RISK FACTORS FOR TUBERCULOSIS AMONG HIV NEGATIVE INDIVIDUALS: A CASE OF BOMACHOGE CHACHE SUB COUNTY, KENYA

BY

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DECLARATION AND APPROVAL

Declaration

This thesis is my original work and has not been presented for the award of a degree or diploma in any other university or institution.

……..

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Approval

This thesis has been submitted for examination with our approval as university supervisors.

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DEDICATION

I dedicate this work to my late father, who was my mentor and a true ambassador for higher education.

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ABSTRACT

Despite control initiatives by WHO and the Kenyan government through the Ministry of Health, TB remains the most common infectious disease and a significant health problem worldwide. Kenya is one of the 22 high TB burden countries in the world which collectively contribute 80% of the global TB disease burden. About 61% of TB patients in Bomachoge Chache Sub County are HIV negative and this means that they are exposed to other risk factors. The objective of the study was to determine the risk factors that are associated with the development of tuberculosis among the HIV negative individuals. The specific objectives were: to determine the socio-demographic characteristics of HIV negative individuals, to establish presence of biological factors, to determine environmental and health system factors associated with the development of TB among the HIV negative individuals. This was a case control study employing quantitative and qualitative methods. The study was carried out in Bomachoge Chache Sub County which has a population of 99,612 people. The study population was TB patients above 14 years of age who were attending the seven TB clinics in the Sub County during the study period and key informants. Ninety four HIV negative individuals with TB and ninety four community controls, seven health care providers and seven managers from each of the facilities were interviewed. A questionnaire consisting of closed and open ended questions and an interview schedule was used to collect data. Logistic regression analysis was used to examine the separate and combined effects of variables on the odds of being a TB case. The level of significance was fixed at 0.05%. It was observed that being single or widowed was a significant determinant of TB contraction ($P=0.001$) as well as history of smoking ($P=0.006$). The study revealed that a family history of TB ($P=0.001$) and a previous episode of TB in the individuals were strongly associated with TB infection ($P<0.0001$). There was also a positive relationship between absence of a BCG scar ($P<0.0001$) and being under weight ($p=0.005$) with higher odds of being a TB case. For the health system factors, TB screening at the out patients and follow up of contacts of index cases was not done comprehensively in the health facilities as revealed by the health managers. They also revealed that the DOTS strategy was poorly implemented and that TB was associated with a significant level of stigma. Policy makers and health facility managers should ensure that contacts of index TB patients are traced and screened for TB, the DOTS strategy is fast tracked, health education on the harmful effects of tobacco is disseminated to the community, people with previous history of TB are screened at pre-determined intervals to assess risk of contracting TB and that the BCG immunization coverage is expanded to include every child.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

WHO World Health Organization

TB Tuberculosis

HIV Human Immunodeficiency Virus

DTLC District Tuberculosis and Leprosy Coordinator

DMOH District Medical Officer of Health

MDR-TB Multiple drug resistant tuberculosis

DHIS District Health Information System

CBS central bureau of statistics

CDC centers for disease control and Prevention

DLTLD Division of leprosy, tuberculosis and lung disease

DHMT District health management team

DOTS direct observed treatment strategy

CHAPTER ONE: INTRODUCTION

1.1: Background of Study

1.1.1: Epidemiology

According to Haslett et al (2002) Tuberculosis (TB) is defined as a chronic infectious disease caused by a bacterium called *Mycobacterium tuberculosis*. Infection with *M. Tuberculosis* occurs most frequently through inhalation of infected droplets, with the primary infection occurring in the lungs in 80 percent of cases. *Mycobacterium tuberculosis* can remain viable as airborne droplet suspended in the air for a long time or as part of house dust for weeks. However, transmission usually occurs only after substantial exposure to someone with active TB. The development of TB in man is a two-stage process in which a susceptible person exposed to an infectious TB case becomes infected and may later develop the disease, depending upon various factors. Any condition modifying the balance established in the body between the host's immune defenses and the tubercle bacilli can have an impact on the risk of developing the disease. Clinical presentation of pulmonary TB includes chronic cough, often with haemoptysis, pyrexia of unknown origin, weight loss, general debility, exudative pleural effusion and spontaneous pneumothorax (Haslet et al, 2002).

Tuberculosis disease has re-emerged as a major public health problem in the world. It is estimated that a third of the world's population is infected with the *tubercle bacillus* with about nine million people progressing to active tuberculosis disease each year. Those who are ill can infect up to 10-15 other people through close contact over the course of a year and without proper treatment, 2 million will die of the disease (DLTLD Kenya, 2009)

1.1.2: Who is most at Risk?

According to DLTLD Kenya (2009) poor socio-economic status leading to overcrowded slums in the peri-urban areas coupled with poor nutrition and limited access to health services have been identified as contributing factors to the high TB burden. Risk of active TB is also greater in persons suffering from other conditions that impair the immune system. Among the category of persons with impaired immunity are people living with HIV/AIDS, diabetics, substance abusers

(alcohol, drugs), persons suffering from silicosis and those receiving long term oral steroids or immunosuppressive therapies. Smokers too have an increased risk of developing disease.

1.1.3: Global impact of TB

TB occurs in every part of the world. Globally, the WHO (2012) estimates that 9.2 million people were diagnosed with TB in 2010. In the same year, 1.1 million people without HIV died from the disease and 0.35 million people living with HIV also died. In 2011, the largest number of new TB cases occurred in Asia, accounting for 60% of new cases globally. However, Sub-Saharan Africa contributed the greatest proportion of new cases per population with over 260 cases per 100 000 population in 2011. In addition, it is estimated that over 95% of TB cases and deaths are in developing countries.

In the recent past significant gains have been made in curbing TB transmission. According to WHO (2012), the Millennium Development Goal (MDG) target to halt and reverse the TB epidemic by 2015 has already been achieved. The incidence of TB has been declining for several years and fell at a rate of 2.2% between 2010 and 2011. The TB mortality rate has decreased by 41% since 1990 and the world is on track to achieve the global target of a 50% reduction by 2015. Mortality and incidence rates are also falling in all of WHO's six regions and in most of the 22 high-burden countries that account for over 80% of the world's TB cases (WHO, 2012).

1.1.4: TB burden in Kenya

Kenya is one of the 22 high TB burden countries in the world which collectively contribute 80% of the global TB disease burden. Kenya is experiencing a generalized TB epidemic affecting the young economically productive age groups (15-44 year old). In Kenya, more men than women are notified as TB cases (DLTLD Kenya, 2012).

Kenya reported more than 106,083 TB cases in 2011 with more than 4000 deaths, retaining the status of one of the 22 high TB burden countries in the world. The country is now ranked position 15 to 13 in 2011(DLTLD Kenya, 2012).

1.1.5: TB burden in Bomachoge Chache Sub County

In the year 2012-2013, 233 adult (>14 years) TB cases were detected in the District-including 122 female and 111 male cases. 133 were tested for HIV and 52 (40%) of them were positive and 81 (60%) were HIV negative. 26 deaths were reported during the same period (DHIS, 2013).

1.2: Problem Statement

Despite Kenya having a well structured and funded division of tuberculosis and leprosy, more than 106,083 TB cases were reported in 2011 with more than 4000 deaths. This made Kenya retain the status of one of the 22 high TB burden countries in the world (DLTLD Kenya, 2012). In the year 2012-2013, the number of adult (>14 years) TB cases detected in Bomachoge Chache were 233 representing the highest figure reported in Kisii county among the 9 sub counties (DHIS, 2013). According to WHO (2012) about 70% of TB cases arising among 15-49 years old in sub-Saharan Africa and 60% in Bomachoge Chache (DHIS, 2013) are HIV negative, and are attributed to other risk factors. These risk factors (social demographic, co-morbidities, environmental and health system factors) that are associated with the transmission of TB infection other than HIV/AIDS are poorly understood in Bomachoge Chache sub-county.

1.3: Objectives of the study

The broad objective of the study was to investigate the risk factors associated with the development of tuberculosis among the HIV negative individuals in Bomachoge chache Sub County.

1.3.1: Specific objectives

i. To determine the socio-demographic characteristics of the respondents.
ii. To establish presence of biological factors associated with the development of TB among HIV negative individuals.
iii. To determine environmental factors associated with TB transmission among HIV negative individuals.
iv. To establish the health system factors associated with TB transmission among HIV negative individuals.

1.4: The research questions of the study were:

i. What are the social-demographic characteristics of HIV respondents?
ii. What are the biological associated with the development of TB among HIV negative individuals?
iii. What are the environmental factors associated with TB transmission among HIV negative individuals?
iv. What are the health system factors associated with TB transmission among HIV negative individuals?

1.6: Justification of the study

In terms of loss of life, disability and economic costs, TB ranks among the worst diseases. It requires 500 000 kenyan shillings (KES) to treat one case of normal tuberculosis and about 2 million (KES) to treat a case of multiple drug resistant Tuberculosis. 26 deaths were reported in Bomachoge chache sub county in one year. There is need to stop this unnecessary loss of lifes and safe financial resources that could be used for other health needs.

1.5: Significance of the Study

Understanding the risk factors for TB infection among HIV negative individuals will help ministry of health policy makers in the formulation of strategies geared towards the prevention and control of the disease. The findings can also be used to develop statistical models that can be used in the management of TB contacts such as the determination of who is eligible for prophylaxis.

1.7: Operational definition of Terms

Risk Factors: An attribute, such as a habit (e.g. Cigarette smoking) or exposure to some environmental hazard, that leads the individual concerned to have a greater likelihood of developing an illness. The relationship is one of probability and as such can be distinguished from a causal agent.

Tuberculosis: A chronic infectious disease caused by a bacterium called *Mycobacterium tuberculosis.*

HIV: Human immunodeficiency Virus that causes AIDS.

Host: A susceptible human being.

Environment: Refers to extrinsic factors that either promote or prohibit disease transmission.

DLTLD: Division of Leprosy, Tuberculosis and Lung Disease at the ministry of Health is in charge of the control and prevention of TB.

