Tuberculosis Treatment

The major goals of treatment for TB disease are to cure the individual patient, minimize risk of death and disability and reduce transmission of *M. tuberculosis* to other persons.

To ensure that these goals are met, TB disease must be treated for a minimum of 6 months and in some cases even longer. Most of the bacteria are killed during the first 8 weeks of treatment; however, there are persistent organisms that require longer treatment. If treatment is not continued

for a long enough duration, the surviving bacteria may cause the patient to become ill and infectious again, potentially with drug-resistant disease (CDC, 2013).

There are several options for daily and intermittent therapy, but the goal of treatment for TB disease should be to provide the safest and most effective therapy in the shortest period of time. Given adequate treatment, almost all patients will recover and be cured. Regimens for the treatment of TB disease must contain multiple drugs to which the bacteria are susceptible. The standard of care for initiating treatment of TB disease is four-drug therapy. Treatment with a single drug can lead to the development of a bacterial population resistant to that drug. Likewise, the addition of a single drug to a failing anti-TB regimen can lead to additional resistance. When two or more drugs to which *in vitro* susceptibility has been demonstrated are given together, each helps prevent the emergence of tubercle bacilli resistant to the others (CDC, 2013).

2.12 Importance of Monitoring Treatment Outcome

Rigorous monitoring of all patients who have started treatment and a rapid response to ensure that patients who interrupt their treatment are returned to care are essential components of effective case management and community-wide TB control. In public health practice, failure to ensure treatment observation has been associated with a significantly increased risk of relapse, often compounded by the emergence of drug resistance; monitoring treatment outcome has been shown to reduce both relapse and drug resistance (Frieden and Sbarbaro, 2007)

2.13 Barriers to Successful Treatment Outcomes

Barriers affecting adherence to treatment for tuberculosis can be classified into five dimensions (WHO, 2003).

Socioeconomic-related factors : This includes lack of effective social support networks and unstable living circumstances (Liefooghe, 2014); culture and lay beliefs about illness and treatment (Sumartojo, 1993; Banerji, 2002); ethnicity, gender and age (Hudelson, 1996); high cost of medication; high cost of transport; criminal justice involvement; involvement in drug dealing (WHO, 2003)

Health care team/health system-related factors: This is where there are poorly developed health services; inadequate relationship between health care provider and patient; health care providers who are untrained, overworked, inadequately supervised or unsupported in their tasks*)*; inability to predict potentially non-adherent patients (Mushlin and Appel, 1977).

Condition-related Factors: The condition includes asymptomatic patients; drug use; altered mental states caused by substance abuse; depression and psychological stress (Dick and Lombard, 1997).

Patient-related Factors: Comprises of forgetfulness; drug abuse, depression; psychological stress etc. (Dick and Lombard, 1997).

2.14 Importance of Mobile Health (mHealth) on Adherence

Mobile health (mHealth) refers to the use of mobile devices, such as mobile phones, tablets, computers and personal digital assistants (PDAs) to support the practice of medicine and public health (Haji, 2015). Presently, mHealth is a rapidly growing field with potential applications for frequent use of mobile phones for health care services (Akhter *et al.,* 2012; Lester *et al*., 2010). In low and middle income regions, the growing field of mHealth has seen an increasing number of projects targeting patients with diseases such as HIV/AIDS (Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome), Malaria, Diabetes and TB. Various Strategies have been proposed regarding the use of phones to support patients' treatment (Barclay, 2009; Kunawararak, 2011). Studies have revealed that mobile reminder systems can be effective for

improving patients keeping follow up appointments (Lester *et al*., 2010; Okuboyejo *et al*., 2012, Haji, 2015). Two mobile interventions that have been recently used for reminders are SMS (short message service) and telephone phones (Haji, 2014).

2.14.1 SMS text messages

A pilot study conducted in South Africa by Bridges.org (2015) in which daily SMS reminders were used to remind patients who self-administer their medication (i.e. not on DOTS) to take their drugs showed that the SMS intervention and the clinic-based DOTS groups were similar with regard to rates of TB cure (62.35% vs. 66.4%) and treatment success (72.94% vs. 69.4%); but the rate of completion of TB treatment was slightly higher in the SMS intervention group compared to the clinic-based DOTS group (10.59% vs. 3.0%) (Nglazi *et al.,* 2013).

Broomhead and Mars (2011) conducted a retrospective analysis of a 2005 pilot study of smear positive TB patients commencing a 6-month course of anti-tuberculosis therapy in South Africa, in which health outcomes in patients given a wireless pill bottle (SIMpill®) that sends an SMS to a central server notifying it of the patient taking their medication (plus standard DOTS) were compared with matched controls who received standard DOTS only. The study also found significantly higher TB cure rates in the SIMpill® - DOTS group than in the DOTs only group (RR 2.32, 95% CI 1.60 to 3.36). These findings suggest that there was improved treatment adherence when using SIMpill® in combination with standard DOTS than when using standard DOTS alone (Nglazi *et al.*, 2013).

Owiti *et al.* (2012) in a pilot feasibility study from Kenya, assessed the use of SMS reminders to improve clinic appointment compliance. Rates of scheduled clinic appointment attendance were compared between patients receiving and those not receiving (for technical reasons) SMS reminders. It was discovered that those who received an SMS reminder were 1.6 times more likely

to adhere to scheduled clinic appointment compared to those who did not (95% CI 1.06 to 2.29) (Nglazi *et al.,* 2013)..

Iribarren *et al.* (2012), in a pilot parallel design randomized control study among newly diagnosed TB patients commencing anti-tuberculosis treatment in Argentina, randomly assigned 19 patients to standard care (self-administration of medication) and 18 to the intervention arm (standard care and a SMS-based intervention). After a 60 day period, it was discovered that patients in the intervention group had a higher self-reported adherence rate than those in the control group, but this difference was not statistically significant (RR 1.49, 95% CI 0.90 to 2.42) (Nglazi *et al.,* 2013).

Mohammed *et al.* (2015) carried out a research in Pakistan in which it was reported that SMS reminders had a positive effect on medication adherence of TB patients. Lester *et al.* (2010) carried out a study in Kenya in which it was reported that HIV Patients who received SMS support had significantly improved Antiretroviral Therapy (ART) adherence and rates of viral suppression compared with the control individuals. Maduka and Tobin (2013) carried out a study in Nigeria, in which it was reported that text message reminders significantly improved drug adherence in HIV patients.

Okuboyejo *et al.* (2012) proposed an application that assists a user remember drug times and dosages. The system employs the use of SMS (short message service) to send automatic reminders to patients so as to enhance compliance with drug regimens. The system also contains a feature that enables patients replay the SMS alerts to indicate whether they have taken their pills or not.

SMS systems are used as a "store and forward" communication technique, whereby it helps store the message if the recipient's cell phone is not available and forwards it as soon as the phone is reachable (Sidney *et al*., 2012; Perron *et al*., 2013)

Although text messages have potential in helping patients to take their medication and keep appointments more effectively, the problem of language and literacy barriers still pose challenges, especially in the areas of developing nations (Kaplan,2006; Prasad, 2012)

2.14.2 Phone calls

Researches have reported that telephone call reminder method can encourage patiuents to follow up their medication (Parikh *et al*., 21; Hanauer *et al*., 22). Telephone call communication is real-time and requires good network coverage as well as high management costs (Sydney *et al.*, 2012), and this is challenging in the majority of developing countries (Haji, 2014). Chen *et al*. (2008) reports unavailability of patients' phone as a major challenge.

Liu *et al.* (2014) carried out a review for Cochrane to assess the effects of reminder systems on improving attendance at TB diagnosis, prophylaxis, and treatment clinic appointments, and their effects on TB treatment outcomes. The following were reported concerning the effect of phone calls on TB outcomes: For people being treated for active TB, clinic attendance and TB treatment completion were higher in people receiving pre-appointment reminder phone-calls. For people on TB prophylaxis, clinic attendance was higher with a policy of pre-appointment phone. For people undergoing screening for TB, three trials of pre-appointment phone-calls found little or no effect on the proportion of people returning to clinic for the result of their skin test.

