

**THE EFFECTS OF ANTITUBERCULOSIS DRUGS SIDE EFFECTS ON
TREATMENT ADHERENCE AMONG TB PATIENTS AT KENYATTA
NATIONAL HOSPITAL**

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DECLARATION

I, Benson Kinyua, declare that this is my original work and has not been presented or produced by any other person for an award of credit in any other university or any other institution.

Signature.....

Date.....

CERTIFICATE OF APPROVAL

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DEDICATION

I dedicate this work to my lovely family and friends for their unending support and prayers. You inspired me from the very beginning.

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God bless you all

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LIST OF ABBREVIATIONS

ALT	Alanine aminotransferase
ANTI- TB	Anti tuberculosis
AST	Aspartate aminotransferase
CBC	Complete blood count
CCC	Comprehensive care centre
DOT	Direct observed therapy
EMB	Ethambutol
ERC	Ethics research committee
HAART	Highly active antiretroviral therapy
HBCs	High burdened countries
HIV	Human immunodeficiency virus
INH	Isoniazid
KNH	Kenyatta National Hospital
MDR	Multi- drug resistant
MDR/RR	Multi- drug extra resistant
MTb	Mycobacterium tuberculosis
NAT 2	N acetyl transferase 2
NRTIS	Nucleoside reverse transcriptase inhibitors
NNRTIS	Non-nucleoside reverse transcriptase inhibitors

PCP	Pneumococcal pneumonia
PI	Protease inhibitors
PN	Peripheral neuropathy
PZA	Pyrazinamide
REC	Research and Ethics Committee
RHZ	rifampicin,isoniazid, pyrazinamide
RIF	Rifampicin
SPSS	Statistical package for social scientists
TB	Tuberculosis
UON	University of Nairobi
WHO	World Health Organization.
XDR- TB	Extra resistant tuberculosis

OPERATIONAL DEFINITIONS

Adherence: it is the ability of a patient to follow regimen prescribed by a healthcare professional consistently and accurately

Adherence Counseling: Advice given to the patient by the health worker on how to maintain

The prescribed regimen as required.

Adult: An individual who is above 18 years of age.

Arthralgia: joint pain that is caused by an allergic reaction to medication

Comorbidity: the co-existence of two or more diseases in an individual

Drug susceptible TB: A type of TB that responds to first line anti-tuberculosis drugs.

Hepatotoxicity: Injury or damage to the liver that is caused by drugs

Highly active Antiretroviral Therapy (HAART): A type of medication of several ARVs that ensure maximal suppression of HIV.

Non adherence: inability of persons to accurately follow the regimen prescribed by a health care worker.

Peripheral neuropathy: A condition affecting the peripheral nerves outside the spinal cord characterized by weakness, numbness and tingling.

Side effect: An undesirable effect of a drug to the body of the patient taking the drug

Tuberculosis (TB): a highly infectious bacterial disease that involves the growth of tubercles in the lungs.

Multi drug resistant TB: A type of TB that does not respond to key anti-tuberculosis drugs such as isoniazid and rifampicin.

ABSTRACT

Background: Side effects are one of the major causes that result to poor adherence of anti-TB treatment. Poor adherence could lead to prolonged treatment, drug resistance, treatment failure, increased morbidity and mortality of disease (WHO, 2017). Little is known about the effects of anti-tuberculosis drugs' side effects on treatment adherence at KNH.

Study objective: The main objective of this study was to determine the effect of anti-tuberculosis drugs side effects on treatment adherence among TB patients at KNH.

Study area: The study was conducted at KNH. The study design was a descriptive cross sectional design at the CCC, TB clinic, medical wards 7A, 7B, 7C, 7D, 8A, 8B, 8C and 8D. The sample size was calculated using the Fisher's formula. A total of 169 patients were meeting the inclusion criteria of this study. The respondents were sampled using the purposive method of sampling.

Data collection and analysis: Quantitative data was collected using a structured questionnaire and analyzed using SPSS Version 24.0. Data was summarized in form of bar graphs and pie charts. Qualitative data was collected using interviews as per the objectives and then analyzed using N-Vivo software 11 where themes and sub-themes that constituted narrative based on research objectives were generated.

Results: The level of adherence at KNH was poor 34.9% (n=51). Side effects occurred among many respondents 77.9% (n=114) and this made a significant proportion 62% (n=71) of those who experienced side effects to default on treatment. There was a significant association between minor side effects of anti-tuberculosis drugs and adherence to TB treatment as indicated by nausea/vomiting (p= 0.034), loss of color vision (p =0.015), skin rash (p =0.003) and discoloration of body fluids (p=0.001). There was a significant association between major side effects of anti-tuberculosis and adherence to TB treatment as indicated by jaundice (p = 0.014), joint pain (p=0.003) and ankle swelling (p= 0.001). Other factors associated with adherence included being male (p=0.037) Increasing age (p=0.027) and high education level (p=0.001). Alcoholism (p=0.003) was associated with non-adherence to anti-tuberculosis medication.

Conclusion: The level of adherence among TB patients at KNH hospital is poor 34.9% (n=51). Minor side effects of anti-tuberculosis drugs result to poor adherence of TB treatment. (Nausea / vomiting (p=0.034), discoloration of body fluids (p=0.001), loss of color vision (p=0.015) and skin rash (p=0.003). Major side effects of anti-tuberculosis drugs result to poor adherence of TB treatment. (jaundice (p=0.014), joint pain (p=0.003), ankle swelling (p=0.001). Alcoholism (p=0.003) also contributed to poor-adherence in this study.

Recommendations: Health care workers should emphasize the importance of adherence to TB patients on anti-tuberculosis drugs regardless of experiencing side effects. The patients need to be educated on possible side effects of anti-tuberculosis drugs and how to handle them. Health care workers should manage the side effects of anti-tuberculosis drugs so as to ensure adherence.

CHAPTER ONE: INTRODUCTION

1.1 Background Information

Tuberculosis is an infection that is caused by a bacteria known as mycobacterium tuberculosis. It initially affects the lungs. However, it can spread to other body organs.(WHO, 2014) According to WHO report, tuberculosis is a huge disease burden. Tuberculosis is at number nine in causing deaths globally. In the year 2016, 10.4 million people got infected with TB. About 16% of those died throughout the world. TB infection is more common in resource-limited countries with high HIV infection rates co-existing with low social economic status. According to WHO regions, incident cases for TB in the year 2016 were as follows. South-East Asia Region 45%, Africa 25%,Western Pacific Region 17%,Eastern Mediterranean 7%,Europe3% and America (3%). The top five countries in terms of incidence were India, Indonesia, China, Philippines and Pakistan. Africa and Asia are the continents carrying the heaviest TB burden in the world. (WHO, 2017)

Africa contributes a high percentage of the global TB burden. Among the 30 high burden countries, 15 countries are in the Africa. Kenya is among the high burdened countries (HBCs) and had an infection rate of 300 per 100,000 population. Since 2010, Kenya has had a 6.9% decline in TB incidence rate. Treatment of TB is important in averting deaths and also preventing the complication to drug resistant TB which is a major health concern. TB treatment has averted 44 million deaths among HIV negative people between the years 2000 to 2016. (WHO, 2017).

The World Health Organization recommends that newly diagnosed TB patients should be treated for six months with a multi drug regimen treatment. This should start with a two month intensive treatment phase followed by a continuation phase of four months. For the two month intensive TB drug treatment phase they should receive rifampicin

(RIF), Isoniazid (INH) Pyrazinamide (PZA) and Ethambutol (EMB). This is followed by using Isoniazid (INH) with rifampicin (RIF) for the continuation TB drug treatment phase. The Multi drug regimen treatment causes many side effects to TB patients resulting to poor adherence. (WHO, 2010).

A drug side effect is an adverse drug reaction that is either primary (related to a known mechanism) or secondary (occurring in other systems but can be explained through clinical pharmacology).(Natarajan, Lulic and Aranda, 2007). These side effects are classified as minor or major. Minor side effects are common and include loss of appetite, abdominal pain, joint pain, nausea, discoloration of body fluids and skin rashes. A patient can continue with drug therapy due to minor side effects. Major side effects are rare but lethal and they often lead to drug discontinuation. They include jaundice, ototoxicity, peripheral neuritis and arthralgia.(Gadkowski, 2014). Side effects of Anti tuberculosis drugs are a major reason as to why patients did not adhere to medication.(Gugssa Shimels and Bilal, 2017)

Poor adherence to treatment results to serious complications. Poor adherence to medication is the inability to follow prescribed treatment and is multidimensional health problem. The causes of poor adherence may be related to the patient, treatment, and/or health care provider.(Hugtenburg *et al.*, 2013).Poor compliance leads to an increase in morbidity and mortality for TB patients, prolonged period of TB infectiousness, multidrug resistance, relapse, death and a very high cost of TB treatment. This leads to an increase in national and community burden in TB control interventions (Kiplangat *et al.*, 2017)

In 2016, an estimated 4.1% of new cases and 19% of previously treated cases were of MDR/RR-TB worldwide. There were around 600,000 incidences of MDR/RR- TB in

the same year. 490,000 of these cases were of MDR –TB. In 2015, 240,000 deaths were reported from MDR/RR TB. The report also indicates that among previously treated TB cases, MDR- TB prevalence was 20.2%. (WHO, 2017). Studies done in Sub-Saharan Africa indicate that 11.3-29.6% of TB patients are not followed up resulting to non-adherence. This leads to a reduction in the success rates of TB treatment.(Adane *et al.*, 2013)

1.2 Problem Statement

A study done in Ethiopia indicated that side effects of anti-tuberculosis drugs are a major cause of poor adherence among TB Patients (Adane *et al.*, 2013).Lack of proper adherence to treatment is a big problem for TB patients taking medication. This leads to complications such as drug resistance (Kiplangat et al, 2017). The danger of drug resistance is the formation of Multi drug resistant TB (MDR-TB) and extensive drug resistant TB (XDRTB) (Minion et al., 2013). According to WHO (2012) global TB report, about 3.7% of new TB patients in the world were infected with MDR-TB strains. Of 3.7%, 9% is XDR-TB strain. In India, 280,000 deaths occur annually due tuberculosis complications. (WHO, 2012). A study done in Nakuru County in Kenya indicated that side effects due to anti-tuberculosis drugs contributed to non-adherence. 23% of the respondents indicated that side effects led them to terminate their treatment. (Oyugi *et al.*, 2017)

A study done by Wahome *et al.*, 2013 found out that about 300 TB cases are diagnosed at KNH each month. Among those treated and followed up in KNH, only75% of them were treated successfully. Little research has been done on the effect of Anti-Tbs side effects on treatment adherence in Kenyatta national hospital. My study proposed to address the effects of Anti-tuberculosis drugs side effects on treatment adherence among TB patients at KNH.

1.3 Study Justification

Side effects of anti-tuberculosis drugs contribute to poor adherence among TB patients (Obwoye, 2016). Poor adherence to anti-tuberculosis drugs has led to high mortality rates and the emergence of resistant TB strains. Mortality level of TB is high in Kenya with a mortality rate of 50 per 100,000 persons in 2016. The cases notification of TB was 77,376 in the year 2016 indicating that the rate of spread is still high. (WHO, 2017). In addition, treating non-resistant TB is easier than handling resistant TB. The success rate of treating extensive drug-resistant TB is only 30% (WHO, 2017). The government spends at least Sh1.5 million to treat every patient who has developed resistance which is very costly. (Brief, 2013).

Tuberculosis researchers have shown keen interest in researching about other factors that influence TB treatment adherence such as knowledge and attitude of TB patients, family influence, stigma against TB patients and healthcare workers' conduct but have put little effort on researching about how anti-tuberculosis drugs' side effects influence TB treatment adherence. The findings of this study may be used to reduce the high mortality and morbidity rates that result from non-adherence to anti-tuberculosis drugs.

1.4 Research Questions

- i. What is the level of adherence among patients diagnosed with TB at Kenyatta National Hospital (KNH)?
- ii. What is the effect of Anti-tuberculosis drugs' minor side effects on treatment adherence among patients diagnosed with TB at Kenyatta National Hospital (KNH)?
- iii. What is the effect of Anti-tuberculosis drugs' major side effects on treatment adherence among patients diagnosed with TB at Kenyatta National Hospital (KNH)?