CHAPTER TWO: LITERATURE REVIEW

2.1: Introduction

Tuberculosis disease has re-emerged as a major public health problem in the world and Kenya. According to DLTLD (2009) Kenya has a large and rising TB disease burden and is ranked 13th among the 22 high burden countries that collectively contribute about 80% of the world's TB cases. Tuberculosis case notification being 338 per 100000 population in the country. In Gucha sub County, with a total population of 99612, 254 cases were detected between July 2012 and June 2013, of which 26 died (Gucha DHIS 2013). Among the factors contributing to this high burden is high poverty levels and the consequent social-economic deprivation. DLTLD (2009) suggests that a general improvement in social-economic conditions may be the answer to TB control in the long term.

2.2: Factors Affecting TB Transmission

The factors outlined below affect TB transmission in varied ways and are grouped into: host and environmental factors.

2.2.1: Host Factors

2.2.1.1: Age

It is worth noting that a number of studies have reported an association between TB incidence and the age of the individuals affected. WHO (2012) report shows a significant increase in TB incidence with an increase in age for both men and women. A review of studies done by Narasimham et al (2013) reveals that age is an important risk factor in tuberculosis infection. The authors note that infants and people aged 15 years and above were at an increased risk of tuberculosis infection as compared to children above one year to four years old. A study by Ndungu et al (2013) also found out that the prevalence of tuberculosis was higher in people aged 40 years and below as compared to people aged 40 years and above. However, results from this study are not conclusive as it only targeted people who were 18 years and above who were being treated for tuberculosis infection. This could have biased the study because the whole population was not studied in order to rule out other confounding factors.

2.2.1.2: Tobacco Smoking and alcohol drinking

One of the host factors that seem to increase the incidence of tuberculosis is smoking and drinking. According to a study done in rural India by Gajalakshmi and Peto (2009), on smoking and drinking in relation to the incidence of tuberculosis, the incidence rate among men who do not drink alcohol but smoke was 2.6 times higher than that of non-smokers. The study indicated that among those who do drink, the smokers had a TB incidence rate of 1.7 times that of non-smokers. This study therefore shows that there is no significant relationship between drinking alcohol and incidence of tuberculosis. However, Kuznetsov et al (2013) and Narasimhan et al (2012) demonstrate that chronic alcohol consumption on its own positively correlates with tuberculosis infection. The authors argue that the reason for an increase in risk is probably due to the alteration in the immune system, specifically the signaling molecules responsible for cytokine production.

Another study carried out by Batista et al (2008) found no association between alcohol consumption and relapse even after smoking and relapse was adjusted for each of the socio economic variables which are confounding factors. Lienhardt et al (2005) also observed that smokers were vulnerable to TB infection probably owing to the pathophysiological changes in the lungs induced by chronic smoking.

2.2.1.3: Marital Status and Gender:

Marital status may also play a role in TB infection as indicated by Liestol et al (2008) and Gustafson (2003) in their study on socio economic differences in the cause of TB infection. Both studies show the effect of social conditions and lifestyle whereby married individuals have lower odds for TB infection than unmarried individuals have. These studies are contrary to Ndungu et al (2013) study who found out that marital status had no role to play in the rate of infection.

Lienhardt et al (2005) shows that the incidence of TB is higher in singles than in married individuals and more males than females were affected. The same study also notes that male sex is a risk factor for TB for all categories of patients. Other studies carried have also observed that there is a strong positive relationship between TB and male gender (Neely et al 2009, Goldhaber-Fiebert et al 2011). However, Farah et al (2005), points out that the risk of TB infection for both genders may be the same despite a slight higher TB rate among women immigrants particularly

in the early years post-migration. Contrary to many studies, a national cohort study done in Afghanistan on sex difference in tuberculosis observed that infection rates were higher among women than men (Sabawoon and Sato 2012). It is noted that the differential use of health services may have contributed to the sex difference rates in TB. In Afghanistan, women often use public health services, which have TB-diagnostic facilities and are either free or charge only a nominal fee. In contrast, men often use private health services, which may have shorter waiting times but which can lack TB-diagnostic facilities and are more expensive.

2.2.1.4: Knowledge and Awareness of TB:

Awareness of TB risk factors, signs and symptoms and treatment may serve to warn a person about the presence of a disease or future occurrence of that disease. This may enable individuals seek measures to prevent infection especially if they are contacts of the disease cases. Desalu et al (2012) in their study carried out in Nigeria note that more men than women were aware of TB warning signs. The authors have also observed a geographical variation in knowledge of TB which could be attributed to the burden of disease in the countries. Other significant predictors of awareness of TB warning signs were increasing age, being a Christian, a higher family income and education.

Another study by Tasnim et al (2012) reported a fairly good level of knowledge associated with urban setting of the study which has a better opportunity to access to information and education level.

2.2.1.5: biological factors:

A growing body of evidence indicates that there is a link between co morbidities and TB infection (Narasimham et al 2013). Some of the diseases that have been linked with tuberculosis include diabetes and HIV. There is biological evidence that these two diseases impair the innate and adaptive immune responses, thereby accelerating the proliferation of active tuberculosis. However, other studies have also indicated that tuberculosis can induce glucose intolerance and deteriorate glycaemic control in patients diagnosed with diabetes (Narasimham et al 2013).

Goldhaber-Fiebert et al (2011) points out that there is an association between diabetes mellitus type 2 and TB infection. However, the observers relied only on symptoms of TB and diabetes

which may have introduced bias into the study. There is a positive correlation between diabetes and HIV and multi drug resistant TB (Aliyu et al 2013). The observers note that the odds of a positive history of diabetes mellitus among cases with any resistance were 3.59 times higher than cases without any resistance indicating that there is an increased tendency to infection with multi drug resistant TB despite the fewer number of cases in their study and the fact that the study measured a self reported history of diabetes mellitus.

Many studies have also demonstrated a link between HIV and TB infection (Gustafson et al 2004, Anochie et al 2013, Baussano et al 2006, Zenteno-Cuevas et al 2011). The studies indicate that HIV infection plays a role is shaping tuberculosis morbidities. Zenteno-Cuevas et al (2011), particularly demontstrates that the only variable associated with tuberculosis infection is a low CD 4 count of below 200 cells/mm^3. This is probably due to impaired immunity in HIV positive individuals which increase vulnerability to tuberculosis infection. Some studies have also shown that HIV positive patients are at risk of multi drug resistant tuberculosis (Aliyu et al 2013).

Other studies have also indicated a link between HIV infection and multi drug resistant TB. However, in a systematic review of studies done by Suchindran et al(2009), the authors note that this is not the case in Africa and therefore conclude that the association of MDR TB and HIV infection could be confounded by other factors. For example, the observed association could be confounded by the window period and other shared risk factors such as socio economic status and alcohol consumption.

Another disease that has been associated with tuberculosis infection is chronic obstructive pulmonary disease. In a population based study comprising of 115,000 COPD patients, individuals with a hospital discharge diagnosis of COPD had a three-fold increased risk of developing active TB as compared to the general population (Inghammar et al 2010). This was attributed to an excess risk of pulmonary TB. On the contrary other studies have indicated that there is a decreased risk of tuberculosis infection in patients suffering from asthma.

2.2.2: Environmental Factors:

2.2.2.1: Socio Economic Factors

Socio economic factors have been shown to influence tuberculosis infection with the poorest having the highest risk. This is probably because the poor are exposed to several risk factors including poor housing, malnutrition, alcohol abuse and smoking. People with a low socio economic status are likely to live in crowded small houses which are not well ventilated. Ndungu et al (2013) point out that people who earn less are more likely to suffer from tuberculosis. Studies have shown an association between risks of TB with the number of adults in a household. Lienhardt et al (2005) observed a consistent effect of former experience of TB within the household and risk of TB. This study is supported by Gustafson et al (2003) who associated active TB with poverty. The authors used secondary indicators of poverty like housing quality and poor living conditions which were found to increase the risk of TB. Adult crowding was also a risk factor and each adult in the household increased the risk of TB by 5%. The study also showed that people living without children, alone or with adults of their own sex only, had higher risks of developing TB than people living in households with children or and adults of the opposite sex. The studies concluded that living with children was protective because children were immunized and were likely to confer some immunity to the adults living with them in the same house.

According to Lienhardt et al (2005), the risk of TB is higher in skilled manual workers and farmers as compared with unskilled manual workers. Another study by Liestol et al (2008) also depicts a similar picture when considering occupational groups. The study shows that people in technical and scientific 'high status' occupations have low odds of acquiring TB infection while the highest odds are found among those who are unemployed and manual workers. The reason for an increased risk of tuberculosis infection in people who are skilled in manual labour probably could be related to occupational exposures within the environment. Occupational exposures such as chemicals, smoke and dust may alter clearance of lung mucosal secretions thus impairing the immunity which increase susceptibility to tuberculosis infection. Other studies have shown that employees in sales and service industry are at intermediate levels probably because they are not exposed to occupational hazards as skilled manual labourers.