2.15 Tools and Strategies for improving Treatment Outcome

Various measures have been introduced at different settings in an attempt to improve patients adherence to TB treatment regimen (CDC, 1998; Sbarbaro and Sbarbaro, 1994). The interventions for improving adherence can be classified into the following categories (WHO, 2003):

Staff motivation and supervision: It entails training and management processes aimed at improving the way in which providers care for patients with tuberculosis.

Defaulter action*:* These are actions to be taken when patient fails to keep a pre-arranged appointment.

Prompts: These are routine reminders for patients to keep pre-arranged appointments and take their medications. It involves the use of methods such as home visits, SMS, phone calls, or electronic devices that ranges from beepers to alarm watches.

Health education**:** This entails making provision of information about tuberculosis and the need to attend treatment.

Incentives and Enablers**:** This entails money or cash in kind to reimburse the expenses of patients attending the treatment centre, or to improve the attractiveness of visiting the treatment centre.

Contracts: These are agreements (written or verbal) to return for an appointment over course of treatment.

Peer assistance*:* This entails people from the same social group (e.g family members and friends) helping someone with tuberculosis to return to health centre by prompting or accompanying them.

Direct Observed Therapy (DOT): This involves an identified, trained and supervised agent (health worker, community volunteer or family member) directly monitoring the swallowing of anti-TB drugs by patients.

2.16 Tools and Strategies for Measuring Adherence

The measurement of adherence in the treatment of TB can be categorized into two: Direct measures and indirect measures (CPFNTC, 2005).

2.16.1 Direct measures

2.16.1.1 Directly observe patients

In this case trained health care providers observe and record a patient's adherence (CPFNTC, 2005).

Advantages: The advantages include adherence verification and recorded by a health care provider. It ensures that the patients/caregivers are administering the medications as prescribed.

Health providers can administer medications and teach techniques for administering medications and can be effectively combined with DOT visit of TB case (CPFNTC, 2005).

Limitations: The limitation of this method includes expensive and resource intensive, inconvenient for patients and caregivers, some programs do not have the infrastructure to provide DOT in-home or on-site visits and DOT is required for biweekly regimens (CPFNTC, 2005).

2.16.1.2 Measure biological markers / therapeutic drug markers (TDM)

In this method, levels of TB medications in the urine are measured to assess patient's adherence (CPFNTC, 2005).

Advantages: The major advantage is that providers can verify self-reported adherence of medications within the last 72 hours (CPFNTC, 2005).

Limitations: Some of the limitations is that is very expensive and inconvenient, no information available about levels of the medication before the 72 hour period and reason for non-adherence cannot be ascertained (CPFNTC, 2005).

2.16.2 Indirect measures

2.16.2.1 Self report

In this method a health care provider or health educator assesses a patient's adherence to TB treatment by asking the patient specific questions (CPFNTC, 2005).

Advantages: Quick and inexpensive, easy to use, self-reported non-adherence is usually reliable and can reveal reasons for missed doses (CPFNTC, 2005).

Limitation: Patients may be reluctant to admit non-adherence.

Poor recall can result in inaccurate reporting (CPFNTC, 2005).

2.16.2.2 Monitor clinic attendance

Monitoring and recording clinics visits allows health care providers to identify patients who are adherent or delinquent in terms of attendance (Carrion *et al.,* 1993).

Advantage: Poor clinic attendance can be a good indication of non-adherence to TB treatment.

Limitations: Good clinic attendance doesn't always correlate with adequate medication adherence, adherence to medications is not assessed and reason for non-adherence is not available (CPFNTC, 2005).

2.16.2.3 Monitor pills

In this method patients are asked to bring in their medication bottles, and the remaining doses are counted at clinic visits

Advantages: Inexpensive and easy for staff to conduct

Limitations: It is unable to ascertain whether pills were ingested or discarded, when they were ingested, or whether the appropriate number of pills was taken at the correct intervals (CPFNTC, 2005). Pill counts have been shown to overestimate adherence (Fletcher et al.,1979; Pullar, 1989). It is not widely used in regular clinic practice because it is difficult to ensure that the medication bottles are brought back to the clinic (CPFNTC, 2005).

2.16.2.4 Calculated medication refill rate

Pharmacy database can be used to check when prescriptions are refilled initially, re-filled over time and prematurely discontinued (CPFNTC, 2005).

Advantages: Inexpensive and non-obstructive for patient

Limitations: Provides no information on pill ingestion, patterns of non-adherence cannot be determined using this method and it is not practical in clinical settings where patients use several Pharmacies (CPFNTC, 2005).

2.16.2.5 Medication possession ratio

This is another method employed in measuring adherence. This is a very useful tools in measuring adherence since medications are often taken (or not taken) outside the view of the Pharmacist or Physician's view (express scripts, 2012). Medication possession ration (MPR) can be calculated by tracking how frequently the patients refill their medications. The adherence is measured over six to twelve months period for most conditions

2.16.2.6 Proportion of days covered (PDC)

This is another method employed in measuring medication adherence using refill records. It is usually expressed in percentages proportion days covered (PDC) can be calculated as follows

PDC – number of days in period covered
Number of days

MPR – total days supply in period
Number of days

2.16.2.7 Electronic monitoring devices

Prescription bottles equipped with Electronic Monitoring Devices (EMDs) can be distributed and collected at monthly visits and used to measure adherence (Arnsten *et al.*,2001). The EMD uses an electronic device located in the cap of the prescription bottle which records the date and time that the cap is removed. An example is the Micro Electronic Monitoring Systems (MEMS®, Aardex Corp., Palo Alto, CA) (CPFNTC, 2005).

Advantages: Provides detailed information including actual dosing interval.

Can be used to provide feedback on adherence to patients (CPFNTC, 2005).

Limitations: Expensive, complex to use, doesn't track number of pills removed or ingested, not practical for large patient populations and inaccuracies may occur due to improper use or technical problems (CPFNTC, 2005).

2.17 Pharmacist Intervention in the Management of Tuberculosis

Pharmacists can play an important role in facilitating optimal pathways to the care of tuberculosis (TB) (Daftary *et al.,* 2017). Studies showed that Pharmacists from high burden communities indicate strong support to participate in TB programs (Gharat *et al.,* 2007; Bell et al., 2012)

In low and middle income countries Pharmacist could play the following roles (Daftary *et al.,* 2017):

Detection: By providing active referrals and notifications.

Treatment: By dispensing, monitoring and patient support.

Regulation: Through antibiotic stewardship and professional regulation.

Surveillance: During over-the-counter and prescription drug sales.

Private sector engagement: Through voucher schemes, and provider and industrial liaising.

Drug related problems (DRPs) can be either due to inappropriate therapy decisions, abuse, adverse effects, drug interactions or patient non-compliance (Weistein *et al.,* 2001). Pharmacists being close to the prescribing process, are in the position to identify and adjust prescribing errors before dispensing. Various studies have quantified the number of Pharmacy based interventions. Most short-term studies (1-2 weeks of observation) report frequencies of around one out of 100 prescriptions leading to a Pharmacy-based intervention (Rupp *et al.,*1988; Rupp *et al.,* 1992; Caleo *et al.,* 1996; Smith *and Christensen,* 1996; Hawksworth *et al.,* 1999). Pharmaceutical interventions have been reported to impact positively on morbidity, adverse drug effect (Gillespie *et al*., 2009; Schnipper *et al*., 2006) and the reduction of cost of treatment (Kausch *et al*., 2005).

Abrogoua *et al.* (2016) reports that the presence of a Pharmacist at inpatient contributes to the prevention and resolution of problems related to the pharmacotherapeutic management of TB and that Pharmacists could position themselves as major players in the therapeutic management of TB inpatient in resource-limited setting.

Venkatapraveen *et al.* (2012) in a study carried out in a Teaching Hospital in India, involving 144 participants, reported that group with Pharmacist intervention resulted in 80.71% successful treatment outcome, while that without intervention (control) yielded only 43.86%.

