

**EXTENT AND RISK FACTORS FOR MULTIPLE DRUG RESISTANCE  
AMONG TUBERCULOSIS PATIENTS IN BARINGO  
COUNTY, KENYA**

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SCIENCES OF KENYATTA UNIVERSITY**

**NOVEMBER, 2021**

## DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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## **DEDICATION**

I dedicate this thesis to my beloved husband Gilbert Rop, and dear children Meshack and Abigael for moral and financial support through my entire studies. Gratitude goes to my dear parents, siblings, in-laws and the entire extended family for their unconditional love, understanding, endurance and support which has powered the aspiration and strength for my unrelenting search for more knowledge.

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**ABBREVIATIONS AND ACRONYMS**

<b>AIDS:</b>	Acquired Immuno-Deficiency Syndrome
<b>DM:</b>	Diabetes Mellitus
<b>DST:</b>	Drug Susceptibility Testing
<b>EPTB</b>	Extra Pulmonary Tuberculosis
<b>HIV:</b>	Human Immuno-Deficiency Virus
<b>KEMRI:</b>	Kenya Medical Research Institute
<b>MDR-TB:</b>	Multi-Drug Resistant Tuberculosis
<b>MTB:</b>	Mycobacterium tuberculosis
<b>PTB:</b>	Pulmonary Tuberculosis
<b>RIF:</b>	Resistance to Rifampicin
<b>SPSS:</b>	Statistical Package for Social Sciences
<b>SCH:</b>	Sub-County Hospital
<b>TB:</b>	Tuberculosis
<b>VIF:</b>	Variance Inflation Factor
<b>WHO:</b>	World Health Organization

**DEFINITION OF OPERATIONAL TERMS**

<b>Gene Xpert MTB/RIF</b>	: A laboratory test used to detect mycobacterium tuberculosis DNA and Rifampicin (TB first line drug) resistance in mycobacterium tuberculosis.
<b>Measures of Association</b>	: A statistical calculation done to estimate a relationship between two variables.
<b>Multi Drug Resistant Tuberculosis</b>	: Isoniazid- and rifampicin-resistant tuberculosis.
<b>MDR TB factors</b>	: Factors associated with onset of MDR TB.
<b>MDR TB Risk Factors</b>	: Selected Risk factors that increase TB patients chances of developing MDR TB such as Socio-demographic factors, TB Treatment related factors, history of imprisonment, history of migration, education-related factors, behavioral practices, health system and provider factors.

## ABSTRACT

In Kenya, tuberculosis remains a principal cause of morbidity and mortality. This study sought to determine the extent of and risk factors for multiple drug resistance among tuberculosis patients in Baringo County, Kenya. The study aims were: to identify the prevalence of MDR TB in Baringo County, and to establish the relationship between socio-demographic factors, previous TB treatment, TB treatment related factors, history of imprisonment, history of migration, education-related factors, behavioral practices, health system and provider factors and occurrence of MDR TB among tuberculosis patients in Baringo County. The study employed the cross-sectional survey design. Using purposive sampling, proportional to size sampling, and purposive census to recruit the respondents. 263 participants were selected from six sub-county hospitals. Data was collected using structured questionnaires including dichotomous questions (yes and no questions). The experts in the Department of Community Health and Epidemiology improved the validity of the instrument. The tool was pilot-tested to measure its reliability coefficient. The research instrument's reliability was 0.796, which was within acceptable threshold. Descriptive statistics (frequency distributions, means and standard deviation) and inferential statistics (chi-square) were utilized to explore the collected data using IBM SPSS program version 26. The finding of the study revealed MDR TB prevalence among tuberculosis patients in Baringo County to be 14.9%. The study adopted 0.05 Alpha ( $\alpha$ ) level. The chi-square results indicate that, highest level of education, incomes of TB patients, TB treatment related factors: history of imprisonment, history of migration, behavioural practices, health system and provider factors have no significant relationship with MDR TB prevalence in Baringo County. The results for the correlation are: Fisher's Exact Test = 8.230;  $p = 0.075$ ,  $\chi^2 = 0.295$ ;  $df = 1$ ;  $p = 0.705$ , ( $\chi^2 = 0.706$ ;  $df = 1$ ;  $p = 0.49$ ), ( $\chi^2 = 0.053$ ;  $df = 1$ ;  $p = 0.853$ ), ( $\chi^2 = 0.305$ ;  $df = 1$ ;  $p = 0.658$ ), Fisher's Exact Test = 3.311;  $p = 0.200$ , respectively. Consequently, the study established strong statistically significant positive relationship ( $\chi^2 = 68.371$ ;  $df = 1$ ;  $p < 0.001$ ), between previous TB treatment, and prevalence of MDR tuberculosis among the study participants. The qualitative findings shows that long distance, stigma, drug abuse, and mal-absorption syndrome leads to none adherence to ant-TB medication which leads to MDR-TB. The findings may help in informing policymakers to formulate relevant public health strategies to increase adherence and compliance to tuberculosis therapy. Additionally, findings from the study will be used by ministry of health to come up with specific MDR TB preventative strategies. Future research should capture other contributory factors in settings beyond Baringo County, and provide more generalizable findings.

## CHAPTER ONE: INTRODUCTION

### 1.1 Background

Multiple drug resistance among tuberculosis patients is a globally challenge and Global TB control interventions experience a potent threat from two the fronts, that is: Multi-Drug Resistant Tuberculosis (MDR TB) and HIV/AIDS (WHO Tuberculosis Report, 2014). In 2013, over 210, 000 people died of causes associated with MDR TB, with an estimated 480, 000 new cases recorded worldwide (Lukoye *et al.*, 2015). As per Lukoye *et al.* (2015), of the global MDR TB cases reported in 2013, 80% were from the European region, Asia, China and Southern Africa.

A rise in the global number MDR TB cases has been noted since 2009. As per the Global Tuberculosis Report (2014), a significant increase of 23% was observed between 2012 and 2013, with India, Uzbekistan, and Ukraine recording a significant portion of it (WHO 2014). Despite the progress made in the diagnosis of MDR TB, significant gaps remain. For example, East Africa had a gap of 5, 948 cases between the reported estimate of MDR TB cases and the actual number of diagnosed cases in the year 2013 (Kidenya *et al.*, 2014).

The numbers of notifications of MDR TB in Africa appear lower than it is expected. This may not translate to actual low prevalence of MDR TB but could be because most African countries lack comprehensive national surveillance systems that capture MDR TB data (WHO, 2014). Data from African countries indicate that the occurrence of MDR TB varies from 17.7% in the Central African region to 10.4% in the Southern region of Africa (WHO, 2014). According to the Global Tuberculosis Report (2014), East Africa records the highest percentage of MDR TB cases (29.2%) among the past treated MDR TB cases in Africa.

According to the Kenya Tuberculosis Survey of 2016, the prevalence of tuberculosis in the adult population was 558 cases per hundred thousand (100,000) population. (Enos et al., 2018). Knowledge of the MDR TB risk factors is vital for prevention, control, and management of the disease's spread. Various demographic and behavioral factors have been linked to MDR TB. According to Ricks *et al.*, (2012), the acquisition of the drug-resistant strain of bacteria is linked to being in close proximity to a case of MDR TB.

According to Akl and Mahalli (2012), MDR TB cases emerge as a result of errors in TB treatment, such as utilizing a single TB medication, failing to identify pre-existing resistance, and introducing a single drug type to an ineffective regimen. Non-adherence to TB treatment, ignorance, under-nutrition and low socio-economic status are other risk factors related to the increase in MDR TB cases (Lomtadze et al., 2006). Referring to recommendations from previous findings, compliance with TB treatment, improvement of housing conditions, access to medical and healthcare services, and a focus on people with lower socio-economic status are some of the ways through which MDR TB can be prevented and managed (Akl & Mahalli, 2012; Lomtadze et al., 2006; and Ricks et al., 2012).

## **1.2 Problem Statement**

Tuberculosis is a key contributor of illness and mortality in Kenya. The country is one of 22 countries with a high prevalence of tuberculosis, which collectively account for 80% of the global TB burden (Global Tuberculosis Report, 2013). The TB treatment defaulter rate in Kenya remains one of the highest at 15%. As a result, MDR TB incidence has risen in the country.

MDR-TB is more challenging to treat, is more fatal and poses greatest challenges in adherence than completing first-line treatment for TB, particularly in resource-scarce settings. MDR-TB risk factors are known but vary from one location to another. Baringo County as an arid and semi-arid area had its own unique risk factors for MDR- TB. There were limited studies on the extent of risk factors among MDR TB patients in Baringo County. Consequently, lack of enough data on MDR TB hampered with efforts to control the condition. Fatality rate among the MDR TB in Baringo was high. It was, however, not clear how the risk factors unique to Baringo contributed to complications and death. This study sought to establish the extent of and risk factors for MDR TB in Baringo County, with the aim to provide information to guide public health interventions to prevent MDR TB.

### **1.3 Justification of the Study**

Tuberculosis with multidrug resistance is a global public health issue. Although studies in other settings have established MDR TB-associated factors, the association between MDR TB and socio-economic, nutritional, medical history, and environmental factors were unknown in Baringo County. Understanding associated factors for MDR TB in Baringo County in Kenya were epidemiologically significant for the control of the disease in Baringo County and in Kenya. This study's findings will expand the pool of current knowledge useful for the enhancement of the Kenya's National TB Control Programme. Through this research, evidence-based interventions will be developed and recommended.

#### **1.4. Research Questions**

- i) What is the MDR TB prevalence among tuberculosis patients in Baringo County?
- ii) What are the socio-demographic and economic factors affecting the prevalence of MDR TB among tuberculosis patients in Baringo County?
- iii) What are the previous TB treatment factors affecting MDR TB prevalence among tuberculosis patients in Baringo County?
- iv) What is the association between selected risk factors and the MDR TB prevalence among tuberculosis patients in Baringo County?

#### **1.5. Hypotheses**

- i) Socio-demographic and economic factors are not significantly related to the prevalence of MDR TB among tuberculosis patients in Baringo County
- ii) Previous TB treatment factors have no statistically significant relationship with prevalence of MDR TB among tuberculosis patients in Baringo County
- iii) There is no statistically significant association between selected risk factors and the MDR TB prevalence among tuberculosis patients in Baringo County.

#### **1.6. Objectives**

##### **1.6.1. Broad Objective**

To determine the extent of and risk factors for MDR TB among tuberculosis patients in Baringo County.