2.3: Conceptual Framework

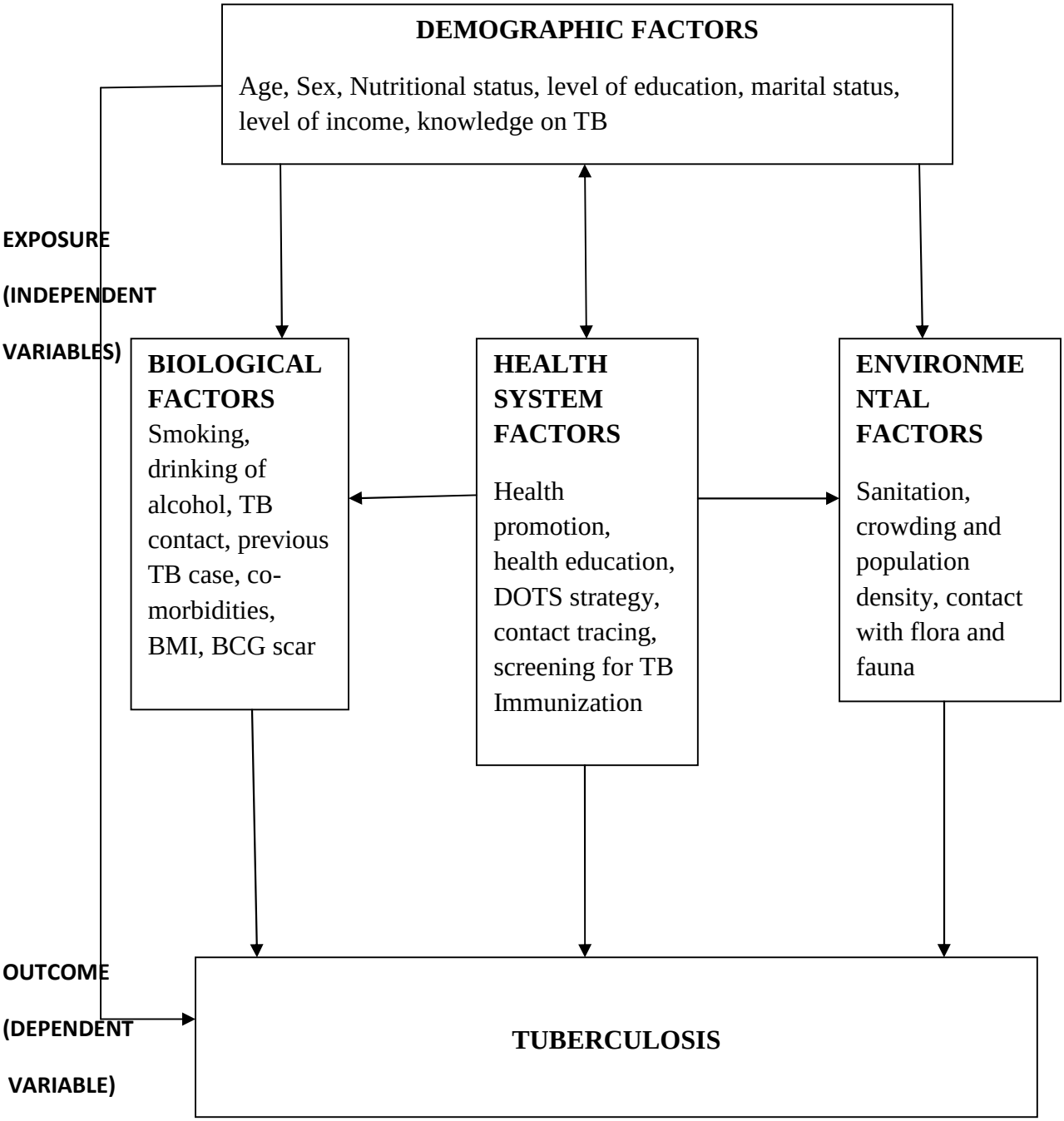

Fig 2.1: Showing the relationship between the host factors, environmental factors and TB disease.

Source : Adapted from the epidemiologic triangle.

The epidemiologic triangle provides one of the fundamental public health conceptions of disease. The conceptual framework represents the relationship between the host factors, environmental and disease out come.

Agent refers to the *Mycobacterium tuberculosis*. The agent factors are infectivity (capacity to enter and multiple in a susceptible host), pathogenicity (capacity to cause disease), virulence (ability to produce severe clinical manifestation of the disease), toxigenicity (capacity to produce toxins), resistance (ability to survive adverse environmental conditions and antigenicity (the ability of the agent to induce antibody production in the host). Depending on these factors, the agent is able to produce just an infection, sub-clinical disease, active disease or a fatality.

Host is any susceptible human being. Host factors such as age, sex, co-morbidities, educational levels, life style smoking and drinking, influence the host's susceptibility to infection, host's resistance and tolerance. It also determines whether the host becomes a carrier or has an active disease. The social economic factors of the host influence the type of life style one leads, whether they will smoke or drink alcohol and the co-morbidities likely to afflict him or her. It also influences the type of environment they will live in and the quality of health care they will access. These in turn determines whether one is susceptible to TB or not.

Environment refers to extrinsic factors that either promote or prohibit disease transmission. Tuberculosis infection results from the interaction between the *Mycobacterium tuberculosis* and the susceptible host in an environment that supports transmission of the agent from a source to that host. The environment one lives in, such as the level of sanitation, is also influenced by the type of health education one gets from the health providers.

Health care system factors will determine whether a patient with signs and symptoms of TB seeks medical help early enough, whether the health care provider will have a high index of suspicion and investigate a suspected case, whether the laboratory tests and drugs are available at the point of service and whether the patients can afford them and finally whether defaulters are traced and brought back to care. The health care system also influences the type of life styles the people it serves practice and the type of environment they live in through health promotion messages and health education. The system can have a positive or negative effect depending on its efficiency and effectiveness.

CHAPTER THREE: MATERIALS AND METHODS

3.1: Study Sites

The study was carried out in Bomachoge Chache Sub County which is one of the 9 sub counties in Kisii County, Kenya. It is inhabited by members of the Abagusii community and has a population of 99,612 people who are mainly small scale farmers. It covers an area of 105 square kilometres, with a population density of 948 persons/ sq. Km. The ratio of female to male is 52:48 and has a population growth rate of 2.3%. It borders Bomachoge Borabu to the south, Bobasi Sub County to the east, South Bogirango to the west, and Kitutu Chache south to the north. It is a rich agricultural land that is devoted to farming, with heavy rainfall throughout the year (CBS 2009).

Administratively, it has one division with 4 locations. The Sub County health care system is comprised of one Sub County hospital, one model health care centre, seven dispensaries and three medical clinics. The health care system is coordinated by the Sub County Health Management Team (DHMT) that is headed by the Sub County Medical Officer of health (ScMOH). The TB control program at the district is coordinated by the Sub County TB and Leprosy coordinator (ScTLC) and care is available free of charge at all government health facilities (Gucha AWP 2013).

Seven TB clinics were involved in the study: the Sub County referral hospital, one model health centre and five dispensaries. These were the only health facilities that offer TB services.

3.2: Study Design

This was a case control study employing quantitative and qualitative methods. Cases were consenting HIV negative individuals with TB identified in the seven TB clinics in the sub county. The controls were recruited from the neighbourhood of the case's household. For each case, a healthy community control was selected at random in the neighbourhood of the case's household, by choosing a random direction from the case's home and visiting the third household to the right. After explaining the purpose of the study to the household members, a control was identified by age-matching to within 10 years of the case. If there are several possible candidates within the household, the control was selected using simple random sampling. If the household head declined to take part in the study, the same procedure was

repeated to select another household in the neighbourhood. This design was appropriate for this study because the study subjects already had the outcome under investigation and it was exploring retrospectively, the possible risk factors (exposure) associated with this outcome. It also enabled the researcher to study multiple risk factors associated with the development of tuberculosis among the HIV negative individuals in Bomachoge chache sub county.

To gain insight into the health system related factors (creating awareness at the community level, implementation of DOTS, contact tracing and TB screening), the health care workers involved in provision of TB services together with the managers of the health facilities were interviewed through an interview schedule.

3.3: Study Population

The study population was TB patients above the age of 14 years who attended the TB clinics in the sub-county during the study period.

The hospital's health care providers involved in provision of TB services together with the managers of the hospital were all interviewed through key informant interviews.

3.3.1: Inclusion Criteria

The study participants met the following criteria

1. Residents of Bomachoge Chache sub-County in the previous one year
2. TB patients above the age of 14 years attending the TB clinic in the sub-County during the study period
3. HIV negative individuals
4. Those who had given informed consent

3.3.2: Exclusion Criteria

Participants with any of the following characteristics were excluded from the study

1. Non residents of Bomachoge Chache sub-County in the previous one year
2. Patients who were less than 14 years
3. HIV positive individuals
4. Those who had not given informed consent

3.4: Sample Size

The following formula used to calculate the sample size for comparing two proportions was used to come up with the desired sample size for this study.

$$n = \frac{(p_0 q_0 + p_1 q_1)(Z_{1-\alpha/2} + Z_{1-\beta})^2}{(p_0 - p_1)}$$

n = sample size in each group

p_1 = the proportion of exposure among cases

p_0 = the proportion of exposure among controls

q_1 = 1- p_1

q_0 = 1- p_0

$Z_{1-\alpha/2}$ = value of the standard normal distribution corresponding to a significance level of alpha (1.96 for α = 0.05)

$Z_{1-\beta}$ = value of the standard normal distribution corresponding to the desired level of power (0.84 for power of 80%)

The proportion of HIV negative TB patients being 60% in Bomachoge Chache (DHIS 2013), the following values were used to compute sample size:

p_1 = proportion of TB patients with risk factors for TB other than HIV =0.6

p_0 = proportion of controls with risk factors for TB other than HIV = 0.6- 0.2 = 0.4

q_1 = 1 – 0.6 = 0.4

q_0 = 1- 0.4 = 0.6

$Z_{1-\alpha/2}$ = 1.96

$Z_{1-\beta}$ = 0.84

$$n = \frac{\left[(0.6)(0.4) + (0.4)(0.6)\{1.96 + 0.84\}^2\right]}{(0.6 - 0.4)^2}$$

= 94 subjects per group

Total sample size = 188 (94 TB cases, 94 controls)

Sampling Method: Stratified sampling method was employed in this study. The Sub County was divided into 7 catchment populations/area (strata) representing the seven health facilities. Proportionate allocation of sample size was then done depending on the proportion of TB patients who attend clinic at that particular health facility to the total district TB clinic attendance.