2.18 Counseling in Tuberculosis Treatment

It has been reported that DOTS (Directly Observed Treatment Short-Course) that involved counseling, in which the patient is given guidance and advice on how to manage TB, is more effective in bringing about successful completion of TB treatment than only routine DOTS (Joseph *et al.*,2000; Amir *et al.*, 2016).

According to a study conducted by Joesph *et al.*(2000) on TB patients attending private health care service, it was reported that intensive counseling and modified methods of supervision were successful in achieving cure rates as good as DOTS. Along with adherence to treatment, the cure rate was 87.7%, with no relapse in 6 months follow up and 80% patients resumed normal life.

Amir *et al.* (2016) also reported that majority of the experimental group patients adhered to the therapy 25 (83.3%) till the last follow –up counseling session dropout rate was 5 (16.6%) while among control group 9 (30 %) continued the treatment and kept on coming up for follow up sessions their dropout rate was 21 (70%).

2.19 Secondary Health Facilities

In secondary health care facilities, health care services are provided by medical specialists. They may not have first contact with patients; patients usually access these services through physician referral or self-referral. Secondary health care providers include cardiologists, urologists, dermatologists and other such specialists. The health care services include acute care, short period stay in a hospital emergency department for brief but serious illness. There may be secondary care providers who do not work in hospitals - psychiatrists, physiotherapists, respiratory therapists, speech therapists and so on. In Nigeria, District Hospitals and Community Health Centres are examples of Secondary Health Facilities within the public health system.(Lal, 2016).

CHAPTER THREE

3.0 METHODS

3.1 Study Design

The study design was hospital base prospective randomized study, whereby a total of one hundred and ten (110) respondents were enrolled from January to June 2018. (A total number of 50 TB outpatients of Asokoro District Hospital and 60 Tb outpatients from Nyanya General Hospital)

The respondents were randomized into control and intervention groups using online randomize number picker. The study was in two phase questionnaire & outcome measure. A self-administered questionnaire was distributed to the respondents before and after Pharmacist interventions. The questionnaires comprises of three sections as explained below.

3.1.1 Socio-demographic Distribution

All the 110 respondents were asked five questions that comprised of age, gender, educational status, marital status and employment status.

3.1.1.1 Age

The age distribution was grouped at ten years interval from less that 15 to above 64 years (see appendix 1)

3.1.1.2 Gender

This section has two response of male or female

3.1.1.3 Educational status

This was made up of four responses ranging from no formal education to higher or tertiary education

3.1.1.4 Marital Status

The respondents had four responses where they chose from as single, married, divorced and widow or widower.

3.1.1.5 Employment status

This section had six different responses as to their employment and type or area of employment. The responses comprised of civil/public servant, private, self-employed, house wife, unemployed and student.

3.1.2 Disease knowledge Assessment

The 110 participants were asked at the second portion of the questionnaire their knowledge of tuberculosis disease before coming to the facility. There were six questions in this section. The questions addressed causes of TB, what were the signs and symptoms, mode of transmission. It had various option (Appendix 1)

3.1.3 Medication Adherence Assessment

Medication adherence Assessment the extent to which the participants adhered to their medications was measured by using the patient medication refill card. The participants

cards were examined to see the date the patients comes to refill their medication. The percentage adherence for each of the patient was calculated

3.1.4 Social History of participants

This section comprised of three questions that seek to assess the participants history of cigarette smoking and consumption of alcoholic beverages and the last time they were engaged in the consumption of these items.

The total numbers of 110 questionnaires were distributed to the participants (54 for control group and 56 for intervention groups) before and after Pharmacist interventions. Information leaflets were distributed to the intervention group (Appendix 2) and face to face interactions at every visit which was weekly during the two months of intensive phase and forth nightly up till the end of treatment. The intervention group was also followed-up with phone calls once weekly and text messages twice weekly.

The wording of the text message goes thus:

"Good day Mr./Mrs. XYZ, remember your medication (or your appointment). Let me be aware of any unpleasant experience from your medication" (Pharmacist)

Each participant in the intervention group was followed up till the end of their medication which was for six months.

The second phase of the study comprises of administration of questionnaire to all participants to measure their knowledge of disease causes, signs and symptoms and mode of transmission after the Pharmacist intervention.

3.1.5 Treatment Outcomes of Tuberculosis

A specially designed form was used (Proforma) to collect information on the treatment outcomes which was broadly classified into successful (cured and completed) and unsuccessful (died, failure, defaulted).

3.2 Study Sites

The study was carried out in two secondary health facilities in Abuja Municipal Area Council of Federal Capital Territory. The two facilities were Asokoro District Hospital (ADH) and Nyanya General Hospital (NGH). Abuja, the capital of Federal Republic of Nigeria was formed on 3rd February 1976 from parts of states of Nassarawa, Niger and Kogi and situated in the north central of the country. Abuja is a planned city and mainly built in the 1980's. It officially became Nigeria's capital on 12th December 1991, replacing Lagos. At the 2006 census, Abuja municipal area had an estimated population of seven hundred and seventy six thousand, two hundred and ninety eight (776, 298), adults. Some recent studies showing it to be 2.4 million as of 2018 (WPR, 2018). It occupies a land area of about 7,753.9sq km. It is lying on coordinates $8^0$50'N$7^0$10'E. Asokoro District Hospital is located at the city centre while Nyanya General Hospital is located at the satellite town of FCT.

3.2.1 Asokoro District Hospital (ADH)

Asokoro District Hospital is a secondary facility that also offers some degree of tertiary services. It is a 120 bed spaced hospital. The hospital has various units that provides wide range of services which includes Pharmaceutical services (In-patient, Out-patient, NHIS, ARV pharmacy, DRF store), Accident and Emergency services, general out- patient services, Obstetrics and Gynecology (O and G) services, Paediatric and Neonatal services, General Neurology surgery, Internal medicines (cardiology clinic, urology, Endocrine unit,

etc.), Intensive Care Unit (ICU), Renal dialysis unit, Optometry and Ophthalmology services, Laboratory services (including DOTS Lab) Radiological services, Physiotherapy, Immunization and family planning services as well as housing Institute of Human Virology (IHVN) and CDC specialized laboratory. The hospital engages in Residency training of Resident Doctors in Family medicine as well as Pharmacy resident.

3.2.2 Nyanya General Hospital (NGH)

NGH is a secondary health facility serving a large population of both FCT residents as well as neighbouring and nearby states of Nassarawa, Kaduna and Plateau. NGH offers free antenatal care to women, care and free treatments to children below five years of age. It is a 61 bedded facility with various units that provides a wide range of services which includes Pharmaceutical Services (in-patient, out-patient, ARV Pharmacy, DRF store), accident and emergency services, general out-patient obstetrics and Gynaecology, Dental service, Physiotherapy, DOT unit, immunization and family planning unit.

3.3 Study Population

New sputum smear positive pulmonary tuberculosis patients that were registered in the two health facilities were the study population.

3.4 Sample Size Determination

The sample size was determined by Taro Yamane Method 95% confidence interval.

$N = N/CI+N\ (e)^2$. 'N' is the sample size for the study while 'N' is the population under study and in this particular study it was 63 for Asokoro District Hospital and 76 for Nyanya General Hospital. After calculation; 50 participants met the eligibility criteria from Asokoro district Hospital while 60 from Nyanya General Hospital making a total of

110 participants for the study. ‘e’ is the margin error which could either be 0.10; 0.05 or 0.01. For this study it was 0.05

3.5 Eligibility Criteria

The Eligibility criteria include;

Pulmonary tuberculosis patients with sputum smear positive

Those patients that were willing to participate

Patients and care givers that can read and write

Patients and caregivers that have phone

3.6 Sample Selection

A total of 110 TB out patients were randomized into intervention group and control group using online randomize number picker. After assigning numbers to the participants as they were registering at the facilities.

3.7 Study Instruments

3.7.1 Questionnaire development

Questionnaire and Proforma development experts in the field of tuberculosis developed the questionnaire to assess the disease knowledge of the participants while adherence measure was based on previous study done (Alfa *et al*, 2016)

A designed Proforma was used in collecting the treatment outcomes.

3.7.2 Questionnaire validation

3.7.2.1 Face validity

The questionnaires used were reviewed by project supervisor including site supervisor for face validity of contents, scope and appropriateness of the questions.