### **1.6.2. Specific objectives**

- i) To establish MDR TB prevalence among tuberculosis patients in Baringo County.
- ii) To establish socio- demographic and economic factors affecting MDR TB prevalence among tuberculosis patients in Baringo County.
- iii) To establish the previous TB treatment factors affecting MDR TB prevalence among TB patients in Baringo County.
- iv) To find out the correlation between selected risk factors and the MDR TB prevalence among TB patients in Baringo County.

## **1.7 Limitations and Delimitations**

### **1.7.1 Limitations**

Since the study used interviews as method of data collection, the quality of participants responded were subjected to recall bias. To minimize the bias, the interviews included questions about events in the period not exceeding three months prior to the study.

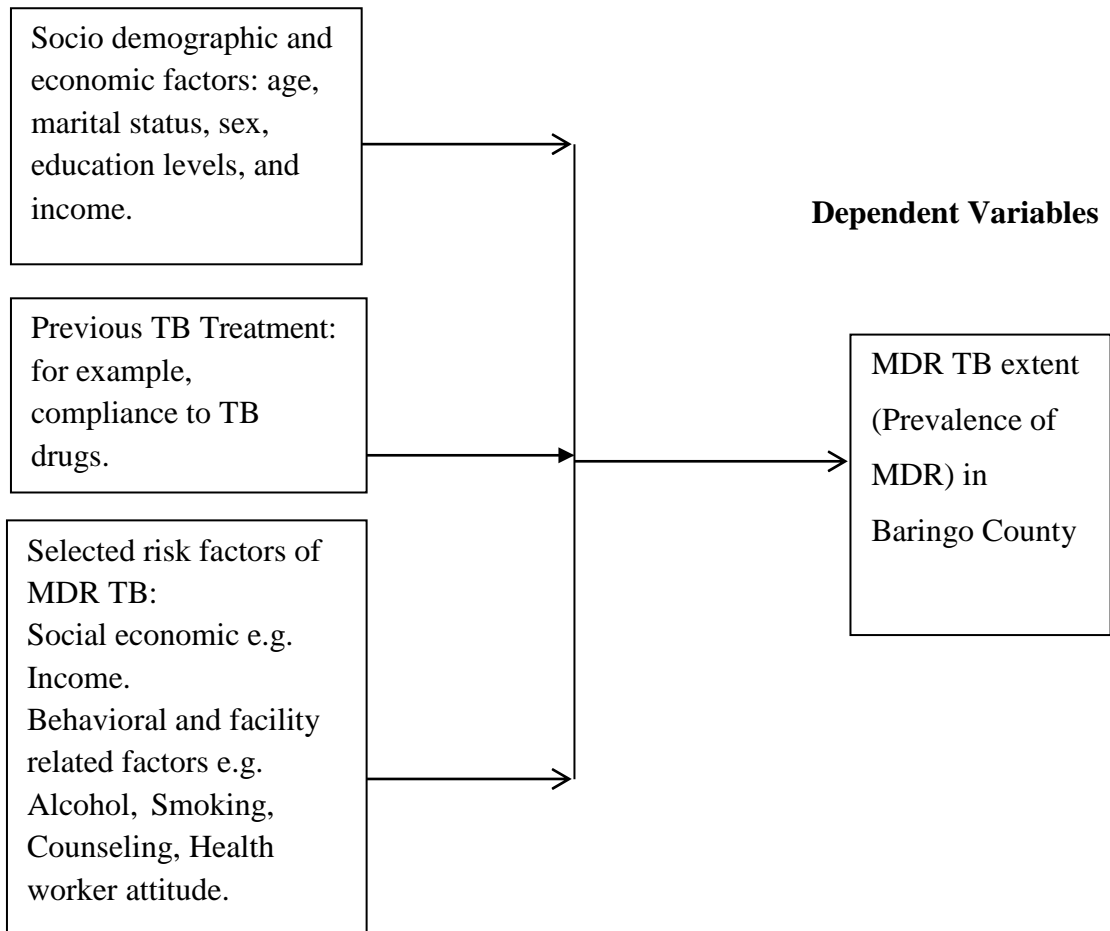
### **1.7.2 Delimitations**

The scope of this study was to find out what factors were linked to poor treatment results in MDR TB patients in Kenya's Baringo County, and provided data with useful implications for the future guidance of these patients in Baringo County, Kenya, given the limited data to date in this crucial area. The six sub-counties of Baringo County acted as clusters in sampling participants for the study. However, the sampling within the group was not done separately in the urban and rural locations, hence, the study did not consider the relative burden of the disease in rural and urban areas of Baringo.

## 1.8 Conceptual Framework

The risk factors perceived to be associated with MDR TB were interlinked to produce a conceptual framework which guided the conduct of this study. As shown in Figure 1.1, MDR TB prevalence among TB patients is a function of TB treatment, socio-demographic factors, TB treatment related factors, history of imprisonment, history of migration, education-related factors, behavioral practices, health system and provider factors and prevalence of MDR TB among TB patients.

### Independent Variables



**Figure 1.1: Conceptual Framework of factors associated with MDR tuberculosis**

The independent variables as indicated in figure 1 are previous TB treatment, sociodemographic factors, previous TB treatment, and selected MDR TB risk factors, while the dependent variable is MRD TB extent in Baringo County.

### **1.9 Study Significance**

This study will enhance policy formulation and suggest public health strategies which will increase adherence and compliance to tuberculosis therapy. Data from the study is crucial in awareness of MDR TB preventative strategies. Documentation of MDR TB in Baringo stimulates both active and passive surveillance to detect MDR TB cases. Ultimately, timely detection of anti-TB treatment defaulters in the County and adjacent rural settings will be realized and the necessary public health actions will be taken to address the menace.

## **CHAPTER TWO: LITERATURE REVIEW**

### **2.1. Introduction**

This chapter looked at the previous studies done by other researchers on the prevalence of MDR-TB and its risk factors among TB patients globally to identify the existing gaps.

### **2.2 Global MDR TB Epidemiology**

MDR TB is a public health scourge afflicting many countries globally. Describing its distribution and establishing the associated risk factors are crucial steps in the management, control and prevention of MDR TB. The Global Tuberculosis Report published by the World Health Organization indicates that approximately 480,000 people had MDR TB as at 2014 (WHO, 2014). This estimate was based on surveillance data on drug resistant TB obtained from 144 countries by the World Health Organization. This parameter may be an underestimation as most of the countries listed in the survey do not have proper TB surveillance systems and, as such, lack current adequate TB prevalence and incidence data. As per the report, 136,000 cases of MDR were diagnosed in 2013 and 97,000 started on treatment. It is deducible therefore that large a proportion of cases are yet to be treated. These untreated people remain a potential source of further spread of MDR TB to susceptible hosts.

Worldwide, only 48% of the cases of MDR TB identified in 2011 were treated fruitfully. Out of these, 16% died and 24% interrupted treatment but did not have the outcome of their treatment documented. Furthermore, 12% were not cured despite receiving treatment (WHO, 2014).

According to Fimbriai (2015), 80% of the MDR-TB notifications in 2013 were derived from the European region whereas India and South Africa contribute the largest relative proportions of new MDR-TB notifications. The biggest increases in new cases, however, were observed in Uzbekistan, Ukraine, and India.

### **2.2.1 Distribution of MDR-TB**

Although data on MDR-TB from some Africa countries may not be entirely adequate, available data from the continent indicate a variation in MDR-TB prevalence per countries. It is estimated to be 17.7% in Central Africa and 10.4% in the Southern African region (Lukoye et al., 2015). The inadequacies of data collection on MDR-TB in Africa may result in low number of notifications in the African region. This should not however be misconstrued to denote a lower MDR-TB prevalence but need to be interpreted accordingly and with utmost care (WHO, 2014).

The rate of MDR tuberculosis among previously treated tuberculosis patients is alarmingly high across the continent; Eastern Africa has the highest prevalence of 29.2% while the Southern African region has the lowest prevalence of 24% (Amor et al., 2008). The primary MDR TB prevalence is only 1.2% in the Central African region. This seemingly impressive figure could be due to under-reporting. Nevertheless, it is equally low in West Africa, where it is estimated to be 2.3% among new cases of TB (Lukoye et al., 2015). If the data from these countries reflect the true position, then it can be argued that whatever efforts concerned agencies are putting in place to control emergence of MDR TB are proving to be effective.

Though preventing and controlling the spread of MDR TB strains is a universal problem, there is paucity of data on the MDR TB prevalence in patients diagnosed with TB in referral hospitals in Kenya including Baringo County.

### **2.2.3 MDR TB Risk Factors**

Persons with active TB develop drug resistance due to mismanagement of their disease. Poor management of treatable TB can be due to patient or programme factors. Although treatment regimens for TB are standardized by guidelines developed by the WHO, not all patients are able to adhere to the required standards. This can be due to a multiplicity of factors including poor socio-economic status, low levels of education, HIV/AIDS and malnutrition. Inappropriate treatment combination given by unqualified health providers is a potential MDR TB risk factor.

Program related factors such as irregular supply of medication are other recognized risk factors. According to Singh *et., al.* (2007), occurrence of MDR tuberculosis portrays a systematic failure of a nation to manage the curable disease. Various host and environmental factors contribute to prevalence of MDR TB. Kliiman (2009), noted that previous medical treatment, TB/HIV co-infection and malnutrition contribute immensely to the disease. Poverty, alcohol and drug and substance abuse, poor living conditions, and overcrowding, and extremes of age as well as age group of between 25 years and 44 years and under 65 years are additional risk factors for MDR TB. According to Fimbirai (2015) and Keter *et., al.* (2015), the rise in the new cases and prevalence of MDR TB is the result of interrelated factors such as inadequate treatment regimens, sub-optimal drug quality, mishandling of TB cases, and spread of resistant strains.

#### **2.2.4 Socio-Demographic and Economic Factors**

One of the demographic parameters that influence MDR TB prevalence is age. D'Souza et al. (2011) found that most MDR TB patients fell in the age range of 15 to 40. Merza et al., (2011) observed that people aged 45 and under have a higher risk of developing MDR TB compared to those above 45. Another important MDR TB risk factor is sex. According to Merza et al., (2011), males are at an increased risk of exposure to MDR TB when compared to the risk of females. The reasons for this disparity are not clear, however, it can be assumed that men engage in activities which make them non-adherent to recommended drug regimens as compared to women.

Low socio-economic status, history of migration, lack of formal education, and poor living conditions as well as changing place of residence when under medication are additional risk factors for developing MDR tuberculosis (Keter et al., 2015). Poor socio-economic status impedes access to health services while lack of agreeable standards of education introduces ignorance, a risk factor for MDR tuberculosis (Metcalf *et. al.* (2010).

