FACTORS ASSOCIATED WITH DEFAULT FROM TREATMENT AMONG TUBERCULOSIS PATIENTS IN NAIROBI PROVINCE, KENYA

BY

BERNARD N. MUTURE (B.Sc. Chemistry)
Reg. No. 157/12699/2005

Thesis submitted in partial fulfillment of the requirements for the award of the Degree of Master of Public Health in the School of Health Sciences of Kenyatta University.

May 2009
DECLARATION

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

Signature Bernard N. Muture Date 14/05/2009

Bernard N. Muture

157/12699/2005

Department of Public Health

SUPERVISORS’ APPROVAL

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

1. Signature Dr. Margaret Keraka (PhD) Date 14/05/09

Dr. Margaret Keraka (PhD)

Department of Public Health

Kenyatta University

2. Signature Prof. Ephantus W. Kabiru (PhD) Date 21/08/09

Prof. Ephantus W. Kabiru (PhD)

Department of Pathology

Kenyatta University
DEDICATION

I dedicate this work to the Late Dr. Geoffrey Griffin, former Director, Starehe Boys' Centre, Mrs. Jane Hornbaek of Stege, Denmark, my mother Hannah, my wife Jane, and my children Peris, Kenneth, Ann and Joe.
ACKNOWLEDGEMENT

I am grateful to my supervisors, Dr. Margaret Keraka and Prof. Ephantus Kabiru, both of Kenyatta University for guidance and valuable assistance from conception to conclusion of this thesis. Valuable technical advice and issues on logistics and introduction to TB coordinators and those in charge of facilities in various TB zones and health facilities were provided by Dr. Peter Kimuu of the National Leprosy and Tuberculosis Programme, Nairobi Province. Contributions from Mr. Francis Oguya of Kenyatta University during the designing and development of the study proposal are highly appreciated. Dr. Joseph Sitienei and Mr. David Malusi of NLTP central unit availed valuable background information and country data on tuberculosis control. Several District Tuberculosis and Leprosy Coordinators in various zones were very helpful during data collection and especially during defaulter tracing. Health care workers in the sampled facilities assisted in various capacities during the desk review of the TB facility registers. Through the tireless efforts of the community health workers in various health facilities, tracing of defaulters was made possible. All those who in one way or the other contributed to ensure completion of this study are highly acknowledged and their contributions highly appreciated.
TABLE OF CONTENTS

Declaration ..................................................................................................................II
Dedication ..................................................................................................................III
Acknowledgement ....................................................................................................IV
Table of Contents ..................................................................................................... V
List of Tables............................................................................................................ IX
List of Figures .......................................................................................................... X
List of Appendices .................................................................................................. XI
Definition of Operational Terms ............................................................................ XII
Abbreviations and Acronyms .................................................................................. XIII
Abstract .................................................................................................................. XV

CHAPTER ONE INTRODUCTION ............................................................................ 1
1.1: Background Information ................................................................................ 1
1.2: Statement of the Problem .............................................................................. 3
1.3: Justification ..................................................................................................... 4
1.4: Research Questions ........................................................................................ 5
1.5: Null Hypothesis ............................................................................................. 5
1.6: Objectives ....................................................................................................... 5
1.6.1: Broad Objective ........................................................................................ 5
1.6.2: Specific Objectives: .................................................................................. 5
1.7: Significance of Study ..................................................................................... 6
1.8: Delimitations and Limitations ....................................................................... 6

CHAPTER TWO LITERATURE REVIEW ................................................................ 8
2.1: Historical Background of Tuberculosis......................................................... 8
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2: Burden of Tuberculosis</td>
<td>9</td>
</tr>
<tr>
<td>2.3: Transmission of Tuberculosis</td>
<td>10</td>
</tr>
<tr>
<td>2.4: Clinical Manifestation of Tuberculosis</td>
<td>11</td>
</tr>
<tr>
<td>2.5: Diagnosis of Tuberculosis</td>
<td>12</td>
</tr>
<tr>
<td>2.6: Management of Tuberculosis</td>
<td>14</td>
</tr>
<tr>
<td>2.6.1: Chemotherapy Of Tuberculosis</td>
<td>14</td>
</tr>
<tr>
<td>2.6.2 Preventive Therapy (Prophylaxis) of Tuberculosis</td>
<td>17</td>
</tr>
<tr>
<td>2.7: Tuberculosis Treatment Outcomes</td>
<td>18</td>
</tr>
<tr>
<td>2.8: Non-Adherence and Default from TB Treatment</td>
<td>19</td>
</tr>
<tr>
<td>2.8.1: Interruption of Tuberculosis Treatment</td>
<td>19</td>
</tr>
<tr>
<td>2.8.2: Reasons and Factors Associated with Default from Tuberculosis Therapy</td>
<td>20</td>
</tr>
<tr>
<td>CHAPTER THREE MATERIALS AND METHODS</td>
<td>25</td>
</tr>
<tr>
<td>3.1 Study Area</td>
<td>25</td>
</tr>
<tr>
<td>3.2 Study Design</td>
<td>25</td>
</tr>
<tr>
<td>3.3 Study Variables</td>
<td>26</td>
</tr>
<tr>
<td>3.3.1 Independent Variables</td>
<td>26</td>
</tr>
<tr>
<td>3.3.2 Dependent Variables</td>
<td>26</td>
</tr>
<tr>
<td>3.4: Target and Study Populations</td>
<td>26</td>
</tr>
<tr>
<td>3.5: Inclusion and Exclusion Criteria</td>
<td>27</td>
</tr>
<tr>
<td>3.6 Sampling Techniques</td>
<td>27</td>
</tr>
<tr>
<td>3.6.1 Sample Size Determination</td>
<td>28</td>
</tr>
<tr>
<td>3.7 Research Instruments</td>
<td>29</td>
</tr>
<tr>
<td>3.8 Pre-Testing of Questionnaire</td>
<td>29</td>
</tr>
<tr>
<td>3.9 Data Collection Technique</td>
<td>30</td>
</tr>
<tr>
<td>3.10 Data Analysis</td>
<td>30</td>
</tr>
</tbody>
</table>
CHAPTER FOUR RESULTS AND DISCUSSION

4.1: Characteristics of the Study Population

4.1.1 Characteristics of the Study Population Stratified for Treatment Defaulters and Non-Defaulters

4.2: Prevalence of Default from Tuberculosis Treatment in Nairobi

4.3: Duration in Tuberculosis Therapy before Default

4.4: Factors Associated with Default from Tuberculosis Treatment

4.4.1: Reasons TB Treatment Defaulters Attributed to their Default

4.4.2: Association of Social Demographic and Socioeconomic Factors with Default

4.4.3: Association of Knowledge and Perceptions on Tuberculosis with Default

4.4.4: Disease and Treatment Factors Associated with Default

4.4.5: Association of Health-Care Provider Factors with Default

4.4.6: Health-Care Personnel Factors Associated with Default

4.4.7: Factors Independently Associated with Treatment Default Outcome

4.5: Discussion

5.1: Conclusions

5.2: Recommendations

5.3: Implications of the Findings

5.4: Recommendation for Further Research

REFERENCES
APPENDICES
LIST OF TABLES

Table 1.1: Tuberculosis Case Notifications in Nairobi and National (Kenya), 2000-2005 ....3

Table 4.1 Number of Sampled Facilities and Patients in each TB Control District of Nairobi ................................................................................................................................................ 33

Table 4.2: Demographic and Socioeconomic Characteristics of the Study Population.......36

Table 4.3: Prevalence of Default from Tuberculosis Treatment in Districts of Nairobi in 2006....................................................................................................................................................39

Table 4.4: Analysis of Association of Social Demographic and Socioeconomic Factors with Default Outcome. ................................................................................................................................................ 47

Table 4.5: Univariate Analysis of Association of Knowledge on Tuberculosis with Default ....................................................................................................................................................50

Table 4.6: Univariate Analysis of Association between Disease and Treatment Factors with Default ....................................................................................................................................................54

Table 4.7: Univariate Analysis Results of Association of Health Facility Factors with Default ....................................................................................................................................................57

Table 4.8: Univariate Analysis of Association of Attitude of Health Care Personnel with Default....................................................................................................................................................59

Table 4.9: Multivariate Logistic Regression Analysis of Independent Association of Factors with Default....................................................................................................................................................60
LIST OF FIGURES

Figure 4.1: Monthly income levels (in Kshs) for the study population ..........................33

Figure 4.2: Distribution of defaulters and the successfully treated patients in 5-year age
groups (n=1978) ........................................................................................................35

Figure 4.3: Monthly income-levels (in Kshs) for defaulters and the successfully treated
patients in Nairobi .........................................................................................................37

Figure 4.4: Highest level of education attained by defaulters and the successfully treated
patients in Nairobi .........................................................................................................37

Figure 4.5: Prevalence of default from tuberculosis treatment in the TB control districts of
Nairobi in 2006 ............................................................................................................39

Figure 4.6: Distribution of defaulters and the month from initiation of medication when
treatment was terminated (n=912) .............................................................................41

Figure 4.7: Kaplan-Meier survival analysis for TB treatment defaulters surviving in the
treatment over different lengths of time for patients on the 6 and 8-month regimen in Nairobi
(n=798) .......................................................................................................................42

Figure 4.8: Reasons for defaulting TB treatment in Nairobi ........................................43

Figure 4.9: Distribution of TB patients by diseases and health conditions suspected prior to
TB diagnosis ..................................................................................................................51

Figure 4.10: Distribution of TB patients by perceptions of the tuberculosis disease in
communities and societies they came from ....................................................................51
LIST OF APPENDICES

Appendix 1: Study Area ................................................................. 79

Appendix 2: An overcrowded and poorly ventilated low income settlement where some of the TB patients in Nairobi live ................................................. 80

Appendix 3: Sampling frame .......................................................... 81

Appendix 4: Questionnaire .............................................................. 82

Appendix 5: Research Authorization ............................................... 89
DEFINITION OF OPERATIONAL TERMS

**Defaulter:** A tuberculosis patient who fails to attend two consecutive treatment appointments. If efforts to motivate a defaulter to return to treatment fail to ensure resumption of treatment, the patient is considered to have gone 'Out Of Control'. Patients in both categories formed the cases in this study.

**Case:** A case was defined as any patient registered in Nairobi for TB treatment who defaulted from treatment or went 'out of control' from 1st January 2006 to 31st March 2008.

**Control:** A control was defined as any patient registered in Nairobi for TB treatment and was either cured or completed treatment from 1st January 2006 to 31st March 2008.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFB</td>
<td>Acid-Fast Bacilli</td>
</tr>
<tr>
<td>AIDS</td>
<td>Acquired Immunodeficiency Syndrome</td>
</tr>
<tr>
<td>aOR</td>
<td>Adjusted Odds Ratio</td>
</tr>
<tr>
<td>ART</td>
<td>Anti-Retroviral Therapy</td>
</tr>
<tr>
<td>ARVs</td>
<td>Anti-Retroviral drugs</td>
</tr>
<tr>
<td>BCG</td>
<td>Bacillus Calmette Guerin</td>
</tr>
<tr>
<td>CBO</td>
<td>Community Based Organization</td>
</tr>
<tr>
<td>CHW</td>
<td>Community Health Worker</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence Intervals</td>
</tr>
<tr>
<td>CNR</td>
<td>Case Notification Rate</td>
</tr>
<tr>
<td>CV</td>
<td>Community Volunteer</td>
</tr>
<tr>
<td>DOTS</td>
<td>Directly Observed Therapy Short Course</td>
</tr>
<tr>
<td>DTC</td>
<td>Diagnostic Testing and Counseling</td>
</tr>
<tr>
<td>DTLC</td>
<td>District Tuberculosis and Leprosy Coordinator</td>
</tr>
<tr>
<td>EH</td>
<td>Ethambutol and isoniazid drugs combination</td>
</tr>
<tr>
<td>FBO</td>
<td>Faith Based Organization</td>
</tr>
<tr>
<td>FDC</td>
<td>Fixed Dose Combinations</td>
</tr>
<tr>
<td>GOK</td>
<td>Government of Kenya</td>
</tr>
<tr>
<td>HCW</td>
<td>Health Care Worker</td>
</tr>
<tr>
<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
</tr>
<tr>
<td>IUATLD</td>
<td>International Union against Tuberculosis and Lung Diseases</td>
</tr>
<tr>
<td>LTBI</td>
<td>Latent tuberculosis infection</td>
</tr>
<tr>
<td>MDG</td>
<td>Millennium Development Goals</td>
</tr>
<tr>
<td>MDR-TB</td>
<td>Multi drug resistant tuberculosis</td>
</tr>
</tbody>
</table>
MOH  Ministry of Health
NGO  Non Governmental Organizations
NLTP  National Leprosy and Tuberculosis Programme
OR  Odds Ratio
PPD-S  Purified Protein Derivative-Standard
PTB  Pulmonary Tuberculosis
PTB-  Smear negative Pulmonary Tuberculosis
PTB+  Smear positive Pulmonary Tuberculosis
PTLC  Provincial Tuberculosis and Leprosy Coordinator
RH  Rifampicin and isoniazid drugs combination
RHE  Rifampicin, isoniazid and ethambutol drugs combination
RHZE  Rifampicin, isoniazid, pyrazinamide and ethambutol drugs combination
SCC  Short Course Chemotherapy
SRHZE  Streptomycin, rifampicin, isoniazid, pyrazinamide and ethambutol drugs combination
TB  Tuberculosis, also Tubercle Bacilli
WHO  World Health Organization
ZN  Ziehl-Neelsen stain
ABSTRACT

Tuberculosis is caused mainly by *Mycobacterium tuberculosis*. It affects all tissues and organs except hair, teeth and nails. Over 2 billion people were estimated to be infected with the *tubercle bacilli* in 2005. The immune system is able to contain the bacillus. Only 10% of infections progress to clinical disease. Over 90% of global TB cases and deaths occur in the developing countries. The WHO estimates an incidence of 207,311 new cases in Kenya and 44,576 tuberculosis related deaths annually. Kenya is ranked 10th among countries with high tuberculosis burden. Tuberculosis treatment requires use of combination of drugs for 6-8 months. Adherence is vital for successful cure and prevention of drug resistance and treatment failure. In the year 2005, 7.6% of patients defaulted from treatment nationally. The high default rate in the country impedes the achievement of the global target to successfully treat 85% of detected TB cases. Treatment adherence is a complex issue and improving treatment outcomes for tuberculosis requires a full understanding of the factors that prevent people from taking medicines correctly and those that help them complete their treatment. Determination of predictive factors for default was thus justified for early interventions and for policy and strategy formulation to address non-compliance of TB treatment. Default from treatment enhances risk of developing multi-drug resistant tuberculosis, lowers treatment success rates and increases cost of treatment.

The objective of this study was to determine factors associated with default from tuberculosis treatment in Nairobi. A Case-Control study was used. Defaulters formed the case and the successfully treated the control group. Secondary data from conveniently sampled treatment facilities was used. Further, cases and controls were traced and interviewed using a structured questionnaire. The response variable was default outcome. Independent variables included drug side-effects, knowledge on TB, access to health care, stigmatization, HIV co-infection and demographic and socioeconomic factors among others. Data was analyzed using SPSS and Epi Info statistical software. Descriptive statistics and analyses of contingency tables to determine association were used. Chi-Square, Fishers exact tests and confidence intervals were used to establish significance. Multivariate logistic regression modeling of associated factors and Kaplan-Meier method to determine probability of staying in treatment over time were employed. Results revealed a 16.7% prevalence of treatment default in Nairobi. Default occurred most frequently during the initial three months of treatment. Among defaulters who were AFB smear positive at initiation of treatment, 47.7% defaulted before conversion was confirmed. Major reasons for default included ignorance, traveling, feeling better, side effects, opting for herbal medication, alcohol use, inadequate food, poor facility factors and stigma. Factors independently associated with default included HIV co-infection (OR 1.56, P<0.001), the male sex (OR 1.43, P<0.001), history of previous default (OR 2.33, P=0.017), herbal medication use (OR 5.7, P=0.017), low income (OR 5.57, P=0.04), inadequate knowledge on TB (OR 8.67, P=0.017) and alcohol use (OR 4.97, P=0.007). Findings from this study indicate that enhanced health education on TB, pre-treatment counseling, advocacy on treatment compliance, social support and integration of TB and HIV services should be prioritized by MOH so as to address tuberculosis treatment default.
CHAPTER ONE

INTRODUCTION

1.1: Background Information

Tuberculosis (TB) is one of the major causes of disability and death and most common major infectious diseases today in most of the world, especially in the developing countries. It is an infection caused mainly by *Mycobacterium tuberculosis* and occasionally by *M. africanum* and *M. canetti*, all primarily from humans and *M. bovis* primarily from cattle. It commonly affects the lungs (pulmonary TB), but also almost all other tissues and organs (extra pulmonary). Virtually all new *M. tuberculosis* infections are acquired via airborne transmission (Bass *et al.*, 1990). Consumption of raw milk or/and meat containing *M. bovis* from infected animals also cause TB infection.