Table 3.1: Proportionate allocation of sample size

Catchment area strata	% TB clinic attendance	Proportionate Sample size(cases) (n)	Proportionate Sample size(controls) (n)
Gucha DH	158/254 (62%)	58	58
Nyamasege disp	5/254 (2%)	2	2
Misesi MHF	63/254 (25%)	23	23
omorembe disp	12 /254 (5%)	5	5
sengera H/C	8/254 (3%)	3	3
Egetonto disp	5/254 (2%)	2	2
Keragia disp	3/254 (1%)	1	1
total	100%	94	94

Purposive sampling was then used to choose the cases depending on who turns out to be HIV negative. HIV/AIDS screening among TB patients in the sub County is 95% (Gucha DHIS 2014).

3.5: Instruments

The study used a semi-structured questionnaire (appendix 1) to collect primary quantitative data and an interview schedule to collect qualitative data. The questionnaire consisted of 36 close-ended and multiple response open-ended questions and was divided into two sections- host related and environmental factors.

The interview schedule (appendix 2) consisted of 8 questions.

3.6: Piloting

3.6.1: Reliability

Reliability was determined by pre-testing the questionnaire by use of the test-retest method at Bomachoge Chache Sub County Hospital using respondents who are not part of the study sample. The research assistants (community health workers) who administered the questionnaire were trained on the questions, thus ensuring uniformity and any clarification was made on the spot.

3.7: Data Collection Procedures

The questionnaires were administered by research assistants, using appropriate language (the language the respondents understand). Community health workers in the respective catchment areas were trained on the purpose of the study, the objectives, translation into the local dialect and how to check questionnaires for completeness to ensure accurate data was collected.

In addition, an interview schedule was administered through arranged interview sessions with the health care providers and managers of the health facilities

3.8: Ethical Consideration

Approval to carry out the study was sought from the director for health Kisii County. Written informed consent forms were obtained from all participants. For minors, assent was sought then written consent obtained from their parents or guardians. The proposal and the consent forms were reviewed and approved by the research and ethics committee of Jaramogi Oginga Odinga Teaching and Referral Hospital.

3.9: Data Analysis and Presentation

The questionnaires were checked for completeness and consistency of information at the end of every data collection day and before storage. Data capturing was done using Microsoft Excel software. The data from the completed questionnaires were cleaned, re-coded and entered into the computer using the statistical package for social sciences (SPSS) version 22.0 for Windows for analysis. Basic descriptive statistics was used to summarize the demographic and social-economic characteristics of TB patients. All continuous variables are presented as mean or median and categorical variables presented as frequency distributions. Logistic regression analysis was used to examine the separate and combined effects of variables on the odds of being a TB case. The level of significance was fixed at 0.05%

CHAPTER FOUR: RESULTS

One hundred and eighty eight (188) respondents were interviewed for this study with a response rate of 100 %.

4.1: Demographic Characteristics of the Respondents

4.1.1: Age of Respondents

Figure 4.1 shows the age groups for both the cases and controls. Majority of the respondents in both groups were between 15 and 34 years of age (n=70, 74.5%). However, the logistic regression done as shown in table 4.4 did not show any association between TB and age of individuals (un adjusted OR 0.9 95% CI 0.5-1.8 and OR 0.8 95% CI 0.4-1.8).

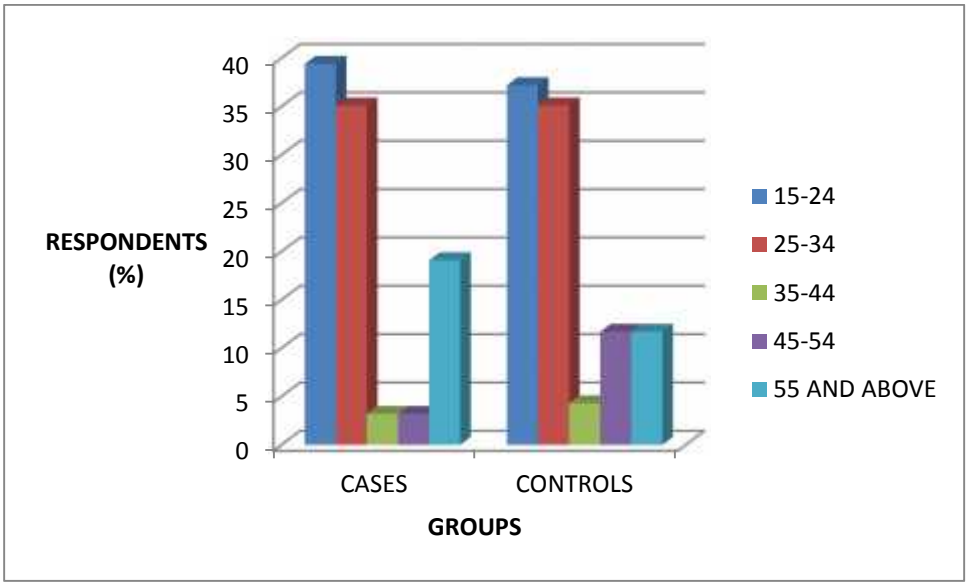

Fig 4.1: Age of the respondents in years

4.1.2: Gender of the Respondents

Figure 4.2 illustrates gender for both groups. Among the cases, there were more men (n=58, 61.7%) with TB than females (n=36, 38.3%) while among the controls there were more females (n=49, 52.1%) than males (n=45, 47.9%). A marginal association was noted using the un adjusted bivariate logistic regression analysis (OR 0.6, 95% CI 0.4-1.0, P<0.056) whereby females were 40% less likely to contract TB infection as illustrated in table 4.4. However after adjusting for the other factors, as shown in table 4.5, gender was found not to be significant for TB infection.

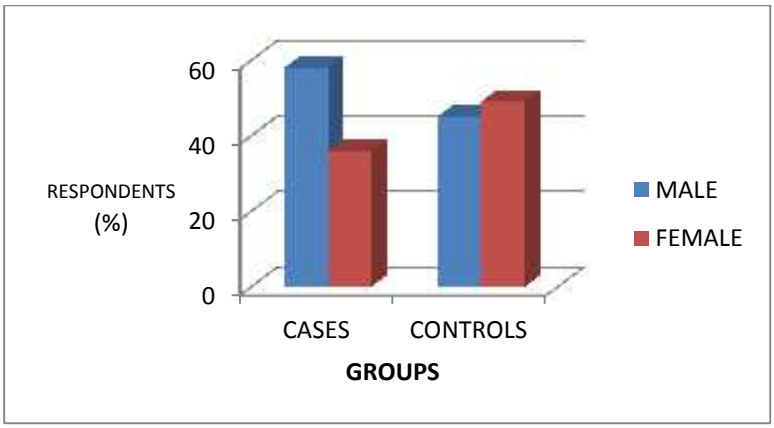

Fig 4.2: Gender of the respondents

4.1.3: Marital Status

Majority of the controls were married (n=79, 84%) as compared to respondents among the cases who were distributed into married (n=49, 52.1%), single and widowed (n=45, 47.9) as depicted in fig 4.3. Compared to being married, the odds of TB were 4.8 higher in the single and windowed individuals (un adjusted OR 4.8, 95% CI 2.4-9.5) as shown in table 4.4. The association was even stronger after adjusting for the other socio demographic, co-morbidities and environmental factors (Adjusted OR 7.1, 95% CI 2.2- 23.2) as shown in table 4.5.

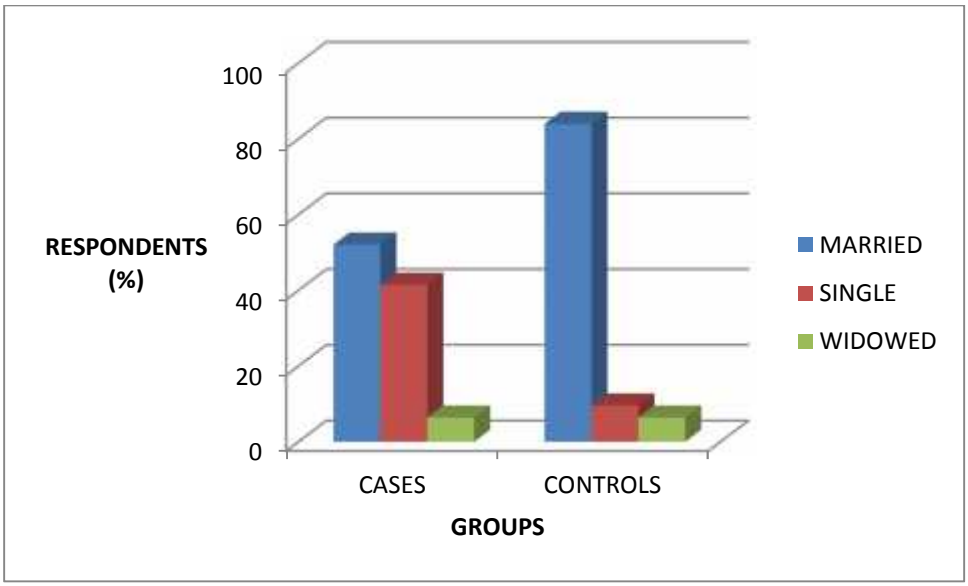

Fig 4.3: Marital status of the respondents

4.1.4: Educational level of Respondents

Majority of the controls had secondary (n=46, 48.9) and tertiary education (n=10, 10.6) as compared to the cases who were mostly primary school graduates (n=56, 59.6%) as shown in fig 4.4. However, the results of the logistic regression analysis shown in table 4.4 ,did not depict an association between the different levels of education and TB where secondary and primary educational levels were compared with university/tertiary education with odds ratios of (1.0, 95% CI 0.3-2.8 and 2.1, 95% CI 0.7-6 respectively).