#### **2.2.5 Medical History Related Factors**

According to Kliiman (2009), patients who were previously treated for TB have a risk of MDR TB that is four times higher than persons that do have not been previously treated for the disease. Thus, previous TB treatment is a leading factor for MDR TB incidence. Indeed, the WHO emphasizes that prior exposure to anti-tuberculosis medication be regarded as the most likely reason for drug resistance, since it has been incriminated in many surveys and surveillance systems worldwide.

Nevertheless, Jason *et al.* (2010) found a rather interesting and different scenario; about 30% of MDR TB patients had no prior exposure to anti-TB treatment whereas a smaller percentage had received more than one TB treatment regimen. Suboptimal infection control measures, poor adherence to TB treatment regimens, poor patient follow up and poor contact tracing are some of the preventable factors linked with MDR TB in cases previously treated (Kodmon *et al.* 2010). These correctable omissions indict the health delivery systems of concerned nations. Focused approaches are therefore necessary to address these amenable deficiencies.

#### **2.2.6 Nutritional and Metabolic Factors**

Poor nutrition, especially under nutrition and unhealthy lifestyles increases the likelihood of contracting not only susceptible TB but also MDR TB (Biadlegne, Rodloff, & Sack, 2015). In his study, Kliiman (2009) found that malnutrition was the leading risk factor for contracting MDR TB. Diabetes Mellitus (DM), a metabolic disorder has the potential to alter the immune system of persons affected.

According to Kim *et al.* (1995), patients with diabetes become more susceptible to a variety of bacterial infections including *Mycobacterium tuberculosis* (MTB). Furthermore, Bashar *et al.* (2001), indicates that latent TB cases are also prone to activation and relapse due to DM. In their study in the city of New York, Bashar *et al.* (2001) found that diabetics were 8.6 times more likely to contract MDR tuberculosis than non-diabetics. Kim *et al.* (1995) found diabetics to have 5 times more at risk of contracting TB than non-diabetics. The cause of MDR TB is therefore a complex web of interrelated factors. The multiplicity of risk factors linked with MDR TB makes the condition even more difficult to prevent.



Nevertheless, understanding the role of each one risk factor and setting up preventative priorities will ultimately halt the spread of the condition.

### **2.3 Summary of Literature Review Isolating the Gap**

According to a research done by World Health Organization indicates that approximately 480,000 people had MDR TB as at 2014 (WHO, 2014). Basing on surveillance data on drug resistant TB obtained from 144 countries by the World Health Organization there is lack of proper TB surveillance systems and, lack of current adequate TB prevalence and incidence data. In addition, TB treatment defaulter rate in Kenya remains one of the highest at 15%, this has attributed to the rise of new MDR TB cases in the country (Global Tuberculosis Report, 2013). There is limited literature on the MDR TB extent and the MDR TB risk factors in Baringo County, hence the need for this study.

## **CHAPTER THREE: MATERIALS AND METHODS**

### **3.1 Introduction**

The aim of the study was to explore the extent of and MDR TB risk factors among TB patients in Baringo County, Kenya. This chapter addresses the methodology applied to explore the study topic. Specifically, this chapter describes the justification for the research method and design, including a description of the study setting, overview of the sampling frame, and the criteria for inclusion of participants in the study. The chapter also outlines the ethical aspects of informed consent, trustworthiness, and confidentiality. The chapter also includes sections that present a description of data collection materials and methods, instrumentation, and data analysis.

### **3.2 Research Design**

According to Polit and Beck (2007), study design represents the overall plan for the collection and analysis of data, including the specifications adopted to enhance the validity of the study. This study used the cross-sectional survey design of study. The design is appropriate in studying the prevalence of phenomenon, situation problem or attitude of respondents at a particular point in time (Lewin, 2014). Since this study was structured to gain information on MDR TB extent and risk factors TB patients in Baringo County, then, the research design was ideal.

### **3.3 Variables**

Independent variables were; social demographic factors, previous TB treatment, TB treatment related factors, history of imprisonment, history of migration, education-related factors, behavioral practices, health system and provider factors whereas the

extent of MDR TB was the dependent variable.

### **3.4 Study Location**

The research was carried out in Kenya's Baringo County. The county has six sub-counties, namely Baring Central, Eldama Ravine, Baringo North, Baringo South, Tiaty, and Mogotio. The study included all sub-county hospitals, that is Mogotio, Eldama Ravine, Chemolingot, Kabarnet, Marigat, and Kabartonjo sub-county hospitals. The current prevalence of tuberculosis in Baringo County was 102 per 100,000 people (Kenya Demographic Health Survey, 2014). The County of Baringo bordered five counties that is: Laikipia, Kericho, Elgeiyo-Marakwet, West-Pokot, and Nakuru Counties. Nomadic pastoralism was the major way of life in the County.

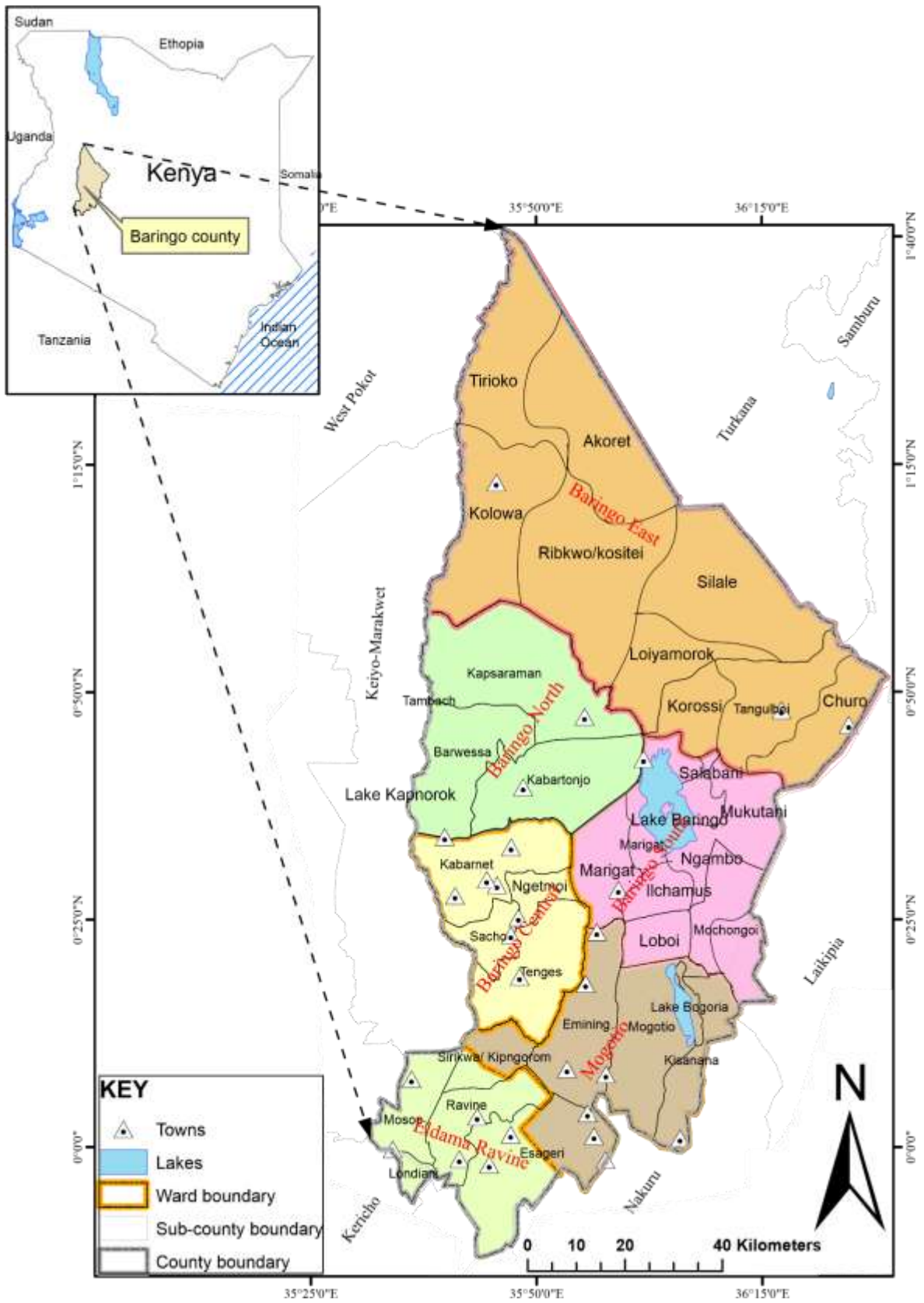


Figure 2.1: Map of Baringo County, Kenya.

Source: Baringo development plan 2017-2022

### **3.5 Study Population**

According to Bowling (2002), the study population is a collection of objects or people with similar features of interest to the researcher. The study population comprised all TB patients registered in Baringo County. The total population of Baringo County was 754,014 (Baringo County Population Density and Distribution, 2018). Using the calculation from the county prevalence of TB, the number of TB patients was estimated as  $(754,014 \div 100,000) \times 102$ , which gave a target population of approximately 769 TB patients.

#### **3.5.1. Inclusion and Exclusion Criteria**

##### **3.5.1.1. Inclusion Criteria**

The study included all TB patients' residing in Baringo County who consented to be participants in the study.

##### **3.5.1.2 Exclusion Criteria**

Patients with tuberculosis who were severely unwell and did not provide the essential information or who did not consent were excluded from the study.

### **3.6 Sampling Techniques**

The researcher adopted purposive sampling technique to select Baringo County as the area of study. The study used purposive sampling to select all sub-county hospitals in Baringo County, including Mogotio Sub-County Hospital (SCH), Koibatek SCH, Tiaty SCH, Baringo Central Sub County Referral Hospital, Baringo South SCH, and Baringo North SCH.

Purposive census was used to pick the clinicians in-charge of TB-clinics in the selected SCH to participate in the study. MDR TB patients are specifically treated in the Sub-County hospitals. The proportional to size sampling was used to allocate TB patient population of each hospital selected, according to Yamane (1967), to assign appropriate sample size (Table 3.1). Additionally, the respondents in each sub-county hospital were sampled using purposive census until the required number is achieved.

### 3.6.1. Sample Size Determination

The appropriate size of the sample for the study was calculated utilizing Yamane, 1967 formula.