One third of the world’s population (2 billion people) is infected with *Mycobacterium tuberculosis* out of which 14.6 million have active tuberculosis disease. Globally, tuberculosis kills 2 million people every year (WHO, 2005). More than 90% of global TB cases and deaths occur in the developing world. In Africa, TB kills 150 people daily or 500,000 people a year. Recognizing TB as one of the major global public health problems, the World Health Organization declared the TB epidemic a global emergency in 1993.

Kenya was ranked 10th among the high TB burdened countries in 2005 (WHO, 2005). The number of reported new TB cases in the country increased nine-fold from 11,625 in 1990 to 116,723 in 2007 (Table 1.1). The onset of HIV/AIDS in the 1980s significantly increased the TB incidence rates especially in countries with high HIV prevalence. Current data show that 57% of TB patients in Kenya are co-infected with
HIV (MOH, 2006b).

Without chemotherapy, 50% of tuberculosis patients die within 5 years of diagnosis. Tuberculosis can be cured by taking several strong antibiotics daily for at least six months but many patients fail to complete this treatment because the drugs have unpleasant side-effects and the treatment is complicated. In addition, people often feel better soon after starting treatment so they stop taking their tablets before all the bacteria in their body are dead. Poor treatment adherence means that people remain infectious for longer and are more likely to relapse and die. Erratic or selective compliance to treatment and outright default is likely to foster emergence of drug resistant tuberculosis and treatment failure. A patient who fails to attend two consecutive appointments during TB treatment is considered to have defaulted and gets ‘Out of Control’ if efforts to motivate him to return to treatment fail.

Nairobi hosts 18% of the country’s TB burden, the highest among provinces, and has the highest default rate (MOH, 2005). The World Health Organization estimates that only 47% of TB cases are detected in Kenya implying that the remaining 53% of undetected cases continue to transmit the disease. Case holding, to ensure all the detected TB cases complete treatment, is a challenge to TB control programs the world over. Due to the serious consequences of default, several countries offer incentives and social support to ensure treatment compliance and completion to maximize the likelihood of cure and minimize the chance that drug resistance will develop (Jakubowiak et al., 2007).
Table 1.1: Tuberculosis Case Notifications in Nairobi and National (Kenya), 2000-2005

<table>
<thead>
<tr>
<th>Year</th>
<th>Case notification</th>
<th>Annual increase (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>National</td>
<td>Nairobi</td>
</tr>
<tr>
<td>2000</td>
<td>64,159</td>
<td>12,963</td>
</tr>
<tr>
<td>2001</td>
<td>73,017</td>
<td>13,983</td>
</tr>
<tr>
<td>2002</td>
<td>82,114</td>
<td>15,979</td>
</tr>
<tr>
<td>2003</td>
<td>95,310</td>
<td>18,360</td>
</tr>
<tr>
<td>2004</td>
<td>105,783 (320*)</td>
<td>19,871 (733*)</td>
</tr>
<tr>
<td>2005</td>
<td>108,401 (324*)</td>
<td>19,486 (708*)</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Case notification rate (CNR) per 100,000 population (Source, MOH, NLTP Annual reports, 2004 and 2005)

1.2: Statement of the Problem

Adherence to long term therapy has been found to be problematic and caused by multiple factors. Close to 10% of patients on tuberculosis treatment in Nairobi defaulted from therapy in 2004 in spite of free TB services offered by the government. Tuberculosis is curable but without chemotherapy, 50% of patients die within 5 years of diagnosis, most of these within 2 years.

Defaulting from tuberculosis treatment increases the risk of development and transmission of multi-drug resistant tuberculosis (MDR-TB) and treatment failure (Pablos-Mendez et al., 1997). Multi drug-resistant strains of TB and Extreme Drug-Resistance in Tuberculosis (XDR-TB) are currently emerging as major global public
health concerns. Treatment of multi drug-resistant tuberculosis requires a prolonged duration of over two years and use of expensive second-line drugs not easily available in most countries. Further, defaulters continue to transmit infections especially to their close contacts, notably household associates. Default from treatment also influences low treatment success rate hindering the achievement of the global target to successfully treat 85% of detected cases. TB treatment success rate has stagnated at around 80% in Kenya since the adoption of DOTS in 1997 (MOH, 2006b).

1.3: Justification

Tuberculosis is an epidemic of global emergency and a target to halt and reverse its incidence by the year 2015 is among the Millennium Development Goals (MDGs). Kenya is among the countries with the highest tuberculosis burden in the world and the introduction of the WHO recommended Directly Observed Treatment Short Course (DOTS) has contributed to improved tuberculosis control but better patient compliance is needed to halt the epidemic.

Nairobi hosts 20% of the country’s TB burden and 23% of the country’s defaulters. A high population of tuberculosis patients in the province lives in congested and poorly ventilated environment thus susceptible to Mycobacterium tuberculosis infections.

Treatment adherence is a complex issue and improving treatment outcomes for tuberculosis requires a full understanding of the factors that prevent people from taking medicines correctly and those that help them complete their treatment. Default retrieval mechanisms have generally been weak in Kenya (MOH, 2006), thus the need to identify factors influencing default for early prediction of possible defaulters. The purpose of this study was to determine the factors that are associated with default
from tuberculosis treatment for policy and resource allocation in addressing the default menace. Several studies have been carried out in various countries to determine predictive factors for default. However, documented data on factors influencing TB treatment default on Kenya is lacking in peer reviewed journals.

1.4: Research Questions

a) What is the prevalence of default from treatment in Nairobi?

b) What duration do patients stay on treatment before defaulting?

c) What social demographic, socio-economic, treatment and health care provider factors are associated with default from treatment?

1.5: Null Hypothesis

There is no difference in social demographic, socio-economic, treatment and health care provider factors between the two groups- tuberculosis treatment defaulters (Cases) and the successfully treated (Controls) in Nairobi.

1.6: Objectives

1.6.1: Broad Objective

To determine the factors associated with default from tuberculosis treatment.

1.6.2: Specific Objectives:

a) To determine the prevalence of default from tuberculosis treatment in the study area.

b) To determine the duration TB treatment defaulters (Cases) stay in treatment.
before terminating medication.
c) To determine the social demographic, socio-economic, treatment and health-care provider factors associated with default from tuberculosis treatment.

1.7: Significance of Study

Completion of anti-tuberculosis treatment is the foremost priority of tuberculosis control programs. Interrupted or incomplete treatment increases the risk of treatment failure, relapse of disease, and acquisition of drug-resistant TB (Hong Kong Chest Service/British Medical Research Council, 1991). Knowledge generated from this study could aid in policy and strategy formulation in addressing adherence and compliance of tuberculosis therapy and in timely predictions of possible defaulters in Nairobi and other urban settings. Interventions made based on knowledge generated could impact positively in lowering tuberculosis treatment default rate and would benefit both the patient and the public at large. Consequently, improved TB treatment success rates, reduced risk of development of multi-drug resistant tuberculosis, reduced cost of treatment and lower TB infections in the region may be realized.

1.8: Delimitations and Limitations

The study was carried out in Nairobi Province and patients were drawn from public health facilities; government, non-governmental (NGO), faith-based FBO) and community based CBO). All TB control districts in the province were included in the study. Private-for-profit facilities were excluded due to low number of cases per facility and time available for study. Facilities in prisons and remand centres have high numbers of TB cases but were excluded from the study due to logistics and presumed differences in risk factors. Available secondary data could not establish
whether patients took their medications every day but adherence was assumed as long as patients attended clinics on appointment dates. Duration of adherence to treatment was thus calculated from the date treatment was initiated to the default date. Patient tracing was limited to those whose residential addresses were available and correct and in facilities with community health workers to assist in tracing. Defaulter tracing was quite a challenge due to relocation of defaulters from recorded residences, deaths, and inaccurate, missing or false residential physical addresses.
CHAPTER TWO LITERATURE REVIEW

2.1: Historical Background of Tuberculosis

Tuberculosis is an ancient infectious disease reported in Egypt from early dynastic times, present perhaps as early as 3700 BC. Reviewed evidence suggests that human TB may have evolved during the Neolithic period, 7th and 6th millennia BC, at which time population increase and cattle domestication occurred in Europe and the Eastern Mediterranean. The disease, once named 'Consumption' and 'Red Death' as it seemed to consume people from within, with its symptoms of bloody cough, fever, pallor, and long relentless wasting and due to the vomiting of blood that occurred. The disease historically is considered a population density-dependent disease, owing its increase to urbanization and the development of aggregate population groups. The TB causing microorganism, Mycobacterium tuberculosis, was first isolated by Robert Koch in 1882 and triggered concerted efforts to combat the disease (Snider, 1994).

A number of trials conducted in the 1950s and 1960s demonstrated that TB treatment could effectively be given on an outpatient basis and that hospitalization and bed rest were unnecessary. The development in the 1970s of short-course chemotherapy (SCC), usually understood to mean treatment regimens of 9 months or less, was a critical factor that enabled the development of effective strategies for global TB control (D’Esopo, 1982). If adhered to, SCC has been found to produce almost 100% cure rates. The Short Course Chemotherapy was first piloted in Kenya in 1993 and later introduced to the rest of the country. Presently, the government provides free TB treatment in public health facilities.
2.2: Burden of Tuberculosis

Occurrence of tuberculosis is worldwide but industrialized countries showed a downward trend of mortality and morbidity for many years before the HIV emergence reversed the gains made. One third of the world's population (2 billion people) is infected with *Mycobacterium tuberculosis* out of which 14.6 million have active tuberculosis disease. Globally, tuberculosis kills 2 million people every year (WHO, 2005). More than 90% of global TB cases and deaths occur in the developing world, where 75% of cases are in the most productive 15-54 years age-group (Ahlburg, 2000). Recognizing TB as one of the major global public health problems, the World Health Organization declared the TB epidemic a global emergency in 1993.

In Africa, TB kills 150 daily or 500,000 people an year. Forty six African Ministers of Health unanimously adopted a resolution at the WHO regional committee held in Maputo, Mozambique, on 25\textsuperscript{th} August 2005 and declared TB an African emergency. Among resolutions of the declaration was to reduce treatment default. TB is recognized by the World health Organization as the leading killer of people living with HIV and 10-50% of AIDS related deaths are associated with TB.

Kenya was ranked 10\textsuperscript{th} among the high TB burdened countries in 2005 (WHO, 2005). The number of reported new TB cases in the country increased nine-fold from 11,625 in 1990 to 116,723 cases in 2007. The onset of HIV/AIDS in the 1980s significantly increased the TB incidence rates especially in countries with high HIV prevalence. It is currently estimated that 57% of TB patients are also infected with HIV in Kenya.
2.3: Transmission of Tuberculosis

Tuberculosis is a bacterial disease caused mainly by *Mycobacterium tuberculosis* and *Mycobacterium bovis*. *M. africanum* and *M. canetti* are both responsible for a small number of cases in Africa. Bacillus from infected persons with TB of the lung or larynx is transmitted to a susceptible host through expiratory efforts such as coughing, sneezing, laughing, spitting, speaking or singing (droplet infection). The infected person produces tiny infectious droplets, 1-5 μm in size, known as droplet nuclei. In indoor environment, the droplet nuclei can remain suspended in the air for long periods of time (up to 24 hours) unless removed by ventilation, filtration or ultraviolet irradiation.

A vulnerable contact inhaling these contaminated droplet nuclei into the pulmonary alveolae, where they are taken up by alveolar macrophages is at risk of becoming infected. The magnitude of this risk is primarily dependent upon the concentration of the droplet nuclei in the air and the duration of exposure. Virtually all transmissions occur in enclosed environments (Snider, 1994). Inhaled bacilli settle in the lung and cause infection. Most cases of tuberculosis are inapparent (non-clinical) but can still transmit the disease (Gordis, 2003). Risk to TB infection is highest among close contacts to the infected. The risk of developing disease is highest in children under three years of age, lowest in later childhood and high again among young adults, the very old and the immunosuppressed.

*Mycobacterium bovis* is transmitted via the oral route through ingestion of meat or unpasteurized milk from infected animals. Effective antimicrobial chemotherapy usually eliminates communicability within 2-4 weeks. Children with primary
tuberculosis are generally not infectious (Heymann, D.L. (2004)

2.4: Clinical Manifestation of Tuberculosis

The development of tuberculosis is a two-stage process; first an infection must become established and second, that infection progress to clinical disease. The initial infection usually goes unnoticed but demonstrable primary lesion or significant tuberculin test sensitivity appears within 2-10 weeks. Subsequent risk of progressive pulmonary or extra pulmonary TB is greatest within the first year or two after infection, latent infection may persist for a lifetime. Among all persons who become infected with \textit{M. tuberculosis}, approximately 10\% will eventually progress to active or clinical disease (Bass \textit{et al.}, 1990), half of them during the first two years following infection. In some individuals, initial infection may progress rapidly, from weeks to months, to active tuberculosis. This is more common among infants and in the immunosuppressed, such as HIV-positive individuals.

In majority of tuberculosis infections, 90\%, the bacilli are contained by the immune system and remain dormant for the rest of a person’s life without further consequences. Activation of dormant TB is enhanced when the immune system is compromised by among others, diabetes, aging, poor nutrition, carcinoma and HIV/AIDS. Without HIV co-infection, the lifetime risk of TB progression from latent to active disease is 10\% but is increased 5-10 times more in HIV infected persons (Heymann, D.L. (2004).

Tuberculosis disease commonly affects the lungs (pulmonary TB), but may also affect any organ or tissue except nails, hair and teeth (extra pulmonary). In order of frequencies, other organs and tissues affected include: lymph nodes, pleura,
pericardium, kidneys, bones and joints, larynx, middle ear, skin, intestines, peritoneum and eyes. Extra pulmonary TB occurs less commonly (30%) than pulmonary TB (Heymann D.L. (2004).

The classification of TB for treatment purposes is based mainly on the presence or absence of tubercle bacilli in the sputum. A smear positive for acid-fast bacilli (AFB) is indicative of high infectiousness. Patients with TB often present with early or late symptoms of fatigue, fever, night sweats and weight loss in addition to symptoms specific to the involved organ. Pulmonary TB usually presents with a cough that lasts more than two weeks and may be associated with sputum production, haemoptysis and chest pain (MOH, 2006b).

2.5: Diagnosis of Tuberculosis

Pulmonary TB in adults is diagnosed by history of: cough persisting for three or more weeks with or without blood stained sputum, chest pains, close contact with a case of TB, shortness of breath, loss of weight, intermittent fever, anorexia and night sweats and fatigue or malaise. Physical chest examination of a pulmonary tuberculosis case may detect crepitations, bronchial breathing, diminished breath sounds or dullness. Diagnosis of extra pulmonary TB depends on clinical presentation and the organ involved.