3.7.2.2 Evaluation and modification

Pretesting of the questionnaire used was done at Wuse General Hospital and Maitama District Hospital to evaluate patients understanding of the questions. About 10% of the study population was used for pretesting (n=11). Some questions were reworded to eliminate ambiguous phrasing

3.8 Data Collection

3.8.1 Training of research assistance

Those that were to assist in the collection of data (Pharmacist, nurse and CHEW) were trained on how to administer the questionnaire, given of health education counseling and proper documentations.

3.8.2 Education of participants

The 110 participants whom were sputum smear positive TB patients were trained on cough etiquette (appendix 4), how to answer the questionnaire, hand hygiene. The intervention group was also informed to be expecting phone calls and text messages as a follow-up to their treatment.

3.8.3 Administration of questionnaire

One of the data instruments used was questionnaire which was a self-administered by the participants

3.8.4 Documentation approach

Other information needed was collected using a Proforma. These were medication adherence from medication refill cards and treatment outcomes of tuberculosis from patient folders.

3.9 Outcomes Measured

The various outcomes of the study measured were; disease knowledge of participants, medication adherence and treatment outcomes of tuberculosis. Treatment outcomes of tuberculosis measured were successful which comprised of cured and treatment completed patients while unsuccessful outcomes comprises of treatment failure, defaulter, death. And lastly those that were transferred out that cannot be evaluated. The treatment outcomes data were collected from patients' folder and treatment register.

3.10 Data Analysis and Presentation

The data collected were imputed into IBM statistical package for social science version 22.0 and presented as percentages in tables and charts. Chi square was used to compare the categorical variables in the intervention and control group as well as the treatment outcomes. For all the statistical analysis, a P-value of ≤ 0.05 was considered to be statistically significant in this study.

3.11 Ethical Issues/consideration

Ethical approval was obtained from Health research Ethics committee of health and Human Services Secretariat, Federal Capital territory Administration (FCTA) (appendix III). Also, a written and signed consent form (appendix IV) was obtained from the participants after explaining to them and given them information sheet (appendix II).

CHAPTER FOUR

4.0 RESULTS

4.1 Socio-Demographic Distribution of Sputum Smear positive tuberculosis patients.

The total number of respondents that participated in this study was 110. There were slightly higher number of male in both control 28 (51.9%) and intervention 30 (53.6%) groups than female respondents 26 **(**48.1%) and 46.4% respectively in both control and intervention. Majority of the respondents falls within the age range of 25 – 44 years in both control and intervention groups respectively (table 4.1). The educational status showed that majority of the respondents had secondary school education in both control 30 (55.6%) and 28 (50.0%) respectively. This was followed by those that attained tertiary education 12(22.2%) and 23(41.1%) for control and intervention groups respectively. The least percentage of participants was those with primary and those without formal education. On the level of employment status, majority of the respondents were self-employed 18(33.3%) and 23(41.1%) in control and intervention groups respectively and civil servants were 11(10.4%) and 15(26.8%) respectively while the least was the unemployed who formed 3(5.6%) and 4(7.1%) of control and intervention groups respectively (table 4.1)

Table 4.1: Sociodemographic Distribution of Smear Positive Tuberculosis Patients

Patients Characteristics	Control		Intervention		Chi-square	p-value
Age	**n=54**	**%**	**n=56**	**%**	**4.987**	**0.417**
<15	0	0.0	0	0.0		
15-24	6	11.1	12	21.4		
25-34	13	24.1	18	32.1		
35-44	21	38.9	13	23.2		
45-54	7	13.0	7	12.5		
55-64	5	9.3	5	8.9		
>64	2	3.7	1	1.8		
Total	**54**	**100.0**	**56**	**100.0**		
Gender					0.033	0.857
Male	28	51.9	30	53.6		
Female	26	48.1	26	46.4		
Total	**54**	**100.0**	**56**	**100.0**		
Education					6.492	0.090
No formal education	6	11.1	2	3.6		
Primary school	6	11.1	3	5.4		
Secondary school	30	55.6	28	50.0		
Tertiary school	12	22.2	23	41.1		
Total	**54**	**100.0**	**56**	**100.0**		
Employment status					8.637	0.124
Civil servant	11	20.4	15	26.8		
Private	7	13.0	1	1.8		
Self-employed	18	33.3	23	41.1		
House wife	8	14.8	3	5.4		
Unemployed	3	5.6	4	7.1		
Student	7	13.0	10	17.9		
Total	**54**	**100.0**	**56**	**100.0**		

Statistically Significant Difference ($p < 0.05$)

4.2 Assessment of Disease knowledge Assessment of the respondents before Pharmacist Intervention

The questions here were grouped into 5.The respondent's knowledge of the word Pulmonary TB, the causes, signs and symptoms and mode of transmissions were assessed before and after Pharmacist intervention.

A total of 54 and 56 respondents were in the control and intervention groups respectively. Before intervention, 15(27.8%) and 27(48.2%) the respondents knew what tuberculosis was in both control and intervention group respectively. While 39(72.2%) and 29(51.8%) did not know what tuberculosis was in both group. As per the causes of tuberculosis, majority of the respondents did not know what causes tuberculosis in both control and intervention group. For how the disease can be transmitted, 25(46.3%) and 26(46.4%) knew how it is transmitted while 29(53.7%) and 30(53.6%) did not know the disease was transmitted.(Table 4.2) After the Pharmacist intervention, the control group had 26(48.11%) that knew what pulmonary tuberculosis was while 28(51.85 did not know what TB was. The intervention group had 54(96.4%) that knew what TB is and only 2(3.6%) did not know 16(29.6%) and 60(89.3%) knew what causes TB in the control and intervention group respectively after Pharmacist intervention, majority of the respondents knew the signs and symptoms of TB 42(77.8%) and 51(91.1%) respectively in both control and intervention group. 38(70.4%) respondents in the control group and 52(92.9%) in the intervention group knew how TB can be transmitted while 16(29.6%) and 4(7.1%) in control and intervention group respectively did not know how TB can be transmitted after Pharmacist intervention.(Table 4.3)

Table 4.2: Assessment of Disease Knowledge Assessment before Pharmacist Intervention

Characteristics	Response	Control	Intervention	Chi-square	p-value
Have you heard about tuberculosis	1	29 (53.7%)	25 (44.6%)	0.903	0.342
	0	25 (46.3%)	31 (55.4%)		
What is pulmonary Tuberculosis	1	15 (27.8%)	27 (48.2%)	4.864	0.027
	0	39 (72.2%)	29 (51.8%)		
What cause Tuberculosis?	1	9 (16.7%)	18 (32.1%)	3.555	0.059
	0	45 (83.3%)	38 (67.9%)		
What are the signs and symptoms of tuberculosis	1	6 (11.1%)	18 (32.1%)	7.129	0.008
	0	48 (88.9%)	38 (67.9%)		
How can tuberculosis be transmitted	1	25 (46.3%)	26 (46.4%)	0.000	0.989
	0	29 (53.7%)	30 (53.6%)		

Statistically Significant Difference ($p < 0.05$)

Table 4.3:Assessment of Disease Knowledge Assessment after Pharmacist Intervention

Characteristics	Response	Control	Intervention	Chi-square	p-value
Have you heard about tuberculosis	1	54 100.0%)	56 (100.0%)	-	-
	0				
What is pulmonary Tuberculosis	1	26 (46.4%)	54 (96.4%)	34.300	0.000
	0	30 (46.4%)	2 (3.6%)		
What cause Tuberculosis?	1	16 (29.6%)	50 (89.3%)	40.765	0.000
	0	38 (70.4%)	6 (10.7%)		
What are the signs and symptoms of tuberculosis	1	42 (77.8%)	51 (91.1%)	3.718	0.054
	0	12 (22.2%)	5 (8.9%)		
How can tuberculosis be transmitted	1	38 (70.4%)	52 (92.9%)	9.345	0.002
	0	16 (29.6%)	4 (7.1%)		