According to Yamane, (1967),  $n = \frac{N}{1 + N(e^2)}$

Where:

n - Sample size

N - Target Population

e - Margin of error which is 5%

The total population of Baringo County was 754,014 (Baringo County Population Density and Distribution, 2018). Using the calculation from the county prevalence of TB, the number of TB patients was estimated as  $(754,014 \div 100,000) \times 102$ , which gave a sample of 769 TB patients.

$$n = \frac{769}{1 + 769(0.05^2)}$$

n 263

**Table 3. 1.: Sample Size Distribution**

<b>Sub-County</b>	<b>TB Population Size</b>	<b>Sample size</b>
Koibatek	98	34
Mogotio	89	30
Baringo South	185	63
Baringo Central	184	63
Baringo North	92	32
Tiaty	121	41
<b>TOTAL</b>	<b>769</b>	<b>263</b>

### **3.7. Research Instrument**

To collect data, the researcher administered open- and closed-ended questionnaire to elicit the data from the TB patients on treatment. The tool was selected because it allows a high level of data standardization and generalization of information (Fisher, et al., 2016). Interview guide was used to collect data from the clinicians working in the selected Sub-County TB clinics. A checklist was used to confirm the date of notification, history of the patient, type of TB, drugs used, DOTs method, laboratory tests sputum for gene expert, culture and sensitivity, and latest test done Appendix 4. The instruments captured socio-demographic factors, previous TB treatment, TB Treatment related factors, history of imprisonment, history of migration, education-related factors, behavioral practices, health system and provider factors to address the objectives of the study.

### **3.8 Pre-Testing**

The instruments of data collection were pilot-tested at Elgeyo Marakwet Sub-County Hospital to check for consistency and the time taken to administer the questionnaire.

A random sample of MDR TB patients was drawn from all TB patients and interviewed in the respective clinics and wards of the hospital. The instrument was refined to eliminate the shortcomings observed.

#### **3.8.1 Validity**

Validity, in research, is the appropriateness or soundness of an instrument or test in measuring what it is purposed to measure (Polit & Beck, 2007). Face and content validity are the basics in validity testing. Face validity was tested by submitting the data collection tools to selected individuals to deliberate on their appropriateness to measure the variables concerned. Content validity was tested by subjecting the instruments to scrutiny by experts in the field of TB.

#### **3.8.2. Reliability**

Reliability denotes the degree to which an instrument gives the same result when it is applied to different circumstances (Kimberlin, 2008). To achieve the reliability of the data collection tool, a test re-test reliability test was employed: Mugenda & Mugenda (2003), recommends that Depending on the sample size, the pilot test sample should be between 1% and 10% of the projected sample. The calculated sample of this study was 263; therefore, pilot-testing using 26 TB patients was acceptable. The same tool was given to the same people on two different occasions (after two weeks) and compares the scores. The Cronbach's Alpha value of 0.70 and above is regarded as



reliable.

For the data gathering instrument, the Cronbach Alpha reliability coefficient was found to be 0.796, which according to Gamble (2018), was above the threshold of 0.7 and hence was considered excellent for study.

### **3.9 Data Collection Techniques**

To collect data from the selected study sample, the researcher in-person administered the structured questionnaire in each Sub-County TB clinic. The TB clinic clinicians were interviewed to collect qualitative data basing on the study objectives. Additionally, the patient's medical records were reviewed to ascertain the date of notification, type of TB, patients' history, drug use history, DOTS method, Gene Xpert and Drug sensitivity test results.

### **3.10 Data Analysis**

When the raw data had been collected, the preliminary analysis was done to clean the data of any inconsistencies and then coded in SPSS. Descriptive and qualitative analysis; frequencies, and percentages were generated to describe the prevalence and attributes of associated factors of MDR TB among TB patients. In addition, descriptive statistics specifically frequencies, were used to generate the MDR TB prevalence rate among patients with TB in Baringo County. Relationship between socio-demographic factors (highest level of education and income) among TB patients and prevalence of MDR TB in Baringo County was established using Chi-square and Fisher's Exact Test. Data analysis was done using SPSS version 26, a computer aided programme.

### **3.11 Logistical and Ethical Considerations**

Kenyatta University's graduate school granted authorization to perform the study. The study also obtained the Kenyatta University Ethical Review Committee (KUERC) research clearance. The National Council for Science, Technology, and Innovation also granted permission to undertake the research (NACOSTI).

The County Directors of Public Health and Clinical Services in Baringo County were requested to give permission to conduct the study in their facilities. Informed permission was sought from all eligible study subjects. The study's aims and the potential risks and benefits, as well as the intended use of the data collected, were all fully described to participants. To safeguard privacy, names and any other identifiable characteristics were omitted from study instruments to ensure anonymity and confidentiality. In addition, the researcher did not coerce or induced patients to agree to participate. Lastly, the researcher secured informed, written consent in all cases.

## **CHAPTER FOUR: RESULTS**

### **4.1. Introduction**

This chapter presents the study's results and discussions. The chapter presents demographic information of the respondents, results analysis was grounded on the objectives of the study. The analysis of the association between variables employed descriptive and inferential statistics. Descriptive statistics include frequencies, and percentages, while inferential statistics include chi-square and Fisher's tests.

#### **4.1.1 Questionnaire Return Rate**

The research study targeted two hundred and sixty-three (263) respondents. However, out of the distributed 263, two hundred and twenty-eight (228) were filled and returned, representing 86.69% rate of response. The response rate was an exceptional representation and conforms to Mugenda and Mugenda (2003), who proposes that a response rate of 50% and above, 60% and above, and 70% and over is adequate, reasonable, excellent for analysis and reporting, respectively. The response rate was considered exceptionally sufficient to allow for the determination of the MDR TB extent and risk factors among patients with TB patients in Baringo County.

#### **4.2 Respondent's Economic and Socio-Demographic Characteristics**

Descriptive analysis conducted in the study included a consideration of age, marital status, sex, highest education attained, religion, status of employment, average monthly income, daily income, number of residential rooms, and number of persons living in the residential rooms. Table 4.1 displays the participants' economic and socio-demographic characteristics.

**Table 4. 1.: Distribution of Participants' Socio-demographics and Economic Characteristics (N=228)**

		Frequency	Percent (%)
Sex	Male	152	66.7
	Female	76	33.3
Age (years)	1-18	45	19.7
	19-30	67	29.4
	31 - 45	56	24.6
	46 - 60	42	18.4
	61 - 75	18	7.9
Highest education	Primary Education	42	18.4
	Secondary Education	99	43.4
	College Education	46	20.2
	Never went to school	41	18.0
Marital Status	Single	67	29.4
	Married	114	50.0
	Divorced	7	3.1
	Widowed	13	5.7
	Single Parent	2	0.9
	Minor	25	11.0
Religion	ATR	35	15.4
	Christian	109	47.8
	Muslim	23	10.1
	None	61	26.8
Employment Status Employed	Yes	52	22.8
	No	176	77.2
Self employed	Yes	48	21.1
	No	180	78.9
Number People Sharing the Same Room	One	63	27.6
	2 to 4 people	115	50.4
	5 to 7 people	40	17.5
	8 and above	10	4.4
History of imprisonment among TB Patients	Yes	15	6.6
	No	213	93.4
Daily income	Less than Kshs.100	137	60.1
	Kshs. 100 – 500	91	39.9

The results in Table 4.1 demonstrate that the greater part of the participants were male (66.7%) and 33.3% female.

This indicates that males were the majority of the TB patients which indicate that male have contracted TB more than the females in Baringo County. This could be attributed to male risk behaviors like smoking and taking of alcohol which heightens the contraction of TB. The results shown in Table 4.1 showed that 18.4% indicated their highest level of education attained as primary education, 43.4% Secondary education, 20.4% of the respondents had attained College education level and those who never went to school were 18% of the participants of the study. This implies that the majority of the participants who have contracted TB are those who indicated their highest level of education as secondary school education.

In terms of age (in completed years), 29.4% of the people included in the study were aged 19-30, 24.6% aged 31-45, 19.7% aged 1-18, 18.4% aged 46-60 and 0.4% aged over 76 (Table 4.1). This implies that most of the participants affected by TB were the youth (aged between 19-30 years), this could be probably due to the behavioral factors like peer pressure among youth, for example engaging in smoking, alcoholism and other substance use.

In terms of marital status, 50% percent of the participants were married, 29.4% percent were single, 3.1% percent were divorcees, 11% were children under 18 years and 5.7% percent were widowed and the least being the single parent (0.9%) (Table 4.1). This implies that majority of TB contracted patients were married, followed by single parents and children. The single parents represent the least percentage of the respondents. This could be due to immunological factors in relation to age and activities.

In terms of the type of religion, 15.4% of the respondents were of ATR Religion, 47.8%, Christians, 10.1% Muslim while those with no religion were 26.80%, which indicates that the majority of the participants profess the Christian faith (Table 4.1). In terms of employment, the results of the study reveal that 22.8% of the participants were employed while 77.2% were unemployed. This implies that the most of TB patients were unemployed signifying unreliable income which may translate to poor living standards. Additionally, the results displayed in Table 4.1 revealed 21.1% of the study participants were self-employed compared to 78.9% who were not self-employed.

In terms of the number people sharing the same room, 27.6% of the participants indicated that they share a room with one person, 50.4% indicate 2-4 people share one room while 17.5% and 4.4% indicated 5 to 7 people and 8 people and above share one room respectively. This implies that, majority of the TB patients share one room with more than two people which escalate the contraction of TB among patients in Baringo County.

In terms of history of imprisonment among TB, 93.4% of TB patients in Baringo County had no history of imprisonment while 6.6% acknowledged that they had history of imprisonment. In terms awareness of MDR TB, majority 72.4% of TB patients in who participated in study were not aware of MDR TB. Comparatively 27.6% of TB patients in Baringo County acknowledged that they are aware of MDR TB. This could be attributed to lack of education.

In terms of income, 60.1% of the TB patients said that they earn a daily income of less than Ksh 100 while 39.9% earn Ksh 100 to 500 on a daily basis. This designate that, those respondents earning less than Ksh 100 per day were the majority of TB patients in Baringo County (Table 4.1).

#### 4.3. MDR-TB Prevalence among TB Patients in Baringo County

The first study objective was to establish the MDR-TB prevalence among patients with TB in Baringo County. As displayed in table 4.2, the study established that MDR-TB patients were 14.9% among all patients sampled in this study. It was found out that 66.2% had PTB and 18.9% of the respondents had EPTB.

**Table 4. 2: MDR-TB Prevalence among Patients with TB**

		Frequency	Percent
<b>Type of TB diagnosed</b>	PTB	151	66.2%
	EPTB	43	18.9%
	MDR-TB	34	14.9%
	Total	228	100.0%

The results revealed that among all the TB patients, MDR-TB patients were 14.9%. Those who had PTB were 66.2% while EPTB patients were 18.9% (Table 4.2). Further, the study looked at the MDR-TB related factor as shown in Table 4.3. The study established that all patients (100%) with MDR-TB had lived with a person who was suffering from MDR-TB and had been treated for TB previously. However, MDR-TB patients had ever stopped TB treatment (76%) and the patient had left treatment due side effects (76%). A clinician said in an interview, *“most patients on TB treatment default due to prolonged treatment and treatment side effects which contribute latter to anti-TB drug resistance”*.