The development of an acid-fast stain by Ehrlich in 1885 and the discovery of X-rays by Roentgen in 1895 made possible early and accurate diagnosis of tuberculosis disease. Sputum smear microscopy examination for acid-fast bacilli is the most cost effective diagnostic test for the diagnosis of pulmonary tuberculosis (World Bank, 1993) and is the first priority in developing countries. *Mycobacterium tuberculosis* is
a rod-shaped bacillus that retains certain stains after treatment with acid-alcohol solution, thus classified as an acid-fast bacillus (AFB) (Heymann D.L. (2004)

Therapeutic decisions are commonly based on the results of direct sputum smear microscopy examination using the Ziehl-Neelsen (ZN) technique. Demonstration of acid-fast bacilli in stained smears from sputum or other body fluids is presumptive diagnosis of active TB disease and usually justifies initiation of anti-tuberculosis treatment. In cases where TB is suspected but sputum smear examination is negative, more sophisticated and sometimes expensive examinations such as chest X-ray, biopsy or sputum culture are needed to arrive at a diagnosis.

Tuberculosis is difficult to diagnose with certainty on X-ray alone but the chest X-ray may aid the diagnosis of PTB. All patients with chest X-ray features suggestive of PTB should have microbiological sputum examination done. Radiography of the chest reveals pulmonary infiltrates, cavitations and, later, fibrotic changes with volume loss, all most commonly in the upper segments of the lobes. Chest X-ray is helpful in the diagnosis of tuberculosis in smear negative pulmonary TB, extra pulmonary TB and TB in children. In the absence of bacteriological confirmation, active disease can be presumed if clinical, histological or radiological evidence is suggestive of TB and other likely disease processes can be ruled out.

Where resources permit, isolation of organisms of *Mycobacterium tuberculosis* complex on culture confirms the diagnosis of TB and also permits determination of drug susceptibility for the infecting organism. In countries with limited resources and laboratory capacity, Kenya included, drug susceptibility testing is usually restricted to re-treatment cases such as treatment failures and defaulters of previous treatment.
Diagnosis of TB in children is difficult and is done primarily on history, clinical signs and symptoms and results of a tuberculin test. Children seldom produce sputum and if obtained, the bacterial load is too low to be detected (MOH, 2006b). Latent tuberculosis infection (LTBI) is detected through a tuberculin skin test. Immunocompetent people who are infected with *Mycobacterium tuberculosis*, *M. africanum* or *M. bovis* usually react to an intermediate strength tuberculin skin test of Purified Protein Derivative-Standard (PPD-S). The tuberculin skin test (Mantoux) should not be used to diagnose TB in adults. This test only indicates that a person has previously been infected with TB bacillus (Heymann D.L. (2004).

2.6: Management of Tuberculosis

2.6.1: Chemotherapy of tuberculosis

Without chemotherapy, about 65% of patients with sputum smear-positive pulmonary tuberculosis die within 5 years of diagnosis, most of these within 2 years. The cure for TB has evolved from combination of rest, fresh air and sunshine provided by isolated mountainous sanatoria and healthy diet, through more invasive surgical procedures to modern outpatient drug therapy. The modern strategy of treatment is based on standardized short-course regimen and proper case management to ensure completion of treatment.

The discovery of the tubercle bacilli led to intense interest in development of chemotherapy of TB. Waksmann and coworkers discovered streptomycin in 1944 and trials confirmed its efficacy but drug resistance soon emerged (Fox, 1981). Today, tuberculosis chemotherapy uses six primary drugs comprising of streptomycin (S), rifampicin (R), isoniazid (H), ethambutol (E), pyrazinamide (Z) and thiacetazone (T).
Treatment involves use of these multiple drugs taken in combination. When single
drugs are used, the tubercle bacilli quickly develop resistance to the drug used. Anti-
TB drugs should always be used in combination and currently most anti-TB drugs are
available as tablets containing multiple drugs in Fixed Dose Combinations (FDC).

Tuberculosis takes 6 to 8 months to cure and patients have to take drugs on a strict
and regular basis (once a day) for the entire course of treatment. It is difficult for
some to comply with treatments for such long duration. In the first two months of
treatment (intensive phase) four drugs are used to rapidly reduce the number of
tubercle bacilli (bacillary load) in the body. After two months, two drugs are used for
4-6 months (continuation phase). Both phases are ambulatory. In the continuation
phase, the patient collects a supply of drugs four-weekly for daily self-administration
at home (MOH, 2003).

In early 1980s, African countries embraced and implemented the WHO recommended
DOTS strategy, which was meant to standardize methods for case detection, case

All patients not treated previously (new patients) use a combination dose of isoniazid,
rifampicin, pyrazinamide and ethambutol (RHZE) for two months followed by 6
months of ethambutol and isoniazid (EH) or 4 months of rifampicin and isoniazid
(RH). For patients previously treated for TB for more than one month including those
who have relapsed, those who defaulted from previous treatment or those who failed
previous treatment, the regimen used is two months of SRHZE followed by one
month of RHZE and then five months of RHE.

Because of the crucial importance of the treatment regimen used for patients with
newly diagnosed tuberculosis, all drug dosages are administered during the first 2 months (the intensive phase) under the direct observation of a health worker or other responsible persons, including relatives or others with whom the patient has a close relationship. The supervision is expected to ensure compliance and adherence to treatment. This form of supervision takes place in a variety of settings: clinic, home, place of employment, school or manyatta (sort of sanatoria) for nomadic patients and is called DOTS or Directly Observed Treatment Short course.

Private-for Profit health facilities in Kenya use a six-month regimen, two months of RHZE followed by 4 months of RH, while the public sector facilities use the eight-month treatment regimen, two months of RHZE followed by 6 months of EH, for patients who have not been treated previously in Kenya. The six-month regimen was introduced to the public sector in 2007 and is currently in use in Nairobi and Homa Bay District and is planned to replace the eight months regimen by 2010.

The World health Organization set a global target to cure 85% of all detected cases of pulmonary TB, the most infectious type (WHO, 2003a). One of the obstacles in achieving better tuberculosis control is poor adherence to treatment (Frieden, 2006). Non adherence to treatment increases the risk of spreading infection and drug resistance and may increase the cost of treatment (Pablos-Mendez, et al., 1997).

Commonly encountered minor side effects of anti-TB drugs include local and general reaction caused by streptomycin, nausea, vomiting, diarrhoea, red urine, attacks of fever, chills, headache and bone and joint pains. Major side effects include ringing in the ears and/or dizziness, hypersensitivity reaction, jaundice, peripheral neuropathy, blurred vision and shortness of breath among others (MOH, 2003).
2.6.2 Preventive Therapy (Prophylaxis) of Tuberculosis

Efforts to prevent TB by inducing resistance to infection began early. Calmette and Guerin produced an attenuated strain of *M. bovis* vaccine, named BCG (*Bacillus Calmette and Guerin*) and was first safely administered to a child in 1921. Its use spread quickly in Europe. Vaccination with BCG has demonstrated a high protection rate against serious forms of tuberculosis in children (tuberculous meningitis and disseminated tuberculosis) but its protective efficacy shows enormous variability, ranging from 0-80% (Luelmo, 1982). The wide range of protective efficacy is not well understood and, in countries with a low tuberculosis incidence, vaccination is not recommended so as to preserve the tuberculin skin test as a useful tool to diagnose latent tuberculosis infection (LTBI). There is an emerging consensus that BCG vaccination does not prevent infection, and that, when it is protective, it reduces the risk of extra pulmonary tuberculosis. However, BCG vaccination is of benefit in reducing tuberculosis mortality among children and is an important component of the WHO Expanded Programme on Immunization (EPI). However, the WHO policy is that BCG should not be given to children with full-blown AIDS.

With the development of chemotherapy of tuberculosis, it became possible to consider treatment of infected persons to prevent the development of disease. Lincon (1954) observed that isoniazid could prevent complications like meningitis in recently infected children with clinical manifestation of disease. Subsequent trials demonstrated that one year of isoniazid chemoprophylaxis reduced the incidence of clinical disease by 55-83% (Farebee, 1970: IUAT, 1982). Daily isoniazid (INH) for at least 6 months as preventive therapy for young children with infection who have not yet developed disease greatly reduces the likelihood of developing TB during
childhood (WHO and Stop TB Partnership Childhood TB subgroup, 2007). Low dose intake of contrimoxazole reduces the risk of deaths and hospitalization in HIV infected TB patients.

2.7: Tuberculosis Treatment Outcomes

By law, tuberculosis is a notifiable disease in Kenya. In 1993, the World Health Organization introduced surveillance of treatment outcome in order to evaluate the impact of tuberculosis (WHO, 2003b). As a result, all cases on treatment are recorded in the tuberculosis treatment facility registers. The International Union against Tuberculosis and Lung Diseases (IUATLD) and the WHO recommends a standardized classification of tuberculosis treatment outcome into six categories, namely; Cured (C), Treatment Completed (TC), Died, Treatment Failure (F), Out of Control (OOC) and Transferred Out (TO).

The ‘cured’ category refers to smear positive (PTB+) patients who complete treatment and are smear negative at the end of treatment. Pulmonary smear negative (PTB-) and extra pulmonary (EPTB) patients are considered successfully treated once they complete their treatment schedules and given a treatment outcome of ‘Treatment Completed’. Treatment success rate is the proportion of smear positive pulmonary tuberculosis patients that get cured and complete treatment, and is thus directly influenced by those not completing treatment such as defaulters. The global target is the achievement of 85% treatment success rate.

Surveillance data on TB treatment documented by Kenya’s National Leprosy and Tuberculosis Programme (NLTP) recorded a success cure rate of 82% for the 2004 cohort of smear-positive patients (MOH, 2005). The cure rate in the country has
stagnated around 80% for several years. This indicates a shortfall of 5% below the WHO benchmark ratified by the World Health Assembly Resolution WHA 44.8 of 1991 aimed at rapid reduction of TB mortality, prevalence and transmission and a gradual reduction of TB incidences and less acquired drug resistance. Default from treatment and the high HIV prevalence (57%) among TB patients are among Kenya’s setbacks in achieving the global target. HIV patients have been observed to have a poorer treatment success rate in Nairobi (Chakaya et al., 2002).

In Europe a success rate of 77% has been recorded with as high as 14% of patients interrupting their treatment or failing to be cured (WHO, 2003a). A systematic review conducted in Europe to evaluate treatment outcome from 1988-2001 reported a pooled estimate for successful outcome at 74.4%. Spain and Switzerland each had 88% (Faustini et al., 2005). In Kazakhstan, a treatment success rate of 72.2% was observed (Bumburidi et al., 2006) while 81.1% treatment success was reported in Italy whereby immigrants had a higher default rate (Ambrosetti et al., 1999)

2.8: Non-adherence and default from TB treatment

2.8.1: Interruption of Tuberculosis Treatment

The World Health Organization defines a TB treatment defaulter as a patient whose treatment was interrupted for two consecutive TB treatment appointments or more ref. On resumption of treatment, a patient who defaulted for not more than two consecutive appointments continues with the same regimen but the duration of default is added to the treatment schedule. However, if treatment is interrupted for more than two consecutive appointments and the defaulter goes ‘Out Of Control’, resumption to treatment requires a fresh start of treatment and use of the re-treatment regimen
comprising daily streptomycin injection among others during the first two months of the intensive phase.

Patients resuming treatment after default or after treatment failure should have culture and drug susceptibility (sensitivity) tests done to rule out drug resistance. Ideally, TB patients should have their residential physical address, their telephone number and that of the DOTS observer recorded in the TB register so that a defaulting patient is traced and motivated to resume treatment. In Kenya, default retrieval mechanisms are generally weak and majority of defaulters get out of control (MOH, 2006).

Poor compliance accounts for most treatment failures and subsequent relapses, but other possible risk factors may include HIV co-infection, suboptimal serum levels of tuberculosis drugs, preexisting drug resistance of *Mycobacterium tuberculosis*, and silica dust exposure (Pulido *et al.*, 1997). Masahiro *et al.* (2001) observed that the development of MDR tuberculosis in patients appeared to be due, in large part, to non-adherence to therapy rather than to low drug levels.

2.8.2: Reasons and Factors associated with Default from Tuberculosis Therapy

Defaulting from tuberculosis treatment is a major public health concern. Several studies have been carried out in various countries on adherence to tuberculosis treatment, to determine predictive factors for default. However, documented data on Kenya is lacking in peer review journals. In a presentation to the sixth International Congress on Drug Therapy in HIV Infection, Wasonga (2003) reported causes of tuberculosis treatment defaulting in poor resource settings to be multi-factorial. Among the most important causes for default for slum dwellers in Nairobi were poor counseling on compliance, societal stigma, discrimination and denial of TB patients,
lower accessibility to health facilities as well as poor provider attitudes.

Older age-group, the male sex, marital status and unemployment are among demographic factors that have been implicated in TB treatment default. Age was found significantly associated with default in Singapore (Chee et al., 2000) and the rate of defaulting from TB treatment reported to be higher in older age-groups in Addis Ababa, Ethiopia (Demissie and Kabede, 1994). Age was not observed as significantly associated with default in Ndola, Zambia (Kaona et al., 2004). The male sex was identified an important risk factor for non-compliance in Sagamu, Nigeria (Daniel et al., 2006), in Hong Kong (Chan-Yeung et al., 2003), and in Tamatave, Madagascar (Comolet et al., 1998) and the rate of defaulting reportedly higher in males in Addis Ababa, Ethiopia. Marital status was reported to be among predictors of default in Singapore, but was not significantly associated with compliance in Ndola, Zambia.

The socio-economic status of patients influences major decisions not only on tuberculosis treatment but other diseases. The health seeking behaviour and compliance to treatment is usually better for patients from better socioeconomic status. Issues of diverse nature to caring of patients at home are rampant in communities that have low literacy levels (Ponyk et al., 2001). The high incidence of chronic TB-related problems among the patients increases the probability that care of TB patients becomes costly at home, in terms of food provision and other essentials (Steen et al., 1999). Patients on tuberculosis treatment usually experience an increased appetite and although a good sign indicating clinical response, to the low income group where access to adequate food is a problem, this poses a challenge to treatment adherence (MOH, 2006b). Low monthly income was significantly
associated with default in Ghana (Dodor and Afenyandu, 2005) and employment status observed a predictive factor for default in Singapore. Unemployment and homelessness was also independently associated with default in Russia and social support found to lower the default rate significantly (Jakubowiak et al., 2007). Unavailability of social support was significantly associated with default in Ghana while low education level reported a statistically significant predictor for defaulting in Addis Ababa, Ethiopia. In Ndola, Zambia, Kaona et al. did not find low education significantly associated with compliance.

After taking drugs successfully for a period of two months, most patients start to feel well and many smear positive patients convert and become bacteriologically negative. They are however required to complete the full treatment schedule for successful cure. Jaiswal et al. (2003) reported patients defaulting in India due to conception of equating well-being with cure. Feeling of improvement was also reported among top reasons for default in Ethiopia and inadequate knowledge found a significant predictor for defaulting. Among major factors reportedly leading to non-compliance in Zambia included patients beginning to feel better and lack of knowledge on the benefits of completing a course. Ignorance for the need of full compliance was also cited the main reason for defaulting among slum dwellers in Nairobi.

Tuberculosis, like HIV/AIDS is often stigmatized and thus may create resistance among patients to treatment. A study carried out in Nigeria (Odusanya et al., 2004) raised an important point of delays in care seeking behaviour due to stigma experienced by TB patients. Ponyk et al. (2001) have shown that stigmatization creates a lot of self-denial among those with diseases like TB and sexually transmitted infections; hence most of them fail to comply with the treatment regime. Societal
stigma associating TB with HIV/AIDS was cited as reasons for default among slum dwellers in Nairobi, Kenya.

Alcohol abuse and illicit drugs use have been associated with default (Jakubowiak et al., 2007; Oliveira et al., 2006). Besides being associated with default, alcohol is injurious to the liver. Anti-TB drugs also may be toxic to the liver. The combination of alcohol and anti-TB drugs may lead to greater risk of hepatic reactions. It is advisable therefore to encourage patients on TB treatment to reduce the amount of alcohol intake if it cannot be avoided entirely (MOH, 2006b).