1.5 Objectives of the Study

1.5.1 Broad Objective

To determine the effect of Anti-tuberculosis drugs side effects on treatment adherence among patients diagnosed with TB patients at Kenyatta National Hospital (KNH).

1.5.2 Specific Objectives

- i. To assess the extent of adherence among patients diagnosed with TB at Kenyatta National Hospital (KNH).
- ii. To determine the effect of Anti-tuberculosis drugs' minor side effects on treatment adherence among patients diagnosed with TB at Kenyatta National Hospital (KNH).
- iii. To determine the effect of Anti-tuberculosis drugs' major side effects on treatment adherence among patients diagnosed with TB at Kenyatta National Hospital (KNH)

1.5.3 Research Hypothesis

There is no significant relationship between Anti-tuberculosis drugs side effects and treatment adherence among TB patients at Kenyatta National Hospital (KNH).

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The main purpose of the literature review is to show evidence and findings from studies in the past or other literature with similar concepts and content related to the study under evaluation. Exploring the existing literature is important in ensuring that the study topic has not been repeated and also important in reducing redundancies that could come up with research (Creswell, 2013). This review is organized in order to enhance ability to read, comprehend, and has a proper flow of content explored in this study.

2.1.1 The level of adherence among patients diagnosed with Tuberculosis.

The World Health Organization recommends that TB patients should be treated for a period of six months with a multi drug regimen. Tuberculosis patients should have an adherence level of greater than 90% for them to be cured. (WHO, 2013). The many drugs together with a long duration of treatment causes many side effects to TB patients resulting to poor adherence. (WHO, 2010). Although the directly observed therapy has been used in many African countries to improve adherence, treatment adherence has still been poor. In Kenya, it stood at 78% only in the year 2016 (Aamir, 2016). The rate of poor adherence to treatment of TB is a great problem in all the continents. Lack of proper follow up for TB patients on anti tbs results to high rates of non- adherence (Kibango et al., 2011).

The follow up for TB patients living in Sub Saharan Africa is poor; it ranges from 11.3% to 29.6%. (Adane *et al.*, 2013). This leads to low rates of treatment success for TB patients (Mainbourg, Belchior and Goncalves, 2017). A study in Ethiopia indicated that the rate of treatment success is low and stands at (84%) (Adane *et al.*, 2013). In Kenya, Tuberculosis treatment success is 85% (Kiplangat et al., 2017). Non-adherence

is usually high especially when patients on anti tbs experience side effects. Side effects increase the likelihood of non- adherence to medication to 90%(Tola *et al.*, 2015). In a study conducted in Kenya, side effects led to 60% of TB patients on anti tbs to default treatment (Oyugi *et al.*, 2017). However, in a study conducted in government health institutions in Ethiopia, only 24.7% of the patients did not adhere to treatment (Gube *et al.*, 2018).

2.1.2. Effects of minor side effects of anti-tuberculosis drugs on treatment adherence.

Minor side effects in patients treated with anti tbs are common. They include body fluid discoloration, nausea, vomiting, skin rash and headache(Arbex *et al.*, 2010) .In a study done in Ethiopia, 75.2% of research respondents on Anti-tuberculosis drugs reported to have experienced urine discolorations as a side effect. This made them fear to continue taking their medication (Adane *et al.*, 2013). This study had similar findings to another study conducted in Tigray, north Ethiopia that indicated that 34.2% of the patients had urine discolorations and therefore stopped taking their drugs(Medhin, Alemu and Desalegne, 2015). In Kenya, Kiplangat *et al.*,(2017),reported that urine color change made the TB patients fail in adherence.

Side effects affecting the gastrointestinal system such as diarrhea, nausea and vomiting due to anti-tuberculosis drugs also result in non-adherence. A study conducted in Iran on side effects to anti-tuberculosis drugs in Iranian tuberculosis patients indicated that 82% of the patients on Anti-tuberculosis drugs had gastrointestinal side effects(Farazi *et al.*, 2014). Similarly, a study conducted in Ethiopia found out that 33.4% of patients on anti tbs experienced nausea and vomiting resulting to non-adherence(Gube *et al.*, 2018) . In a study conducted in Nakuru,40% of the TB patients experienced nausea and vomiting hence defaulted on treatment(Oyugi *et al.*, 2017).Another study conducted in

Nakuru county involving healthcare workers about antiTbs side effects found out that 36% of healthcare workers reported defaulting among their patients due to vomiting. It was experienced at the beginning of treatment(Kiplangat et al., 2017). A study in Nakuru showed that 12% of the patients who developed diarrhea due to anti tbs defaulted(Oyugi *et al.*, 2017)

Tuberculosis patients taking EMB usually experience ocular toxicity. It cause various types of toxicities optic neuritis being the most important. Patients complain that both eyes experience progressive painless blurring of vision or decreased colour perception. The most affected is central vision, though other visual field losses can occur(Grzybowski *et al.*, 2015) EMB toxicity is dose-related, with a reported incidence of 18% in patients receiving more than 35 mg/kg/day, 5-6% with 25 mg/kg/day, and less than 1% with 15 mg/kg/day of Ethambutol, for more than two months.(Chan and Kwok, 2006). A study conducted in Pakistan found out that 18% of patients receiving more than 30 mg/kg per day of ethambutol per day experienced ocular toxicity and this negatively affected their adherence(Shah *et al.*, 2014)

Headaches or dizziness is also experienced by patients taking anti-tuberculosis drugs. A study done in Ethiopia on the level of patient adherence to ANTI TBs in DOT centers indicated that 26.3% of the research participants experienced headache. This affected their adherence(Medhin, Alemu and Desalegne, 2015). The same was reported in another study in Northwest Ethiopia that found out that 37% of research participants complained of headache or dizziness hence affecting their adherence(Adane *et al.*, 2013). These two studies were similar to a study whose results found out that headache and dizziness was experienced by 23.4% of those on anti tbs resulting to non-adherence(Gube *et al.*, 2018).

Skin rash occurs among patients diagnosed with TB and who are on treatment. It occurs in about 6% of the patients (Maciel *et al.*, 2010). Skin rash is an important side effect that causes defaulting of anti-tbs treatment (Khayyam *et al.*, 2010). A study conducted in Britain found out that 8% of the patients experienced skin rash and this interrupted their medication (Breen *et al.*, 2006). In a study conducted in Nigeria on side effects by anti tbs, 10 out of the 63 patients on anti tbs reported skin rash. However, none of them discontinued treatment (Michael *et al.*, 2016). This was contrary to a study conducted in Nigeria that found out that 6% of the patients on anti tbs had their treatment discontinued due to severity (Schaberg, Rebhan and Lode, 2008).

2.1.3 Effects of major side effects of anti-tuberculosis drugs on treatment adherence.

When major side effects occur, they are more severe than the minor ones. However, they are less common and occur in approximately 2% - 8% of the patients on anti tbs and normally lead to the stopping /alteration of treatment (Maciel *et al.*, 2010). Hepatotoxicity is one of the major side effects and is characterized by jaundice and elevation in liver enzymes (ALT and AST). Pyrazinamide is the most hepatotoxic drug followed by Isoniazid. Rifampin is the least hepatotoxic drug (Arbex *et al.*, 2010). Overall, hepatotoxicity attributed to anti-TB drugs has been reported in 5%–28% of people treated with anti-TB drugs (Jeong *et al.*, 2015). A study conducted in Nigeria found an incidence of symptomatic hepatotoxicity of 18% (Isa *et al.*, 2016). Hepatotoxicity is the commonest of all adverse effect leading to drug discontinuation in 11% of patients treated with combination of isoniazid, rifampicin and pyrazinamide (Schaberg, Rebhan and Lode, 2008).

In a cohort retrospective study conducted at a tertiary hospital in Jakarta - Indonesia, (94.7%) of the patients on anti tbs developed hepatotoxicity. Majority (78.9%) of the

patients had their anti-TB drugs stopped, while 15.8% of them were given substitution therapy with ethambutol and streptomycin after discontinuing the hepatotoxic anti-TB drugs. Only 5.3% of them continued TB treatment with the same regimen therapy. The treatment period of (83.8%) of the patients affected was lengthened from 6- 14 months increasing the risk of defaulting(Maria, Radji and Burhan, 2017).

A study conducted in Turkey had similar findings, eighty four patients developed hepatotoxicity due to anti tbs. Among them, twenty eight stopped treatment. Severe hepatotoxicity occurred in 9 (0.8%) patients leading to final termination of at least 1 of the 3 standard drugs. Treatment was later restarted in 18 of these patients and severe hepatotoxicity was noted again in 27.8% of them. Pyrazinamide which was the drug associated with hepatotoxicity in this study was stopped(Gülbay *et al.*, 2006)

In a retrospective cross sectional study conducted in Ethiopia to assess factors affecting adherence of TB patients to anti Tbs in Adama referral hospital, hepatotoxicity occurred in 8.78% of the patients and appeared mostly in the initiation phase of treatment. In this study, (29.67%) of the patients defaulted treatment due to this side effect (Kelifa *et al.*, 2015). In a study conducted in Brazil in which RIF,PZA and INH were used in treatment, the treatment regimen had to be changed in 3.7% of the patients due to hepatotoxicity (Maciel *et al.*, 2010).

Farazi *et al.*, (2014) found out that hepatotoxicity risk among TB patients on anti-tuberculosis drugs is much higher in patients who either consume alcohol, smoke, have pre- existing liver disease or old. Comorbidities such as HIV infection and hypertension were also found to enhance the chances of hepatotoxicity. This increased the amount of those who defaulted treatment. El Bouazzi *et al.*, (2016) in his study found out that the risk factors for hepatotoxicity are genetics, increased age, the extent of the disease,

female gender, poor nutritional status, drug overdose, concomitant use of hepatotoxic drugs, alcoholism, viral hepatitis, and HIV infection also increased the risk of hepatotoxicity.

Patients who are HIV Positive on HAART have high chances of experiencing hepatotoxicity. Hepatotoxicity is caused by PIS, NNRTIS and NRTIS (Ramappa and Aithal, 2013). A study conducted in Ethiopia among HIV Positive TB patients being treated concomitantly indicated that the amount of side effects was high resulting to defaulting of treatment (Gebremariam, Bjune and Frich, 2010).

Patients on anti-tuberculosis drugs also experience numbness as a side effect. This is due to peripheral neuropathy which is a condition affecting the peripheral nerves that is common in patients diagnosed with tuberculosis on anti-tuberculosis medications (Mafukidze, Calnan and Furin, 2016). It occurs in about 2- 44% of patients on Isoniazid due to NAT2 acetylation status and increases at doses higher than 300mg/day (Stettner *et al.*, 2015).

A study in Britain found out that 2% of the study participants experienced peripheral neuropathy and stopped taking their medication (Breen *et al.*, 2006). However, a study done in India found out that 4.65% of the patients on anti-tuberculosis drugs developed hyperesthesia, tingling, or numbness of upper limbs and lower limbs. The neuropathy of this patients was specifically attributed to isoniazid. However, none of these patients discontinued their treatment. (73.07%) who were on Vitamin B complex supplementation had their symptoms resolve completely (Sahasrabudhe, 2015). While pyridoxine is routinely prescribed with INH in the industrialized world, developing countries with limited resources may fail to use it due to the overall increase in treatment cost (Van Der Watt *et al.*, 2011). Teklay *et al.*,

(2016) found out that lack of pyridoxine for patients on anti Tbs increased the risk of PN contributing to some patients discontinuing treatment. A recent cross-sectional study of patients on anti tbs in South Africa found out that only less than 10% of patients on TB treatment were receiving adequate pyridoxine supplementation (25 mg/day). This increased the number of those who experienced PN resulting to most of them stopping medication.

Another study conducted in Thibela South Africa found out that 0.21% of the fifty study participants experienced peripheral neuropathy. Three of them had to be discontinued from Isoniazid which was part of treatment(Grant *et al.*, 2010). A study by Gube *et al.*, (2018) found that peripheral neuropathy was experienced by 30% of the patients on anti Tbs making some of them to default treatment.