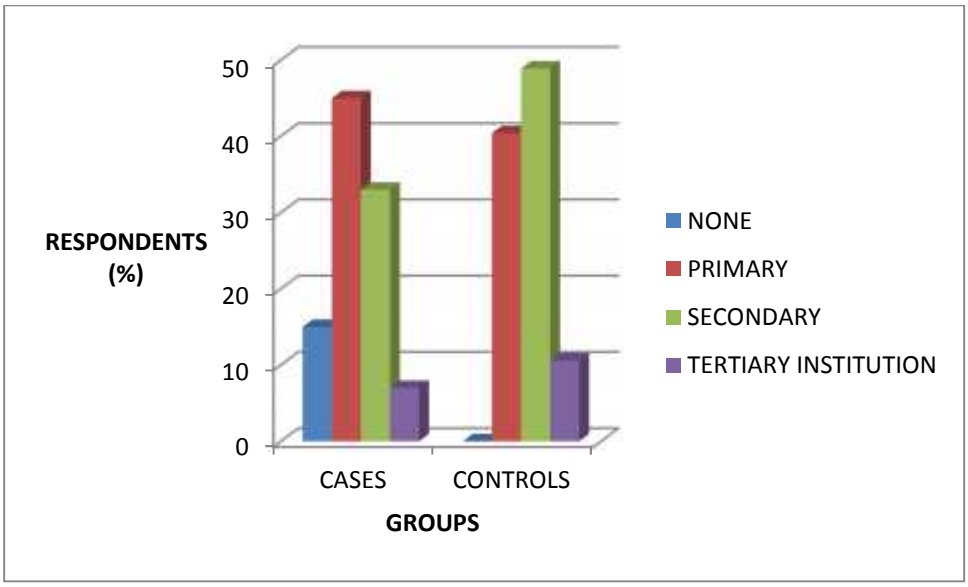

Fig 4.4: Educational level of respondents

4.1.5: Level of income

As illustrated in fig 4.5, majority of the respondents earn less than 5000 ksh per month (n=63, 67% for the controls and n=90, 95.7% for the cases). This corresponds with the occupations held by these respondents and implies that poverty levels are high within the community.

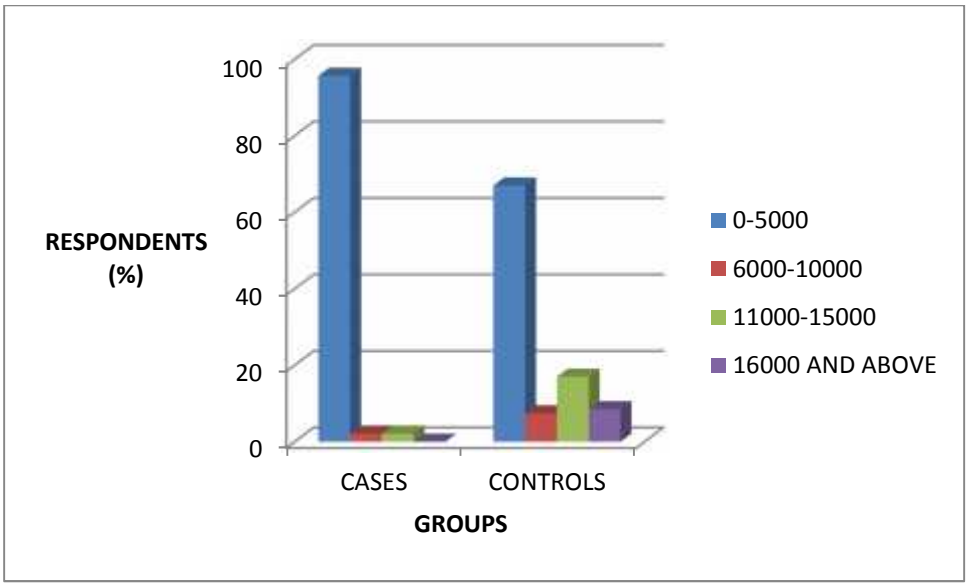

Fig 4.5: Level of income of the respondents

4.2: Biological Factors Affecting Incidence of TB

4.2.1: BMI of Respondents

Fig 4.7 shows the body mass index of the respondents. Among the under weights, majority were cases (n=40, 42.6%) while among the over weights and obese, majority were controls (n=18, 19.1%). As shown in table 4.4, the odds of being a TB case among the underweight was 1.9 higher than individuals with normal weight (un adjusted OR 1.9, 95% CI 1.0-3.8) while being overweight/obese was associated with a 70% less risk of being a TB case (un adjusted OR 0.3 95% CI (0.1-0.8). However after adjusting for the other socio-demographic, environmental and health system factors, the only significant factor was being overweight which showed a negative association (Adjusted OR 0.1, 95% CI 0.02-0.5).This is shown in table 4.5.

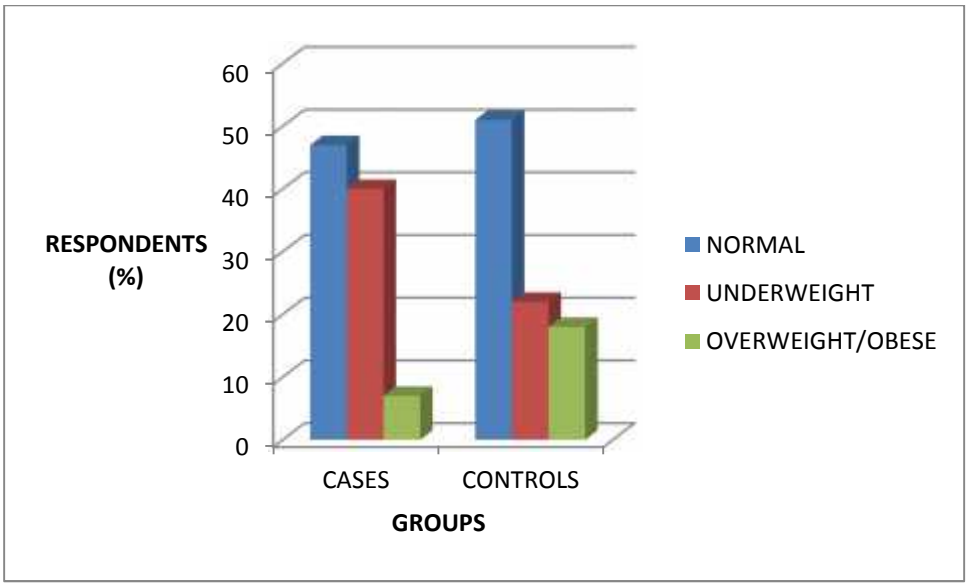

Fig 4.6: BMI of respondents

4.2.2: Previous Episode of TB

Having a previous episode of TB as shown in figure 4.7, was more common with the cases (n=67, 71.3%). Majority of the controls (n=92, 97.9%) did not have any history of TB. The logistic regression results in table 4.4 show a strong association between TB and a positive history of a previous episode of TB (un adjusted OR 18.5, 95% CI 4.2-80.6). The association was even stronger after adjusting for the other factors (Adjusted OR 52.7 95% CI 7.0-396.2) as illustrated in table 4.5.

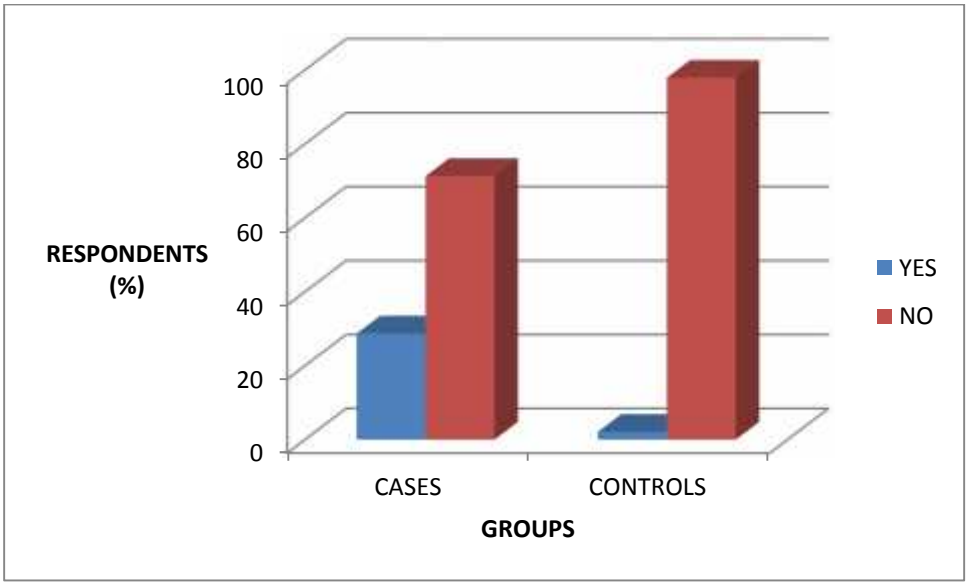

Fig 4.7: Previous episodes of TB

4.2.3: Evidence of Childhood Immunization

As displayed in figure 4.8, majority of respondents in both groups had a BCG scar (n=84, 89.4% for controls and n=68, 72.3% for cases) but among those that did not have a scar, majority were the cases (n=26, 27.7%). As shown in table 4.4 the odds of being a TB case among the individuals without a BCG scar was 3.2 higher as compared to those who had one (un adjusted OR 3.2 95% CI 1.4-7.12) and after adjusting for other factors as illustrated in table 4.5, the association was stronger (Adjusted OR 16.7 95% CI 3.6-77.4).