The treatment regimen recommended within the DOTS approach is associated with significant side-effects. Side-effects such as hepatitis, dyspepsia, exanthema and arthralgia were found responsible for termination of therapy in up to 23% of patients during the intensive phase (Schaberg et al., 2007). Medication side-effects have also been significantly associated with defaulting in Ethiopia (Tekle et al., 2002). The side-effects profile of TB chemotherapy is magnified in patients with concurrent HIV treatment and/or prior history of hepatitis (Fry et al., 2005). Inability of health staff to deal with drug side-effects was cited a major factor for default in India while TB drugs being too strong were cited as reason for default in Zambia. History of previous default was one of the key risk factors associated with non-compliance in Hong Kong and among Brazilian children. Previous treatment was not significantly associated with default from treatment in Nigeria.

In Nigeria, HIV-co infected patients were reported to have twice the risk of defaulting during the intensive phase of treatment than HIV-negative patients. Combining ARV and TB drugs means taking many tablets at once and can be very difficult and challenging to a patient. Multiple drug resistance was also associated with default
from treatment in Hong Kong. Initial sputum smear result was reported as significantly associated with default in Russia but was not established a significant factor for default in Sagamu, Nigeria.

Wasonga (2002) observed that lower accessibility of health facilities was among causes of default from TB treatment among slum dwellers in Nairobi. Ability to afford services has been significantly associated with default and financial problems found the main reason for default in Ghana (Dodor and Afenyandu, 2005). Patients living near to treatment centre in Addis Ababa, Ethiopia were observed to have a higher rate of defaulting. Access to care is more critical to outcomes in acute diseases and acute events within chronic diseases but becomes less critical in outcomes of chronic diseases. Access is generally understood to mean removal of financial barriers to standard medical encounters. Broadly though, access may include such matters as transportation to clinical site and provision for continuity with same physician if desired (Leigh and Theodore, 1999).

Adherence to TB treatment is affected when the health care providers fail to meet patients’ needs such as convenient clinic timings, arrangements for provision for treatment in the event of family emergency and provision for complicated cases like alcoholics. Poor service provider attitudes have been reported as cause for default among slum dwellers in Nairobi. Negative attitude by tuberculosis patients towards the treatment centre was observed a significant predictor for default in Addis Ababa, while running out of drugs at home was cited as course for default in Zambia.
CHAPTER THREE  MATERIALS AND METHODS

3.1 Study Area

The study was carried out in Nairobi Province, purposively sampled due to its high TB burden and high default rate. With a population of 3 million (about 10% of the country’s population), Nairobi is the capital of Kenya and its principal economic and administrative center (appendix 1). It lies at 1 17 S and 36 49 E, in an altitude of just over 1660m. It is the smallest but most densely populated Province and has a multi-ethnic composition of people. A large population in Nairobi lives in large urban low-income informal settlements (Appendix 2) and unemployment and underemployment rates are high. The Province is divided into two TB control regions, Nairobi North with 91 TB facilities and Nairobi South with 93. Each region is further subdivided into four TB control Districts. The eight Districts are subdivided into 17 TB control zones with varying number of facilities. In total, the Province has 184 TB treatment facilities. In 2005, the Province recorded nearly 20% of the country’s annual new TB cases and 1823 (9.2%) defaulted and went ‘Out of Control’ for the 2004 treatment cohort.

3.2 Study Design

This was a Case-Control study where both primary and secondary data were used. The Case-Control study design was used so as to compare observation variables between the two groups, defaulters and the successfully treated, and to allow analytical examination of multiple factors related to TB treatment default and the determination of associations between dependent and independent variables.
3.3 Study Variables

3.3.1 Independent Variables

Independent variables included demographic, disease and treatment, socioeconomic, health personnel and facility factors, knowledge on TB and perceptions and attitudes towards TB disease. Age, sex, occupation, level of education, marital status, income and size of house were among the demographic and social economic variables assessed. Disease and treatment variables included drug side effects, treatment (DOTS) observer, TB type, and HIV co-infection. Availability of drugs, TB health education, acceptability of services offered, access to health services and waiting duration for services were the health facility factors assessed while the health personnel factors included the attitudes of health staff with regard to being friendly and understanding, sympathetic, explaining to patients adequately about TB illness and whether patients were treated with dignity.

3.3.2 Dependent Variables

The main dependent variable, was defaulting from TB treatment. Another related dependent variable included duration of treatment before default.

3.4: Target and Study Populations

The target population was tuberculosis treatment patients who defaulted from treatment between January 2006 and March 2008 in Nairobi. About 1800 TB patients defaulted from treatment in Nairobi in 2004.

The study population was tuberculosis patients. It included cases (TB treatment
defaulter.  and controls (non-defaulters) registered in Nairobi Province whose
treatment outcome fell between 1st January 2006 and 31st March 2008. Nairobi
Province hosts about 20% of the country’s TB burden. About 20,000 new patients
started TB treatment in Nairobi in 2005.

3.5: Inclusion and Exclusion Criteria

Cases (patients that defaulted from treatment or went ‘Out of Control’) and Controls
(patients that were cured or completed treatment) registered in the public sector TB
treatment facilities (GOK, NGO, FBO, CBO) in Nairobi Province with treatment
outcome between 1st January 2006 and 31st March 2008 were included in the study.

TB patients on treatment in prison health facilities and in private-for-profit health
facilities were excluded due to logistics and presumed differences in risk factors for
default.

3.6 Sampling Techniques

Nairobi Province was purposively sampled due to the high TB case notification and
default rates in the region. Surveillance data for defaulters and successfully treated
patients from 30 systematically selected TB treatment facilities distributed across all
TB control District in Nairobi was reviewed (Appendix 3).

All defaulters and ‘Out of Control’ patients (Cases) from the sampled health facilities
with treatment outcomes falling after 1st January 2006 were included in the study. An
approximately equal number of successfully treated patients (Controls) from each
facility with treatment outcome falling within the study period were randomly
selected using random numbers. Out of 248 defaulters conveniently sampled and
enlisted for tracing, 120 were traced and a questionnaire administered to obtain primary data. Convenient sampling was also used to identify 154 successfully treated patients and the same questionnaire administered.

3.6.1 Sample Size Determination

The minimum sample size of cases and controls required to be traced was determined in accordance to Lemeshow et al., (1986) formula for studies involving comparison of two groups.

The number of cases and controls necessary to have 80% confidence or power \((Z_p=0.842)\) of identifying an odds ratio of \(R (R=3)\) or larger at the 95% level of statistical significance \((Z_p=1.96 \text{ two tailed})\) if the rate of exposure in the controls is equal to \(p_2 (0.1)\), is determined as follows:

\[
\text{Exposure rate among cases } p_1 = \frac{p_2 R}{1 + p_2 (R-1)}
\]

\[
\text{Sample size, } n = \frac{\left[ Z_p \sqrt{2pq} + Z_{\alpha} \sqrt{p_1 q_1 + p_2 q_2} \right]^2}{(p_1 - p_2)^2}
\]

Where \(p = \frac{p_1 + p_2}{2}\)

\(p_2=\)exposure rate among controls=0.1 (from 10% default rate in Nairobi),

\(q_2=1- p_2 =1-0.1 =0.9\)

\(Z_\alpha=1.96\) (Standard deviate at 95% confidence level

\(Z_\beta =0.842\) for 80% power

\(R=3\) (difference of odds ratio to be identified)

Thus, \(p_1= \frac{p_2 R}{1 + p_2 (R-1)} = \frac{0.1 \times 3}{1 + 0.1 (3-1)} = 0.25\)

\(q_1= 1-p_1=1-0.25=0.75\)
\[ p = \frac{0.25 + 0.1}{2} = 0.175 \quad q = 1 - p = 1 - 0.175 = 0.825 \]

\[ n = \frac{(1.96 \sqrt{2 \times 0.175 \times 0.825} + 0.842 \sqrt{(0.25 \times 0.75 + 0.1 \times 0.9)})^2}{(0.25 - 0.1)^2} = 100 \]

Minimum sample size for cases, \( n = 100 \)

Employing continuity correction, the minimum number of Cases and Controls to be traced \( n = 113 \text{ each} \), giving a minimum total of 226 patients.

3.7 Research Instruments

A structured questionnaire (Appendix 4) was used to collect data. Part 1 of the questionnaire was used to extract relevant data from the TB treatment facility registers which mainly pertained to demographic and disease and treatment factors. The patient's district TB registration number was used as the patient identifier and later used as the unique key in data entry and analysis and as the link between the two parts of the questionnaire. Part 2 was used to collect data not usually recorded in the TB registers. These included data pertaining to social economic, knowledge of tuberculosis disease, perceptions of TB disease and health care provider factors and attitudes of health personnel towards patients. The questionnaire, consisting of both closed and open ended questions, was administered through an interview schedule to traced defaulters and controls. The instrument was pre-tested before main study.

3.8 Pre-testing of Questionnaire

One health facility (Riruta Health Centre) was used to test the questionnaire. Four Community Health Workers (CHWs) were involved in the pilot study and 12 patients used to test the questionnaire.
3.9 Data Collection Technique

Facilities in each district were conveniently sampled with the help of the TB coordinator in each zone. Data pertaining to all defaulters and those with a treatment outcome of 'Out of Control' was extracted from the register in the selected facility for patients whose treatment outcome was from January 2006. Random sampling, utilizing random numbers, was used to obtain approximately an equal number of successfully treated patients. Part 1 of the questionnaire was used to extract data. The list of defaulters in each facility and their residential physical addresses or telephone numbers was drawn for tracing.

Part 2 of the questionnaire was administered to traced defaulters who consented verbally. For children, the family’s or care taker’s socioeconomic data was collected. Approximately the same number of controls was interviewed after tracing or as they attended their last appointment usually to submit last sputum sample for smear positive pulmonary (PTB+) patients or for clearance from treatment and treatment outcome recording. Assistance from community health workers was sought in tracing of defaulters.

3.10 Data Analysis

Epi Info for Windows, Version 3.3.2, and SPSS 11.5 statistical software packages were both used for data analysis. Data was coded, entered into a Microsoft Access database, cleaned and validated, exported to SPSS and Epi Info and then analyzed. Descriptive statistics, comparison of means for quantitative variables, and analyses of contingency tables to determine associations were used. The two-tailed Yates-corrected chi-square or Fisher exact test (for cells with values less than 5) were used
to assess categorical variables. Odds ratios (cross product) were used as the measure of association and corresponding 95% confidence intervals calculated using the Taylor (T) series. Variables significant at the two-tailed 0.1 level during univariate analysis were included in the multivariate logistic regression model. Kaplan-Meier survival analysis method was used to determine the probabilities for defaulters surviving in the treatment program over different lengths of time.

3.11: Ethical Consideration

Research and ethical clearance to conduct the study was obtained from Kenyatta University and research permit from the Ministry of Science and Technology (Appendix 4). TB is strongly associated with HIV/AIDS leading to stigmatization and is difficult to discuss in public. All patients were assured of confidentiality and anonymity. Patients' names and residential addresses were collected for the purpose of follow-up only and no person-identifiers would be used for publication. Informed consent was obtained from participants and traced defaulters were encouraged to resume treatment.
CHAPTER FOUR RESULTS AND DISCUSSION

4.1: Characteristics of the Study Population

A total of 1978 tuberculosis patients, of which 945 were treatment defaulters and 1033 successfully treated, from eight TB control Districts of Nairobi were enrolled in this study. Table 4.1 shows the number of sampled facilities and number of enrolled patients stratified according to case status from each TB control District. The mean and median age was 30.3 years and 30 years respectively (range 1-80 years). Fifty six percent were male (1104). Of 606 patients whose marital status was established, 308 (59.1) % were married and 170 (28.1%) single. Among 268 patients traced and interviewed, 147 (54.9%) had attained a maximum of primary level education and 175 (65.3%) were unemployed.

Tuberculosis is historically associated with poverty (Andersson, 1990) and this was evident from findings of this study. Monthly income for 156 out of 192 (82.8%) of patients was less than Kshs 10,000 (approximately 140 US dollars) (Figure 4.1). Income of less than Kshs 10,000 per month per household falls in the Kenyan urban lower income-level. An overwhelming majority of patients (92.5%) lived in rented houses with amount of monthly rent ranging from Kenya Shillings 250 to 15,000. The majority (77.8%) lived in single-roomed houses and in overcrowded and poorly ventilated informal settlements (Appendix 2) thus exposing household members to risk of TB infection.

The household mean population was 5.1 persons per household. Duration of residency in treatment locality varied widely but 72.6% of the patients had been residents for over two years.
Table 4.1 Number of Sampled Facilities and Patients in each TB Control District of Nairobi

<table>
<thead>
<tr>
<th>TB District</th>
<th>No. of Facilities</th>
<th>Defaults</th>
<th>Non-defaulters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Dagoretti</td>
<td>7</td>
<td>114</td>
<td>12.0</td>
</tr>
<tr>
<td>Embakasi</td>
<td>3</td>
<td>74</td>
<td>7.8</td>
</tr>
<tr>
<td>Kamukunji</td>
<td>4</td>
<td>247</td>
<td>26.0</td>
</tr>
<tr>
<td>Kasarani</td>
<td>1</td>
<td>38</td>
<td>4.0</td>
</tr>
<tr>
<td>Langata</td>
<td>8</td>
<td>256</td>
<td>26.9</td>
</tr>
<tr>
<td>Makadara</td>
<td>3</td>
<td>117</td>
<td>12.3</td>
</tr>
<tr>
<td>Starehe</td>
<td>1</td>
<td>47</td>
<td>5.0</td>
</tr>
<tr>
<td>Westlands</td>
<td>3</td>
<td>57</td>
<td>6.0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>30</td>
<td>950</td>
<td>100</td>
</tr>
</tbody>
</table>

Figure 4.1: Monthly income levels (in Kshs) for the study population
4.1.1 Characteristics of the Study Population Stratified for Treatment Defaulters and Non-defaulters

Table 4.2 shows demographic and socio-economic characteristics of the study population stratified according to case status, defaulters and the successfully treated patients. Patients who defaulted from treatment were older than those whose treatment was successful (mean age, 31.2 years versus 29.5 years). The 30-34 years age-group the highest number of defaulters (20.1%) while the highest number of the successfully treated patients (20.1%) were in the 25-29 years age-group (Figure 4.2). Default from treatment was more frequent in male patients: 59.4% of defaulters were men, as opposed to 53.0% among the successfully treated patients. Adherence and completion of tuberculosis treatment was more frequent in married patients; 62.6 of successfully treated patients were married as opposed to 54% of defaulters.

Default from treatment was more frequent for the unemployed. The unemployment rate was 70.2% among defaulters, higher than the 61.7% for the successfully treated patients. Defaulters generally had poorer socio-economic status such as lower monthly income and amount spent on food and rent, and lived in houses with fewer rooms. Ninety two percent of defaulters had monthly income of less than Kshs 10,000 as opposed to 71.8% of non-defaulters (Figure 4.3).

A substantially high number of patients among defaulters had no formal education (10.3%) compared to the successfully treated patients (2.6%). Most of the defaulters had primary level of education (61.9%). On the other hand, majority of non-defaulters (51%) had secondary level of education (Figure 4.4).

Patients who had not been residents in the treatment area for long (less than 2 years...
residency) defaulted more frequently. Thirty nine percent of defaulters had lived in the treatment area for less than two years as opposed to 19.3% of the successfully treated patients.