Hyperuricemia caused by pyrazinamide leads to poly-arthralgia which presents with joint pains and ankle swelling (Arshad, 2007).Hyperuricemia occurs in patients treated with pyrazinamide at a rate of 43% to 100% (Mahantesh *et al.*, 2014).Ethambutol also causes hyperuricemia by decreasing the rate of uric acid clearance (Pham, Doan and Andersen, 2014). A study conducted in Britain that found out that 1 % of TB patients on anti tbs experienced joint pains and ankle swelling and stopped taking medication (Breen *et al.*, 2006).Hyperuricemia may lead to non-compliance.

A study conducted in Turkey among hospitalized TB patients found out that 2.7% of the patients developed hyperuricemia. Among them, 0.6% had to terminate treatment(Gülbay *et al.*, 2006). In a study conducted in Iran, pyrazinamide was discontinued due to persistent arthralgia with hyperuricemia in 3 (0.3%) patients in that study (Farazi *et al.*, 2014).

A study conducted in Kyrgystan prisons in Zurich on factors promoting adherence to TB medication, found out that hyperuricemia was responsible for termination of therapy in up to 23% of patients during the intensive phase of treatment (Graner, 2007). Further, a study conducted in Nigeria on risk factors of isoniazid, rifampin and pyrazinamide found that only 2% of the patients had their treatment discontinued due to hyperuricemia (Schaberg, Rebhan and Lode,2008).

2.1.4 Effect of other related factors on adherence to anti-tuberculosis drugs.

A study conducted in Argentina has shown that difference in sex has an effect on anti-TB drug nonadherence among TB patients. (Herrero, Ramos and Arrossi, 2015). A study done in Nigeria showed no significant association between gender and adherence(Woimo *et al.*, 2017)

Education plays an important role in adherence. A study conducted in Southwest Ethiopia indicated that educational level of a person was important in ensuring adherence(Woimo *et al.*, 2017). Similarly, a study conducted in South East Nigeria showed that patients who were more educated adhered to treatment in a better way (Gube *et al.*, 2018). However, education was not found to influence the rate of adherence in a study done in Southern Ethiopia (Ibrahim *et al.*, 2014).

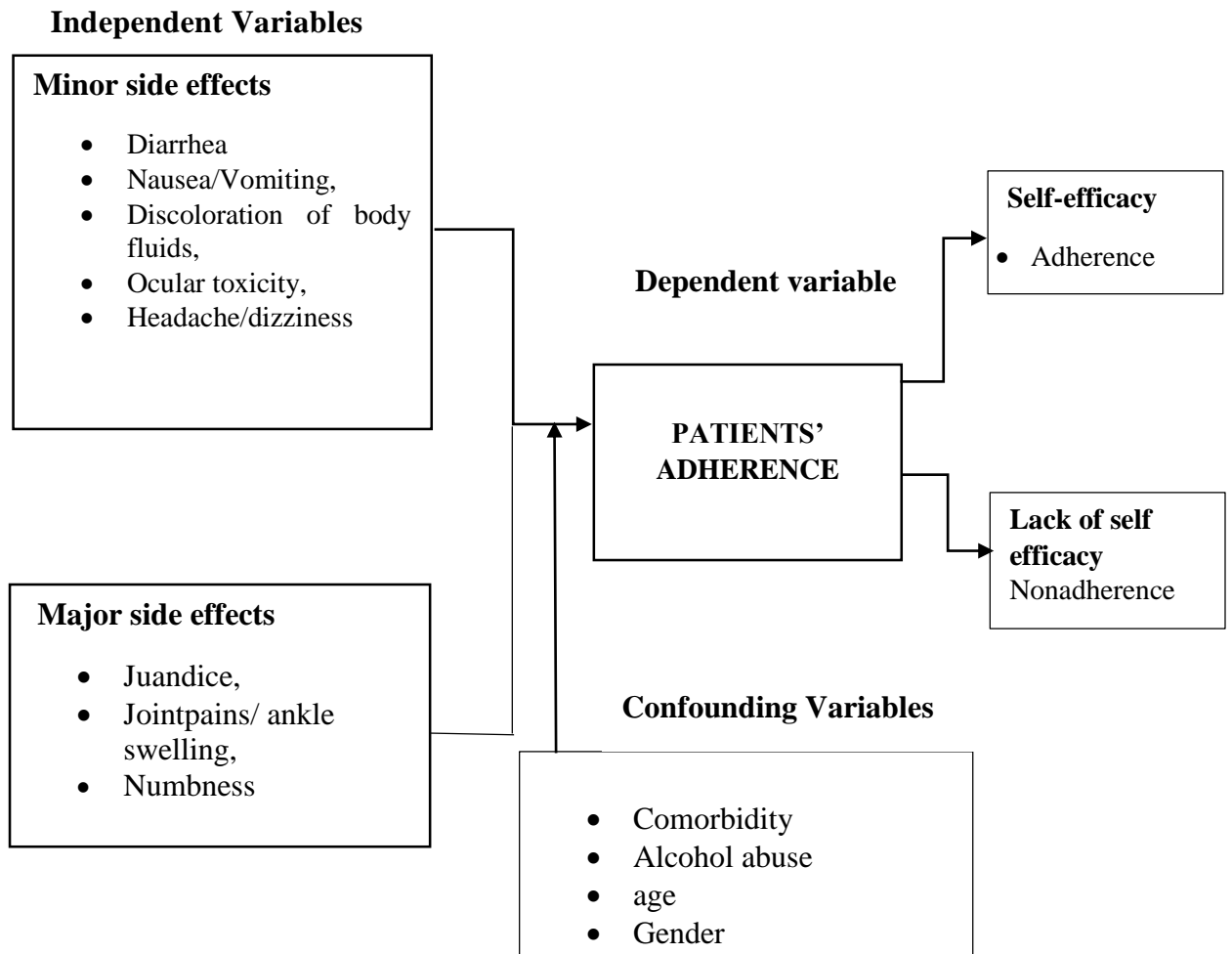
A study in Nigeria indicated that alcohol does not influence adherence to anti tbs treatment (Gube *et al.*, 2018).Similarly, a study still done in Ethiopia found no significance between alcoholism and adherence (Woimo *et al.*, 2017). However, a study in North East Ethiopia found association between alcohol and non-adherence. This study also found out that being younger than 24 years, being HIV positive resulted to non-adherence(Ibrahim *et al.*, 2014)

2.2 Summary and the research gap

Side effects of anti tbs are a great hindrance to adherence. There is a notable gap in the literature specifically on the levels of non-adherence among TB patients. Although the directly observed therapy has been used in Kenya in order to improve adherence, treatment completion rates have not been very successful. Although the directly observed therapy has been used in Kenya, it has not been very effective in ensuring compliance. Very few local studies have been done specifically to find out the effects of each of these side effects on adherence. This gap is what this research aims to address. This will therefore contribute to the existing literature and will also help in finding out ways in which to address side effects and therefore improve adherence.

2.3 Conceptual Frame Work

The following conceptual frame work was used. It shows the relationship between the various variables



Source (authors), 2014

Figure 1: Conceptual Framework

2.4 Theoretical Framework.

A theory is a set of organized principles that explain and guide an analysis. A theoretical framework was used in guiding the entire process of research study. This study utilized Health Belief Model (HBM) which was developed by social psychologists Hochbaum, Rosenstock and Kegels in 1950s. This is a psychological model that tries to explain and predict the health behaviors of people. HBM has been adopted in this study because patients on anti tbs still need to choose whether to take the drugs or not.

The HBM is based on the belief that the person will take certain health related action like adherence to anti-tbs in order to avoid complications. The person has a positive expectation that by applying a recommended action he/she avoids negative health problem; in this case non-adherence results to complications such as resistance and death.

HBM can be used for peoples' response to signs and symptoms and treatment adherence. This model has six constructs namely; Perceived susceptibility where the person perceives the risk of acquiring a disease and she is vulnerable to that illness, perceived severity which are the person's feelings on the seriousness of the disease that can cause death or suffering to significant others, Perceived benefits which is the person's perception on the effectiveness of numerous available actions to control the disease. The course of action taken by the individual depends on the severity and he/she accepts the health action if perceived to be beneficial. Another construct is perceived barriers which are the personal feelings or hindrances to perform the health action as recommended. In this case, the barriers are the side effects that the patients taking anti tbs experience. Cue of action is the force needed to trigger the decision making to take up the recommended health action. The influence can be internal like coughing, fever, chest pain and night sweats or external like proper follow up /advice from a health care

worker. Self-efficacy is the person's confidence to be able to perform the behavior which in this case is adherence. It outlines whether the person performs the expected behavior.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Study Design

The study adopted a cross sectional design aimed at determining the effects of side effects on treatment adherence among TB patients at KNH. A cross-sectional study design is less time consuming, less expensive, and thus more manageable for the researcher. This design was useful in collecting data at one point in time from a sample selected to represent a larger population. This method was useful in giving authentic insight into people's experiences. Cross-sectional studies can explore relationships and correlations. Qualitative study was also preferred for the ability of the approach to incorporate respondents' perceptions that may not be quantified.

Triangulation technique was used where there was inquiry through quantitative approach and validation through qualitative approach. Phenomenological method under qualitative approach was employed. An in-depth experience of TB patients who experienced side effects was recorded.

3.2 Study area

This study was conducted at Kenyatta National hospital (KNH). Kenyatta National Hospital (KNH) is a state owned national referral and teaching Hospital, situated in Nairobi, Kenya. Kenyatta National Hospital has a capacity of 1800 beds. It was established in 1901 with only two-wards with 40 bed capacity at the junction of Government Road (the present Moi Avenue) and Kings Way (the present University Way). The hospital was named King George VI Hospital in 1952. The Ismail Rahimtullah Wing was constructed in 1953 exclusively for the Asian community. The Infectious Diseases Hospital (IDH) was opened in 1956 as part of King George VI Hospital. Following attainment of Kenya's independence in 1963, the King George VI

Hospital was renamed Kenyatta National Hospital in honor of the first president of the Republic of Kenya, Mzee Jomo Kenyatta. The hospital offers a wide range of curative and diagnostic services such as laboratories, radiology and endoscopy. KNH consists of clinics where patients and wards. The hospital is located about 3.5 kilometers west of Nairobi City, the capital city of Kenya. The hospital hosts in its wards between 2500 and 3000 patients per day. The hospital also has over 6000 staff members. This study was to focus on TB adult patients attending the main out- patient TB clinic located in the medical clinic number 66 of KNH, Comprehensive care center(CCC) and those admitted at the medical wards on level 7 and 8. That is ward 7A, 7B, 7C, 7D, 8A, 8B, 8C and 8D.

3.3 Study Population

The study population involved TB patients who attend TB clinic for follow up care, CCC patients, and TB patients admitted in the medical wards. The average number of patients who are diagnosed and treated at KNH every month are approximately 300 (TB clinic records, KNH 2017). The patients were followed up at the CCC, the outpatient TB clinic and in the medical wards formed the study population.

3.4 Sampling and sample size.

3.4.1 Sampling Size calculation

Was determined based on the population of TB patients. The sample size was determined using the n factored Fischer's statistical formula. (Mugenda A and Mugenda O, 1998)

$$n = \frac{Z^2pq}{d^2} \cdot 4$$

n = the desired sample size if the target population is greater than 10,000.

z = the standard normal deviate at the required confidence level set as 1.96 (95%)

p = (There are no documented studies had been done on these subjects, an estimated proportion of 50% will be used to determine the sample size).

$q = 1-p$ without characteristic of interest $1-0.5= 0.5$

d = the level of statistical significant set. $5/100= 0.05\%$

$$n = \frac{1.96^2 * 0.5 * 0.5}{0.05^2} = 384.16$$

If the target population is less than 10,000 then the final estimate is calculated using the formula. The number of patients who are offered TB services at the TB clinic, CCC and in the medical wards per month at KNH is about 300 patients.

$$nf = \frac{n}{[1 + (n/N)]} = \frac{384.16}{[1 + (\frac{384.16}{300})]} = 169 \text{ clients}$$

Where

nf = desired sample size where population < 10,000

N = is the desired sample size when population is more than 10,000.

n = estimated sample size.