Key : 1 = yes/ correct

0= no/ wrong

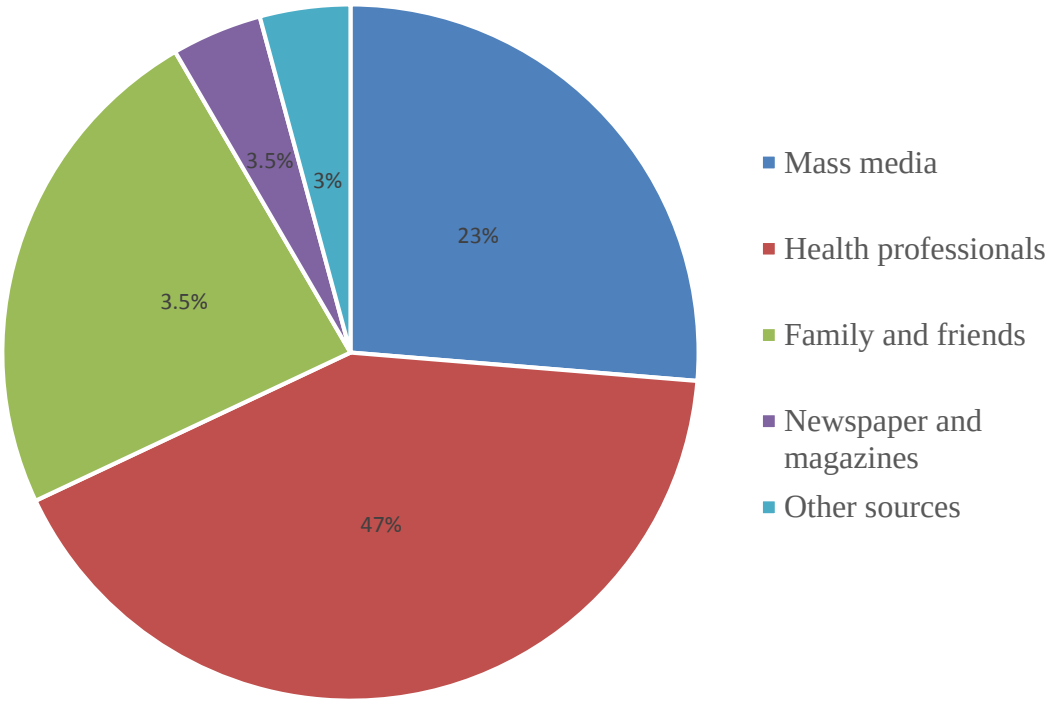

Fig.1: Sources of Information on Tuberculosis by Respondents in the Health Facility

4.3 Assessment of patient medication Adherence before and after Pharmacist Intervention in the Health Facilities using Patient Medication Refill Card and Oral interview

The study showed the level of medication adherence of the patients in the health facilities. A total number of 110 sputum smear positive pulmonary tuberculosis patients participated. These were divided into 54 and 56 participated in the control and intervention group respectively. 50 (92.6%) and 51 (91.10%) had poor medication adherence (<100%) before the intervention in both control and intervention groups respectively. While only 4 (7.4%) and 5 (8.9%) had good medication adherence (100%) respectively. After the Pharmacist intervention, 40 (71.4%) of the participants in the Pharmacist intervention group had good medication adherence (100%) while only 13 (24.1%) had good medication adherence (100%) in the control group. 41 (75.9%) and 16 (28.6%) had poor medication adherence (<100%) in the control and intervention group respectively.

Table 4.4: Assessments of Medication Adherence before and after Pharmacist Intervention

Characteristics	Medication adherence	Control	Intervention	Chi-square	p-value
Pre				0.085	0.771
	Poor	50 (92.6%)	51 (91.1%)		
	Good	4 (7.4%)	5 (8.9%)		
Post				24.691	0.000
	Poor	41 (75.9%)	16 (28.6%)		
	Good	13 (24.1%)	40 (71.4%)		

4. 4 Social History of Respondents in Nyanya General Hospital Before and After Pharmacist Intervention

The total number of 60 patients (30 each in control and intervention group respectively) participated in this facilities (Table 4.)

4.5 Social History of Respondents in Asokoro District Hospital

There was a significant association between ($p < 0.05$) respondents that smokes at baseline and after Pharmacist follow-up. After Pharmacist intervention, the number of respondents that smokes significantly ($p < 0.05$) reduced (Table4.4).

Most of the respondents can't remember when last they smoke (Table 4.4).

There was a significant association between ($p < 0.05$) frequency of intake of alcohol of respondents at baseline and Pharmacist follow-up. After intervention the frequency of alcohol intake by respondents significantly ($p < 0.05$) reduced (Table 4.5).

Table 4.5; Assessment of Social History of Respondents in Nyanya General Hospital

Characteristics		Before N(%)	After N(%)	Chi-square	P value
Did you smoke cigarette?	No response	0 (0.0)	0 (0.0)	29.400	0.000*
	Yes	5(16.7)	4 (13.3)		
	No	25 (83.3)	26 (86.7)		
	Total	30 (100.0)	30 (100)		
When last did you smoke?	No response	24 (80.0)	27 (90.0)	115.600	0.000*
	Yesterday	0 (0.0)	0 (0.0)		
	Last week	1 (3.3)	0 (0.0)		
	Last Month	3 (10.0)	1 (3.3)		
	More than six month	2 (6.7)	2 (6.7)		
	Total	30 (100)	30 (100)		
How often do you drink alcohol or alcoholic beverages?	No response	0 (0.0)	0 (0.0)	58.667	0.000*
	Daily	3 (10.0)	1 (3.3)		
	2-3 times in a week	3 (10.0)	0 (0.0)		
	Weekly	1 (3.3)	0 (0.0)		
	Once in a while	13 (43.3)	13 (43.3)		
	Don't drink at all	10 (33.3)	17 (36.7)		
	Total	30 (100)	30 (100)		

* statistically significant ($p < 0.05$)

Table 4.6 Assessment of Social History of Respondents in Asokoro District Hospital

Characteristics		Before N(%)	After intervention N(%)	Chi-square	P value
Did you smoke cigarette?	No response	1 (3.8)	1 (3.8)	57.731	0.000*
	Yes	5(19.2)	2 (7.7)		
	No	20 (76.9)	23 (88.5)		
	Total	26 (100.0)	26 (100.0)		
When last did you smoke?	Can't remember	19 (73.1)	21 (80.8)	106.077	0.000*
	Yesterday	1 (3.8)	0 (0.0)		
	Last week	2 (7.7)	0 (0.0)		
	Last Month	1 (3.8)	2 (7.7)		
	More than six month	3 (11.5)	2 (7.7)		
	Total	26 (100)	26 (100)		
How often do you drink alcohol or alcoholic beverages?	No response	0 (0.0)	1 (3.8)	65.231	0.000*
	Daily	1 (3.8)	0 (0.0)		
	2-3 times in a week	3 (11.5)	2 (7.7)		
	Weekly	1 (3.8)	1 (3.8)		
	Once in a while	14 (53.8)	13 (50.0)		
	Don't drink at all	7 (26.9)	9 (34.6)		
	Total	26 (100)	26 (100)		

* statistically significant ($p < 0.05$)

4.6 Assessment of Literacy Status and Treatment Outcomes of Pulmonary Tuberculosis Patients after Pharmacist Intervention in the Health Facilities.

The 110 participants were divided into control and intervention groups. The outcomes measured were categorized as successful (sum total of cured and treatment completed patients) and unsuccessful (sum total of defaulter died, treatment failed, transferred out patients) with their literacy status

The study showed a total sum of successful outcomes of 40 (74.1%) and 49 (87.5%) in the control and intervention groups respectively. Among these, those with secondary school education had the highest successful outcomes of 33.3% in the control group followed by 16.7% for those with higher education while those with primary and no formal education had 9.2% and 14.8 successful outcomes respectively. The intervention group with 87.5% successful outcome had it based on literacy status with those secondary educational level having a successful outcome of 24 (42.9%) followed by secondary education of 33.9%. all the participant with primary and no formal education formed 7.1% and 3.6% respectively and they all had successful outcomes in the intervention group.