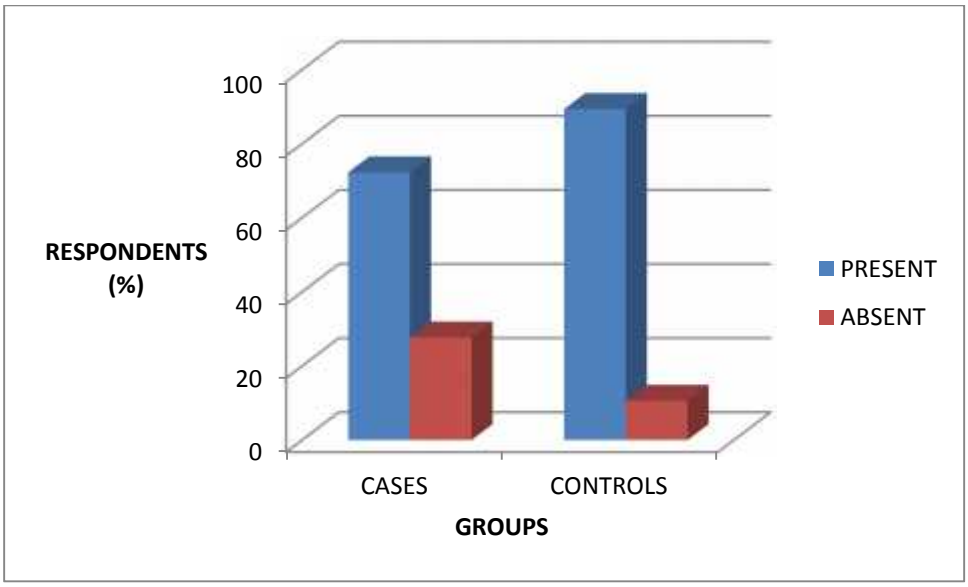

Fig 4.8: Presence of BCG scar

4.2.4: Family History of TB

Figure 4.9 shows the family history of TB among the respondents. Majority of the cases (n=48, 51.1%) had a family history of TB as compared to the controls (n=7, 7.4%). This is supported by the results of the logistic regression analysis which showed that the odds of being a TB case among those with a positive family history was 13 times higher than those with no family history (un adjusted OR 13.0 95% CI 5.4-31.0). The adjusted odds ratio shown in table 4.5 illustrates a stronger association (Adjusted OR 9.7 95% CI 2.5-37.5).

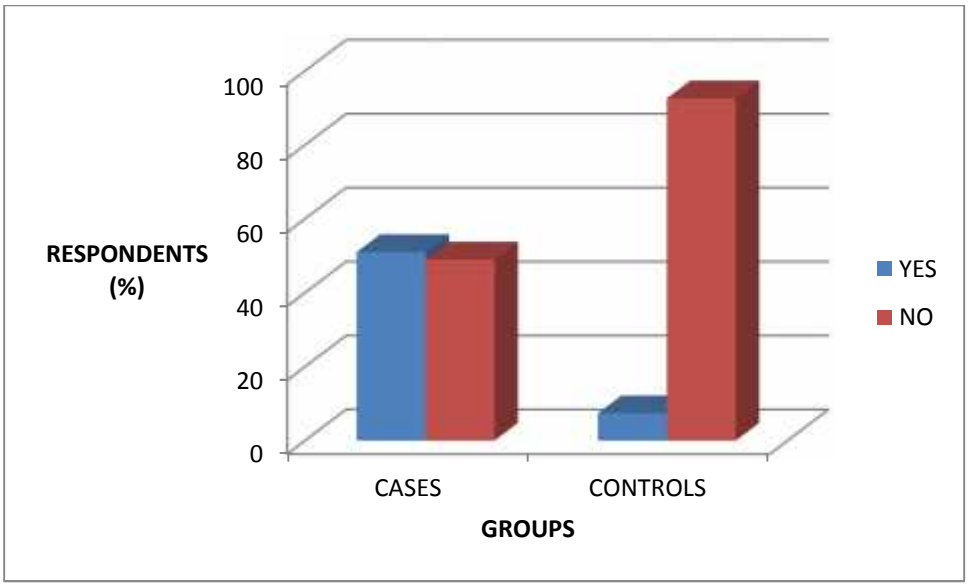

Fig 4.9: Family history of TB

Table 4.1: Smoking habits among respondents

	SMOKING	
	CASES	CONTROLS
NEVER	46(48.9%)	78(83%)
PAST	14(14.9)	9(9.6%)
CURRENT	34(36.2)	7(7.4%)

Smoking was associated with infection with TB. Many of the controls have never smoked (n=78, 83.0%) compared to the cases (n=46, 48.9%). There are more of cases who are current smokers (n=34, 36.2%) compared to the controls (n=7, 7.4%). These are shown in table 4.1. The bivariate logistic regression analysis illustrated in table 4.4 shows an increasing odds of being a TB case between individuals who smoked in the past and those who were currently smoking as compared to those who had never smoked at all (un adjusted OR 2.6 95% CI 1.1-6.6 and OR 8.2 CI 3.4-20.1 respectively). After adjusting for other factors, a stronger association is depicted between current smoking and TB as shown in table 4.5(Adjusted OR 8.6 95% CI 1.8-39.9) while past smoking was no longer a risk factor.

Table 4.2: Alcohol intake habits among respondents

	ALCOHOL INTAKE	
	CASES	CONTROLS
NEVER	50(53%)	68(72.3%)
PAST	13(14%)	17(18.1%)
CURRENT	31(33%)	9(9.6%)

Alcohol drinking was associated with infection with TB. Many of the controls had never taken alcohol (n=68, 72.3%) compared to the cases (n=50, 53%) There are more of cases who were currently drinking (n=31, 33%) compared to the controls (n=9, 9.6%). These are shown in table 4.2. The odds of being a TB case among individuals who were currently drinking was 4.7 times higher than those who had never taken alcohol before (unadjusted OR 4.7, 95% CI 2.0-10.71) while past drinking did not show any association as depicted in Table 4.4. This was however not the case after adjusting for the other factors, where current alcohol drinking was no longer associated with TB (Adjusted OR 2.0 95% CI 0.3-12.2).

Table 4.3: Presence of diabetes among respondents

	DIABETES	
	CASES	CONTROLS
YES	18(19.1%)	5(5.3%)
NO	76(80.9)	89(94.7%)

Most of the respondents in both groups did not have diabetes (n=89, 94.7% for controls and n=76, 80.9%) but among those who reported history of diabetes, majority were TB cases (n=18, 19.1%). Compared to those with no history of diabetes, the odds of TB was 4.2 higher in those with a positive history of diabetes (unadjusted OR 4.2, 95% CI 1.5-12.0) but after adjusting for other factors, there was no significant association between TB and diabetes. This is shown in Tables 4.4 and 4.5 respectively.

4.2.5: Presence of asthma among respondents

Majority of the respondents in both groups did not report a positive history of asthma (n=93, 98.9% for the controls and n=91, 96.8% for the cases). Very few had asthma in both groups.

4.3: Environmental Factors

4.3.1: No. of Adults in the Household

Figure 4.10 shows the number of adults in the household. Majority of respondents in both groups had one to three adults in their households (n=49, 52.1% for cases and n=64, 68.1% for controls) followed by four to six adults (n=39, 41.5% for cases and n=30, 31.9% for controls).

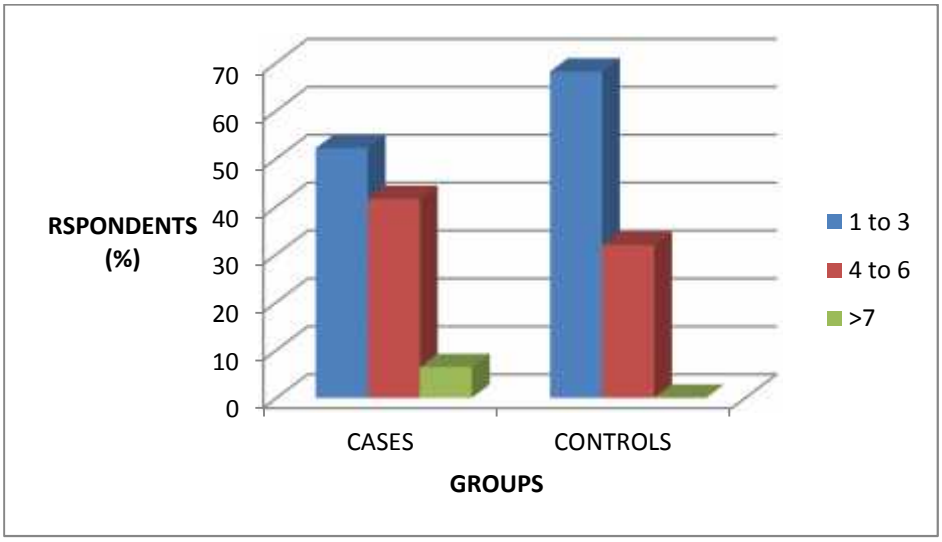

Fig 4.10: Number of adults in the household

4.3.2: No of Windows in the House

As shown in Figure 4.11, one or more windows was the commonest response from the respondents in both groups (n=88, 93.6% for cases and n=94, 100% for controls.

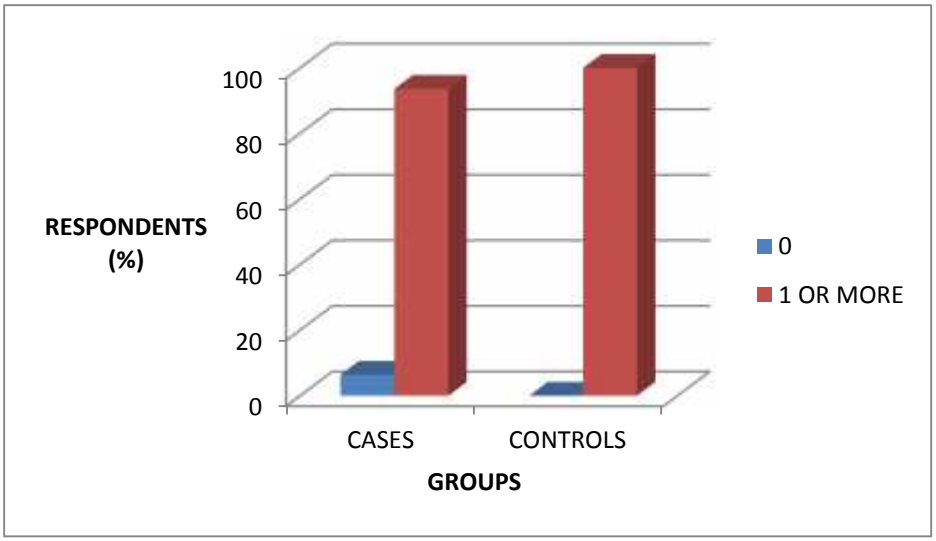

Fig 4.11: Number of windows in the house

Table 4.4: Bivariate logistic regression analysis. Shows the unadjusted Odds Ratios