3.4.2 Sampling method

A total of 169 respondents were to fill in the questionnaires. Purposive sampling was used .These were TB patients attending TB clinic, CCC for follow up and also those admitted in the medical wards at KNH that were on TB medication. For the qualitative component, 70 TB patients were selected purposively and included those who had already participated in the quantitative data collection who reported to have experienced side effects.

3.4.3 Inclusion Criteria

The study participants were supposed to have the following characteristics.

- 1) Adult TB Patients who gave consent to participate in the study.
- 2) Patients who had been on anti TBS for more than a week.

3.4.2 Exclusion Criteria

A participant was excluded from the study if they had the following characteristics.

- 1) Adult TB Patients who did not give consent to participate in the study.
- 2) Patients who had been on anti TBS for less than a week.

3.5 Sampling technique

A purposive non-random sampling technique was used to select the participants for the study. Purposive sampling was chosen because it enables the researcher to choose a sample from a population that is likely to generate the information needed for the study in relation to the study objectives (Palinkas *et al.*, 2015). The TB patients had to be adults, they had to give consent to participate in the study and must have been on anti-tuberculosis drugs for more than a week. This was confirmed by checking health records of the TB patients within the specific study areas and also confirming from the patients directly. A list of all TB patients from the different study areas at KNH was made as follows.

- a) Those followed up at the outpatient TB.
- b) Those followed up at the CCC.
- c) Those admitted at KNH medical wards. (7A, 7B, 7C, 7D, 8A, 8B, 8C and 8D)

These places were purposively sampled because they receive the largest numbers of TB patients. The 169 patients were equally recruited from the nine study areas. The 8 medical wards, the CCC and the outpatient TB clinic. $169/10= 16.9$ approximately 17. Therefore, 17 TB patients on Anti-tuberculosis drugs from each study area participated in the study. For the qualitative component, 70 TB patients were selected, they had already participated in the quantitative data collection and reported to have experienced side effects to anti tuberculosis drugs.

3.6 Data Collection and Management

3.6.1 Study tools

A self-administered semi-structured questionnaire was used to collect quantitative from the 147 study participants. Interviews were used to collect qualitative data (Bell 2014). The study instrument used for a study depends on researcher's knowledge, method convenience, study approach (qualitative or quantitative), sample size, and accessibility to respondents (Creswell 2013). The patients' questionnaire (see appendix 1) had four parts; the first part contained information on the demographic data of the participants. The second part of the questionnaire contained information on TB treatment adherence, the third part contained information on anti-tuberculosis drugs minor side effects on adherence while the fourth part contained information on anti-tuberculosis drugs major side effects on adherence. In-depth interviews (see appendix II) were conducted in a private room at different times within the study areas. Seventy patients gave consent and participated in the interviews.

3.6.2 Validity of the Study tools

The questionnaire was pretested for appropriateness at Mbagathi district Hospital among TB patients. 10% (n= 17) of the questionnaires were used. Mbagathi district hospital is one of the government hospitals within the capital city, Nairobi. It was used

because it also receives TB patients just like the study area (KNH). The purpose of pre-testing was to evaluate the research tool for its practicability and validity. Any questions that were ambiguous were reconstructed after pretesting. This helped in ensuring validity. The interview guide was subjected to peer review and member check for accuracy and validity.

3.6.3 Reliability of the Instrument

To measure reliability, the study used the test-retest method which involved selecting seventeen respondents from the TB clinic at Mbagathi District Hospital and administering the same instrument twice to the same group of respondents after two weeks' time lapse.

3.6.4 Data Collection process

Data was collected using both quantitative and qualitative methods. Quantitative data comprises of information collected using a questionnaire (see appendix I). Visual analogue scale and pill count were used to measure the level of adherence. This type of data is ideal for describing and examining relationships, and determining causality among variables. Quantitative research includes deductive reasoning in order to generalize the findings. Qualitative data was captured using in-depth interviews (see appendix II) conducted. In-depth interviews were based on patients' experiences of side effects and the health care workers' contribution to non-adherence. The discussions were audio-taped and the principle investigator took short notes during the discussion. The researcher and two research assistants (Kenya registered community health nurses) collected data from the respondents having allocated them serial numbers to ensure confidentiality. Data collection took 8 weeks. The researcher then analyzed the data with the assistance of a statistician

3.6.5 Data entry and cleaning

After the questionnaires were filled, they were collected and checked for completeness and consistency. Inconsistent information was eliminated and the unclear responses clarified from the respondents. Data from the completed questionnaires was entered using SPSS version 24 and the password protected. Confidentiality was maintained for information given on questionnaires as no names or personal identifications were used. The tape recordings were transcribed into a Microsoft office word document before being transferred into NVIVO software version 11.

3.7 Data Analysis and presentation

The quantitative data generated from the questionnaires were coded and keyed into MS Access database. The Access database was imported into SPSS v 24 for descriptive analysis to generate frequencies, percentages and tabulations. Demographic data was analyzed using descriptive statistics. Categorical data was presented as frequencies and percentages. Adherence was measured using visual analogue scale and pill count. Multiple regression was done to find out the statistical significance of the association between the independent and dependent variables were interpreted using Chi Square test where P values of 0.05 or less were considered to be significant. Verbatim transcription of in-depth interview notes was done in Microsoft office word. The transcripts were imported into N-Vivo software program version 11 for axial coding and categorization on pre- identified thematic areas. Coding was performed manually and inductively, in stages, then analyzed in form of main themes, subthemes and narratives.

3.8 Data Storage

The data collected was stored the data in a computer and secured it with a unique password. The data was retrieved during the analysis process and later kept in the same safe environment until the study was completed. Once the researcher completed the use of the raw data; it was professionally disposed to reduce unethical usage of the data.

3.9 Ethical considerations

This describes the moral values that should be followed while undertaking the research (Bell 2014). In this case, the researcher had a layout of how the various aspects of research ethics were to be considered in the process of the study.

- a) The researcher submitted the proposal to the Kenyatta National Hospital - University of Nairobi Ethics and Research Committee for approval.
- b) Once it was approved, the next step was to seek permission from the study setting by appealing and obtaining authorization from the relevant authority at KNH administration.
- c) An informed consent, often a written one, affirms that the participant is aware of the proposed study, understands the risks involved, and accepts to be part of the research without any form of intimidation (Fouka & Mantzorou, 2011). With this understanding in mind, the researcher sought to affirm that respondents were requested to give an informed consent on voluntary basis without any form of coercion.
- d) Respondents were informed about the objectives, risks and benefits, voluntary participation, information sharing of the study and they were assured of confidentiality and respect
- e) In ensuring anonymity and confidentiality, the researcher used codes such as 001, 002 for both quantitative and qualitative data to identify the study tools.

- f) A commitment and declaration was made by the researcher to the respondents and authorities involved that the data will only be used in the study and for the study purposes and shall not be used for personal interest or to advance any personal or malicious outcomes.

CHAPTER FOUR: RESULTS

4.1 Introduction

This section contains the findings of the study according to the objectives. The findings are represented using pie charts, bar graphs, and tables. Interpretation of the results has also been done. The first section contains the sociodemographic characteristics of the TB patients who were participants. The other sections contain the minor and major side effects and their association with adherence. The study reported a response rate of 87%, (n=147). The study was done at KNH. The questionnaires given to the patients were filled and returned to the researcher.

4.2 Socio-demographic characteristics of the study participants

4.2.1 Gender

Majority of the respondents 74.8%, (n=110) were male. 25.2%, (n=37) of them were female. This indicates that males were three times more than females.

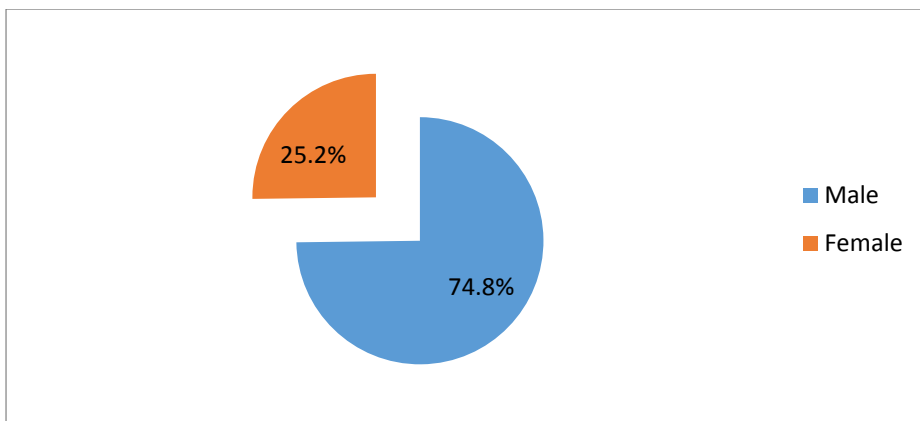


Figure 4.1: Gender

Age in years

Respondents aged 18 to 29 years were 32.0% (n=47). Those aged 40 to 49 years were 23.8% (n=35). The least 4.8% (n=7) were those aged 50 to 59 years. The other respondents 39.5%, (n=58) were aged between 30-39 years.

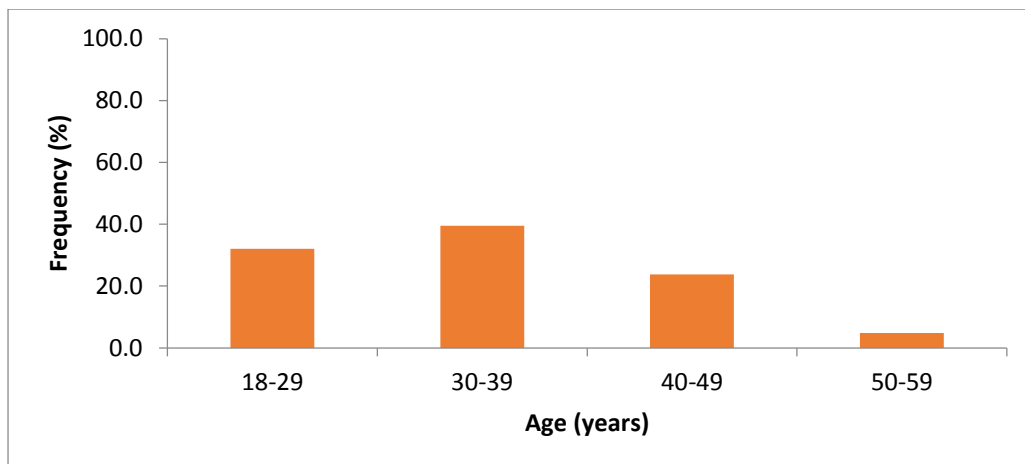


Figure 4.2: Age in years

Marital status

44.1%, (n=64) of the respondents were currently married 37.2%, (n=54) single; 13.8%, (n=20) divorced and 4.8%, (n=7) widowed.

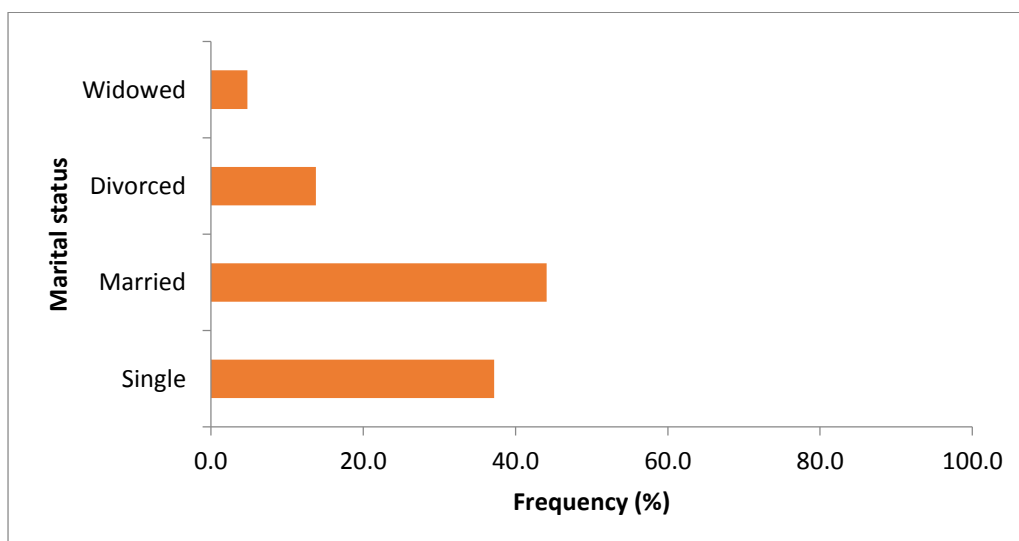


Figure 4.3: Marital status

Education level

Half of the respondents 50.3% (n=73) had attained secondary education. 26.9% (n=39) primary education, 22.1% (n=32) had college education with those having completed university education being the least. 0.7% (n=1). Only a few of the participants had attained tertiary education (college and university).