**Table 4. 3: Prevalence of MDR-TB Related Factors (N=34 for each factor)**

<b>MDR TB Prevalence Related Factors</b>	<b>Frequenc y</b>	<b>Percent</b>
Lived with a person who was suffering from MDR TB	34	100%
Ever Stopped TB treatment	26	76%
Leave treatment due to side effects	26	76%
Treated for TB previously	34	100%

#### **4.4. Economic and Socio-demographic Factors affecting MDR-TB Prevalence**

The second objective was to establish the socio-demographic and economic characteristics which affected prevalence of MDR-TB as presented in table 4.4. The study realized that 22(9.6%) male and 12(5.3%) female had MDR-TB. This shows that among sex; male was slightly more affected than female. As regards to age, more of those who contracted MDR-TB were between 31-60 years of age (10.6%). About 2.2% of the respondents who had MDR-TB were between 19-30 years old, 1.3% were of age between 61 to 75 years and 0.9% between 1-18 years of age. It was clear that the most active and productive population was the one contracting MDR-TB in Baringo County. On the highest level of education among MDR-TB patients, those with primary education were 2.6%, secondary level (6.1%), college level of education (4.4%) and those who never went to school and contracted MDR-TB were 1.8%. The study noted that more of those who were non-religious (6.1%) had MDR-TB. Results showed that those who had MDR-TB earned up to KSh.500 (Table 4.4). Further analysis of the results to establish the relationship between economic factors, socio- demographic, and MDR-TB prevalence is displayed in table 4.4. The study showed statistically significant correlation between having MDR TB and one's age (Fisher's Exact Test = 15.451;  $p = 0.006$ ), marital status (Fisher's Exact Test = 11.904;  $p = 0.023$ ) and religion ( $\chi^2 = 16.467$ ;  $df = 3$ ;  $p = 0.001$ ).



One of the clinicians in an interview said that, “social problems like lack of enough food contribute to poor drug adherence since anti-TB drug requires proper nutrition with less extraneous activities”.

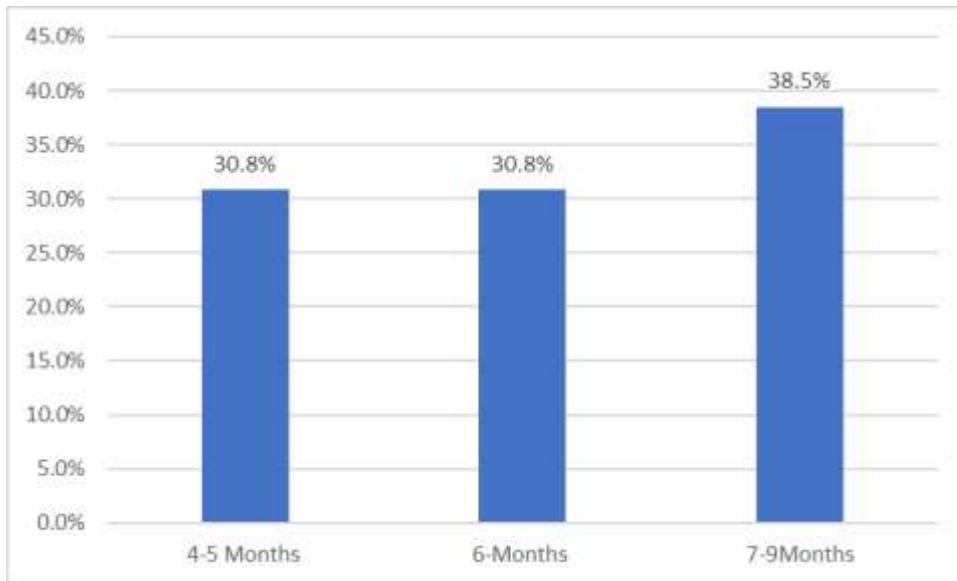
**Table 4.4.: Socio-demographic and Economic Factors affecting MDR TB prevalence**

Variable		With MDR - TB	Without MDR - TB	Relationship
Sex	Male	22(9.6%)	130(57%)	$\chi^2=0.69$ ; $df=1$ ; $p=0.844$
	Female	12(5.3%)	64(28.1%)	
Age (years)	1-18	2(0.9%)	43(18.9%)	Fisher's Exact Test =15.451; $p=0.006$
	19-30	5(2.2%)	62(27.2%)	
	31 - 45	12(5.3%)	44(19.3%)	
	46 - 60	12(5.3%)	30(13.2%)	
	61 - 75	3(1.3%)	15(6.5%)	
Marital Status	Single	7(3.1%)	60(26.3%)	Fisher's Exact Test =11.904; $p=0.023$
	Married	19(8.3%)	95(41.7%)	
	Divorced	4(1.8%)	3(1.3%)	
	Widowed	3(1.3%)	10(4.4%)	
	Single Parent	0(0.0%)	2(0.9%)	
	Minor	1(0.4%)	24(10.5%)	
Highest education attained	Primary Education	6(2.6%)	36(15.8%)	Fisher's Exact Test =8.230; $p=0.075$
	Secondary Education	14(6.1%)	84(36.8%)	
	College Education	10(4.4%)	37(16.2%)	
	Never went to school	4(1.8%)	37(16.2%)	
Religion	ATR	5(2.2%)	30(13.2%)	$\chi^2=16.467$ ; $df=3$ ; $p=0.001$
	Christian	7(3.1%)	102(44.7%)	
	Muslim	8(3.5%)	15(6.6%)	
	None	14(6.1%)	47(20.6%)	
Number of people Sharing the Same Room	One	12(5.3%)	51(22.4%)	Fisher's Exact Test =6.490; $p=0.075$
	2 to 4 people	14(6.1%)	101(44.3%)	
	5 to 7 people	4(1.8%)	36(15.8%)	
	8 and above	4(1.8%)	6(2.6%)	
History of imprisonment	Yes	9(3.9%)	39(17.1%)	$\chi^2=7.06$ ; $df=1$ ; $p=0.493$
	No	25(11%)	155(68%)	
Employment Status	Yes	7(3.1%)	45(19.7%)	$\chi^2 = 0.112$ ; $df = 1$ ; $p = 0.738$
	No	27(11.8%)	149(65.4%)	
Daily income	Less than Kshs.100	19(8.3%)	118(51.8%)	$\chi^2 = 0.295$ ; $df = 1$ ; $p = 0.705$
	Kshs. 100 – 500	15(6.6%)	76(33.3%)	

The study revealed no significant statistical relationship between sex and MDR TB ( $\chi^2 = 0.69$ ;  $df = 1$ ;  $p = 0.844$ ). That means that being male or female didn't matter as much as developing MDR -TB was concerned and that both sexes had the disease. According to the study findings, there was no statistically significant link between MDR TB and educational attainment (Fisher's Exact Test = 8.230;  $p = 0.075$ ), number of people sharing the same room (Fisher's Exact Test = 6.490;  $p = 0.075$ ), history of imprisonment ( $\chi^2 = 7.06$ ;  $df = 1$ ;  $p = 0.493$ ), employment status ( $\chi^2 = 0.112$ ;  $df = 1$ ;  $p = 0.738$ ), and daily income ( $\chi^2 = 0.295$ ;  $df = 1$ ;  $p = 0.705$ ). What this meant was that to develop MDR TB it did not matter the level of education one is in, the number of people one is sharing with a room, history of one's imprisonment, one's employment status and how much someone earned daily.

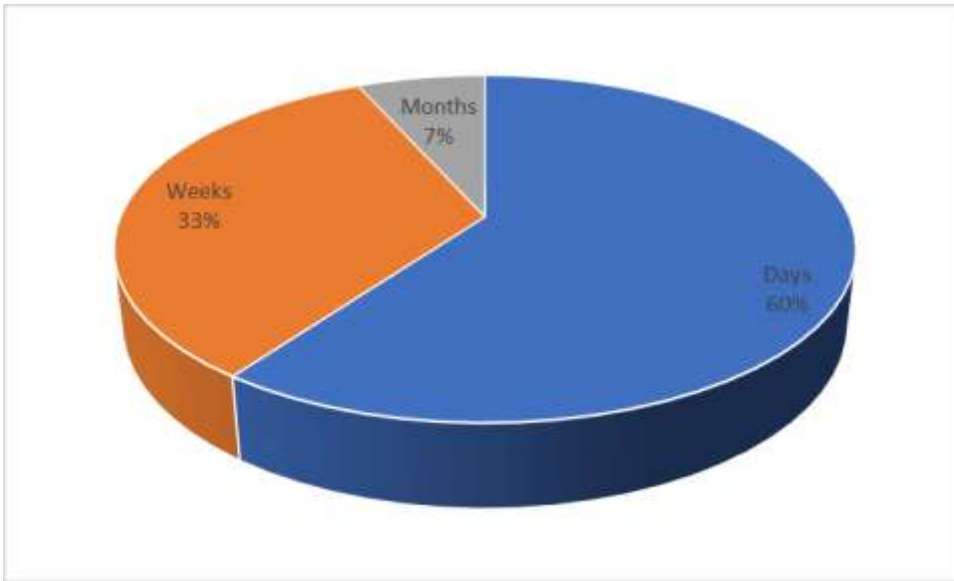
#### **4.5. Previous TB Treatment factors affecting MDR TB Prevalence**

The third objective established previous TB treatment factors affecting the MDR TB prevalence in Baringo County. Results for previous TB treatment; factors are shown in table 4.5 below. The study exposed that 11% of the respondents with MDR TB had previous treatment for TB while 3.9% reported no previous treatment for TB. As seen in the results, MDR TB was linked to having previously been treated for tuberculosis. ( $\chi^2 = 68.371$ ;  $df = 1$ ;  $p < 0.001$ ). When asked of how long the MDR TB patients had been previously treated, many of them (38.5%) said 7-9 months, 30.8% indicated 6 months and another 30.8% of them said 4-5 months (Figure 4.1.).