Table 4.7 Assessment of Literacy Status and Treatment Outcomes of Pulmonary Tuberculosis Patients after Pharmacist Intervention in the Health Facilities.

	Control		**Intervention**	
Literacy Status	Successful N (%)	Unsuccessful N(%)	Successful N(%)	Unsuccessful N(%)
No formal education	8 (14.8)	1 (1.9)	2 (3.6)	0 (0)
Primary education	5 (9.2)	1 (1.9)	4 (7.1)	0 (0)
Secondary education	18 (33.3)	9 (16.7)	24 (42.9)	2 (3.6)
Higher or tertiary education	9 (16.7)	3 (5.5)	19 (33.9)	5 (8.9)
TOTAL	**40 (74.1)**	**14 (25.9)**	**49 (87.5)**	**7 (12.5)**

* statistically significant ($p < 0.05$)

4.7 Assessment of Employment Status and Treatment Outcomes of Pulmonary Tuberculosis Patients after Pharmacist Intervention

The total 110 participants from the two health facilities were divided into control and intervention groups. They were categorized according to their areas of employment. The study showed the sum total of successful outcome across all employment categories as 40 (74.1%) and 49 (87.5%) in control and intervention groups respectively. Among these; the study showed that those that were self-employed had a successful outcome of 12 (22.2%) and 19 (33.9%) in both control and intervention group respectively. The study showed civil servant category had successful outcome of 10 (18.5%) and 14 (25%) participation in both control and intervention group respectively. The students category had 7 (12.9%) and 9 (16.0) participants having successful treatment outcomes in both control and intervention group respectively. Housewives and those that were unemployed had 3 (5.6%) and 3 (5.4%) successful outcomes in both categories for control and intervention groups respectively. While those that worked in private establishment had 5 (9.3%) and 1 (1.8%) successful outcomes in both control and intervention groups respectively.

Unsuccessful outcomes was 7 (12.9%) in self-employed category for control and 4 (7.1%) for intervention groups. Civil servant had unsuccessful outcome of 2 (3.7%) and 1 (1.8%) for control and intervention group respectively. The private employment category had 1 (1.8%) and 1 (1.8%) unsuccessful outcome in both control and intervention group while unemployed and student category had no unsuccessful outcome 0 (0%) in control group. They all had successful outcome. Private and housewife category in the intervention group had zero (0%) unsuccessful outcomes respectively. (Table 4.6)

The total sum of unsuccessful outcomes in both control and intervention group were 25.9% and 12.5% respectively. (Table 4.6)

The study showed a statistically significant different ($p < 0.005$) in the treatment outcomes between control and intervention group after pharmacist intervention.

4.8 Assessment of Employment Status and Treatment Outcomes of Pulmonary Tuberculosis Patients after Pharmacist Intervention

	Control		**Intervention**	
Employment status	Successful N (%)	Unsuccessful N (%)	Successful N (%)	Unsuccessful N (%)
Civil servant	10 (18.5)	2 (3.7)	14 (25)	1 (1.8)
Private	5 (9.3)	1 (1.85)	1 (1.8)	0 (0)
Self employed	12 (22.2)	7 (12.9)	19 (33.9)	4 (7.1)
House wife	3 (5.6)	4 (7.4)	3 (5.4)	0 (0)
Unemployed	3 (5.6)	0 (0)	3 (5.4)	1 (1.8)
Student	7 (12.9)	0 (0)	9 (16.0)	1 (1.8)
TOTAL	**40 (74.1)**	**14 (24.9)**	**49 (87.5)**	**7 (12.5)**

Table 4.9 Treatment Outcomes of Sputum Smear Positive Pulmonary Tuberculosis Patients in the Health Facilities.

	Control N(%)	**Intervention N(%)**	χ^2	p value	df
Successful	40 (74.1)	49 (87.25)	97.676	<0.001*	1
Unsuccessful	14 (25.9)	7 (12.75)			
Total	54 (100)	56 (100)			

* statistically significant difference($p < 0.05$)

χ^2= Chi-square df = degree of freedom

4.8 Treatment Outcomes of Tuberculosis of the Respondents in Nyanya General Hospital and Asokoro District Hospital

Comparing Nyanya General hospital and Asokoro District Hospital, a successful outcome of 90% and 84.5% respectively was obtained in intervention group. The study also showed unsuccessful outcome of 80% in Nyanya and 66.7% in Nyanya and Asokoro respectively. The study showed there was a statistically significant difference ($p<0.05$) between successful and unsuccessful outcome after Pharmacist intervention for both Hospitals. (fig 3)

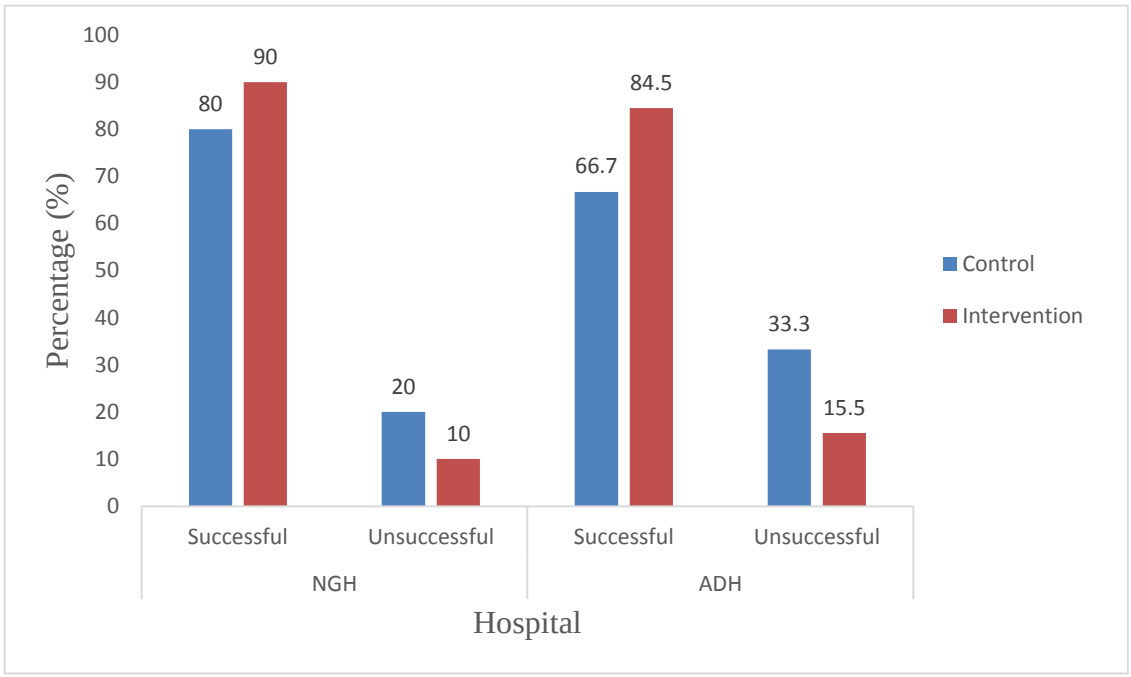

Fig. 2: **Treatment Outcomes of Tuberculosis of the Respondents in Nyanya General Hospital and Asokoro District Hospital**

CHAPTER FIVE

5.0 DISCUSSION

This study was conducted at two secondary health facilities in Abuja, Asokoro District hospital and Nyanya General Hospital both situated in Abuja Municipal Area council of Abuja. The study evaluated Pharmacist intervention on the treatment outcomes of pulmonary tuberculosis patients. The study also assessed the disease knowledge of the signs and symptoms as well as modes of transmission. Other components of the study were assessment of medication adherence through medication refill and as well as comparing the treatment outcomes from the two health facilities.

The socio-demographic findings in this study showed the majority of the participants age distribution was in range of 25 – 44 years. The finding of this study was in agreement with similar study in India that tuberculosis occurs in adults in their productive age of 25 – 54 years. (Dudala, 2013). The study showed that the male participants were slightly higher than females from the two facilities. This finding was in agreement with global TB report that had more male population having tuberculosis than female. (WHO, 2018)

The findings of this study on their educational status showed majority of the participants having secondary school educational and was closely followed by those with tertiary or higher educational status. Previous research showed that educational level of patients was an integral part of disease management (Cooper *et al*, 2001). The findings of this study also showed that comparing the ratio of those with secondary or higher education with those without formal education or primary, those with higher education had better understanding of the disease as it was observed in the disease knowledge assessment section of the study.