Figure 4.2: Distribution of defaulters and the successfully treated patients in 5-year age groups (n=1978)
Table 4.2: Demographic and Socioeconomic Characteristics of the Study Population

<table>
<thead>
<tr>
<th>Descriptive Variable</th>
<th>Defaults</th>
<th>Non-defaulters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Age, years, mean (range)</td>
<td>31.2 (1-80)</td>
<td>29.5 (1-78)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>558</td>
<td>59.4</td>
</tr>
<tr>
<td>Female</td>
<td>382</td>
<td>40.6</td>
</tr>
<tr>
<td>Occupation status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>80</td>
<td>70.2</td>
</tr>
<tr>
<td>Informal Employment</td>
<td>25</td>
<td>21.9</td>
</tr>
<tr>
<td>Formal Employment</td>
<td>8</td>
<td>7.0</td>
</tr>
<tr>
<td>Student</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Retired</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Level of education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-formal</td>
<td>10</td>
<td>8.8</td>
</tr>
<tr>
<td>Primary</td>
<td>70</td>
<td>61.9</td>
</tr>
<tr>
<td>Secondary</td>
<td>31</td>
<td>27.4</td>
</tr>
<tr>
<td>Post secondary</td>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>78</td>
<td>31.2</td>
</tr>
<tr>
<td>Married</td>
<td>135</td>
<td>54.0</td>
</tr>
<tr>
<td>Separated</td>
<td>22</td>
<td>8.8</td>
</tr>
<tr>
<td>Widowed</td>
<td>15</td>
<td>6.0</td>
</tr>
<tr>
<td>Duration of residence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 years or less</td>
<td>40</td>
<td>38.8</td>
</tr>
<tr>
<td>Over 2 years</td>
<td>63</td>
<td>61.2</td>
</tr>
<tr>
<td>Monthly income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than Kshs 10,000</td>
<td>82</td>
<td>92.1</td>
</tr>
<tr>
<td>Kshs 10,000 or more</td>
<td>7</td>
<td>7.9</td>
</tr>
<tr>
<td>Monthly house rent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kshs, mean (range)</td>
<td>1,086 (250-10,000)</td>
<td>2313 (500-15,000)</td>
</tr>
<tr>
<td>Amount on food daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kshs, mean (range)</td>
<td>138</td>
<td>(30-500)</td>
</tr>
<tr>
<td>Household size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Persons, mean (range)</td>
<td>4.7</td>
<td>(1-18)</td>
</tr>
<tr>
<td>House size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than double rooms</td>
<td>8</td>
<td>6.9</td>
</tr>
<tr>
<td>Single or double rooms</td>
<td>108</td>
<td>93.1</td>
</tr>
</tbody>
</table>
Figure 4.3: Monthly income-levels (in Kshs) for defaulters and the successfully treated patients in Nairobi

Figure 4.4: Highest level of education attained by defaulters and the successfully treated patients in Nairobi

4.2: Prevalence of Default from Tuberculosis Treatment in Nairobi

Secondary data from the 2006 TB treatment cohort was used to determine the prevalence of default in Nairobi. Table 4.3 shows the number of TB patients on
treatment and those who defaulted from tuberculosis treatment in the year, and the corresponding prevalence of default in tuberculosis control districts of Nairobi and in the country.

The rates of defaulting from treatment in the tuberculosis control districts, Nairobi province and in the country are illustrated in Figure 4.5. Prevalence of treatment default varied within the TB control Districts from 9.2% in Kasarani to 27.6% in the Private Sector TB control District (For the purposes of tuberculosis control, private sector facilities are grouped into a TB control District, namely Private Sector TB control District). The prevalence for default in the province was 16.7%, slightly higher than the national 14.9% for the same year. Prevalence of treatment default varied widely within districts of Nairobi from 9.2% to 27.6%. Observed mean from secondary data for the province was 16.7%, slightly higher than the national 14.9% during same period. The actual default rate may however be lower than observed and could be between 10% and 13.5%. Among 248 defaulters earmarked for tracing, 37 (14.9%) were found to have died while 6 (2.4%) had self transferred and were receiving treatment in other facilities. Further, 33 (13.3%) patients had relocated to upcountry homes and a few hospitalized and some among them may still have continued with their treatment. Tracing of patients outside the province was not undertaken.
Table 4.3: Prevalence of Default from Tuberculosis Treatment in Districts of Nairobi in 2006

<table>
<thead>
<tr>
<th>District</th>
<th>Number of cases</th>
<th>Number absconded</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embakasi</td>
<td>2938</td>
<td>490</td>
<td>16.7</td>
</tr>
<tr>
<td>Kamukunji</td>
<td>1949</td>
<td>349</td>
<td>17.9</td>
</tr>
<tr>
<td>Makadara</td>
<td>1692</td>
<td>267</td>
<td>15.8</td>
</tr>
<tr>
<td>Dagoretti</td>
<td>1625</td>
<td>287</td>
<td>17.7</td>
</tr>
<tr>
<td>Langata</td>
<td>2724</td>
<td>359</td>
<td>13.2</td>
</tr>
<tr>
<td>Starehe</td>
<td>1421</td>
<td>385</td>
<td>27.1</td>
</tr>
<tr>
<td>Westlands</td>
<td>865</td>
<td>159</td>
<td>18.4</td>
</tr>
<tr>
<td>Kasarani</td>
<td>3193</td>
<td>293</td>
<td>9.2</td>
</tr>
<tr>
<td>Private Sector</td>
<td>1368</td>
<td>377</td>
<td>27.6</td>
</tr>
<tr>
<td>Nairobi</td>
<td>17,775</td>
<td>2976</td>
<td>16.7</td>
</tr>
<tr>
<td>Kenya</td>
<td>103,864</td>
<td>15,475</td>
<td>14.9</td>
</tr>
</tbody>
</table>

(Source, NLTP, MOH, 2005)

Figure 4.5: Prevalence of default from tuberculosis treatment in the TB control districts of Nairobi in 2006.
4.3: Duration in Tuberculosis Therapy before Default

The duration of tuberculosis therapy was calculated from the difference between the date treatment was initiated and the date the last clinic was attended. Day to day adherence in taking drugs was assumed as long as the clinic appointment was kept and empty packs indicating that all drugs had been used were shown on the clinic days.

Figure 4.6 shows the distribution of patients who defaulted and the month from initiation of medication at which they terminated their treatment. Defaulting from TB treatment occurred most frequently during the first three months of treatment. Among patients who defaulted from tuberculosis treatment, 22.7% terminated their medication during the first month of treatment. A further 20.4% and 16% defaulted during the second and third months of treatment indicating that 59.1% of patients who defaulted from treatment did so within the initial three months of treatment. A general trend of decline in defaulting with time was observed except between the fourth and fifth months.

TB treatment takes six to eight months to cure and patients are put on either a six-month or eight-month regimen depending on whether a patient had previously been treated for TB or not and patient age. A six-month regimen for TB treatment of new patients was piloted in selected facilities in Nairobi from September 2006 and introduced to the entire province in January 2007. The study population was thus on either of the two treatment durations.

Patients are expected to remain in treatment for the entire duration specified as per the regimen in use. Patients who default from treatment do not complete taking the anti-
TB medication. The length of time such patients take medication (survive in treatment) vary. Figure 4.7 shows the proportion of defaulters under each of the regimen, who survived (remained) in treatment after each monthly interval from the initiation of treatment. Among 332 patients on the 6-month regimen who defaulted, the probability of surviving the first and second months of treatment was 77.4% and 54.2% respectively. The probability of a defaulter in this regimen surviving 50% of the treatment duration (three months) was 36.7%. Among 541 defaulters on the eight-month regimen, the chances of surviving the first and second month of treatment was 76.7% and 57.3% respectively while their probability of surviving 50% (four months) and 75% (six months) of the full medication duration was 32.3% and 12.8% respectively. Among 350 defaulters on both regimens who were positive on AFB sputum smear microscopy at the commencement of treatment, 47.7% defaulted before bacteriological conversion was confirmed.

Figure 4.6: Distribution of defaulters and the month from initiation of medication when treatment was terminated (n=912).
4.4: Factors Associated with Default from Tuberculosis Treatment

4.4.1: Reasons TB Treatment Defaulters Attributed to their Default

Despite an intensive active defaulter tracing and investigation undertaken during this study, a good number of defaulters enlisted for tracing could not be traced. This was because of false or inaccurate addresses given by patients, change of residence or relocation to upcountry homes (13.3%) while some defaulters had died (14.9%).

Traced defaulters were asked what they thought made them discontinue treatment and multiple reasons were cited. Among the overriding factors attributed to default included lack of knowledge about TB and ignorance on need for treatment.
compliance (16.5%), traveling away from treatment localities (12.4%), feeling better and healed after taking medication for a while (11.6%), adverse drug side-effects (10.7%), opting to herbal medication (8.3%) and alcohol use during therapy (7.4%).

Other reasons for default included medical (7.4%), unfavourable health provider factors especially waiting too long for services (6.6%), lack of adequate food (6.6%) and 5.8% cited stigmatization as their reason for default (Figure 4.8). Those attributing their default to lack of adequate food claimed that the anti-TB drugs increased their appetite but could not afford food to satisfy the increased appetite. Medical reasons for default included misdiagnosis, heart problems, pregnancy, treatment failure, psychiatric cases and development of multi-drug resistance.

Figure 4.8: Reasons for defaulting TB treatment in Nairobi
4.4.2: Association of Social demographic and Socioeconomic Factors with Default

Analysis results of association of social demographic and socioeconomic factors with default are tabulated in Table 4.4. The major factors that significantly influenced default included age, gender, education level, income and alcohol use.

The mean age for patients who defaulted from treatment was 31.2 years, significantly older than the 29.5 years for the successfully treated patients (T Statistic=2.86, P=0.004). Age grouped into a dichotomous variable of less than 30 years and 30 years and above was also significantly associated with default (OR 1.32, 95% CI 1.1-1.58), with patients in the older age-group more likely to default.

Results obtained using univariate analysis indicated that the male sex was significantly associated with default (OR 1.29, 95% CI 1.08-1.55). Fifty nine percent of defaulters were men as opposed to 53.% of the successfully treated patients indicating the odds of a male defaulting as more likely than completing treatment. On the other hand, female patients comprised 40.6% of defaulters as opposed to 47% of the successfully treated patients.

To obtain a dichotomous variable for marital status, patients who were single, separated or widowed were grouped into the unmarried category so as to compare with the married group. Default from treatment was more frequent among the unmarried group with 46% of defaulters being unmarried as opposed to 37.4% of the successfully treated. Being unmarried was observed a significant factor for default (OR 1.43, 95% CI 1.03-1.98).
Although unemployment was high among the study population, it was more pronounced among the defaulters than among the successfully treated patients. Among female defaulters, unemployment stood at 84.6% compared to 73.5% for the successfully treated female though this was not significant (OR 1.98, P=0.2). Among the male, unemployment was much lower than that of females: 56.5% of male defaulters were unemployed, very comparable to the 56% unemployed among the successfully treated men. Employment status for tuberculosis patients, regardless of gender, was not significantly associated with default (OR 1.2, 95% CI 0.71-2.02).

Lower level of education among patients was strongly associated with default (OR 3.28, 95% CI 1.95-5.54). Seventy one percent of defaulters had either non-formal education or had attained primary education as their highest level as opposed to 43.2% of the successfully treated patients. Among defaulters, only 28.6% had attained secondary or post-secondary education as opposed to 56.8% of the successfully treated patients.

Default from treatment was significantly more frequent in patients who had been residents in the treatment locality for less than two years (OR 2.65, 95% CI 1.5-4.6): 38.8% of defaulters had been residents in the treatment locality for less than two years compared to 19.3% of the successfully treated.

Patients who used alcohol were significantly more likely to default from treatment (OR 5.56, 95% CI 2.88-10.72). Thirty eight percent of defaulters said they used alcohol during therapy as opposed to 9.7% of the successfully treated. Most of the alcohol consumed was illicit, cheap and locally brewed and some of the patients were involved in its trade.
Kenya’s Ministry of Planning groups a household monthly income of less than Kshs 10,000 in the lower income-group bracket for urban dwellers. Although monthly income was generally low for the general study population, it was more apparent and pronounced among the defaulters. Ninety two percent of defaulters had monthly income of less than Kshs 10,000 as opposed to 70.8% of the successfully treated. Monthly income of less than Kshs 10,000 was associated with default (OR 4.59, 95% CI 1.9-11.1).

The amounts spent on food and house rent are usually dictated by the level of income and the household size. Defaulters paid a mean monthly rent of Kshs.1086 as opposed to Kshs. 2313 for the successfully treated patients ($\chi^2=59.9, P<0.001$) while the mean daily amount spent on food by defaulters was Kshs. 138 against Kshs. 223 for the successfully treated ($\chi^2=34.9, P<0.001$). Thus low amounts spent on food and house rent were both associated factors for default. These variables were however highly confounded and interacted by the income of the patients. The confounders and the effect modifiers were controlled by use of multivariate logistic regression in this study.

The amount spent on transport to and from treatment facility varied (maximum, Kshs 200). About 14% of defaulters lived within walking distance (3 Km or less) to health facilities and did not have to pay fare to attend clinics comparable to 11% of the successfully treated patients. Transport costs to and from health facility was not significantly associated with default (OR 1.22, 95% CI 0.7-2.12).
Table 4.4: Analysis of Association of Social Demographic and Socioeconomic Factors with Default Outcome.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Default N (%)</th>
<th>Success N (%)</th>
<th>OR (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age group, years</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30+ years</td>
<td>533(56.8)</td>
<td>515(50.0)</td>
<td>1.32</td>
<td>0.003</td>
</tr>
<tr>
<td>&lt;30 years</td>
<td>405(43.2)</td>
<td>516(50.0)</td>
<td>(1.1-1.58)</td>
<td></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>558(59.4)</td>
<td>546(53.0)</td>
<td>1.29</td>
<td>0.005</td>
</tr>
<tr>
<td>Female</td>
<td>382(40.6)</td>
<td>484(47.0)</td>
<td>(1.08-1.55)</td>
<td></td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single/Widowed/Separated</td>
<td>115(46.0)</td>
<td>133(37.4)</td>
<td>1.43</td>
<td>0.04</td>
</tr>
<tr>
<td>Married</td>
<td>135(54.0)</td>
<td>223(62.6)</td>
<td>(1.03-1.98)</td>
<td></td>
</tr>
<tr>
<td><strong>Employment status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>78(69.0)</td>
<td>95(65.1)</td>
<td>1.20</td>
<td>0.59</td>
</tr>
<tr>
<td>Employed</td>
<td>35(31.0)</td>
<td>51(34.9)</td>
<td>(0.71-2.02)</td>
<td></td>
</tr>
<tr>
<td><strong>Level of education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-formal/Primary</td>
<td>80(71.4)</td>
<td>67(43.2)</td>
<td>3.28</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Secondary/Post secondary</td>
<td>35(28.6)</td>
<td>88(56.8)</td>
<td>(1.95-5.54)</td>
<td></td>
</tr>
<tr>
<td><strong>Duration of residence</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 years or less</td>
<td>40(38.8)</td>
<td>28(19.3)</td>
<td>2.65</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Over 2 years</td>
<td>63(61.2)</td>
<td>117(80.7)</td>
<td>(1.5-4.6)</td>
<td></td>
</tr>
<tr>
<td><strong>Alcohol use during therapy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use alcohol</td>
<td>42(37.5)</td>
<td>15(9.7)</td>
<td>5.56</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Does not use alcohol</td>
<td>70(62.5)</td>
<td>139(90.3)</td>
<td>(1.9-11.1)</td>
<td></td>
</tr>
<tr>
<td><strong>Monthly Income</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than Kshs 10,000</td>
<td>82(92.1)</td>
<td>74(70.8)</td>
<td>4.59</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Kshs 10,000 or more</td>
<td>7(7.9)</td>
<td>29(28.2)</td>
<td>(1.9-11.1)</td>
<td></td>
</tr>
<tr>
<td><strong>Monthly house Rent</strong></td>
<td>1,086(250-10,000)</td>
<td>2313(500-15,000)</td>
<td>$T=4.95$</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Kshs, mean (range)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount on food daily</td>
<td>138(30-500)</td>
<td>223(30-1000)</td>
<td>$T=5.51$</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Kshs, mean (range)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Household Size</strong></td>
<td>4.7(1-18)</td>
<td>5.4(1-18)</td>
<td>$T=1.8$</td>
<td>0.07</td>
</tr>
<tr>
<td><strong>House size</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single or double rooms</td>
<td>108(93.1)</td>
<td>134(87.0)</td>
<td>2.01</td>
<td>0.15</td>
</tr>
<tr>
<td>Larger than double rooms</td>
<td>8(6.9)</td>
<td>20(13.0)</td>
<td>(0.85-4.75)</td>
<td></td>
</tr>
<tr>
<td><strong>Transport costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None/ Kshs 20</td>
<td>125(13.8)</td>
<td>110(11.0)</td>
<td>1.30</td>
<td>0.07</td>
</tr>
<tr>
<td>Fare paid &gt; Kshs 20</td>
<td>780(86.2)</td>
<td>893(89.0)</td>
<td>(0.99-1.71)</td>
<td></td>
</tr>
</tbody>
</table>

OR- Odds Ratio, CI- Confidence Intervals
4.4.3 Association of Knowledge and Perceptions on Tuberculosis with Default

Table 4.5 shows results of univariate analysis of association of factors linked to knowledge and perceptions on tuberculosis with default. In order to solicit for information on knowledge on tuberculosis among the respondents, patients were asked whether they had a history of TB disease in the household and whether they suspected TB disease at onset. Further, they were asked whether they had attended a public health lecture on TB or read materials on TB prior to their illness, their opinion on whether TB is a curable disease, the duration for its cure and its mode of transmission and whether they were discriminated by friends, relatives or at work.