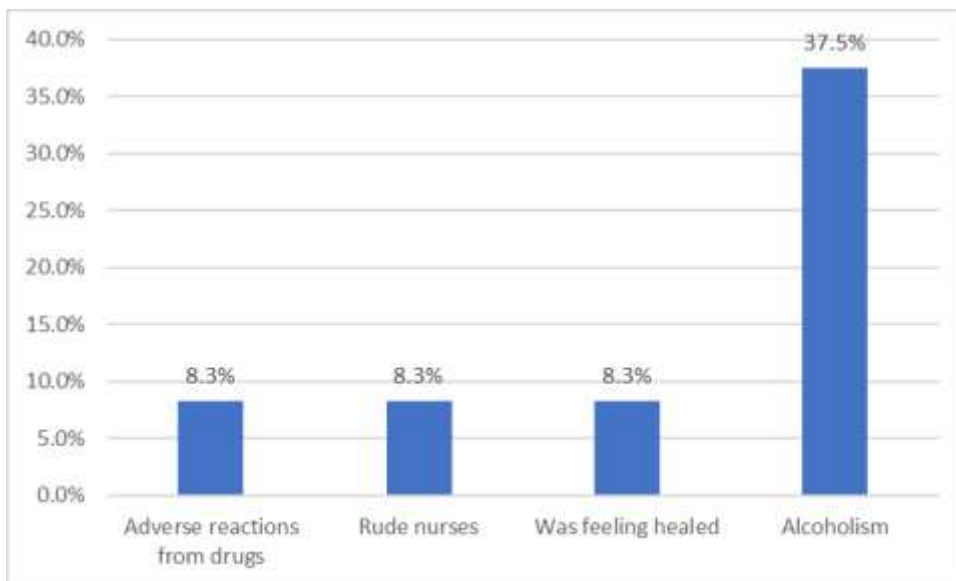
**Figure 4. 1.: Time taken by MDR TB patients in previous TB treatment (n=26)**

The study wanted to know whether MDR TB patients had ever stopped treatment and how it affected MDR TB prevalence. It was found out that 31.3% of the 48 TB patients who indicated that they had ever stopped treatment were MDR TB cases, while 22.9% of them had ever stopped treatment but did not have MDR TB. On further analysis, the study did not establish any statistical association; ever stopped treatment and having MDR TB ( $\chi^2=1.343$ ;  $df=1$ ;  $p=0.385$ ). The study found out that some of those patients with MDR TB and had ever stopped; took days (60%) while others took weeks (33%) and months (7%) (Figure 4.2). The length of time MDR TB patient stopped treatment was not significantly related to MDR TB prevalence (Fisher's Exact Test =0.859;  $p=1$ ).



**Figure 4.2: Length of time taken by MDR TB patients who had ever stopped treatment (n= 48)**

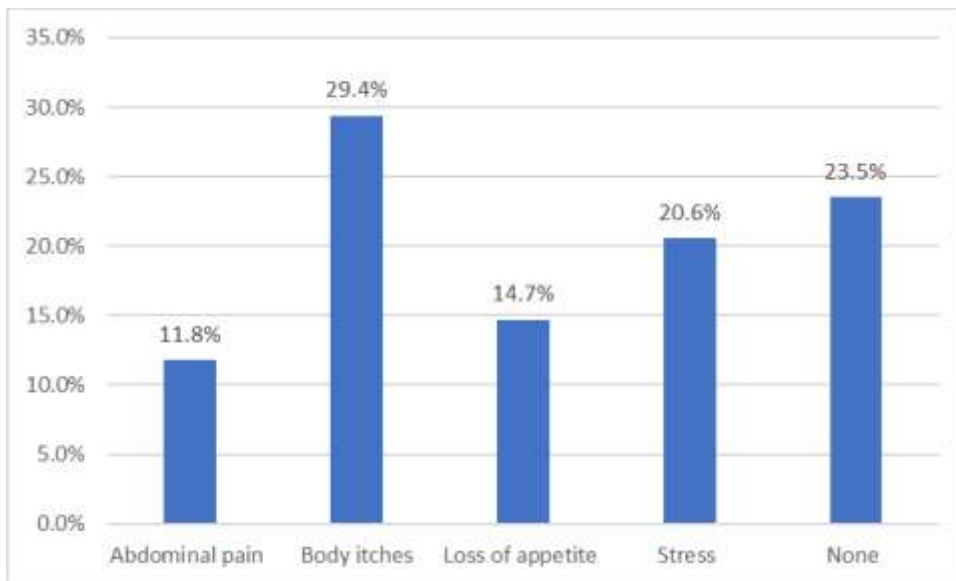
Among the 24 MDR TB patients who gave reasons for stopping treatment, 37.5% of them blamed alcoholism as the cause while 8.3% of the patients in each case indicated adverse reactions from drugs, rude nurse and a feeling being healed (figure 4.3). This showed that there was no link between reasons for quitting treatment and MDR TB prevalence (Fisher's Exact Test = 3.278;  $p = 0.387$ ) (Table 4.5.).



**Figure 4. 3: Reasons given by MDR TB patients for ever stopping treatment**

The study showed that, most of the respondents (77.2%) reported having experienced side effects on treatment of TB. MDR TB patients who experienced side effects were 11.4%, while those without MDR TB were 65.8%. Those with MDR TB and didn't experience side effects were 3.5% and those without MDR TB and didn't report side effects were 19.3% (Table 4.5). The study didn't establish any statistically significant association between reporting of side effects and prevalence of MDR TB ( $\chi^2=0.305$ ;  $df=1$ ;  $p=0.658$ ).

The study noted various side effects reported by MDR TB patients, which made them stop treatment including body itches (29.4%), stress (20.6%), loss of appetite (14.7%), and abdominal pain (11.8%) (Figure 4.4).



**Figure 4.4: Actual side effects experienced**

The study went further to find out whether MDR TB patients stopped TB treatment due to the side effects experienced. The analysis showed that 30.6% of persons who defaulted TB treatment as a result of side effects had MDR TB patients.

About 22.4% of MDR TB patients didn't leave treatment because of side effects (Table 4.5). Having left treatment because of treatment side effects had no significant association with MDR TB infection ( $\chi^2=1.683$ ;  $df=1$ ;  $p=0.256$ ). The study revealed that various people monitored treatment for MDR TB patients including community health worker (9.3%), spouses (2.6%), relatives (2.6%) and friends (0.4%).

Further analysis showed a significant relationship between MDR TB prevalence and monitoring TB treatment (Fisher's Exact Test =11.991;  $p = 0.011$ ) (Table 4.5.). According to another clinician response in an interview," *most of the TB patients who have been initiated on treatment, leave treatment because they come from far. Another one said, patients leave treatment due to stigma from the community and family members*".

**Table 4.5: Previous TB treatment factors affecting the MDR TB prevalence in Baringo County**

Variable		With MDR - TB	Without MDR - TB	Relationship
Previously treated for TB	Yes	25(11%)	22(9.6%)	$\chi^2=68.371$ ; df=1; p<0.001
	No	9(3.9%)	172(75.4%)	
Ever stopped treatment	Yes	15(31.3%)	9(18.8%)	$\chi^2=1.343$ ; df=1; p=0.385
	No	11(22.9%)	13(27.1%)	
Experienced side effects	Yes	26(11.4%)	150(65.8%)	$\chi^2=0.305$ ; df=1; p=0.658
	No	8(3.5%)	44(19.3%)	
Reported side effects	Abdominal pain	4(1.8%)	36(15.8%),	Fisher's Exact Test =3.357; p = 0.498
	Body itches	10(4.4%)	32(14%)	
	Loss of appetite	5(2.2%)	34(14.9%)	
	Stress	7(3.1%)	47(20.6%)	
	None	8(3.5%)	45(19.7%)	
Left treatment due to side effects	Yes	15(30.6%)	9(18.4%)	$\chi^2=1.683$ ; df=1; p=0.256
	No	11(22.4%)	14(28.6%)	
Person monitored treatment previously	Spouse	6(2.6%)	81(35.5%),	Fisher's Exact Test =11.991; p = 0.011
	Friend	1(0.4%)	2(0.9%)	
	Relative	6(2.6%)	16(7%)	
	Community health Worker	21(9.25)	85(37.3%)	
	None	0(0%)	10(4.4%)	
Member of any support group	Yes	15(6.6%)	90(39.5%)	$\chi^2=0.60$ ; df=1; p=0.806
	No	19(8.3%)	104(45.6%)	
Whether HIV Positive	Yes	21(9.2%)	32(14%)	$\chi^2 = 33.229$ ; df = 1; p < 0.001
	No	13(5.7%)	162(71.1%)	
Suffering from Diabetes	Yes	3 (1.3%)	8 (3.5%),	Fisher's Exact Test p = 0.215
	No	31(13.6%)	186(81.6%)	
Experienced Kidney Failure	Yes	2(0.9%)	2 (0.9%)	Fisher's Exact Test p = 0.107
	No	32(14%)	192(84.2%)	

The study looked at whether TB patients were members of any support group. About 46.1% of the respondents were in support groups while 53.9% were not in any support groups. It was established that 6.6% with MDR TB were in support groups while 8.3% with MDR TB were not in support groups. The results analysis showed no significant association with TB patient being a member of any support group and the prevalence of MDR TB ( $\chi^2=0.60$ ;  $df=1$ ;  $p=0.806$ ) (Table 4.5). The results showed that, some TB patients (23.2%) were also HIV Positive while 76.8% of the respondents did not suffer from HIV. The findings showed that 9.2 percent of MDR TB patients were also HIV positive. The results demonstrated a strong co-occurrence of MDR TB and HIV ( $\chi^2 = 33.229$ ;  $df = 1$ ;  $p<0.001$ ). The study also went ahead to find out whether MDR TB patients had diabetes and whether it was associated with it. It was established that only 1.3% of MDR TB patients were diabetic while MDR TB patients who didn't have diabetes were 13.6% (Table 4.5).

There was no link between patients having diabetes mellitus and MDR TB prevalence (Fisher's Exact Test  $p = 0.215$ ). In trying to establish the proportion of MDR TB patients and kidney failure, only 0.9% patients had kidney failure while 14% MDR TB patients didn't have kidney failure. The study didn't establish any significant association between having kidney failure and MDR TB (Fisher's Exact Test  $p = 0.107$ ) (see Table 4.5).

#### **4.6. Selected Risk Factors and MDR TB Prevalence**

The fourth objective of the study considered the link between other selected risk factors and the MDR TB prevalence among TB patients in Baringo County. The factors which were examined included history of imprisonment, history of migration,



behavioral practices, health system and provider factors.

In examining the history of imprisonment, the study found out that 21% of the TB patients had the history of imprisonment while 79% of the TB patients didn't have any history of imprisonment. The study showed that 3.9% MDR TB patients had been in to prison before while 11% MDR TB patients had not been imprisoned before. Study didn't find any relationship that was statistically significant between imprisonment and the prevalence of MDR TB ( $\chi^2=0.706$ ;  $df=1$ ;  $p = 0.49$ ) (Table 4.6). The study interrogated the length of time the TB cases were imprisoned. It was revealed that 14% were imprisoned for 1 month, 1-3 months (39.6%), 4-12 months (16.7%) and 29.2% over 1 year. The study didn't find any statistical association between the length of time one was imprisoned and having MDR TB (Fisher's Exact Test =1.079;  $p=0.870$ ) (Table 4.6).