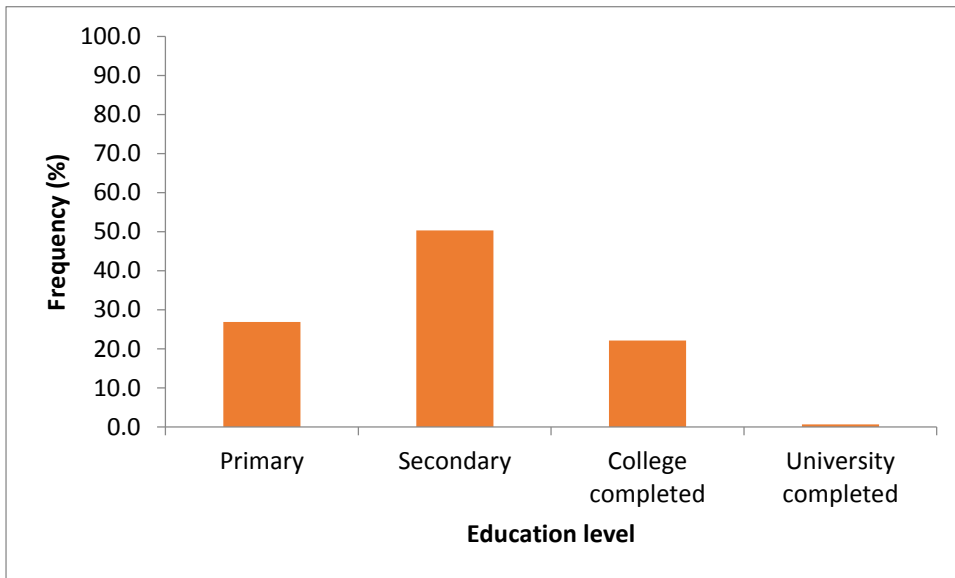


Figure 4.4: Education level

Respondents' occupational status

More than half of the respondents were not employed 55.2% (n=80). Approximately a quarter of them 24.8% (n=36) were employed whereas 20% (n=29) were self-employed.

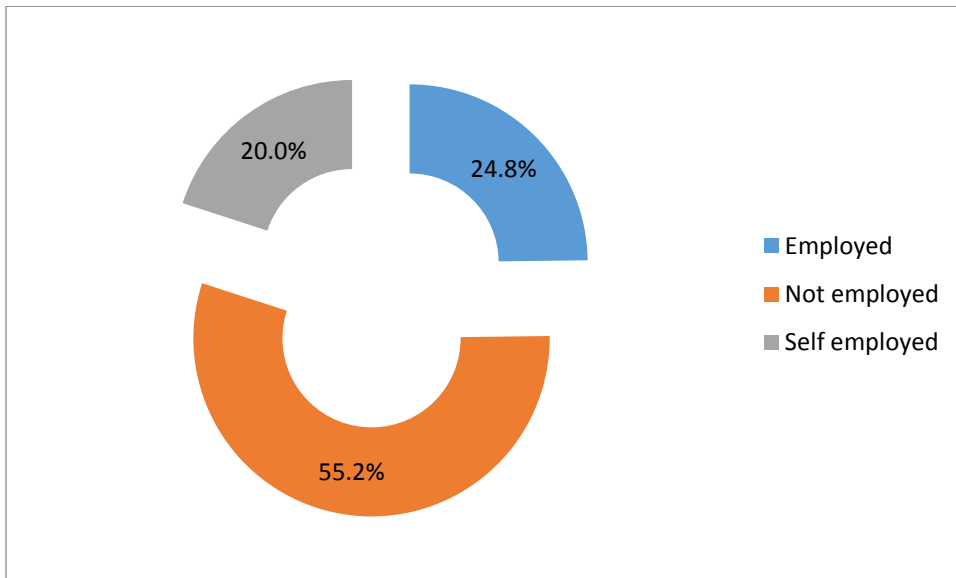


Figure 4.5: Occupation

Respondents smoking and alcoholism status

Majority 80% (n=118) of the respondents did not smoke while 20% (n= 29) of them did. The respondents were asked if they took alcohol, Majority of the participants 76.4% (n=112) indicated that they did not take alcohol.

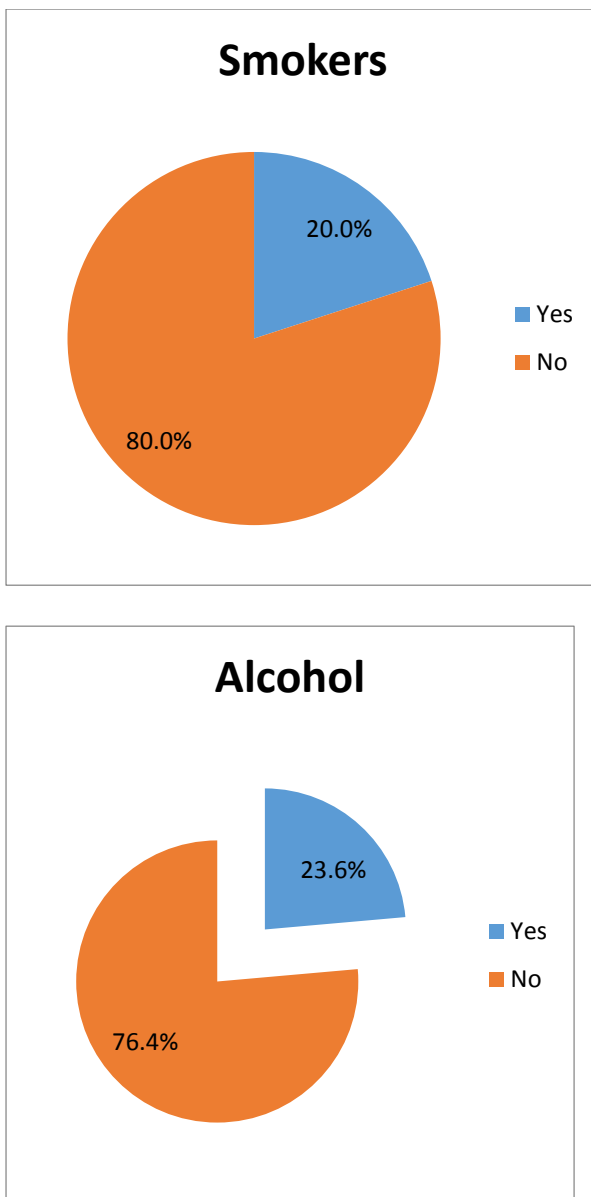


Figure 4.1: Representation of smokers and alcohol consumers

4.3 Level of Adherence

In this study, 65.1% (n=96) of the respondents had missed their medication. This indicates a poor rate of adherence. Only 34.9% (n= 51) adhered.

Adherence to anti tbs

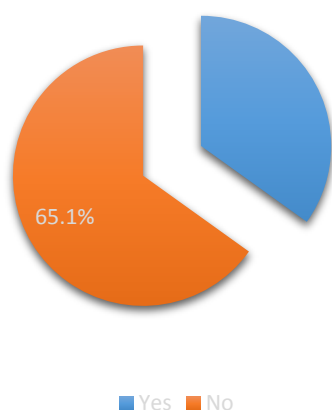


Figure 4.7: Adherence to Anti tbs.

Adherence according to Visual analogue scale

In this study, 6 % (n=9) of the respondents adhered to treatment with the rate of 90% prescription. 29 % (n=43) of them adhered to treatment with the rate of 60%. (65% (n=95) of them adhered at a rate of 55%.The adherence rate for many of the respondents was less than the 90% that is recommended

Table 4.1: Adherence according to Visual analogue scale

Number of respondents	Adherence according to Visual analogue scale
9	90%
43	60%
95	55%

Number of remaining pills being more than the expected

66% (n=97) of the respondents had more pills than the expected. 34% (n=50) of them had the actual number of the expected remaining pills. This indicates a poor rate of adherence.

Table 4.2: Number of remaining pills being more than the expected

Yes	No
97	50

4.3.1 Side effects of Anti-TB drugs

Majority of the respondents 77.9% (n=115) on anti-TB drugs reported that they have ever experienced side effects while 22.1% (n=32) had never experienced anti TBs side effects. This indicates that side effects are common among patients on anti- tbs.

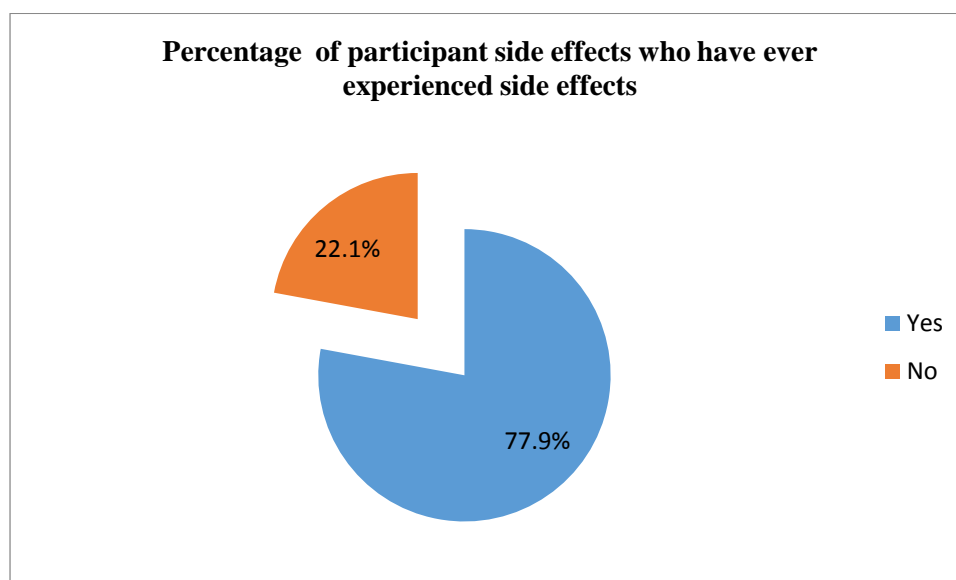


Figure 4.8: percentage of participants who have ever experienced side effects

4.3.2 Minor side effects experienced by patients on anti- tuberculosis drugs

The side effects occurred as follows: Vomiting 27.9%(n=51); followed by headache/dizziness 19.7%,(n=36),followed by discoloration of body fluids 18.6% (n=34); followed by diarrhea 10.9%(n=20); followed by nausea 9.8%(n=18); followed by skin rash 8.7% (n=16) while the least experienced side effect was loss of color vision 4.4% (n=8). Gastrointestinal side effects (vomiting, diarrhea and nausea) are the most common side effects caused by anti tbs. Loss of color vision is the least side effect caused by anti-tbs.

Table 4.3: Minor side effects experienced by patients on anti tbs.

Minor side effects experienced	Frequency	Percentage
Nausea and Vomiting	69	37.7
Headache/dizziness	36	19.7
Discoloration of body fluids	34	18.6
Diarrhea	20	10.9
Skin rash	16	8.7
Loss of color vision	8	4.4
Total	183	100.0

Hypothesis testing.