variables	CASES (n=94) No. (%)	CONTROLS (n=94) No. (%)	OR(95% CI) Unadjusted	
Gender				**P value**
Male(reference)	58(61.7)	45(47.9)		
female	36(38.3)	49(52.1)	0.6(0.4-1)	0.056
Marital status				
Married(reference)	49(52.1)	79(84.0)	1	
Single and widowed	45(47.9)	15(16.0)	4.8(2.4-9.5)	<0.0001
Level of education				
University/tertiary9reference)	7(7.4)	10(10.6)	1	
secondary	31(33.0)	46(48.9)	1.0(0.3-2.8)	0.944
Primary and below	56(59.6)	38(40.4)	2.1(0.7-6)	0.165
Age				
15-24 years(reference)	37(39.4)	35(37.2)	1	
25-34 years	33(35.1)	33(35.1)	0.9(0.5-1.8)	0.871
35 years and above	24(25.5)	26(27.7)	0.8(0.4-1.8)	0.713
Body mass index				
Normal (reference)	47(50%)	51(54.3)	1	
underweight	40(42.6)	22(23.4)	1.9(1.0-3.8)	0.042
Overweight/obese	7(7.4)	18(19.1)	0.3(0.1-0.8)	0.02
BCG scar				
Present(reference)	68(72.3)	84(89.4)	1	
absent	26(27.7)	10(10.6)	3.2(1.4-7.12)	0.004
Previous episode of TB				
no(reference)	67(71.3)	92(97.9)	1	
yes	27(28.7)	2(2.1)	18.5(4.2-80.6)	<0.0001
Family history of TB				
no(reference)	46(48.9)	87(92.6)	1	
yes	48(51.1)	7(7.4)	13.0(5.4-31.0)	<0.0001
Smoking status				
never(reference)	46(48.9)	78(83.0)	1	
past	14(14.9)	9(9.6)	2.6(1.1-6.6)	0.037
current	34(36.2)	7(7.4)	8.2(3.4-20.1)	<0.0001
Alcohol intake				
never(reference)	50(53.2)	68(72.3)	1	
past	13(13.8)	17(18.1)	1.0(0.5-2.3)	0.924
current	31(33.0)	9(9.6)	4.7(2.0-10.71)	<0.0001
Diabetes				
no(reference)	76(80.9)	89(94.7)	1	
yes	18(9.1)	5(5.3)	4.2(1.5-12.0)	0.007

All significant variables were modeled to obtain adjusted Odds Ratios for the variables associated with TB

Table 4.5: shows adjusted OR for TB by socio-demographic, biological and environmental factors

variables	CASES **(N=94) No. (%)**	CONTROLS **(N=94) No. (%)**	OR**(95% CI) Adjusted**	**P value**
Marital status				
Married(reference)	49(52.1)	79(84.0)	1	
Single and widowed	45(47.9)	15(16.0)	7.1(2.2-23.2)	0.001
Body mass index				
Normal (reference)	47(50%)	51(54.3)	1	
underweight	40(42.6)	22(23.4)	0.3(0.07-1.1)	0.06
Overweigh/obese	7(7.4)	18(19.1)	0.10(0.02-0.5)	0.005
Presence of BCG scar				
Present(reference)	68(72.3)	84(89.4)	1	
absent	26(27.7)	10(10.6)	16.7(3.6-77.4)	<0.0001
Previous episode of TB				
no(reference)	67(71.3)	92(97.9)	1	
yes	27(28.7)	2(2.1)	52.7(7.0-396.2)	<0.0001
Family history of TB				
no(reference)	46(48.9)	87(92.6)	1	
yes	48(51.1)	7(7.4)	9.7(2.5-37.5)	0.001
Smoking habit				
never(reference)	46(48.9)	78(83.0)	1	
past	14(14.9)	9(9.6)	3.9(0.5-29.9)	0.179
current	34(36.2)	7(7.4)	8.6(1.8-39.9)	0.006
Alcohol intake				
never(reference)	50(53.2)	68(72.3)	1	
past	13(13.8)	17(18.1)	0.9(0.2-4.6)	0.945
current	31(33.0)	9(9.6)	2.0(0.3-12.2)	0.429
Diabetes present				
no(reference)	76(80.9)	89(94.7)	1	
yes	18919.1)	5(5.3)	2.1(0.5-9.2)	0.311

4.4: Health System Factors

4.4.1: Key Informant Interview

According to the health care managers, TB is associated with a lot of stigma at the community level. That it is believed to be a sign of HIV/AIDS. One of the managers had this to say "*there is need to intensify health promotion and awareness creation at the community level in order to minimize the stigma associated with TB. Otherwise, patients will be coming when it is rather too late*". On the DOTS strategy, it was reported that it was rarely done. Patients picked their drugs and no one monitored the daily swallowing of the tablets. Another participant had this to say "*the fact that patients are not monitored, could be contributing to the rising number of multi drug resistant (MDR) TB in the sub county*". There were 6 MDR cases on treatment in the sub County. Though all facilities have community health workers, contact tracing is poorly done. The reasons given for this was that the health workers were not keen on follow ups because of the work load and the community health workers were not motivated enough to do it because they were not paid any stipend. On TB screening, it was not routinely done at the out patients. Only the patient support centers for the HIV/AIDS patients routinely screened for TB.

CHAPTER FIVE: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Discussion

Several studies have explored the risk factors for Mycobacteria Tuberculosis infection in developing countries. Most of the studies are in agreement that HIV is a major risk factor for the development of both pulmonary and extrapulmonary tuberculosis. However, this is not always the case as other factors have also been found to play a role in the development of pulmonary tuberculosis. The purpose of this study was to determine the risk factors associated with TB infection among the HIV negative TB patients in Bomachoge Chache sub-county. The risk factors were classified into three major groups i.e. the host factors, environmental factors and health system factors.

While other studies have shown a strong positive association between TB infection and male gender (Neely et al 2009, Goldhaber-Fiebert et al 2011 and Aliyu et al 2013), this study indicates only a marginal association whereby females were 40% less likely to contract TB infection. After adjusting for the other factors, gender was found not be significant in TB infection. This is contrary to a study carried out in Afghanistan by Sabawoon and Sato (2012) who noted that infection rates were higher among women than men. However, the results of the study may not have been conclusive as more women in Afghanistan use health care services as compared to men (Sabawoon and Sato 2012).

The logistic regression analysis done in this study did not show any association between TB infection and age of individuals although this was anticipated as the cases were age matched with the controls. This finding is contrary to a number of studies which have reported a positive association (Narasinhan et al 2012, Ndungu et al 2013, Stenton et al 2010).

It was observed that being single or widowed was a significant determinant of TB contraction. The association was even stronger after adjusting for the other socio demographic factors, co-morbidities and environmental factors. These results are consistent with findings by Liestol et al (2008), Gustafson (2003) and Lienhardt et al (2005) who indicated in their studies that married individuals have lower odds for TB infection than their single counterparts. However, Ndungu et al (2013), notes that there is no association between TB infection and marital status. The differences noted from the above studies, Ndungu and others (2013) is the methodology used in

analysis of the variables and the control of confounding variables. The probable explanations as to why married individuals have a lower risk of TB infection are many. One of the theoretical explanations is that married individuals have children and some studies have shown that living with children is protective due to the fact that children are immunized against TB and they are likely to confer herd immunity to the adults. Other explanations could be that single individuals are single due to the fact that they cannot afford to have a family and could be living with relatives therefore increasing the number of people living in the house leading to overcrowding. This is in keeping with a number of studies which have reported a positive association between TB infection and overcrowding (Ndungu et al 2013, Gustafson et al 2003 and Lienhardt et al 2005).

Studies have indicated that malnutrition increases the risk of TB infection because of an impaired immune response associated with malnutrition. This study shows that being underweight was positively associated with TB infection. After adjusting for the other socio demographic factors, environmental factors and health system factors, the only significant factor was being overweight which showed a negative association. However, these results should be considered valid in light of the fact that TB in itself can lead to malnourishment due to a decrease in appetite and other changes in metabolic processes (Narasinhan et al 2013).

Many studies have cited cigarette smoking as a risk factor in a number of infectious and non infectious diseases. Comparing alcohol intake and smoking, it was observed that only smoking is strongly correlated with TB infection. People who are current smokers had an 8.6 times risk of acquiring TB infection. This finding may support other studies with the same conclusion that smoking is a risk factor for TB infection (Gajalakshmi and Peto 2009, Narasinhan et al 2012, Ndungu et al 2013). The theoretical explanation is that tobacco smoking causes alteration of the immune system, specifically the pathophysiological changes in the lungs induced by chronic smoking (Lienhardt et al 2005). Although, the study findings do not show any association between TB infection and alcohol intake, other studies have depicted that alcoholics may be at a higher risk of infection. Kuznetsov et al (2013) notes that alcohol psychoses, a consequence of excessive chronic alcohol consumption is positively associated with TB incidence in their time series analysis of incidence of TB and alcohol consumption. There could be a relationship between chronic alcohol consumption and TB infection owing to the reduced immunity in people

who are chronic alcohol drinkers. However, this study was not able to determine how much the current alcohol drinkers were taking.

Many studies have shown significant relationships between co morbidities and TB infection. The specific co morbidities that were considered in this study were asthma and diabetes mellitus. Asthma was found not to be significantly associated with TB while diabetes mellitus was significant. However, after adjusting for socio demographic factors, environmental and health system factors, this co morbidity was found not to be significantly associated with TB infection. This is inconsistent with findings by Narasimhan et al (2013), who noted that TB infection rates were five times higher in people with diabetes mellitus after potential confounders were controlled for. In yet another study by Aliyu et al (2013), it was noted that the odds of a positive history of diabetes mellitus among Multi Drug Resistance TB (MDR TB) were more than threefold than in cases without resistance but there was marginal significance. Biological evidence shows that diabetes mellitus impairs the innate and adaptive immune responses thereby accelerating the proliferation of TB and other infections (Narasimhan et al 2013). Therefore, it can be concluded that there is a positive association between diabetes mellitus and TB infection. However, the variations in the findings could be explained by lack of evidence with regard to the control of diabetes mellitus among the cases. It is logical that uncontrolled diabetes mellitus impairs the immune system and therefore may increase the risk of infections include TB.