Most patients did not have a history of tuberculosis disease in their household. Seventy five percent of defaulters had no previous TB history in the household, closely comparable to 74.7% of the successfully treated. There was no significant association between history of TB disease in the household with default (OR 1.03, 95% CI 0.56-1.9). Similarly, suspecting TB disease at onset of illness was also not a significant factor for default (OR 1.18, 95% CI 0.72-1.92). A good number of patients did not suspect TB at onset as indicated by 56.6% and 52.6% of defaulters and the successfully treated respectively.

Defaulting from treatment was significantly more frequent among patients who had never attended a public health lecture on TB or read any materials on TB prior to their illness (OR 3.6, 95% CI 2.08-6.25). This was evident from the number of patients without previous TB knowledge among defaulters (45.9%) as opposed to 19.1% of the successfully treated.

Default from treatment was significantly higher among patients with the opinion that
TB was not curable or did not know that it could be cured (OR 13.4, 95% CI 5.04-35.5). Thirty one percent of defaulters were unaware that TB is curable as compared to 3.2% of the successfully treated. Similarly, 20% of defaulters were not aware of how long the tuberculosis therapy takes as opposed to 3.2% of the successfully treated. Lack of knowledge on the duration TB takes to cure was strongly associated with default (OR 7.45, 95% CI 2.72-20.4). Knowledge about transmission of tuberculosis was not established a significant factor for default despite close to 10% of the patients being unaware of how tuberculosis is transmitted.

TB is not perceived like any other disease, and is commonly associated with HIV/AIDS. Defaulting from treatment was more frequent among patients who perceived TB not like any other disease: Eighty percent of defaulters indicated that TB is not perceived like any other disease as opposed 57.8% of the successfully treated. This perception was observed as significantly associated with default (OR 2.99, 95% CI 1.66-5.39). Default was significantly more frequent among patients who claimed they were discriminated against by friends, relatives or at work places (OR 2.28, 95% CI 1.38-3.77) with 55.5% of defaulters indicating they were discriminated against compared to 35.3% of the successfully treated.

Besides TB which was suspected by 47.6% of the patients prior to diagnosis, other diseases suspected included common cough (14.1%), Pneumonia (11.7%), Malaria (8.9%), while 4.8% suspected HIV/AIDS infection (Figure 4.9).

TB was highly associated with HIV/AIDS. It was perceived by majority as a disease related to HIV and AIDS, as was indicated by 50% of respondents. Tuberculosis disease was also perceived as incurable (8.3%), hereditary (6.3%), and as resulting from a curse, witchcraft or taboo (8.3%) (Figure 4.10).
Table 4.5: Univariate Analysis of Association of Knowledge on Tuberculosis with Default

<table>
<thead>
<tr>
<th>Variable</th>
<th>Default N (%)</th>
<th>Success N (%)</th>
<th>OR (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Had TB history in household</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>22(24.7)</td>
<td>37(24.5)</td>
<td>1.03</td>
<td>0.96</td>
</tr>
<tr>
<td>No</td>
<td>67(75.3)</td>
<td>109(75.5)</td>
<td>(0.56;1.9)</td>
<td></td>
</tr>
<tr>
<td>Suspected TB at onset</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>64(56.6)</td>
<td>81(52.6)</td>
<td>1.18</td>
<td>0.6</td>
</tr>
<tr>
<td>Yes</td>
<td>49(43.4)</td>
<td>73(47.4)</td>
<td>(0.72;1.92)</td>
<td></td>
</tr>
<tr>
<td>Had Prior TB health education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>51(45.9)</td>
<td>29(19.1)</td>
<td>3.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Yes</td>
<td>60(54.1)</td>
<td>123(80.9)</td>
<td>(2.08;6.25)</td>
<td></td>
</tr>
<tr>
<td>TB curable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No/don’t know</td>
<td>35(31.0)</td>
<td>5(3.2)</td>
<td>13.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Yes</td>
<td>78(69.0)</td>
<td>149(96.8)</td>
<td>(5.04;35.5)</td>
<td></td>
</tr>
<tr>
<td>Duration TB is cured</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Don’t know</td>
<td>22(20.0)</td>
<td>5(3.2)</td>
<td>7.45</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>6-8 months</td>
<td>88(80.0)</td>
<td>149(96.8)</td>
<td>(2.72;20.4)</td>
<td></td>
</tr>
<tr>
<td>How TB is transmitted</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Don’t know</td>
<td>11(9.8)</td>
<td>11(7.2)</td>
<td>1.39</td>
<td>0.6</td>
</tr>
<tr>
<td>From infected via cough, etc</td>
<td>101(90.2)</td>
<td>141(92.8)</td>
<td>(0.58;3.35)</td>
<td></td>
</tr>
<tr>
<td>Stigmatized:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>61(55.5)</td>
<td>54(35.3)</td>
<td>2.28</td>
<td>0.002</td>
</tr>
<tr>
<td>No</td>
<td>49(44.5)</td>
<td>99(64.7)</td>
<td>(1.38-3.77)</td>
<td></td>
</tr>
<tr>
<td>TB Perceived like any other disease:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>82(80.2)</td>
<td>85(57.8)</td>
<td>2.99</td>
<td>0.001</td>
</tr>
<tr>
<td>Yes</td>
<td>20(19.6)</td>
<td>62(42.2)</td>
<td>(1.66-5.39)</td>
<td></td>
</tr>
</tbody>
</table>

OR- Odds Ratio, CI- Confidence Intervals
Suspected Disease

Normal cough 14.1%
8.9% Malaria
Pneumonia 11.7%
4.8% HIV/AIDS
1.6% Chest problems
3.6% Bewitched
2.0% Asthma
4.4% Other *
1.2% Typhoid

Figure 4.9: Distribution of TB patients by diseases and health conditions suspected prior to TB diagnosis

Figure 4.10: Distribution of TB patients by perceptions of the tuberculosis disease in communities and societies they came from.
4.4.4: Disease and Treatment Factors Associated with Default

Factors relating to tuberculosis disease and treatment studied included the treatment (DOTS) observer, co-infection with HIV/AIDS, initial acid fast bacillus (AFB) sputum results, tuberculosis type, anti-tuberculosis drug side effects, previous default and use of alternative (herbal) medication.

Majority of patients (79.3%) suffered from pulmonary tuberculosis and 77.7% were New TB patients. Of those whose initial diagnosis included sputum smear microscopy, 55.1% were smear-positive. Fifty five percent of the study population, tested through the Diagnostic, Testing and Counseling (DTC) strategy, were co-infected with HIV/AIDS. During the intensive phase of treatment, 73.8% of DOTS observation was by household members, friends or relatives while 25.9% was by Health Care Workers. Table 4.6 shows results of univariate analysis of association of treatment factors with default.

Defaulting from treatment was more frequent in patients whose DOTS (treatment) observation was done by health care workers. Twenty eight percent of defaulters had their treatment observed by health care workers compared to 24% of the successfully treated. DOTS observation by health care workers was on borderline significance with default (OR 1.24, 95% CI 1.01-1.53). This observation may however be influenced by the fact that the more complicated cases of treatment, including those resuming treatment after previous default, relapses and treatment failures, are usually observed by the health care workers during the intensive phase of treatment.
Co-infection with HIV was a significant factor for default (OR 1.57, 95% CI 1.28-1.93). Sixty two percent of defaulters were co-infected with HIV and AIDS compared to 50.3% of the successfully treated.

Patients on re-treatment after previous default were more likely to default again. Three percent of defaulters had previously defaulted from treatment as opposed to 1.5% of the successfully treated patients. Default from treatment was significantly associated with previous default (OR 2.16, 95% CI 1.14-4.09).

Some patients tended to combine the anti-tuberculosis drugs with herbal medicines during therapy. Such patients mostly ended up absconding normal chemotherapy and opting instead to the herbal medication. Reasons given for opting to herbal medication included adverse side effects experienced with the anti-TB drugs and unfavourable facility and health personnel factors. Twenty eight percent of patients who defaulted from treatment had used herbal medication during treatment compared to only 3.2% of the successfully treated. Use of herbal medication was a significant factor for default (OR 11.49, 95% CI 4.31-30.6).

Initial AFB sputum smear results (OR 1.01, 95% CI 0.83-1.24), tuberculosis type (OR 1.02, 95% CI 0.82-1.28) and drug side-effects (OR 1.36, 95% CI 0.84-2.21) were not established significantly associated with defaulting from treatment. A good number of patients experienced drug side-effects (56.2%). A slightly higher proportion of patients who experienced adverse drug effects defaulted from treatment (60.5%) compared to the successfully treated (52.9%). Although the adverse medication side-effects was not significantly associated with default, not addressing and managing the side-effects for those affected was significantly associated with default (OR 4.63,
95% CI 1.73-12.37).

Table 4.6: Univariate Analysis of Association between Disease and Treatment Factors with Default

<table>
<thead>
<tr>
<th>Factors</th>
<th>Default N (%)</th>
<th>Success N (%)</th>
<th>OR (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment observer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment observer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health care worker</td>
<td>240 (28.1)</td>
<td>239 (24.0)</td>
<td>1.23</td>
<td>0.05</td>
</tr>
<tr>
<td>Household member</td>
<td>613 (71.9)</td>
<td>756 (76.0)</td>
<td>(0.999-1.52)</td>
<td></td>
</tr>
<tr>
<td>Co-infection with HIV:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HIV-co-infected</td>
<td>405 (61.5)</td>
<td>458 (50.3)</td>
<td>1.57</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Not co-infected</td>
<td>254 (38.5)</td>
<td>452 (49.7)</td>
<td>(1.31-1.97)</td>
<td></td>
</tr>
<tr>
<td>Initial AFB sputum result</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smear-positive</td>
<td>391 (55.2)</td>
<td>454 (55.0)</td>
<td>1.01</td>
<td>0.90</td>
</tr>
<tr>
<td>Smear-negative</td>
<td>317 (44.8)</td>
<td>372 (45.0)</td>
<td>(0.83-1.24)</td>
<td></td>
</tr>
<tr>
<td>TB Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extra Pulmonary TB</td>
<td>180 (21.1)</td>
<td>208 (20.7)</td>
<td>1.02</td>
<td>0.89</td>
</tr>
<tr>
<td>Pulmonary TB</td>
<td>674 (78.9)</td>
<td>797 (79.3)</td>
<td>(0.82-1.28)</td>
<td></td>
</tr>
<tr>
<td>Drug Side-effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experienced</td>
<td>72 (60.5)</td>
<td>82 (52.9)</td>
<td>1.36</td>
<td>0.47</td>
</tr>
<tr>
<td>Not experienced</td>
<td>47 (39.5)</td>
<td>73 (47.1)</td>
<td>(0.84-2.21)</td>
<td></td>
</tr>
<tr>
<td>History of Default</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defaulted previously</td>
<td>27 (3.1)</td>
<td>15 (1.5)</td>
<td>2.16</td>
<td>0.02</td>
</tr>
<tr>
<td>No previous default</td>
<td>832 (96.9)</td>
<td>999 (98.5)</td>
<td>(1.14-4.09)</td>
<td></td>
</tr>
<tr>
<td>Herbal Medication use</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used</td>
<td>32 (27.8)</td>
<td>5 (3.2)</td>
<td>11.49</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Not used</td>
<td>83 (72.2)</td>
<td>149 (96.8)</td>
<td>(4.31-30.6)</td>
<td></td>
</tr>
</tbody>
</table>

OR- Odds Ratio, CI- Confidence Intervals
4.4.5: Association of Health-Care Provider Factors with Default

In order to solicit response on the health service delivery; several factors pertaining to the health care provider were studied. These included TB drugs availability, whether health education on TB was offered and the subsequent need for treatment compliance explained, whether services offered were acceptable to patients, accessibility to health care, waiting duration for services and whether drug side-effects were addressed. The major factors associated with default included inaccessibility to health care, poor service delivery, lack of health education on TB at facility and long waiting for services. Results from univariate analysis of association of health facility factors with default are tabulated in Table 4.7.

Most of the health-care provider factors were not favourable to TB patients on treatment. Anti-TB drugs were not always available on each appointment time as indicated by 7.9% of defaulters. Unavailability of drugs on clinic days was observed a significant factor for default (P<0.001).

Patients who were not offered health education on TB at the facilities defaulted more frequently. TB health education was not offered to some patients during treatment as was indicated by 30.7% of defaulters and 3.8% of the successfully treated. Failure to offer health education at the facility was significantly associated with default (OR 11.08, 95% CI 4.47-27.5).

The services offered at the TB clinics were not acceptable to patients as was indicated by 36.6% and 3.8% of defaulters and the successfully treated respectively. Patients who felt that services offered were unacceptable were more prone to default from treatment. Default from treatment was observed to be significantly associated with
unacceptable services provided at the health facilities (OR 14.4, 95% CI 5.86-35.6).

Default from treatment was more frequent among patients with low access to health care: 27.8% of defaulters did not easily access health facility as opposed to 3.8% of the successfully treated patients. Low access to health care was observed a significant factor for default (OR 9.64, 95% CI 3.87-23.99).

Waiting time for services ranged from 5 minutes to 4 hours (mean 41 minutes). The mean duration spent at facility for treatment was significantly longer for defaulters (47 minutes) compared to the successfully treated patients (36 minutes) (T Statistic=2.4, P=0.02). Subsequently, defaulting from treatment was more frequent among patients who spent a longer time waiting for health services: about one-third of defaulters (33.9%) waited for 1 hour or more for services as opposed to 17.8% of the successfully treated (OR 2.38, 95% CI 1.34-4.23). The waiting period for services was significantly not acceptable to patients as was indicated by 47.4% of defaulters and 7.7% of the successfully treated and was significantly associated with default (OR 10.8, 95% CI 5.39-21.6).