From the primary data, the results indicated that for the following side effects, there was a statistical significance. Nausea/ Vomiting and adherence with a P value of (0.034), loss of color vision and adherence with a p value of (0.015), discoloration of body fluids and adherence with a p value of (0.001), skin rash and adherence with a p value of (0.003). However, according to the findings of this study, there was no

statistical significance between diarrhea and adherence with a p value of (0.06), and headache/dizziness and adherence with a p value of (0.312).

4.4 Major side effects experienced by respondents on anti-TB drugs

Over half of the respondents experienced Jaundice 56.4% (n=31); followed by the others who experience joint pain 21.8% (n=12); followed by those who experienced numbness 12.7% (n=7) while the least experienced side effect was Ankle swelling 9.1% (n=5).

Table 4.4: Major side effects experienced on anti-TB drugs

Major side effects experienced	Frequency	Percentage
Jaundice	31	56.4
Joint pain	12	21.8
Numbness	7	12.7
Ankle swelling	5	9.1
Total	55	100.0

Hypothesis testing

From the results of this study, there was a statistical significance between hepatotoxicity and adherence with a p value of (0.014). There was also a statistical significance between ankle swelling and adherence with a p value of (0.001). However, there was no statistical significance between peripheral neuropathy and adherence with a p value of (0.072).

Non adherence due to side effects

62% (n=71) of the respondents who experienced side effects stopped taking medication while 38% (n=44) of them did not stop taking medication. This indicates that side effects influenced adherence among a significant proportion of the study participants.

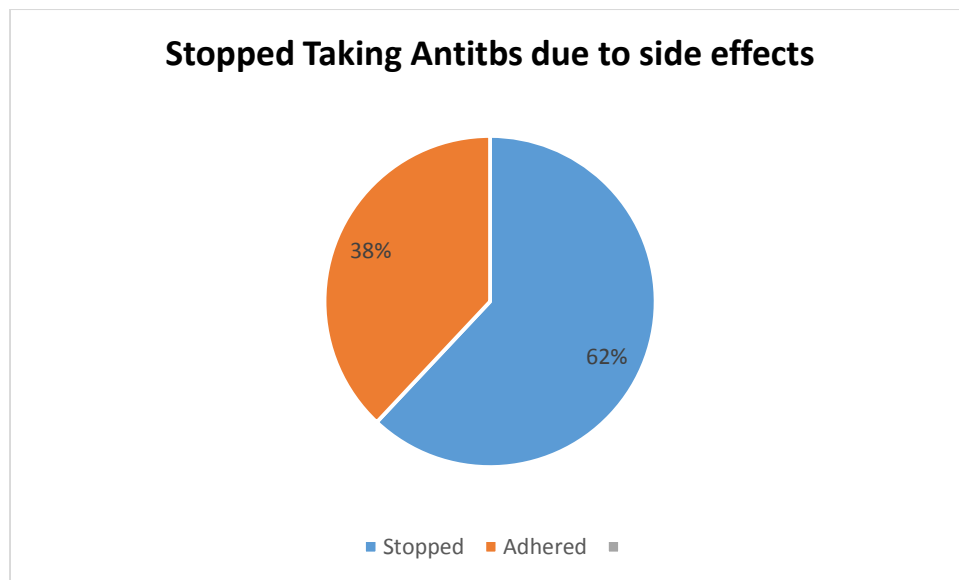


Figure 4.9: Non adherence to Anti-Tbs due to side effects.

Association between other related factors and adherence to TB treatment.

There was a statistical significance between compliance to TB treatment and the age of the participants, ($p= 0.027$). Participants aged 40 to 49 years had the highest score in this category that reported high compliance to TB treatment, 90.9%, (n= 30). The proportion of men who reported compliance to TB treatment, (72.2%) n=78 was statistically significant ($p= 0.037$), compared to 58.3% (n= 21) women. There was no statistical significance between marital status and adherence ($p= 0.318$). The relationship between adherence to TB treatment and highest level of education was statistically significant ($p= 0.001$). Respondents with university and college education reported a high compliance rate of more than (96.7%) n= 30. There was no statistical

significance between occupation status and adherence (p= 0.437). There was also no statistical significance between smoking and adherence (p= 0.006). There was a statistical significance between alcohol and adherence (p = 0.003). Comorbidity was also found to be statistically significant (p =0.003).

4.5 Qualitative Data Analysis

In order to determine patient’s experiences regarding side effects and adherence, this study adopted a qualitative approach using in-depth semi structured interviews where the participants consented and participated in this study. All interviews were recorded on a tape recorder. The interviewees were all coded with numbers such as. Code 020, code 015. Several questions were asked and responded to. NVIVO software 11 was used to analyze the qualitative data. Three themes emerged from the analysis. They were: expectations to experience a side effect, patients’ reaction after experiencing the side effect and health care workers contribution to non-adherence. These three themes were supported by a number of sub-themes.

Theme 1: expectation to experience a side effect.

Majority of the respondents 70% (n=50) interviewed answered that they did not expect to experience side effects. The others 30% (n=20) did expect to experience side effects. This is because when being started on anti tbs, they were never told that they would experience side effects.

“The only thing that was mentioned to us is that if we fail to take our drugs, we would restart treatment again. We were never informed that we could experience vomiting and joint pains.” - Code 30

THEME	EXPECTATION TO EXPERIENCE SIDE EFFECTS	
	NO	YES
SUBTHEMES	50	20

Theme 2: Reaction after experiencing a side effect

The respondents reported that they went to the health facility to report, others waited for the symptoms to subside on their own while others stopped taking medication

Subtheme 1: Stopped taking medication

Approximately two thirds of the respondents 63% (n=44) reported that they stopped taking medication after experiencing a side effect. This was similar to the number of patients stopped adhering to treatment when they experienced side effects as they indicated in the questionnaire.

“I had not been told that my urine would turn red in color, so once I experienced it, I thought it was blood, I got worried and stopped treatment”’ - code 20

“My husband informed me that my eyes had turned yellow in color so I stopped treatment” - code 22.

Sub theme 2: Side effects subsided on their own

Some of the respondents 11% (n= 8) reported to have waited for the side effects to subside on their own.

“I experienced headache in the afternoon that was not too severe, so I continued taking the drugs as usual” - code 15

“I experienced diarrhea, however, it was not that bad, I went ahead taking my medication as prescribed”.- code 17

Sub theme 3: Reported to the health facility.

Some respondents 26% (n=18) went to the health facility to report so that they could be treated.

“Once I experienced a skin rash, I went to the hospital to report. They gave me drugs to go and take at home. After three weeks, the rash resolved” - code 19

Theme	Reaction to Side effects
Stopped adherence	63%(n=44)
Side effects subsided	11% (n= 8)
Reported to the health facility	26% (n=18)

Theme 3: Health care workers contribution to non-adherence.

Most of the respondents 71% (n= 50) felt that healthcare workers contributed to non-adherence by not giving them health education concerning TB and side effects. The others 29% (n=20) felt that health care workers had not contributed to non-adherence.

Subtheme 1: Failure to educate on TB

Some respondents 28% (n= 20) reported that they have never been educated on TB.

“We have never been educated on how TB affects us. I have never known why TB causes me a lot of back pain. It’s important for health care workers to explain to us the effect of TB in our body” . – code 40

Subtheme 2: Failure to educate on side effects

Some respondents 43% (n= 30) expressed that they have never been educated about side effects and they felt it is important for the side effects to be explained to patients before starting treatment.

“Health care workers do not inform us of the side effects to expect. When they occur, we stop treatment. All the side effects should be to us. This will prepare us so that we are not too worried when we experience some of them”. – code 23.

Theme	Contribution of non- adherence
Lack of Education on TB	28% (n= 20)
Lack of Education on side effects	43% (n= 30)
No contribution by health care workers	29% (n = 20)

CHAPTER FIVE: DISCUSSION

5.1 Introduction

This study set-out to determine the effects of anti-tuberculosis side effects on treatment adherence among patients diagnosed with TB at Kenyatta National Hospital (KNH). The findings obtained in this study were adequate to address the study objectives as discussed in the subsequent section under each of the specific objectives targeted in the study. Comparative and contradicting references were provided with due interpretation. Appropriate conclusions and recommendations were made.

5.1.1 Extent of adherence among patients diagnosed with Tuberculosis at Kenyatta National Hospital.

This study found out that the rate of adherence to anti tbs was still poor at KNH. More than half of the respondents in this study have ever missed their medication in at least one occasion. According to the visual analog scale, majority of them did not take their drugs according to prescription. More than two thirds of the respondents had more pills remaining than the actual expected number. This is similar to the findings of Oyugi *et al.*, (2017) who reported that side effects led to 60% of TB patients on anti tbs to default treatment in Nakuru Kenya.

This findings contradicted those of Gube *et al.*, (2018) who found out that the non - adherence level in government health institutions in Southern Ethiopia was only 24.7%. This variation may be attributable to the fact that the study findings represent result from a single hospital. While those of Ethiopia were from many government health institutions from Southern Ethiopia. Two thirds of the respondents who experienced side effects stopped taking medication. This is similar to a study conducted by Tola *et al.*, (2015)who reported that side effects increase the likelihood of non- adherence to

medication to 90%. This indicates that health care workers should come up with better strategies and proper follow up methods in order to enhance adherence.

5.1.2 Effect of minor side effects of anti-tuberculosis drugs on treatment adherence among patients diagnosed with Tuberculosis.

a) (GIT side effects) Nausea / Vomiting and diarrhea

In this study, nausea and vomiting was experienced by over a third of the respondents. Approximately two thirds of those who experienced nausea/ vomiting stopped adhering to medication. In this study, there was a significant association between nausea/vomiting and adherence as many of the respondents who experienced nausea/vomiting stopped treatment. Similar results were found in Ethiopia that 33.4% of patients on anti- tuberculosis drugs who experienced nausea and vomiting resulted to defaulting(Gube *et al.*, 2018). In a study conducted in Nakuru,40% of the TB patients experienced nausea and vomiting hence defaulted on treatment(Oyugi *et al.*, 2017).Another study conducted in Nakuru county involving healthcare workers about antiTbs side effects found out that 36% of healthcare workers reported defaulting among their patients due to nausea vomiting(Kiplangat Arap Sang, 2017). Diarrhea was experienced by a few of the respondents. However, there was no association between diarrhea and adherence. This was contrary to a study in Nakuru that showed that 12% of the patients who developed diarrhea due to anti tbs defaulted (Oyugi *et al.*, 2017). In order to reduce GIT side effects, it's necessary for health care workers to advise TB patients to always take their drugs with meals.

b) Headache/dizziness

Approximately a third of the respondents experienced headaches. About two thirds of them continued taking medication. According to this study, there was no significant association between headache/dizziness and adherence. This contradicted the findings of a study conducted in Northwest Ethiopia that found out that 37% of research participants complained of headache or dizziness hence leading to default of treatment (Adane *et al.*, 2013). Gube *et al.*, (2018) also found out that headache and dizziness was experienced by 23.4% of those on anti-tbs resulting to non- adherence. This means presence or absence of headache or dizziness did not affect adherence to treatment in our study. Headache could be controlled with the use of analgesics hence ensuring adherence.

c) Discoloration of body fluids

Some study participants reported to have experienced discoloration of body fluids. There was a significant statistical association between discoloration of body fluids and adherence. This findings were similar to a study conducted in Ethiopia that found out that 75.2% of research participants on Anti-tuberculosis drugs reported urine discolorations as a cause of non-adherence (Adane *et al.*, 2013). Kiplangat *et al.*, (2017) also reported that many of the patients had not been informed of this side effect resulting to non- adherence. Thus, discoloration of body fluids negatively influenced TB treatment by being a barrier to treatment compliance. This indicates that proper reassurance of patients is important when starting treatment, explanations that this side effect is common and is normal will help in enhancing adherence.

d) Skin rash

Skin rash was recorded by some few participants on anti tbs. About 5% of patients diagnosed with TB on anti tbs present with high bilirubin levels, experience skin rash(El Bouazzi *et al.*, 2016). There was a significant association between skin rash and adherence. This was similar to a study conducted in Nigeria that found out that 6% of the patients on anti tbs had their treatment discontinued due to severity (Schaberg, Rebhan and Lode, 1996). Similarly, a study in Britain found out that 8% of the patients who experienced skin rash interrupted their medication (Breen *et al.*, 2006). However, this finding was contrary to a study by Michael *et al.*, (2016) that none of those patients who developed skin rash discontinued treatment. The overall incidence of severe skin rash in our study was low but played a role in causing non-adherence. This means that patients who experience skin rash fear to adhere. It is therefore important to treat skin rash as a side effect using antihistamines (chlorpheniramine) to enhance adherence among those patients who experience it.

e) Loss of color vision

The least of the respondents on anti tbs developed ocular toxicity. Loss of color vision was the reported symptom. Over half of them stopped taking their anti tbs due to side effects. There was a statistical significance between ocular toxicity and adherence. This study had similar findings with another conducted in Pakistan that found out that 18% of patients receiving more than 30 mg/kg per day of ethambutol per day experienced ocular toxicity and this negatively affected their adherence (Shah *et al.*, 2014). Loss of color vision is a rare yet important side-effect that affects adherence. It should be carefully monitored and controlled to enhance adherence among TB patients.