The study interrogated on the history of migration and its association with MDR TB. The study indicated that 42.9% respondents visited another country. This comprised 36.8% TB patients and 6.1% MDR TB patients. About 48.2% of the TB patients and 8.8% with MDR TB didn't visit another country. There was no relationship that was statistically significant between visiting another country and MDR TB prevalence ( $\chi^2=0.053$ ;  $df=1$ ;  $p=0.853$ ). The study established that, only 1 TB patient had fallen sick from TB while outside the Country and none of the respondent was ill from MDR TB while outside the Country. Further analysis of results indicated that 45.2% of the TB patients among them 6.6% MDR TB cases, were visited by people from another Country. The study didn't show any statistically significant between being visited by someone from another country and the prevalence of MDR TB ( $\chi^2=0.018$ ;

df=1; p=1) (Table 4.6). About 3.9% of the respondents reported that their visitors had TB (3.5%) and 0.4% with MDR TB.

The study didn't reveal any statistically significant association between visitors suffering from TB and the prevalence of MDR TB (Fisher's Exact Test p = 1).

Another clinician said that, *"TB patients face challenges during their medication especially the drug abusers, prisoners, migrators, and those with mal-absorption syndrome due to HIV co-infection"*.

**Table 4.6.: Selected risk factors and their association with MDR TB in Baringo**

Variable		With MDR - TB	Without MDR - TB	Relationship
<b>History imprisonment</b>				
Imprisoned before	Yes	9(3.9%)	39(17.1%)	$\chi^2=0.706$ ; df=1; p=0.493
	No	25(11%)	155(68%)	
Length of time imprisoned (months)	1	1(2.1%)	6(12.5%)	Fisher's Exact Test =1.079; p=0.870
	1-3	5(10.4%)	14(29.2%)	
	4-12	1(2.1%)	7(14.6%)	
	Over 12	2(4.2%)	12(25%)	
Diagnosed with TB while in Prison	Yes	1(2.1%)	13(27.1%)	Fisher's Exact Test p=0.250
	No	8(16.7%)	26(54.2%)	
<b>History of Migration</b>				
Visited another Country	Yes	14(6.1%)	84(36.8%)	$\chi^2=0.053$ ; df=1; p=0.853
	No	20(8.8%)	110(48.2%)	
Fall sick of TB while outside country	Yes	0(0%)	1(0.4%)	Fisher's Exact Test p=1
	No	34(14.9%)	193(84.6%)	
	No	34(14.9%)	193(84.6%)	
Visited from another country	Yes	15(6.6%)	88(38.6%)	$\chi^2=0.018$ ; df=1; p=1
	No	19(8.3%)	106(46.5%)	
Visitor suffered from TB	Yes	1(0.4%)	8(3.5%)	Fisher's Exact Test p=1
	No	33(14.5%)	186(81.6%)	
<b>Behavioral Practices</b>				
Whether smoke	Yes	25(11%)	151(66.2%)	$\chi^2=0.305$ ; df=1; p=0.658
	No	9(3.9%)	43(18.9%)	
Use alcohol	Yes	0(0%)	3(1.3%)	Fisher's Exact Test p=1
	No	34(14.9%)	191(83.8%)	
<b>Facility related factors</b>				
Health workers' attitudes	Good	26(11.4%)	143(62.7%)	Fisher's Exact Test =3.311; p=0.200
	Bad	0(0%)	16(7%)	
	Rude	8(3.5%)	35(15.4%)	
Whether counselled about TB	Yes	30(13.2%)	175(76.8%)	Fisher's Exact Test p=0.757
	No	4(1.8%)	19(8.3%)	

The study examined behavioural factors related with MDR TB and their link to MDR TB. It was found out majority (77.2%) of the TB patients were smokers while 21.8% were not smokers. The study noted that of the respondents 11% were MDR TB who were smokers whereas 3.9% didn't smoke. The analysis showed no significant link between smoking and MDR TB prevalence ( $\chi^2=0.305$ ;  $df=1$ ;  $p=0.658$ ). Another behavioral factor considered use of alcohol. Only 1.3% of the respondents were using alcohol. The study didn't establish any significant association between alcohol use and MDR TB (Fisher's Exact Test  $p = 1$ ) (Table 4.6.).

On the health facility factors the study concentrated on health workers attitudes and whether TB cases were counseled or not. About 74.1% of the respondents reported that health workers had good attitudes, 7% had bad attitudes and 18.9% were rude. About 11.4% of the respondents who had MDR TB said that health workers had good attitudes towards them and 3.5% with MDR TB mentioned that the health workers were rude.

The study didn't show any significant association between health workers' attitudes and the prevalence of MDR TB (Fisher's Exact Test = 3.311;  $p = 0.200$ ) (Table 4.6.). On whether TB patients were counseled, it was confirmed 90% of the respondents confirmed that they were counseled. About 13.2% of the respondents who had MDR TB confirmed that they were counseled and 1.8% with MDR TB said that they were not counseled. The study didn't indicate any statistically significant association between being counseled on TB and the prevalence of MDR TB (Fisher's Exact Test  $p = 0.757$ ) (Table 4.6.)

## **CHAPTER FIVE: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS**

### **5.0. Introduction**

This chapter summarizes and discusses the study results, and presents conclusions and recommendations based on the results.

### **5.1. Discussion of the Study Findings**

Study broad objective was to establish the extent and MDR TB risk factors among patients with TB in Baringo County, Kenya. The analysis of the research study data provided insight into key findings on extent and MDR TB risk factors among patients with TB in Baringo County, Kenya. The study findings were discussed as per the objectives that guided the study.

#### **5.1.1 MDR TB Prevalence among TB Patients in Baringo County**

The study first objective was to establish the prevalence of MDR TB among TB patients in Baringo County. The finding of the study established that approximately 15 out of 100 TB patients suffer from MDR-TB. This is consistent with a study done by Fimbirai (2015) and Keter *et., al.* (2015), stating that, the rise of new cases and prevalence of MDR TB is the result of interrelated factors such as inadequate treatment regimens, sub-optimal drug quality, mishandling of TB cases, and spread of resistant strains.

#### **5.1.2 Relationship between Socio-economic Factors, Socio-demographic, and Prevalence of MDR TB**

The study second objective was to explore the association between socio-economic factors, socio-demographic factors, and MDR TB prevalence in Baringo County.

The findings indicate that, highest level of education and income among TB patients have significant relationship with prevalence of MDR TB Baringo County specified by chi-square results ( $\chi^2 (1) = 392.921, P < 0.01$ ) and ( $\chi^2 (1) = 108.311, P < 0.013$ ) respectively. This implies that TB patients with higher level of education have a significantly reduced risk of MDR TB incidence. This effect could be linked to ability to understand easily how to deal with TB drugs and importance of finishing TB drugs to hinder the prevalence of MDR TB. This indicates that MDR TB incidence in patients with TB is significantly related to income and education-related factors.

The findings of the study agree with the findings done by Alene et al. (2017) on spatial MDR TB pattern and its associations to socio-economic, household, and demographic factors, where the findings of their study established a significant relationship between sociodemographic aspects, including education level and income with spatial patterns of MDR TB in Ethiopia. The study findings agree with the findings of Ramadhany et al. (2020) on a review of income, societal awareness and attitudes toward TB infection where their findings of the study established that education-related factors significantly influence the MDR TB prevalence in persons with tuberculosis.

### **5.1.3. Previous TB Treatment and MDR TB Prevalence**

The third research objective was to consider the significance of the link between previous TB treatment and MDR TB prevalence persons with TB in Baringo County. Grounded on the study findings, it was established that previous treatment for TB was a significant predictor of MDR TB occurrence among persons with TB.

Moreover, the study results revealed a weak statistically significant relationship between previous treatment for TB and the MDR TB prevalence among persons with

TB, specified by a strong positive significant correlation of  $r = 0.257$ ,  $p < 0.00$ . This observation means that past TB treatment was linked to a higher frequency of MDR TB among TB patients in Baringo County. As a result, the positive significant link between past TB treatment and MDR TB prevalence among TB patients in Baringo County has been confirmed. The observation agrees with study done by Eshetie, et al. (2017) on MDR TB and prior history of anti-TB treatment, which found that past anti-tuberculosis treatment was significantly correlated to the MDR TB prevalence among persons with TB.

#### **5.1.4 Selected Risk Factors MDR TB Prevalence among TB patients**

The study fourth objective was consider the link between selected risk factors and MDR TB prevalence in patients with TB in Baringo County. The findings of the study TB treatment related factors: history of imprisonment, ( $\chi^2 = 0.706$ ;  $df = 1$ ;  $p = 0.49$ ), duration of imprisonment Fisher's Exact Test = 1.079;  $p=0.870$ , history of migration to other countries ( $\chi^2 = 0.053$ ;  $df = 1$ ;  $p = 0.853$ ), history of being visited by visitor from other countries ( $\chi^2 = 0.018$ ;  $df = 1$ ;  $p = 1$ ), behavioural factors ( $\chi^2 = 0.305$ ;  $df = 1$ ;  $p = 0.658$ ), (alcohol) Fisher's Exact Test  $p = 1$ , health system and provider factors (attitude) Fisher's Exact Test = 3.311;  $p = 0.200$ ; (counseling) Fisher's Exact Test  $p = 0.757$  indicated that there were no statistically significant relationship with MDR-TB prevalence among persons with TB in Baringo County, Kenya.

#### **5.1.5 Summary of Results**

The study found that the prevalence of MDR-TB was 14.9% in Baringo County. Income, highest level of education and previous TB treatment had relationship with MDR-TB prevalence. However, the selected risk factors did not have any association

with MDR-TB prevalence.

## **5.2 Conclusion**

- i) The MDR TB prevalence among patients diagnosed with TB in Baringo County was 14.9%
- ii) Socio-economic factors significantly manipulate the MDR TB prevalence in patients with TB in Baringo County.
- iii) Previous TB treatment had significant influence on the MDR TB prevalence among patients with TB in Baringo County.
- iv) Selected risk factors (history and treatment related factors, history of imprisonment, history of migration, behavioral practices, health system and provider factors) have no significant relationship with MDR TB prevalence among TB patients in Baringo County.