Failure to explain to patients the need for treatment compliance by the health care providers was evident from 20.2% of patients who defaulted from treatment. Additionally, adverse drug side-effects were not addresses by the health care provider as was indicated by 26.8% and 7.3% of defaulters and the successfully treated patients respectively. Failure to explain the need for treatment compliance (P<0.01) was significantly associated with default.
Table 4.7: Univariate Analysis Results of Association of Health Facility Factors with Default

<table>
<thead>
<tr>
<th>Variable</th>
<th>Default</th>
<th>Success</th>
<th>OR (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
<td>(95% CI)</td>
<td></td>
</tr>
<tr>
<td><strong>Drugs Availability</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not available</td>
<td>9(7.9)</td>
<td>0(0)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Available</td>
<td>105(92.1)</td>
<td>153(100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Education on TB</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not offered</td>
<td>35(30.7)</td>
<td>6(3.8)</td>
<td>11.08</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Offered</td>
<td>79(69.3)</td>
<td>150(96.2)</td>
<td>(4.47;27.5)</td>
<td></td>
</tr>
<tr>
<td><strong>Services offered</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not acceptable</td>
<td>41(36.6)</td>
<td>6(3.8)</td>
<td>14.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Acceptable</td>
<td>79(69.7)</td>
<td>150(96.2)</td>
<td>(4.47;27.5)</td>
<td></td>
</tr>
<tr>
<td><strong>Access to health facility</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not easily accessible</td>
<td>32(28.8)</td>
<td>6(3.8)</td>
<td>9.64</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Easily accessible</td>
<td>83(71.2)</td>
<td>150(96.2)</td>
<td>(3.87;23.99)</td>
<td></td>
</tr>
<tr>
<td><strong>Waiting time for services</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 hr or more</td>
<td>37(33.9)</td>
<td>27(17.8)</td>
<td>2.38</td>
<td>0.004</td>
</tr>
<tr>
<td>Less than 1 hr</td>
<td>72(66.1)</td>
<td>125(82.2)</td>
<td>(1.34-4.23)</td>
<td></td>
</tr>
<tr>
<td><strong>Waiting period for services</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not acceptable</td>
<td>54(47.4)</td>
<td>12(7.7)</td>
<td>10.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Acceptable</td>
<td>60(52.6)</td>
<td>144(92.3)</td>
<td>(5.39;21.6)</td>
<td></td>
</tr>
<tr>
<td><strong>Need for treatment compliance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not explained</td>
<td>23(19.7)</td>
<td>0(0)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Explained</td>
<td>91(80.3)</td>
<td>157(100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Adverse drug side-effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not addressed</td>
<td>19(26.8)</td>
<td>6(7.3)</td>
<td>4.63</td>
<td>0.002</td>
</tr>
<tr>
<td>Addressed</td>
<td>52(73.2)</td>
<td>76(92.7)</td>
<td>(1.73;12.37)</td>
<td></td>
</tr>
</tbody>
</table>

OR- Odds Ratio, CI- Confidence Intervals
4.4.6: Health-Care Personnel Factors associated with Default

The attitudes of health care personnel towards the patients were observed to significantly influence patients to default from tuberculosis treatment. Forty one percent of defaulters did not find the health care personnel friendly and understanding as opposed to 3.2% of the successfully treated. Similarly, 43.9% of defaulters did not find the personnel sympathetic compared to 3.9% of the successfully treated. Thirty four percent of defaulters felt they were not treated with dignity as opposed to 1.9% of the successfully treated patients.

Health care personnel attitudes significantly associated with default included not being friendly and understanding (OR 21.05, 95% CI 8.01-55.3), being unsympathetic (OR 19.4, 95% CI 7.92-47.53) and not treating patients with dignity (OR 26.35, 95% CI 7.88-88.0). Patients who were not explained adequately about their illness defaulted more frequently: Six percent of defaulters were not adequately explained about their illness as opposed to 3% of the successfully treated (OR 10.01, 95% CI 1.22-83.3) (Table 4.8).
### Table 4.8: Univariate Analysis of Association of Attitude of Health Care Personnel with Default

<table>
<thead>
<tr>
<th>Variable</th>
<th>Default N (%)</th>
<th>Success N (%)</th>
<th>OR (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel friendly and understanding No</td>
<td>47(41.2)</td>
<td>6(3.2)</td>
<td>21.05 (8.01;55.3)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>67(58.8)</td>
<td>150(96.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personnel sympathetic</td>
<td>50(43.1)</td>
<td>6(3.9)</td>
<td>19.4 (7.92;47.53)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No</td>
<td>64(56.9)</td>
<td>149(96.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient treated with dignity</td>
<td>39(33.6)</td>
<td>3(1.9)</td>
<td>25.35 (7.92;47.53)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No</td>
<td>75(66.4)</td>
<td>152(98.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illness adequately explained</td>
<td>7(6.1)</td>
<td>1(0.6)</td>
<td>10.01 (1.22;83.33)</td>
<td>0.012</td>
</tr>
<tr>
<td>No</td>
<td>107(93.9)</td>
<td>153(99.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OR- Odds Ratio, CI- Confidence Intervals

#### 4.4.7: Factors Independently Associated with Treatment Default Outcome

All factors significantly associated with default at P=0.1 from univariate analysis were entered into a multivariate logistic regression model to control for confounding (mixing) effects and effect modification (interactions). Since patients who defaulted from treatment were significantly older than those whose treatment was successful (mean 31.2 years vs. 29.6 years, P=0.005) on univariate analysis, age was also included as a factor in the logistic regression analysis to control for age. Logistic regression analysis results are presented in Table 4.9.
Factors that were observed as independently associated with the default outcome included co-infection with HIV/AIDS (aOR 1.56, 95% CI 1.25-1.94), history of previous default (aOR 2.33, 95% CI 1.16-4.68), the male sex (aOR 1.43, 95% CI 1.15-1.78), use of herbal medication (aOR 5.7, 95% CI 1.37-23.7), alcohol use (aOR 4.97, 95% CI 1.56-15.9), inadequate knowledge on TB (aOR 8.67, 95% CI 1.47-51.3) and monthly income (aOR 5.57, 95% CI 1.07-30.0).

**Table 4.9: Multivariate Logistic Regression Analysis of Independent Association of Factors with Default**

<table>
<thead>
<tr>
<th>Factor</th>
<th>aOR</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV co-infection</td>
<td>1.56</td>
<td>1.25; 1.94</td>
<td>0.001</td>
</tr>
<tr>
<td>History of previous default</td>
<td>2.33</td>
<td>1.16; 4.68</td>
<td>0.017</td>
</tr>
<tr>
<td>Gender (Male /Female)</td>
<td>1.43</td>
<td>1.15; 1.78</td>
<td>0.001</td>
</tr>
<tr>
<td>Age</td>
<td>1.006</td>
<td>0.997; 1.015</td>
<td>0.175</td>
</tr>
<tr>
<td>DOTS observer (HCW/HH)</td>
<td>1.20</td>
<td>0.94; 1.53</td>
<td>0.14</td>
</tr>
<tr>
<td>Herbal medication use</td>
<td>5.7</td>
<td>1.37; 23.7</td>
<td>0.017</td>
</tr>
<tr>
<td>Education level</td>
<td>2.29</td>
<td>0.87; 6.0</td>
<td>0.092</td>
</tr>
<tr>
<td>Inadequate knowledge on TB</td>
<td>8.67</td>
<td>1.47; 51.3</td>
<td>0.017</td>
</tr>
<tr>
<td>Alcohol use during therapy</td>
<td>4.97</td>
<td>1.56; 15.9</td>
<td>0.007</td>
</tr>
<tr>
<td>Unfavourable facility factors</td>
<td>6.57</td>
<td>0.60; 71.4</td>
<td>0.12</td>
</tr>
<tr>
<td>Monthly income</td>
<td>5.57</td>
<td>1.07; 30.0</td>
<td>0.041</td>
</tr>
<tr>
<td>Stigmatization</td>
<td>1.92</td>
<td>0.69; 5.39</td>
<td>0.21</td>
</tr>
</tbody>
</table>

aOR: - Adjusted Odds Ratio, CI- Confidence Intervals
4.5: Discussion

4.5.1: Prevalence of Default from Tuberculosis Treatment

The prevalence of default from tuberculosis treatment in Nairobi was 16.7% but varied from 9.2% to 27.6% within its TB control districts. It was slightly higher than the national prevalence of 14.9% for the same year. The prevalence of default in 2004 was 9.2% in Nairobi and 7.6% nationally, indicating that the rate of patients defaulting from treatment is on the rise. The prevalence could be slightly exaggerated as some of the defaulting patients die and not reported to the treatment facilities. This leads to erroneous classification of the patients' treatment outcome. Such patients were noted during tracing whereby about 15% of patients, reportedly defaulters, and 'Out of Control', were observed to have died before the scheduled appointment date for collection of more drugs. It was also observed that some patients who had defaulted from treatment had resumed treatment in other facilities.

The high default rate in Nairobi impacts negatively in lowering treatment success rate in the province. The global target to successfully treat 85% of detected TB cases implies that the proportion of patients who default, die, fail treatment and transfer out collectively should not exceed 15%. Considering the high rate of HIV co-infection and the subsequent high risk of the co-infected patients dying from non-TB opportunistic infections during treatment, it becomes highly necessary to address and reduce the high default rate so as to counter the expected high death rate. That the defaulting rate alone exceeds 15% indicates a major public health concern and a challenge in tuberculosis control in the region. To achieve the 85% treatment success global target, interventions aimed at ensuring patients remain in treatment should be a
The high default rate in Nairobi is behind the increased treatment failures, drug resistance and the low treatment success rate in the region. A number of patients with multi-drug resistant tuberculosis and treatment failure were encountered with during defaulter tracing. High rates of default from tuberculosis treatment have also been observed in other regions. As high as 30% default rates have previously been documented in regions of Russia and in Zambia (Jakubowiak et al., 2007; Kaona et al., 2004). In the Russian regions, social support was initiated to motivate treatment compliance.

4.5.2: Duration in Tuberculosis Therapy before Default

Interruption and consequent default from tuberculosis treatment in Nairobi occurred most frequently during initial three months of treatment within which 59.1% of the defaulters terminated their treatment. In first month of treatment alone, 207 of the 912 defaulters (22.7%) stopped taking medication. Fifty nine percent of patients on treatment who defaulted stopped taking their medication within the first three months from initiation of treatment. This indicates that guidance and counseling at initiation of treatment may be wanting and that many smear positive patients do not survive in treatment long enough for conversion. This was further confirmed in this study by the high proportion of the initially AFB smear positive defaulters who stopped taking medication before conversion was confirmed (47.7%). Similar early default from treatment has been observed in Hong Kong by Chan-Yeung where 39% of defaulters were still bacteriologically positive at the time of default (Chan-Yeung et al., 2003). Such patients contribute to continued infections and risk developing resistant TB disease. In the Hong Kong study, Chan-Yeung et al. observed that 45% of those who
defaulted did so in the first two months of treatment.

A general trend of decline in defaulting with time was observed. This may be due to acceptance and increased awareness on TB with duration in treatment. There was a slight increase on the rate of default during the fifth month of treatment from 11.7% in the fourth month to 12%. This may be due to patients feeling better after four months of medication and perceiving the feeling of improvement as being cured. This is supported by findings in this study that among major reasons patients attributed to their default was feeling better as was indicated by 11% of patients who defaulted. Jaiswal et al. (2003) observed that the conception of equating well-being with cure in India resulted in patient default. Feeling of improvement was also reported among top reasons for default in Ethiopia by Demmissie and Kabede (1994) and Kaona et al., 2004, observed that in Ndola, Zambia, TB patients failed to comply with TB drug taking once they started feeling better.

Among patients on the 6-month regimen who defaulted, only 36.7% survived the initial three months of treatment while 42.1% survived the first three months for those on the 8-month regimen. The first two months of treatment are vital in TB management. During this phase, a combination of four strong anti-TB drugs are taken daily under direct observation of a health care worker, relative or community volunteer to rapidly reduce the number of tubercle bacilli (bacillary load) in the body. Most smear positive patients convert during this phase but must continue to take two drugs daily for another 4-6 months. Patients typically feel well after a few weeks and either may believe that the drugs are no longer necessary or may forget to take medication because there are no longer physical cues of illness. Failure to complete treatment prolongs the morbidity of individual patients and facilitates transmission of
M. tuberculosis.

Defaulting from TB treatment more frequently during the intensive phase was also observed among Brazilian children and in Hong Kong (Oliveira et al., 2006: Chan-Yeung et al., 2003). However, patients in Nigeria were reported to default more frequently during the continuation phase and similarly in Addis Ababa, Ethiopia and Singapore (Daniel et al., 2006: Demissie and Kabede, 1994: Chee et al., 2000).

4.5.3: Factors Associated with Default from Tuberculosis Treatment

Demographic and socio-economic factors associated with default included older age, the male sex, being unmarried, low education, residency in treatment locality of less than two years, alcohol use, low income and low amounts on food. This supports previous reports that the social economically disadvantaged such as the low-income earners, alcohol users and the less educated are at an increased risk of defaulting from treatment.

Older age-group has also been significantly associated with default in Addis Ababa (Demissie and Kabede, 1994). Findings from this study established significant association of the male sex with defaulting from treatment. Similar findings were obtained by Demissie in Addis Ababa, Chan-Yeung in Hong Kong and Daniel in Nigeria (Demissie and Kabede, 1994: Chan-Yeung, et al., 2003: Daniel, et al., 2006) who found the male sex a predictive factor for default. The male sex was also significantly associated with default in the urban environment of Tamatave, Madagascar (Comolet et al., 1998).

Data from this study provide an insight into the poor socio-economic environment of TB patients in Nairobi. Among the TB patients, the rate of unemployment was 65.4%,
54.5% attended school up to primary level and the monthly income of 85.3% fell in Nairobi’s lower income-group of less than Kshs 10,000 a month. Close to 70% lived in single-roomed houses majority of which (64.2%) were temporally or semi-permanent and generally spent low amounts on food daily. In an overcrowded and poorly ventilated room, the TB bacteria can remain in the air for up to 24 hours from the time it is produced by a cough of a TB patient. An overwhelming majority, 92.5%, lived in rented houses with amount of monthly rent ranging from Kenya Shillings 250 to 15,000. The fact that socio-economic factors were associated with default implies that defaulters had even poorer socioeconomic status than the already poor status observed among the general tuberculosis patients.

Low education was significantly associated with default in this study. Demmissie and Kabede (1994) also found low education as significantly associated with default in Addis Ababa. The proportion of defaulters in some states of India was found to decrease uniformly with increasing educational status (Chatterjee et al., 2003).

Income levels and subsequent amount used on food were significantly associated with default. This was also supported by findings in this study whereby about 6.5% of patients who defaulted attributed their terminating treatment to lack of adequate food. Patients on tuberculosis treatment usually experience an increased appetite. Although a good sign indicating clinical response, this poses a challenge to adherence of treatment to the low income group where access to adequate food is a problem (MOH, 2006b). Low income levels and unavailability of social support were associated with default from treatment among TB patients in Ghana (Dodor and Afenyandu, 2005) and the percentage of defaulters observed to decrease uniformly with increasing income in India (Chatterjee et al., 2003). Some countries such as
Russia have introduced incentives and social support especially food and transport provisions to improve treatment compliance (Jakubowiak et al., 2007).

Studies in Russia and in Kazakhstan (Jakubowiak et al., 2007; Bumburidi et al., 2006) observed that use of alcohol was significantly associated with default. Alcohol use was found a major significant factor for default from both univariate and multivariate analysis in this study. Besides being a risk factor for default, alcohol is injurious to the liver while anti-tuberculosis drugs also may be toxic to the liver. Alcohol combined with drugs may lead to a greater risk of toxic hepatic reaction. Patients on TB treatment are therefore advised and encouraged to reduce the amount of alcohol intake if it cannot be avoided entirely. The alcohol used by most of the patients was locally brewed and some patients engaged in its brewing and trade as a means of their income.

Factors related to physical access to the treatment facilities such as transport costs and distance are known to influence adherence to treatment. This study observed that poor access to health facilities was significantly associated with default. Transport costs to and from health facility was not established a significant factor for default in Nairobi implying that other factors beyond payment of fare influenced access to health care. This can be explained by observations during this study that some seriously ill patients, at times bed-ridden, could not access the facilities despite living within walking distance to health facility. Other costs, especially opportunity costs of attending clinics for 6-8 months, may result to poor accessibility to health care. Similar findings were observed by Comolet et al., (1998) in Madagascar who found that the cost of transport to the treatment centre did not seem to have any effect on compliance. One possible reason for lack of significant association of transport costs
with default in Nairobi could be the implementation of the National TB treatment guidelines which emphasize that patients be referred for treatment to facilities closest to their residences to ensure ease in DOTS observation and follow ups. Demissie and Kabende (1994) reported nearer distance as a significant factor for default in Addis Ababa while longer distance was a risk factor for default in India (Jaiswal et al., 2003).