5.1.3 The effect of major side effects of anti-tuberculosis drugs on treatment adherence among TB patients.

a) Numbness

This study found out that a few of the respondents reported numbness as a side effect. This finding was similar to another study done by Stettner *et al.*, (2015) who found out that numbness occurs in about 2- 44% of patients on Isoniazid.

There was no statistical significance between numbness and adherence. This finding was similar to those of a study done in India found out that none of the patients who experienced by numbness continued their treatment. For them (73.07%) responded well to a one week course of pyridoxine supplementation. The neuropathy resolved slowly over next 2 weeks but completely (Sahasrabudhe, 2015). However, a study in Ethiopia found out that peripheral neuropathy experienced by 30% of the respondents made them to default treatment (Gube *et al.*, 2018). This was also supported by a study conducted in Thibela South Africa that found out that among the fifty study participants who experienced peripheral neuropathy three of them had to be discontinued from Isoniazid which was part of treatment (Grant *et al.*, 2010). While pyridoxine is routinely prescribed with INH in the industrialized world, developing countries with limited resources may fail to use it due to the overall increase in treatment cost (Van Der Watt *et al.*, 2011). Teklay *et al.*, (2016) found out that lack of pyridoxine for patients on anti tbs increased the risk of PN contributing to some patients discontinuing treatment. A recent cross-sectional study of patients on anti tbs in South Africa found out that only less than 10% of patients on TB treatment were receiving adequate pyridoxine supplementation (25 mg/day). This increased the number of those who experienced PN resulting to most of them stopping medication. Peripheral neuropathy in this study did

not affect adherence. However, patients who experience numbness should be treated with pyridoxine 100 mg daily to control this side effect.

b) Joint pains and ankle swelling

In this study, joint pains and ankle swelling were experienced by a third the study participants. Those who experienced ankle swelling and joint pains as symptoms of hyperuricemia were more likely to stop adherence. There was a statistical significance between joint pain/ankle swelling and adherence according to this study. This finding was similar to a study conducted in Kyrgystan prisons in Zurich on factors promoting adherence to TB medication, found out that hyperuricemia was responsible for termination of therapy in up to 23% of patients during the intensive phase of treatment (Graner 2007). Joint pain/ankle swelling occurred in a significant proportion of respondents and influenced adherence negatively. Proper monitoring has to be carried out during the whole treatment course, including clinical examination and laboratory tests of uric acid levels.

c) Jaundice

This study found out that more than half of respondents on anti tbs developed hepatotoxicity. Jaundice was recorded as a symptom in all of them. Majority of these patients who developed jaundice stopped taking their medication. This finding was similar to that of a study done in Ethiopia that indicated that jaundice was a common side effect that caused patients to stop adhering to treatment (Medhin, Alemu and Desalegne, 2015).

The results of this study were similar to a study conducted in Turkey that found out that 84 patients on anti tbs developed hepatotoxicity due to anti tbs. Among them, twenty eight stopped treatment. Severe hepatotoxicity occurred in 9 (0.8%) patients leading to

final termination of at least 1 of the 3 standard drugs. Treatment was later restarted in 18 of these patients and severe hepatotoxicity was noted again in 27.8% of them. PZA which was the drug associated with hepatotoxicity in this study was stopped (Gülbay *et al.*, 2006).

This was also found in In a retrospective cross sectional study conducted to assess factors affecting adherence of TB patients to anti TB drugs in Adama referral hospital, where (29.67%) of the patients defaulted treatment due to hepatotoxicity(Kelifa *et al.*, 2015). Hepatotoxicity was the most common major side effect caused by anti tbs in this study and it negatively affected adherence to treatment. This indicates that it is necessary for TB researchers to develop hepato-protective drugs.

Effects of other related factors on adherence to Antituberculosis drugs

In this study, Gender was found to influence adherence. Males were more likely to adhere to medication than females. This finding is similar to that of a study conducted in Argentina has shown that difference in sex has an effect on anti-TB drug nonadherence among TB patients. However, women in this study adhered more to treatment than men (Herrero, Ramos and Arrossi, 2015). These two studies were contrary to a study done in Nigeria that showed no significant association between gender and adherence to anti tbs (Woimo *et al.*, 2017)

Increasing age was associated with an increased likelihood of adhering to anti-TB medication. This result was similar to a study done in North East Ethiopia that found out that being younger than 24 years resulted to non-adherence(Ibrahim *et al.*, 2014)

Education level was also associated with an increased likelihood of adhering to anti-TB medication. These findings were similar to a study conducted in Southwest Ethiopia that indicated that educational level of a person was important in ensuring

adherence(Woimo *et al.*, 2017). Similarly, a study conducted in South East Nigeria showed that patients who were more educated adhered to treatment in a better way (Gube *et al.*, 2018). However, education was not found to influence the rate of adherence in a study done in Southern Ethiopia (Ibrahim *et al.*, 2014). Compliance also requires that patients should be literate or have good literacy in order to understand easily the importance of adherence.

Increasing alcohol consumption was associated with a reduction in the likelihood of adhering to anti-TB medication. Similarly ,a study in North East Ethiopia found association between alcohol and non-adherence (Ibrahim *et al.*, 2014).Alcohol is injurious to the liver, potentiating the hepatic effects of anti-tuberculosis drugs. Alcohol combined with anti-TB drugs may lead to a greater risk of liver damage

In this study comorbidity was associated with non-adherence. Similarly, a study done in Ethiopia also found out that being HIV positive resulted to non-adherence(Ibrahim *et al.*, 2014). This was further recorded by a study conducted in Ethiopia among HIV Positive TB patients being treated concomitantly that indicated that the amount of side effects was high resulting to defaulting of treatment (Gebremariam, Bjune and Frich, 2010).The side-effects profile of TB chemotherapy is magnified in patients with concurrent HIV treatment.

5.2 Strengths and Limitations to the Study

Strengths

The study's major strengths were associated with the quality of the data collected.

They were as follows:

- 1) There was no reason to doubt the sincerity of the respondents, which would have compromised the quality of the study.
- 2) The data collection process was rigorous and enabled the researcher to collect adequate data to saturation. The ability to collect adequate data ensured that the study objectives could be adequately covered and the research questions addressed.
- 3) The researcher had a lot of support all through, which improved the appraisal process through the study process.

Limitations

The following were the study limitations

1. The level of adherence was measured using recalling. However, Visual analogue scale and pill count were also used to measure adherence.
2. Our study did not focus whether the side effects occurred during the intensive phase or continuation phase. However, it included patients on anti-tuberculosis drugs in all those phases, more than a week.
3. Our study did not first assess to know whether the patients knew of the expected side effects. However, we included the specific minor and major side effects in our study.
4. Our study did not assess whether the respondents initially knew about the importance of adherence to anti- tuberculosis drugs, however we recommended that TB patients should be educated about the importance of adherence.

5.3 Conclusion

From the findings of this study, the researcher came up with the following conclusions.

1. Overall there was poor level of adherence 34.9% (n=51) among the respondents. Visual analogue scale and pill count were used as the standards of measurement. According to pill count 66% (n= 97) of the respondents had more pills than the expected. According to Visual analogue scale, 6% (n=9) had 90% prescription rate followed by 29% (n=43) with 60% prescription rate; followed by 65% (n= 95) with a prescription rate of 55%.
2. Minor side effects of anti-tuberculosis drugs contributed to poor adherence as indicated by (nausea & vomiting (p=0.034), loss of color vision (p=0.015), skin rash(p=0.003) and discoloration of body fluids(p=0.001).
3. Major side effects of anti- tuberculosis drugs contributed to poor adherence as indicated by jaundice (p =0.014), joint pain (p = 0.003) and ankle swelling (p= 0.001).

5.4 Recommendations

The study makes the following recommendations based on the findings and conclusion

1. Health care workers should emphasize the importance of adherence to TB patients on anti –tuberculosis drugs regardless of experiencing side effects.
2. The patients need to be educated on possible side effects of anti-tuberculosis drugs and how to handle them.
3. Health care workers should manage the side effects of anti-tuberculosis drugs so as to ensure adherence.
4. The directly observed therapy program at Kenyatta National Hospital should be strengthened

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APPENDICES

APPENDIX I: QUESTIONNAIRE

TITLE: EFFECTS OF ANTITUBERCULOSIS DRUGS SIDE EFFECTS ON
TREATMENT ADHERENCE AMONG TB PATIENTS AT KNH.

DATE:

CODE NUMBER

INSTRUCTIONS

1. Answer by ticking appropriately on the enclosed brackets for the close ended questions.
2. For the open ended questions, please write your response on the spaces provided.
3. Feel free to ask for clarifications whenever in need.

SECTION 1: SOCIODEMOGRAPHIC DATA

1. What is your Gender
Male
Female
2. What is your Age (Years)
18-29
30-39
40-49
50-59
60 and above

3. What is your marital status

Single

Married

Divorced

Widowed

Widower

4. What is your highest education level

Primary completed

Secondary completed

College completed

University completed

5. What is your occupation status?

Employed

Not employed

Self employed

6. Do you smoke?

Yes

No

7. Do you take alcohol?

Yes

No

8. If yes in (6) above, for how long have you been taking alcohol

Six months and below

One year

More than two years

SECTION 2: LEVEL OF ADHERENCE

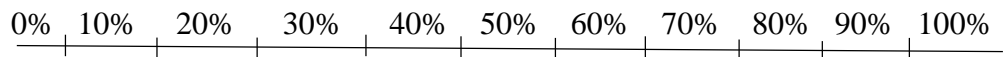
9. Have you ever missed to take your medication?

Yes

No

10. VAS (Visual Analog Scale)

How much of anti TB drugs have you taken as prescribed since you started treatment?



0% means you have taken no drugs at all

50% means you have taken half of the drugs

100% means you have taken all required pills of the drugs

Number of respondents	Adherence according to prescription

14. Are the actual number of pills remaining more than the expected remaining pills today?

Yes	No

SECTION 3: SIDE EFFECTS OF ANTITUBERCULOSIS DRUGS. (ANTI TBS)

15. Have you ever experienced a side effect to anti TBS?

Yes No

16. If Yes in (21) above, what side effect/s below did you experience?

MINOR SIDE EFFECTS:

- a) Diarrhea
- b) Nausea/vomiting
- c) Skin rash
- d) Headache /dizziness
- e) loss of color vision
- f) Discoloration of body fluids

MAJOR SIDE EFFECTS

- a) Jaundice
- b) Numbness
- c) Joint pain
- d) Ankle swelling

17. Did the side effects to anti TBS make you stop taking your medication?

Yes

No

Thank you for participating in the study.

APPENDIX II: IN DEPTH INTERVIEW GUIDE FOR TB PATIENTS ON ANTI TBS TREATMENT

Introduction

I am _____ carrying out a research study on “*Effects of side effects on treatment adherence among TB patients at Kenyatta National Hospital*”, in partial fulfillment for the award of Degree of Master of Science in Nursing , University of Nairobi. The information provided in this interview will be used for academic purposes only and confidentiality will be highly upheld.