The study showed that majority of the participants were self-employed in both control and intervention groups. This might lead to low socio-economic state which was one of the barriers to treatment outcomes (WHO, 2003). This study also confirmed this as majority of the defaulter (part of unsuccessful) were the self-employed category in both groups.

This study assessed the disease knowledge of the patients before and after Pharmacist intervention. Participants were assessed on causes of the disease, signs and symptoms. Before intervention, both control and intervention groups' knowledge of the disease was poor. Though majority of the participants have heard about the disease, majority of them did not know what causes it and most importantly modes of transmission. After the Pharmacist intervention, the study showed majority of the participants in the intervention group had gained the knowledge and knew the causes, modes of transmission. Their knowledge of these would have helped to reduce transmission. The findings of the research also showed that there was statistically significant difference in knowledge of disease before and after Pharmacist intervention between control and intervention group. Majority of the participants that knew about the disease before got the information from health care professionals.

The statistically significant difference observed in this study in the Pharmacist intervention group is in line with WHO recommendation in the strategy for improving adherence is health education which entails provision of information about tuberculosis. (WHO, 2003). This study also assessed the medication adherence through medication refill card and the findings showed that majority of the Pharmacist intervention group had good medication adherence as compared to the control group that only very few had good adherence. The findings of the study also showed statistically significant difference between the control group and Pharmacist intervention group. This study evaluated the treatment outcome of

pulmonary tuberculosis patients in two health facilities. The outcomes measured were successful (which was the sum total of cured and treatment completed) and unsuccessful (died, default, treatment failure and transferred out) outcomes. The study was able to achieve a successful outcome of eighty-seven percent and above in the pharmacist intervention group as against the control group with seventy-four percent successful outcomes. The study was in agreement with findings of the study conducted in a tertiary health facility in Nigeria (Ojieabu and Erah, 2011) where the pharmacist intervention group had a successful outcome of over eighty-seven percent as compared to control group without pharmacist intervention. Majority of the respondents gave up smoking and alcoholic beverages intake after Pharmacist intervention as compared to baseline, indicating the effectiveness of the intervention. Smoking is one of the major risk factor in the development and management of tuberculosis. Alcohol intake is also one of the barriers to successful outcomes (WHO, 2003). This study was in agreement with studies conducted by Joseph *et al*.,(2000), which shows that intensive counseling, follow up phone calls and text messages improves treatment outcomes. A similar study conducted by Amir et al, (2016) had 83.3% successful outcome, follow up patients, Joseph et al (2000) successful outcome of 87.7% in follow up patient. Venkatapraveen *et al*, (2012) had 80.71% successful treatment outcome with Pharmacist intervention.

5.1 Limitations of the Study

1. The research was carried out in two secondary health facilities in Federal Capital Territory Abuja and the result obtained may not be generalized to all secondary health facilities in Abuja or in Nigeria
2. The study did not take into consideration other factors that can influence the treatment outcomes of tuberculosis like commodities of chronic disease states.
3. It was very difficult getting the patients to open up in the areas of smoking and alcoholic consumption, but this was mitigated to some extent after health education as pertaining to adverse effects of taking such with their medication

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The study was able to achieve the recommended percentage of treatment outcome in the Pharmacist intervention group while the control group could not. This could be as a result of the intensive counseling, phone calls and reminder text messages offered to the intervention group. Although both facilities have successful treatment outcomes, those patients in the Pharmacist intervention group attending Nyanya General Hospital had higher percentage of successful treatment outcomes than those attending Asokoro District Hospital. This study also found out that the disease knowledge of the patients greatly improved after the Pharmacist intervention in the intervention group more than the control group without Pharmacist intervention

The study was able to achieve good medication adherence in the Pharmacist intervention group than the control group after intervention. Also, there was improvement in the characteristics of social life of the participant as most of them gave up smoking and alcohol beverage intake in the intervention group as compared to the control group.

The study also found out that in the demographic characteristics, tuberculosis occurred in adults of productive age and occurred more in male than female.

It can be concluded that the study found out that Pharmacist interventions has significantly improved disease knowledge, medication adherence and social life and treatment outcomes of pulmonary tuberculosis patients in the two facilities.

6.2 Contribution to Knowledge

The study establishes the following original contribution to knowledge.

1. There was a significant increase in disease knowledge of pulmonary tuberculosis patients after Pharmacist interventions with a significance level of $P<0.05$ in both hospitals used
2. Increase in medication adherence of the respondent to their medication from poor adherence to good adherence after the Pharmacist intervention was observed in this study ($p< 0.05$)
3. Successful tuberculosis treatment outcomes 87.5% was obtained in the Pharmacist interventions group and 74.1% in the control group from the healthcare facilities. Comparing Nyanya and Asokoro, a successful treatment outcome of 90% and 84.5% was observed at Nyanya General Hospital and Asokoro District Hospital respectively in the intervention group as compared to the control groups that have successful tuberculosis treatment outcomes of 80% and 66.7% in both Nyanya General Hospital and Asokoro District Hospital respectively.

6.3 Recommendations

1. There is need for constant health education to tuberculosis patients and the general public on how to prevent the spread of tuberculosis through hand hygiene and cough etiquette.

2. Pharmacists should be actively involved in dispersing, monitoring and patient education in order to improve treatment outcomes of tuberculosis.

3. Pharmacists should be highly involved in antimicrobial stewardship in order to prevent relapse, treatment failure and development of resistant.

4. Patients should be encouraged to assess health care service in the nearest health facilities to them in order to prevent default and treatment failure.

6.4 Dissemination of Research Findings

1. Two separate manuscripts have been drafted for publications and are currently undergoing correction, while a search is being carried for suitable publishers.
2. A copy of the final thesis will be submitted to the Health Research Ethics committee of Federal Capital Territory as part of the requirement for the issuance of ethical clearance.
3. Research findings will also be targeted directly at Pharmacists and appropriate authorities to enable Pharmacists contribute fully in the management of TB patients in the two facilities studied.

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APPENDICES

Appendix I: Questionnaire

Appendix 1: QUESTIONAIRE ON THE EVALUATION OF PHARMACIST INTERVENTION ON THE TREATMENT OUTCOMES OF TUBERCULOSIS AT FCTA HOSPITALS, ABUJA.

The purpose of this questionnaire is mainly for the partial fulfillment of the requirement of the award of Master's degree in clinical pharmacy at Ahmadu Bello University, Zaria. Please note that your opinion will be solely used for this purpose.

Please tick ( ) as appropriate

BACKGROUND INFORMATIONS

1) AGE GROUP

Less than 15years ☐ 15- 24years ☐ 25-34years ☐

35-44years ☐ 45-54years ☐ 55-64years ☐

Above 64years ☐

2) GENDER

Male ☐ Female ☐

3) EDUCATIONAL STATUS

No formal education ☐ Primary ☐ Secondary ☐ Tertiary /Higher institution ☐

4) MARITAL STATUS

Single ☐ Married ☐ Divorced ☐ Widow ☐

5) EMPLOYMENT STATUS

Civil/Public servant ☐ Private Employed ☐ Self Employed ☐

House Wife ☐ Unemployed ☐ Student ☐

DISEASE KNOWLEDGE ASSESSMENT

5) Have you heard about a disease called Tuberculosis?

(i) Yes

(ii) No

(iii) Can't remember

(6) From where did you learn about the disease? NB: you can choose more than one option

(i) From mass media like radio, television, internet

(ii) Health professionals

(iii) Family and friends

(iv)Newspaper and Magazines

(v) Other sources

(7) What is Pulmonary Tuberculosis?