It was observed that absence of a BCG scar was significantly associated with TB infection. It was noted that the odds of being a TB case among the individuals without a BCG scar was 3.2 times higher as compared to those who had a scar. The association was much stronger after adjusting for the probable confounding factors. This implies that being immunized against TB during childhood is associated with less cases of TB infection. This finding is in keeping with a number of studies which have also shown that BCG vaccine seems to have a protective effect in adults decades after vaccination and this finding has important implications for national policy of BCG vaccination (Pei-Chun Chan et al 2013, Oni et al 2012). A systematic review of randomized control trials by Mangtani et al 2013, confirm that absence of prior *M. tuberculosis* infection or sensitization with environmental mycobacteria is associated with higher efficacy of BCG against pulmonary tuberculosis and possibly against miliary and meningeal tuberculosis. The authors argue that prior infection may mask or block the effects of vaccination. Though,

results from this study show a strong correlation between TB infection and presence of BCG scar, it should be noted that there is a possibility that some of the respondents who did not have a scar were immunized against TB infection.

It was observed that both previous episode of TB and family history were strongly associated with TB infection after adjusting for the probable confounding factors. This results are consistent with findings by Wang et al (2012) who indicate that reactivation of TB is common among individuals with a previous episode of TB. Lienhardt et al (2005), in their case control study examining risk factors for TB infection also confirms that a positive family history is a risk factor for TB infection due to its nature of transmission.

Environmental factors such as overcrowding and poor housing have been linked with infectious/communicable diseases like tuberculosis (Ndungu et al 2013, Akhtar et al 2006, Narasimhan et al 2013). Contrary to these studies, it was observed that the number of adults living in the house with the respondents was not significantly associated with TB infection. These results may be inconclusive as other studies have shown contradicting results. This could probably be due to the small sample size that was used.

5.2: Conclusion

There are a number of host related factors that were demonstrated to have an association with TB infection. Being single or widowed was a significant determinant of TB contraction. The association was even stronger after adjusting for the other socio demographic factors, co-morbidities and environmental factors.

Comparing alcohol intake and smoking, only smoking was strongly correlated with TB infection. People who are current smokers had an 8.6 times risk of acquiring TB infection.

The absence of a BCG scar was significantly associated with TB infection. It was noted that the odds of being a TB case among the individuals without a BCG scar was 3.2 times higher as compared to those who had a scar.

A previous episode of TB and family history of TB were strongly associated with TB infection after adjusting for the probable confounding factors. This is because reactivation of TB is common among individuals with a previous episode of TB as observed from previous studies.

For the health system factors, TB screening at the out patients and follow up of contacts of index cases is not done comprehensively in the health facilities as revealed by the health managers. They also revealed that the DOTS strategy was poorly implemented and that TB was associated with a significant level of stigma.

5.3: Recommendations

Biological factors

1. Health policy makers should come up with a policy that requires people with previous history of TB to be screened at pre-determined intervals to assess risk of contracting TB.
2. Health managers should ensure that BCG immunization coverage is expanded to include every child.
3. Health promotion officers should offer health education on the harmful effects of tobacco smoking to the general population and advised on how to break the addiction.

Health system factors

4. Health facility managers should ensure that contacts of index TB patients are traced and screened for TB and diabetes. Facilities should make use of the gene expert machines to screen the contacts by making use of the several sessions they have with the patients.
5. Public health officers should fast track the Implementation of the DOTS strategy to ensure that all patients take their medication as prescribed. Each patient should be attached to a community health volunteer who will ensure that their drugs are swallowed at the prescribed time and dose.
6. All stakeholders in health should intensify TB awareness at the community. Knowledge on what causes TB and how it is transmitted should constitute the messages. This will help in reducing stigma.
7. The county government should consider giving the community health volunteers a monthly stipend as a form of motivation and appreciation of their efforts in defaulter tracing and community education.

5.4: Recommendations for Further Research

A community survey to explore the role of environmental health factors in the acquisition and spread of tuberculosis

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APPENDICES

APPENDIX: 1

QUESTIONAIRE FOR TB PATIENTS ATTENDING CLINIC AT HEALTH FACILITIES IN GUCHA DISTRICT, KISII COUNTY.

Date_____ Code_____

SECTION 1: Host –Related Factors

1) Gender

Male ( ) Female ( )

2) What is your age category

15-24 years ( )

25-34 years ( )

35- 44 years ( )

45-54 years ( )

> 55 years ( )

3) Weight) _____ height)_____ BMI)_____

4) Confirmation of a BCG scar.

Present ( )

Absent ( )

5) What is your marital status? Tick where appropriate.

Married ( )

Divorced ( )

Single ( )

Widowed ( )

6) What is your present occupation?

1. None ( )
2. Self-employed ( )
3. Civil servant ( )

4. Local government employee ( )
5. Non-governmental service ( )
6. Others

(Specify)_____

7). What is the highest educational level you attained?

1. None ( )
2. Primary ( )
3. Secondary ( )
4. University/ tertiary institution ( )
5. Other

(Specify)_____

8). what is your level of income per month?

Ksh. 1000 – 5000 ( )
Ksh. 6000 – 10000 ( )
Ksh. 11000 – 15000 ( )
Ksh. 16000 – 20000 ( )
Ksh. 20000 and above ( )

9. Have you ever had a previous episode of TB?

Yes ( )
No ( )

10. Do you have a family history of TB?

Yes ( )
No ( )

11. Do you smoke?

Never( )
Past( )
current( )

12. Do you take alcohol?

Never( )

Past( )

current( )

13. Do you suffer from diabetes

Yes ( )

No ( )

14. Do you suffer from Asthma?

Yes ( )

No ( )

SECTION 2: ENVIRONMENTAL FACTORS

15) How many adults live in your household?

1-**3**	**( )**
4-6	( )
>7	( )

16) How many windows does your house have?

0	( )
1	( )
2 or more	( )

Thank you for your participation

APPENDIX 2

INTERVIEW SCHEDULE FOR HEALTH CARE PROVIDERS OF BOMACHOGE CHACHE SUB COUNTY HEALTH FACILITIES, KISII COUNTY

The interview schedule is prepared to facilitate in the collection of relevant data for an academic research whose aim is to study the host- related and environment- related factors associated with the development of tuberculosis among the HIV negative tuberculosis patients in Bomachoge Chache Sub County. The information collected will only be used for this study and shall be treated with strict confidentiality.

1. Highlight some of the factors influencing utilization of TB services in this Health facility.
2. In your own opinion, describe how the following health system factors influence the utilization of TB services.
   i) Health infrastructure availability and more especially Lab services.
   ii) Number, qualification, distribution of HCPs available for provision of TB services.
3. What do you do to promote and create awareness about TB services?
4. What challenges do you encounter when you seek to promote TB services?
5. What measures have you put in place to ensure defaulter and contact tracing is done effectively?
6. Does the facility implement the DOTS strategy?
   1. No ( )
   2. Sometimes ( )
   3. Yes ( )
7. Do you regularly meet with stakeholders to discuss issues affecting TB transmission?
   4. No ( )
   5. Sometimes ( )
   6. Yes ( )

APPENDIX 3

NUMBER OF TB PATIENTS ATTENDED TO AT GUCHA DISTRICT HEALTH FACILITIES BETWEEN 1ST JULY 2012 TO 30TH JUNE 2013

Data element	(Children <14yrs, Female)	(Children <14yrs, Male)	(Adult >14yrs, Female)	(Adult >14yrs, Male)	Children <14yrs	Adult >14yrs	Female	Male	Total
TB cases detected	11	10	122	111	21	233	133	##	254
Smear positive TB	4	3	41	39	7	80	45	42	87
Smear negative TB	5	7	54	45	12	99	59	52	111
Extra-Pulmonary TB patients	3	5	17	8	8	25	20	13	33
Re-treatment TB patients	1	2	6	3	3	9	7	5	12
TB Patients tested for HIV	5	5	67	56	10	123	72	61	133
TB patients HIV+ve	1	2	28	21	3	49	29	23	52
TB HIV patient on CPT	1	2	22	22	3	44	23	24	47
TB Defaulters	2	1	5	3	3	8	7	4	11
TB patients completed treatment	4	5	42	58	9	100	46	63	109
TB deaths			12	14		26	12	14	26

Shows the number of TB Patients July 2012-june 2013.Gucha District

Source: Gucha District Health Information System 2013

APPENDIX 4

PARTICIPANTS' CONSENT FORM

This is a study aimed at determining the host- related and environment- related factors that play a role in the development of tuberculosis among the HIV negative tuberculosis patients in Bomachoge chache Sub County. It is a study for the award of a degree in Master of Public Health. You are kindly requested to participate voluntarily without any compulsion or inducement and to be honest and truthful as much as possible. The stated facts shall be strictly confidential and shall only be used for the purpose of the research. No name shall be mentioned anywhere in the forms to promote confidentiality. Your participation will contribute to the improvement of the management of TB patients in the district. You are free to refuse or withdraw from participating in this study if you find it necessary. This will not in any way affect the quality of care that you will receive.

In case you want to know the results from this study or have any complaints, dissatisfaction or disagreements please do not hesitate to contact the following:

Dr Richard Onkware on cell phone number 0721236582

I have been clearly explained to and fully understand the purpose of this study and freely consent to participate. I have signed below to confirm this.

Signature …… Date …….

I, the undersigned, have fully explained the relevant details of this study to the person whose signature has been appended above.

Name of Principle Investigator/Research assistant…….

Signature…….. Date…….

Witness …….. Signature …….. Date……..

APPENDIX 5: MAP OF THE STUDY SITE

Source: Kenya Bureau of Statistics