## **5.3. Recommendations**

### **5.3.1. Recommendations from the study**

- i) Baringo county government should lower MDR TB prevalence by addressing contributing factors to TB relapse and ensure drug adherence by the patients on treatment through their respective Sub-County TB Coordinators and CHWs.
- ii) The county government to create awareness and sensitization on TB and MDR TB among the community members. This will help educate the community on the effects of the disease and address the provisional needs of patients, including the provision of DOT, and food.
- iii) There is need to create TB-Advocacy groups within the county who will work together with the community health workers to address challenges and create

awareness on benefits of drug completion.

- iv) Additional research is needed on possible risk factors linked to MDR TB prevalence in Baringo County which hinder the treatment of TB hence MDR TB.

### **5.3.2 Recommendation for Further Research**

- i) The national government through the MOH should come up with specific policies inclined towards the eradication of TB and particularly MDR TB by addressing the TB treatment related factors, (factors contributing to defaulting treatment: stopping treatment, treatment of side effects which are significantly related to MDR TB occurrence in patients with TB.
- ii) The study focused on Baringo County alone. This limits the generalizability of the findings to other settings, and therefore, future studies with wider scope are needed to expand the generalization of results.
- iii) Selective capture of the relationship between TB treatment related factors, history of imprisonment, history of migration, education-related factors, behavioral practices and health system and provider factors and MDR TB prevalence in patients with TB in Baringo County constitutes the other limitation. Therefore, future research should capture a greater scope of factors in greater settings of research to provide more robust results.



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## **APPENDICES**

### **Appendix 1: Consent Form**

My name is Doreen Kapterit, a Master of public Health (Epidemiology& disease control) student from Kenyatta University. I am conducting a study on “**Extent and risk factors for multi-drug resistance among Tuberculosis patients in Baringo County, Kenya**”. The information collected will help the Ministry of Health to improve shortcomings affecting prevention and management of tuberculosis in Baringo County as well as in other Counties in Kenya and globally. This study is for academic purposes only.

### **Procedures to be followed**

Taking part in this study will require that you respond to a set of questions asked by the researcher. You will be required to provide your working/active mobile phone numbers. You will be enrolled into the study and followed up for a period of between 1-3 months.

### **Discomforts/risks**

Some questions included may make you uncomfortable. You are requested to answer those questions with honesty and sincerity to enable the researcher come up with appropriate recommendations targeted at prevention and management of Tuberculosis to reduce the number of deaths due to multi-drug resistance. The interview will take at most ten (10) minutes.

**Reward/Benefits**

There is no reward/benefit which will be given for agreeing to participate in this study, however, will be beneficial to the society in terms of preventing and managing Tuberculosis.

**Confidentiality and Privacy**

The interviews will take place in a secluded area of the hospital. For security, the questionnaires will be housed in a closed (locked) cabinet accessed only by the researcher. Your identity (name/phone numbers) will not be disclosed in publications, conferences or in seminars where this work will be shared.

**Consequences of withdrawal**

It is entirely up to you whether or not you choose to take part in the study. You are free to ask any questions about the study at any time. You have the right to refuse to answer any questions and to end the interview at any time. You may also leave the study at any moment with no repercussions.

**Contact information**

Should you require clarifications or questions, you may contact Mr. Kimutai on 0722263301 or Dr. Abakhalwa on 0720945345 or Dr. Ngelechei on 0707144770 or Mr. Kimulwo on 0722556564 or the Kenyatta University Ethical Review Committee Secretariat on [kuerc@ku.ac.ke](mailto:kuerc@ku.ac.ke).

**Participant's Statement**

I understand the above information about my involvement in the study. I was given the opportunity to ask questions, and my queries were satisfactorily answered. It is entirely up to me whether or not I participate in this study. I accept that my

information will be kept confidential and that I am free to leave the study at any time.

Name of Participant.....

Sign or Thumbprint \_\_\_\_\_ Date \_\_\_\_\_

**Investigator’s statement**

I, the undersigned, have explained the procedures to be followed in the study, as well as the risks and rewards associated, to the participant in a language she/he understands.

Name of Interviewer.....Interviewer sign: .....

Date: .....

**Supervisors:**

Sign.....Date.....

Dr. Justus O.S. Osero

Department of community Health & Epidemiology Kenyatta University

Signature.....Date.....

Dr. Ramadhan L. Mawenzi

Department of Clinical Medicine and Surgery Egerton University



**Appendix 2: Questionnaire**

Questionnaire No \_\_\_\_\_

Participants Signature \_\_\_\_\_ Date \_\_\_\_\_

**Socio-demographic Data**

1. What is your age (Completed years) [...]
2. Sex  Female  Male
3. What is your marital status?  Single  married  divorced  widowed  Single parent
4. What is the highest level of education you attained?  Never went to school  Primary  Secondary  Tertiary  University
5. What is your Religion?  African Traditional Religion  Christian  Muslim  None
6. Are you employed?  Yes  No \_\_\_\_\_ Self Employed Yes  No
7. What do you do for a living? \_\_\_\_\_
8. What is your average monthly income? <KES10, 000  KES10, 000-50,000  >KES 50,000
9. What is your daily income <KES100  KES100-500  KES 1000+
10. How many rooms do you live in?

11. You live with how many people in those rooms?  Is the house rented?  house owned?  relative's house?  Parent's house?

### **History and Treatment Related Factors**

12. How long will your current treatment take?  6 months  6 -9 months  9 – 12 months

13. 11. Have you ever been treated for TB previously? Yes  No

14. *If you were put on treatment.* How many months did you undergo treatment?

<1month  1month  2-3months  4-6 months  > 6 months

15. Do you remember the number of drugs you were using?

16. Did you ever stop treatment? Yes  No

17. *If yes* For How long? months  weeks

18. 16. What caused you to leave treatment? No transport money  Adverse reactions from drugs  No drugs at Clinic  Rude nurses

19. Did you ever live in with a person who was suffering from MDR TB Yes  No

20. Who was monitoring you taking treatment in previous treatment?

Wife

Husband

Friend

No one

Health worker

Community Health Worker

21. Were you a member of any support group? Yes  No

22. While taking treatment in previous treatment did you experience side effect Yes

No

23. List the side effects that you experienced  Pain above the abdomen  body itching

loss of appetite  Stress  None

24. Did the side effects led you to leave treatment Yes  No

25. Were you ever tested for HIV? Yes  No

26. If Yes are you HIV positive? Yes  No

27. Are you on HIV treatment? Yes  No

28. Do you suffer from diabetes? Yes  No  *check with chronic disease register if yes*

29. *If yes* which type of diabetes? Type 1  Type 2

30. Have you ever experienced a kidney failure? Yes  No

31. Are you on renal dialysis currently? Yes  No

### **History of imprisonment**

32. Have you been imprisoned before? Yes  No

33. *If Yes* For how long? <1  1month  2 months  3 months  4 months-1year

>1 year

34. Did you go to prison taking anti TB drugs? Yes  No

35. Any history of TB diagnosis whilst in prison? Yes  No .

### **History of Migration**

36. Have you ever visited any country? Yes  No

37. *If Yes* when was the last time...../...../.....
38. If you are regular visitor to other countries. How long do you usually stay there.....
39. Did you fall ill with TB while still outside Kenya? Yes [ ] No [ ]
40. Do you have a relative/visitor who came to visit you from another country? Yes [ ] No [ ]
41. Did the visitor suffer from TB? Yes [ ] No [ ]
42. *If Yes* What type of TB.....don't know [ ]

#### **Education-related factors**

43. Have you ever heard of MDR TB? Yes [ ] No [ ]
44. What do you think causes MDR TB ..... ? Not sure [ ] don't know [ ]
45. Is MDR TB preventable? Yes [ ] No [ ]
46. Do you know the importance of finishing TB treatment course? Yes [ ] No [ ]
47. Have you ever been told the importance of finishing TB treatment course Yes [ ] No [ ]
48. Did you get this information from a health worker? Yes [ ] No [ ]?
49. If you have the information but not from health workers where did you get it?.....

50. What are the dangers of leaving treatment?

51. If you start feeling better after taking TB drugs for a month what should you do?

Leave the drugs  Stay on medication

**Behavioral Practices**

52. Do you smoke? Yes  No

53. Do you smoke when taking TB drugs? Yes  No

54. Did you drink beer during TB treatment? Yes  No

**Health system and provider factors**

55. Have you faced challenges in accessing MDR TB drugs at the clinic? Yes  No

56. Specify the challenges? Transport money  User fee  staff attitude

57. What do you think of the health workers' attitude? Good  bad  rude

58. Did you receive any counseling concerning TB? Yes  No

59. Did you face challenges with accessing drugs at your facility?  Yes  No  60. If yes, kindly name them.....

61. Are there community support groups in your area?  Yes  No

62. If yes, do they offer social support to you or your family?  Yes

**Appendix 3: Clinician Interview Guide**

The purpose of this interview is to determine the factors that contribute to the development of MDR TB among Tuberculosis patients in Baringo County, Kenya.

This interview will last 45 minutes.

**Interview Questions**



1. What sociodemographic factors contribute to MDR TB among TB patients?
2. What environmental factors contribute to MDR TB among TB patients?
3. What patient-related factors contribute to MDR TB among TB patients?
4. What facility-related factors contribute to MDR TB among TB patients?
5. What treatment-related factors contribute to MDR TB among patients?
6. What nutrition-related factors contribute to MDR TB among patients?

**Appendix 4: Checklist**

S/No	Name of The Patient	Date Of Notification		TB Type			Patient's History			Current Drug Use	Length of treatment	Dots Method		Latest Tests Done		
		Given	Not Given	PTB	EP TB	MDR TB	1 <sup>ST</sup> Dx. PTB	1 <sup>ST</sup> Dx. EPTB	1 <sup>ST</sup> Dx. MDRT B	(No of drugs)	(month s)	On DOTS	Not On DOTS	+Ve PTB	+Ve EPTB	+Ve MDR TB
1.																
2.																
3.																
4.																
5.																
6.																
7.																
8.																
9.																
10.																
11.																
12.																
13.																
14.																
15.																
16.																
17.																
18.																

**Key: DX – Diagnosis, +Ve - Positive**

**Appendix 5: Research Permits**

 REPUBLIC OF KENYA	 NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
Ref No: 431791	Date of Issue: 31/March/2020
<b>RESEARCH LICENSE</b>	
	
<p>This is to Certify that Ms. DOREEN JEPCHUMBA KAPTERIT of Kenyatta University, has been licensed to conduct research in Baringo on the topic: <b>EXTENT AND RISK FACTORS FOR MULTIPLE DRUG RESISTANCE AMONG TUBERCULOSIS PATIENTS IN BARINGO COUNTY, KENYA</b> for the period ending : 31/March/2021.</p>	
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