Thank you.

Instructions

- I. The following interview will be audio taped**
- II. Please try to answer all the questions asked**
- III. Please ask for clarification in case you don’t understand a question asked**

PART I: PATIENTS’ EXPERIENCES ON SIDE EFFECTS AND ADHERENCE

1. Did you ever think that you could experience a side effect to anti tbs?
2. How did you react when you experienced a side effect to anti tbs?
3. What do you think is not done by health care workers that leads to high rates of non-adherence?

Thank you for your participation in the interview. The information provided will be kept safe and remain confidential. Thank you

APPENDIX III: STUDY BUDGET

DESCRIPTION/ITEM	UNIT COST	QUANTITY	COST
HUMAN RESOURCE			
Training research assistants(2)	1000	1000× 2	2,000
Transport	500	100 × 2× 15 days	3,000
data collection, entry and analysis.	30,000	30,000 × 1	30,000
Researcher's transport	300	300×30 days	9,000
PROPOSAL AND REPORT			
Proposal typing and printing(55 pages)	10	55× 10	550
Photocopying final report (10 copies)	250	2,500	2,500
Typing and printing)	10(7 pages)	10× 7	70
Photocopying	15(160 copies)	160 × 15	2,400
MATERIALS AND SUPPLIES			
Pens(1 dozen)	100	100×1	100
Pencils(1 dozen)	50	50×1	50
Rubbers(3)	10	10×3	30
Folders(3)	50	50×3	150
Field books(3)	50	50×3	150
Stapler(1)	500	500×1	500
Staples(1 packet)	200	200×1	200
Publishing fee	journal	50,000	50,000
Internet subscription 4 months	2000	8,000	2,000
Report printing fee	5	500 ×5	2,500
Report binding fee	6 copies (500)	3,000	3,000
SUB TOTAL			108,100
CUMULATIVE SUBTOTAL			10,810
GRAND TOTAL			118,910

APPENDIX IV A: CONSENT EXPLANATION FORM.

FOR QUANTITATIVE DATA

Title of the study: Effects of anti-tuberculosis drugs side effects on treatment adherence among TB patients at KNH.

Institution: School of Nursing Sciences, University of Nairobi. P.O BOX 19676-00202

Investigator: Benson Kinyua King'au, Mobile No: 0712856822

Supervisors: Dr.Mwaura, Senior Lecturer School of Nursing Sciences, University of Nairobi, phone number 0722790202. And Dr. Mageto lecturer School of Nursing sciences, University of Nairobi. Phone number 0724205419

Ethics approval: Kenyatta National Hospital/ University of Nairobi Ethical Research Committee, P.O.BOX 20723-00100, Nairobi. Tel 2726300 / 2716450 Ext 44102.

Email: uonbi-erc@uonbi.ac.ke

Website: <http://www.erc.uonbi.ac.ke>

Facebook: <https://www.facebook.com/uonknh.erc>

Twitter; @UONKNH-ERC

I am requesting you to participate in this study by filling a questionnaire that will be availed to you. This research is part of my degree course, Masters of Science in Nursing. Understand the following general principles, which apply to all participant in any research study:

- i. Your agreement to participate in this study is voluntary
- ii. You can withdraw from the study at any time without necessarily giving reasons for your withdraw.

- iii. After reading the explanation, please feel free to ask any questions that will enable you to understand clearly the study.
- iv. The study is anticipated to last 8-10 minutes.

Introduction: In this study, I am determining the effects of anti-tuberculosis side effects on treatment adherence among TB patients at KNH.

Purpose of the Study: The main purpose of this study is to determine the effects of anti-tuberculosis side effects on treatment adherence among TB patients at KNH. You have been approached to participate because you have been diagnosed with TB and are being followed up and managed at this hospital.

Risks: This is a minimal risk study and there will be no invasive procedure involved. However there may be some psychological and emotional risk associated with information disclosure by you during the interview. This will be minimized or completely eradicated by the investigator upholding confidentiality of the information you share. No information collected will bear your name in it. In-case you encounter any psychological challenges kindly consult the researcher for counseling. You will not face any punishment measures if you are not compliant to TB management.

Benefits: There will be no financial incentives or any other benefits to you for taking part in this study. The Ministry of Health, KNH and other key players in the health sector will get a copy of this study findings and recommendations and may use them in improving adherence in TB patients on treatment.

Assurance of confidentiality: Information obtained from you will be handled with confidence. Your name will not be mentioned or used during data handling or used in publication of results. Codes will be used instead and data collected during the study will be stored safely, only accessed by the investigator.

Contacts: If you need further clarification, you can get in touch with me or my supervisors through the contacts provided in the consent form.

APPENDIX IV B: PARTICIPANT’S CONSENT FORM

The above details about the study have been explained to me and I agree to participate
I do hereby give consent/permission to include me in this study on “The effect of anti
TBS side effect on treatment adherence among TB patients being cared for at KNH”. I
fully understand that this is my own choice and if I chose to stop participating, it will
not in any way affect the care i am receiving from this hospital.

Participant’s signature Date.....

Researcher’s signature Date.....

APPENDIX V: INFORMED CONSENT FOR TB PATIENTS ON ANTI TBS

a) FOR THE QUALITATIVE STUDY

TITLE: PATIENTS' EXPERIENCES ON SIDE EFFECTS AND ADHERENCE

PRINCIPLE INVESTIGATOR: BENSON KINYUA

You are invited to participate in this study because you are a TB patient being attended for at (KNH). The main objective of this study is to determine the effects of side effects among patients diagnosed with TB at KNH. The specific objectives is to gather your views and experiences on the side effects that you get and ways in which to improve adherence. You should understand the general principles which apply to all participants in a medical research:

- I. Your decision to participate is entirely voluntary
- II. You may withdraw from the study at any time without necessarily giving a reason for your withdrawal
- III. Refusal to participate in the research will not affect your care in this facility.
- IV. We will give you a copy of this form for your records.

May I continue? YES / NO

WHAT IS THIS STUDY ABOUT?

The purpose of the interview is to find out your experiences about the side effects of anti- tuberculosis drugs and how health care workers contribute to non-adherence. Respondents in this research study will be asked questions about their side effect experiences and what can be done to deal with non-adherence due to side effects.

WHAT WILL HAPPEN IF YOU DECIDE TO BE IN THIS RESEARCH STUDY?

You will be interviewed on a one to one by the researcher in a private room where a tape recorder shall be used to audiotape the conversation. There is no right or wrong answer, the aim is to understand experiences. This will take 10-20 minutes.

ARE THERE ANY RISKS, HARMS DISCOMFORTS ASSOCIATED WITH THIS STUDY?

Medical research has the potential to introduce psychological, social, emotional and physical risks. Effort should always be put in place to minimize the risks. One potential risk of being in the study is loss of privacy. We will keep everything you tell us as confidential as possible. We will use a code number to identify you in a password-protected computer database and will keep all of our paper records in a locked file cabinet.

BENEFITS

There will be no benefits at an individual level or even compensation. However, the results of this study will be used by the hospital management so that interventions can be designed to help to improve the care and follow up of TB patients who often experience side effects.

CONFIDENTIALITY

You will not be identified and no information you give will make it possible for anyone to identify you. All the information will be kept under lock and key and electronic information will be under a password.

WHAT IF YOU HAVE QUESTIONS IN FUTURE?

If you have further questions or concerns about participating in this study, please call or send a text message to the study staff at the number provided at the bottom of this page.

For any information about this study please you can contact the research Benson Kinyua on Telephone number 0712856822 or the supervisors Dr. Mwaura: 0722790202 or Dr. Mageto:0724205419

For more information about your rights as a research participant you may contact the Secretary/Chairperson, Kenyatta National Hospital-University of Nairobi Ethics and Research Committee Telephone No. 2726300 Ext. 44102 email: uonknh_erc@uonbi.ac.ke.

WHAT ARE YOUR OTHER CHOICES?

Your decision to participate in research is voluntary. You are free to decline participation in the study and you can withdraw from the study at any time without injustice or loss of any benefits. If you decline to be audio taped, you shall not participate in the study.

CONSENT FORM (STATEMENT OF CONSENT)

Participant's statement

I have read this consent form or had the information read to me.

I have had the chance to discuss this research study with the researcher

I have had my questions answered in a language that I understand. The risks and benefits have been explained to me.

I understand that my participation in this study is voluntary and that I may choose to withdraw any time. I freely agree to participate in this research study.

I understand that all efforts will be made to keep information regarding my personal identity confidential.

By signing this consent form, I have not given up any of the legal rights that I have as a participant in a research study.

Participant printed name: _____

Participant signature / Thumb stamp _____ **Date** _____

Researcher's statement

I, the undersigned, have fully explained the relevant details of this research study to the participant named above and believe that the participant has understood and has willingly and freely given his/her consent.

Researcher's Name: _____

Signature _____ **Date:** _____

APPENDIX VI.TIME FRAME 2018

ACTIVITY CODE	ACTIVITY	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEP
01	PROPOSAL DEVELOPMENT	■	■							
02	PROPOSAL APPROVAL			■						
03	TRAINING RESEARCH ASSISTANTS				■					
04	TOOL PRETEST				■					
05	DATA COLLECTION					■	■			
06	DATA ANALYSIS							■		
07	FOLLOW UP							■		
07	PRESENTATION OF REPORT								■	
08	DISSEMINATION: SUBMISSION & PUBLICATION									■

Appendix VI: Model summary of other related factors and adherence to anti-TB medication

Confounders		Yes	No	(χ^2)	P-Value
Gender	Male	79 (72.2%)	30 (27.8%)	8.393	0.037
	Female	22 (58.3%)	16 (41.7%)		
Age(Years)	18-29	25 (53.2%)	22 (46.8%)	5.231	0.027
	30-39	31 (54.4%)	26 (45.6%)		
	40-49	30 (90.9%)	3 (9.1%)		
	50-59	5 (71.4%)	2 (28.6%)		
Marital status	Single	43 (79.2%)	12 (20.8%)	0.184	0.318
	Married	46 (72.6%)	18 (27.4%)		
	Divorced	17 (80.0%)	4 (20.0%)		
	Widowed	7 (100.0%)	0 (0.0%)		
Education level	Primary	19 (46.2%)	22 (53.8%)	2.307	0.001
	Secondary	45 (61.1%)	29 (38.9%)		
	College Completed	30 (96.7%)	1 (3.3%)		
	University Completed	1 (100.0%)	0 (0.0%)		
Occupation	Employed	35 (100.0%)	0 (0.0%)	2.733	0.437
	Not Employed	63 (78.5%)	18 (21.5%)		
	Self Employed	25 (82.8%)	6 (17.2%)		
Smoke	Yes	23 (75.9%)	8 (24.1%)	0.299	0.666
	No	102 (88.5%)	14 (11.5%)		
Alcohol	Yes	20 (56.3%)	16 (43.8%)	98.212	0.003
	No	82 (74.3%)	29 (25.7%)		

Appendix VIII: Model for association between minor side effects and adherence to anti-TB medication

Minor side effects experienced	Adherence	Non adherence	x²	P-value
Diarrhoea	18 (89.5%)	2 (10.5%)	2.415	0.067
Nausea & Vomiting	18 (26.7%)	52 (73.3%)	9.874	0.034
Skin rash	4 (22.7%)	12 (77.3%)	14.516	0.003
Headache/dizziness	23 (64.3%)	13 (35.7%)	2.578	0.312
Loss of color vision	3 (40.6%)	5 (59.4%)	17.214	0.015
Discoloration of body fluids	13 (37.9%)	21 (62.1%)	11.658	0.001

Appendix IX: Model for association between major side effects and adherence to anti-TB medication

Major side effects experienced	Adherence	Non adherence	χ^2	P-value
Jaundice	11 (34.5%)	20 (65.5%)	8.432	0.014
Numbness	5 (67.2%)	2 (32.8%)	2.589	0.072
Joint pain	4 (34.5%)	8 (65.4%)	7.654	0.003
Ankle swelling	2 (41.9%)	3 (59.1%)	7.521	0.001