(i) Is a serious headache with body temperature

(ii) Is a cough that is not dangerous

(iii) Dangerous lungs disease

(iv) I don't know it

(8) What causes Tuberculosis?

i) Dry weather

ii) The bite of an insect

iii) Bacterial

iv) It is caused by virus

v) I don't know

(9) What are the signs and symptoms of Tuberculosis?

(i) Coughing and difficulty in breathing

(ii) Tiredness and fever

(iii) Coughing of blood, weight loss, fever, tiredness.

(iv)Diarrhea, fever, weight loss

(v) I don't know

(10) How can Tuberculosis be transmitted? (You can chose more than one option)

i) Through sexual transmission by infected partner

ii) By infected blood transfusion

iii) By inhaling cough/sneeze from infected person

iv)By kissing an infected person

v) By drinking contaminated cow milk

SOCIAL HISTORY

(11)Did you smoke cigarette? (i) Yes (i) No

(12)When did you smoke last

(i) yesterday

(ii) last week

(iii) last month

(iv) more than six month

(v) can't remember

(13)How often do you drink alcohol or alcoholic beverages

(i) Daily (ii)2-3 times in a week

(iii) weekly (iv) Once in a while (v) Don't drink at al

Appendix II: INFORMATION SHEET

Tuberculosis is a chronic infection that is transmitted through inhalation of infected air. Nigeria is still among the 22-high burden countries that collectively account for 80% of TB cases in the World (WHO Global report, 2016).

My name is Ruth Feyisayo Ajayi, am a Master student of clinical pharmacy from Ahmadu Bello University, Zaria.

TITLE OF STUDY

Evaluation of Pharmacist interventions on the treatment outcomes of Tuberculosis patients in FCTA Hospitals, Abuja.

Your participation in this research is needed and your signature on this form means that you understand that participation is voluntary.

WITHADRAWAL

Your participation is voluntary, and you may withdraw from the study at any time. No negative consequences if you withdraw.

PURPOSE OF STUDY

This study is intended to evaluate the impact of pharmacist interventions on the treatment outcomes of Tuberculosis Patients in FCTA Hospitals, Abuja.

RESPONSIBILITY OF PARTICIPANT

You are invited to participate in this study by filling of a questionnaire, listening to our health talk and counseling sessions. Also to honour our reminder texts and phone calls that will be made encouraging you on the use of your medications.

RISKS AND CONFIDENTIALITY

There are no risks involved in participating in the research. There will be utmost confidentiality of all information given and will be solely used for this research alone.

EXPECTED BENEFITS

Although there is no monetary benefit involved for participating in this research, you will be contributing tremendously in achieving better treatment outcomes of Tuberculosis, reduce infectivity and improve adherence.

CONTACT

Pharm Ruth Feyisayo Ajayi

Pharmacy Department, Asokoro District Hospital, Abuja

Appendix III: Consent Form

CONSENT FORM FOR PARTICIPATION IN A STUDY ON EVALUATION OF PHARMACIST INTERVENTION ON TREATMENT OUTCOMES OF TUBERCULOSIS PATIENTS IN FCTA HOSPITALS, ABUJA.

I Mr. / Mrs / Miss /Dr. /Pharm. /Chief…….having

been briefed on the purpose and benefits of the study, wish to be a participant.

I therefore willingly give my consent by signing of this form.

Signature……

Phone Number……

Date …….

ID Number……

Information leaflet for a patient with tuberculosis (TB)

Information leaflet for a patient with Tuberculosis (TB)

What is tuberculosis?

Tuberculosis (TB) is a disease caused by a germ called *Mycobacterium tuberculosis*. TB usually affects the lungs but can affect other parts of the body.

What are the symptoms of TB?

TB disease develops slowly in the body. It may take several months for the symptoms to appear. Any of the following symptoms may be a sign of TB:

- Fever and night sweats
- Cough for more than three weeks
- Losing weight
- Blood in your sputum at any time

.

How is TB spread?

The TB germ is usually spread in the air. Some people with TB of the lungs have infectious TB. This means that they can pass TB to other people. The germ gets into the air when someone who has infectious TB coughs, sneezes, talks or sings.

Can anyone get TB?

Yes, anyone can get TB but you are at greater risk if you live in the same house as the person who is sick or if you are in very close contact with them.

How is TB diagnosed?

There are a number of tests that can be done to check for TB. Your doctor will examine you and decide what tests you need. These may include a chest x-ray or sputum (phlegm) test.

What does the treatment for TB involve?

Treatment involves taking medicine for at least six months and regularly attending an outpatient clinic in the hospital during this period.

Why do I have to take the medicine for so long?

TB germs are killed very slowly. You must continue to take your medicines as prescribed even when you have no symptoms of TB or you no longer feel ill.

Are medicines for TB safe?

All medicines may have side effects. Some side effects are minor, others may be more serious. Your pharmacist will give you information about the different tablets and their side effects. You should discuss any concerns you may have about side effects with your pharmacist and other health care provider managing you

What happens if I stop taking my TB medicine?

If you stop taking the medicine before your doctor tells you to stop, your TB may become worse. You may become infectious and pass on the TB germs to your family and other people you come in close contact with. Your TB might become resistant – this means that the medicine stops working and you could become very ill with TB.

Is there anything I should avoid while on this medicine?

We strongly recommend that you don't drink alcohol while on treatment as drinking alcohol increases the risk of damage to your liver.

.**Cough Etiquette:** use disposable towel (serviette) to cover mouth when coughing and discard immediately into waste bin, if not available cough into upper arm . Wash hand with soap and water or use hand sanitizer.

If you have more questions, please talk to us on: 08171418843

Appendix v

FEDERAL CAPITAL TERRITORY

Health Research Ethics Committee

Research Unit, Room 10, Block A Annex, HHSS, FCTA Secretariat,
No. 1 Kapital Street Area 11, Garki, Abuja - Nigeria

Name of Principal Investigator:	Ajayi, Ruth Feyisayo
Address of Principal Investigator:	Pharmacy Department, Asokoro District Hospital, Asokoro, Abuja.
Date of receipt of valid application:	21/12/2016

Notice of Research Approval
Approval Number: FHREC/2017/01/03/09 - 01-17

Study Title: **Evaluation of Pharmacists Interventions on Treatment Outcomes of Tuberculosis Patients in Federal Capital Territory Administration (FCTA) Hospitals, Abuja.**

This is to confirm that the FCT Health Research Ethics Committee (FCT HREC) has approved the research described in the above stated protocol.

Effective Date: - **09/01/2017**
Expiration Date: - **08/01/2018**

Note that no activity related to this research may be conducted outside of these dates. Only the FCT HREC approved informed consent forms may be used when written informed consent is required. They must carry FCT HREC assigned protocol approval number and duration of approval of the study.

The National Code of Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations, and with the tenets of the code. The FCT HREC reserves the right to conduct compliance visit to your research site without prior notification.

Modifications: Subsequent changes are not permitted in this research without prior approval by the FCT HREC.

Problems: All adverse events or unexpected side effects arising from this project must be reported promptly to FCT HREC.

Renewal: This approval is valid until the expiration date. If you are continuing your project beyond the expiration date, endeavor to submit your annual report to FCT HREC early, and request for renewal of your approval to avoid disruption of your project.

Closure of Study: At the end of the project, a copy of the final report of the research should be forwarded to FCT HREC for record purposes, and to enable us close the project.

Desmond Emeseonyeokwe
Ag. Secretary, FCT HREC
January 09, 2017.

Appendix VI: Knowledge assessment on sources of information to respondents about the disease in Nyanya General Hospital

Source of Information	Frequency	Percentage	Chi-square	P value
Mass media	22	30.6%	45.639	0.000*
Health professionals	33	45.8%		
Family and friends	9	12.5%		
Newspaper and magazines	2	2.8%		
Other sources	6	8.3%		
Total	72	100.0%		

* statistically significant ($p < 0.05$)

Appendix VII: Knowledge Assessment of Where Respondents Learn about the Disease in Asokoro

Source of Information	Frequency	Percentage %	Chi-square	P value
Mass media	13	20.0	54.615	0.000*
Health professionals	34	52.3		
Family and friends	15	23.1		
Newspaper and magazines	2	3.1		
Other sources	1	1.5		
Total	65	100		