Lack of prior health education on TB, lack of knowledge that TB can be cured and the duration for its cure, perception that TB is not like any other disease and stigmatization were significantly associated with default. This is in agreement with findings by Demissie and Kabede (1994) in Ethiopia and concurs with findings among slum dwellers in Nairobi (Wasonga, 2002). Ignorance on need for treatment compliance was the leading factor that patients attributed as having influenced default (16.5%). Patients were also found to default significantly because of receiving insufficient explanation of their disease and lack of understanding of their disease in Madagascar, as observed by Comolet et al., (1998)

Patients with social support networks have been more adherent in some studies, and patients who believe in the seriousness of their problems with tuberculosis are more likely to be adherent. Casual behaviour of patients on treatment was observed by Comolet et al., (1998) to be a significant factor for default in Madagascar. Stigma associating TB with HIV/AIDS was cited by close to 6% of defaulters as the reason why they defaulted from treatment. This finding is similar to observations by Wasonga (2002) who found societal stigma associating TB with HIV/AIDS as reason for default among slum dwellers in Nairobi. There is clear evidence of the effect on adherence of culturally influenced beliefs and attitudes about tuberculosis and its
treatment. Cultural factors are associated with misinformation about the medical aspects of the disease and the stigmatization of persons with tuberculosis. Within the communities and societies the patients came from, tuberculosis was perceived to be HIV/AIDS, an inherited disease, a result of a curse, taboo or witchcraft or an incurable disease among others. Thus, although TB was suspected by the majority of patients prior to diagnosis, the perceptions played an important role in adherence to treatment.

The prevalence of HIV among TB treatment defaulters was 62% compared to 50% for the successfully treated. This study reports a significant association of HIV co-infection with default. The side-effects profile of TB chemotherapy is magnified in patients with concurrent HIV treatment and/or prior history of hepatitis (Fry et al., 2005). Chakaya (2002) reported a poorer treatment success rate of HIV positive patients in Nairobi among re-treatment patients. HIV co-infection was not found a significant factor for default in Nigeria (Daniel et al., 2006). Though majority of the patients live within walking distance to health facilities, the HIV co-infected patients often attend separate clinics or facilities for services making access to services costly and time consuming. Combining ARV and TB drugs means taking many tablets daily and can be very difficult and challenging to a patient.

Use of herbal medication and history of previous default were associated with default. The herbal medication was sought from traditional herbal “doctors”. Since TB drugs were offered free in all visited facilities, opting to the use of herbal medicines may be due to mistrust of modern medicine, ease of accessing herbal medications, unfavourable health-care provider and personnel factors and side effects of the anti-TB drugs.
Adverse drug side-effects were experienced by 56.2% of the patients but were not established as significantly associated with default, similar to findings in India (Jaiswal et al., 2003) and centrally to findings in several other studies. Tekle et al., (2002) found medication side-effects significantly associated with defaulting. For patients who experienced drug side-effects, the adverse effects were not addressed by the health care provider as indicated by 16.3% of the patients. Not addressing the adverse drug side effects at the facility was significantly associated with default. To minimize the adverse impact of drug side-effects in tuberculosis treatment adherence, it is important that TB health personnel are adequately trained on their recognition and management.

This study supports findings by Chang-Yeung and Oliveira who separately associated history of previous default with default outcome. Daniel et al., (2006) in Nigeria did not establish significant association of previous default with subsequent default.

Similar to findings by Daniel et al., (2006), positive sputum smear results at initiation of treatment were not significantly associated with default in this study. Initial sputum smear result was reported as significantly associated with default in Russia. Treatment (DOTS) observation by health care workers was on borderline significance with default (OR 1.24, P=0.05). The poor adherence among patients whose DOTS observation was by the health care workers could result from the fact that health workers usually observe treatment during the initial phase of complicated cases such as those on re-treatment after default, treatment failures and relapses.

Health care provider factors significantly associated with default included unavailability of drugs, not offering health education on tuberculosis at the facility, poor services and access to health care, long waiting for services, not explaining need
for compliance and not addressing side effects. Attitude towards patients by the health care personnel was associated with default. Health personnel were not friendly, understanding and sympathetic, and did not treat patients with dignity and explain the illness adequately as indicated by a substantial number of defaulters. This study supports findings by Demissie and Kabede (1994) in Addis Ababa, Ethiopia and concurs with Wasonga (2002) in Nairobi that negative attitudes towards patients by health-care personnel contributed to default. Poor interpersonal communication of health provider and personnel was also associated with default in India (Jaiswal et al., 2003).
CHAPTER FIVE CONCLUSIONS AND RECOMMENDATIONS

5.1: Conclusions

The findings from this study lead to the following conclusions:

1. The prevalence of default from TB treatment in Nairobi is high thus hinders the achievement of the global target for successful TB treatment and contributes to the increased treatment failures and drug resistance in Nairobi.

2. Patients on TB treatment in Nairobi default more frequently during the first three months of treatment.

3. The main reasons for treatment default in Nairobi include lack of knowledge about TB and ignorance on need for treatment compliance, traveling away from treatment centres, feeling better after taking medication for a while, adverse drug side-effects, opting to herbal medication, alcohol use and inadequate food.

4. Default from TB treatment in Nairobi is influenced by multiple factors. Predictive factors for TB treatment default in Nairobi are inadequate knowledge on TB, herbal medication use, low income, alcohol use, previous default, HIV co-infection and the male gender.

5.2: Recommendations

The conclusions of this study lead to the following recommendations:

The twin Ministries of Health (Ministry of Public Health and Sanitation and Ministry of Medical Services) should make interventions geared towards motivating patients to complete treatment so as to reduce the high prevalence of default in Nairobi. Such
interventions should include social support and other mitigating factors for default.

Health-care providers should provide adequate pre-treatment counseling to TB patients and enhance close monitoring during the initial phase of treatment, especially to the smear-positive patients, to ensure retention in treatment. The health care providers should also facilitate and motivate community health workers in treatment support and default retrieval, as well as training on counseling on need for TB treatment compliance. Health-care workers should be more friendly, understanding and sympathetic towards TB patients and uphold dignity.

The Ministry of Public Health and Sanitation and Ministry of Medical Services should step up integration of TB and HIV services, health education campaigns and advocacy on TB to both the infected and the general public and should strive to improve health service delivery especially by reducing time spent in TB clinics and ensuring clinics are continuously manned. Conducting of regular training and refresher courses for health workers on TB management, effective communication skills, recognition and management of adverse drug side-effects and addressing patients’ needs, should be considered so as to motivate the workers to effectively address the tuberculosis treatment default menace.

Further, adequate and uninterrupted drug supply to TB treatment centres should be ensured and arrangement made for patients who have to travel away from treatment centres to collect enough supply in advance. Advocacy on need for treatment completion even when a patient feels better after taking medication for a while is needed. Issues that lead patients to opt to herbal medication should be investigated and addressed. Use of household and family members to oversee treatment for alcohol users and male patients should be encouraged. Social support especially
provision of foods to those in the low-income group should be considered.

5.3: Implications of the findings

The findings of this study imply patients' understanding of tuberculosis and its treatment are needed so as to improve adherence. Notwithstanding patients' personal characteristics, health providers have a major role to play: to give adequate guidance and counseling to their clients, enhance quality of health service delivery and to tailor support systems to patients' needs. Patients often take their tuberculosis medications under very difficult conditions and they cannot control many of the factors that prevent them taking their drugs. Besides emphasis on need for compliance, much more is needed to address factors such as poverty and HIV co-infections.

5.4: Recommendation for Further Research

Further research is recommended on;

1. Factors that influence default from TB treatment in a rural setting.
2. Factors that influence children to default from TB treatment.
3. Factors contributing to the use of herbal medication in place of anti-TB drugs.
4. An operational research on whether social support can impact positively to lower default rates.
REFERENCES


APPENDICES

Appendix 1: Study Area

Map of Nairobi Province, Kenya
Appendix 2: An overcrowded and poorly ventilated low income settlement where some of the TB patients in Nairobi live
### Appendix 3: Sampling frame

<table>
<thead>
<tr>
<th>District</th>
<th>Control Zone</th>
<th>Facilities sampled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kasarani</td>
<td>E</td>
<td>Kariobangi NCC</td>
</tr>
<tr>
<td>Dagoretti</td>
<td>J</td>
<td>Mbagathi Hosp., Riruta HC, Wema Nursing Home, Kabiru, Bamako</td>
</tr>
<tr>
<td></td>
<td>R</td>
<td>PCEA Kikuyu, Chandaria</td>
</tr>
<tr>
<td>Westlands</td>
<td>K</td>
<td>Westlands HC,</td>
</tr>
<tr>
<td></td>
<td>P</td>
<td>AMURT HC, Kangemi HC</td>
</tr>
<tr>
<td>Starehe</td>
<td>M</td>
<td>Ngara HC</td>
</tr>
<tr>
<td>Langata</td>
<td>A</td>
<td>Langata HC, Kibera DO, Kibera Amref, Ushirika HC, Gatwikira MSF Clinic, Kibera South, Silanga</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>St Mary’s Hosp</td>
</tr>
<tr>
<td>Makadara</td>
<td>C</td>
<td>Remand HC</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>Jericho HC, Mareba, Jerusalem Clinic</td>
</tr>
<tr>
<td>Kamukunji</td>
<td>Q</td>
<td>Bahati HC</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>Blue house Clinic, Eastleigh HC</td>
</tr>
<tr>
<td>Embakasi</td>
<td>H</td>
<td>Kayole 2,</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>Umoja HC</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>Dadora 2 HC</td>
</tr>
</tbody>
</table>
Appendix 4: Questionnaire

Part 1: TB Treatment Data Collection Tool

(To be completed from TB treatment facility registers)

Questionnaire number ____________ Date ________________

1. Facility data

1.1 District ______ 1.2 Zone ______ 1.3 Facility name ______

1.4 Facility type__________

2. Personal specification and treatment data

2.1 Serial no. ______________ 2.2 District registration Number_________________

2.3 Case status ☐ Case ☐ Control 2.4 Age (years) ___________

2.5 Sex ☐ male ☐ female 2.6 Residence (Estate/Village) ___________

2.7 DOTS during intensive phase done by

☐ Health Care Worker ☐ Household member, friend, relative

☐ Community Volunteer ☐ not done

2.8 Type of patient ☐ New ☐ Relapse ☐ Failure

☐ Retreatment after Default ☐ Transferred in
2.9 Tuberculosis type  □ Pulmonary  □ Extra Pulmonary

2.10 Sputum smear result  0 2/3 5 6 8

2.11 Date treatment started  2.12 Date of treatment outcome

2.13 Regimen used  □ 2RHZE/6EH  □ 2SRHZE/1RHZE/5RHE

□ 2RHZ/4RH  □ 2RHZE/4RH

2.14 HIV status  □ positive  □ negative  □ not done

2.15 Marital status  □ married  □ single  □ divorced

□ Widowed  □ others

2.16 Treatment Outcome

□ Cured  □ Treatment Completed  □ Out of Control  □ Defaulted
Part 2: TB Treatment Questionnaire

Questionnaire number ________ Date ______ Name of Interviewer ________

Serial number ___________ District registration number ____________________

District ___________ Zone _______ Health Centre name ______________________

1. Personal specification

1.1 Age (years) __________ 1.2 Sex □ male □ female

1.3 Case Status □ Case □ Control

1.4 Date treatment started _________ 1.5 Date of last clinic attended _________

2. Demographics

2.1 Patient Status □ Alive □ dead (state date) ______________________

□ Place of Death __________ □ Too Sick □ Other (Remarks) ____________

2.2 Residence (Estate/Village) _______________________________________

2.3 How long have you lived in the above place? (Years) _______ (months) ___

2.4 Marital status: □ single □ married □ divorced □ widowed

□ other (Specify) _____________________________________________

2.5 Do you live with your family? □ yes □ no

2.6 How many children do you have? ________________________________
2.7 Number of additional people in the household ____________

2.8 Has anyone of the household members been treated for TB before?

☐ yes  ☐ no  ☐ don’t know  ☐ N/A

3. Socioeconomic status

3.1 Occupation  ☐ unemployed  ☐ informal employment

☐ formal employment  ☐ other (Specify) ____________

3.2 Highest level of education attained  ☐ None  ☐ Primary

☐ Secondary  ☐ Tertiary

3.3 Materials for house (walls)  ☐ stone  ☐ timber  ☐ iron sheets

☐ others (specify) ____________

3.4 Number of rooms in the house you live in

☐ Single room  ☐ double room  ☐ one-bedroom  ☐ two-bedroom or larger

3.5 The house you live in is  ☐ own house  ☐ rented

3.6 If rented, amount of rent per month ____________ (Kshs.)

3.7 Amount of money spent on food daily ____________ (Kshs.)

3.8 Income per month ________________________ (Kshs.)
4. Health Facility Factors

4.1 Were drugs available each time you visited the facility? □ Yes □ no

4.2 Were you offered TB health education at the facility? □ Yes □ no

4.3 Did you suffer from any anti-TB drug side effects in the course of treatment?
□ yes □ no

4.4 Describe the effects _____________________________

4.5 Were the side effects addressed at the health facility? □ yes □ no

4.6 Did the drug side effect influence your adherence to treatment?
□ yes □ no □ N/A

4.7 Were the services offered acceptable? □ yes □ no

4.8 Was the health facility accessible? □ yes □ no

4.9 Was the waiting period at the facility acceptable? □ yes □ no

4.10 Did the health personnel adequately explain to you the need for treatment compliance? □ yes □ no

4.11 During your last visit, how long did you wait before being attended to?
__________________________ (Minutes)

4.12 How much fare did you use to and from health facility? ____________ Kshs

4.13 Was the fare always available? □ yes □ no □ N/A
5. Health Personnel Factors

5.1 Were the health personnel friendly and understanding? □ yes □ no

5.2 Were the health personnel sympathetic? □ yes □ no

5.3 Were you treated with dignity? □ yes □ no

5.4 Were you explained about your illness? □ yes □ no

6. Knowledge and Perceptions

6.1 When you first went for treatment, did you suspect you had TB? □ Yes □ no

6.2 If the answer to 6.1 is no, what disease did you suspect? ________________

6.3 Had you read any material or received public health lecture on TB before your illness? □ yes □ no

6.4 In your own opinion is TB curable? □ yes □ no □ don’t know

6.5 How long does TB take to cure? ________________ (months)

6.6 How does one get infected with TB? ___________________________________________________________________

6.7 Did you use alternative medication other than that provided at the health facility? □ yes □ no

6.8 If yes explain the source ___________________________________________________________________

6.9 If you did not complete treatment, what do you consider made you not to? ___________________________________________________________________
6.10 Do you use alcohol? □ yes □ no

6.11 What do people say/think about TB disease? ____________________________

6.12 Is TB perceived like any other disease in your community/society?

□ Yes □ no □ don’t Know

6.13 Did the way the community/society perceives TB influence your attendance or adherence to treatment? □ Yes □ no

6.14 How were you influenced? _____________________________________________

6.15 Did you suffer from any discrimination by friends, relatives, colleagues at workplace or employer due to your illness? □ Yes □ No

6.16 In your opinion, why do some TB patients default from treatment?

__________________________________________________________
Appendix 5: Research Authorization

REPUBLIC OF KENYA

MINISTRY OF SCIENCE AND TECHNOLOGY

Telephone:+254020318581
Facsimile:+254020251991
Email:@scienceandtechnology.go.ke
Website:www.scienceandtechnology.go.ke

REF: MOST13/001/37C795/2

MUTURE BENARD NJEGA
KENYATTA UNIVERSITY
P O BOX 43844
NAIROBI

Dear Sir

RE: RESEARCH AUTHORIZATION

Following your application for authority to conduct research on “Factors associated with default from treatment among tuberculosis patients in Nairobi Province,” This is to inform you that you have been authorized to carry out research in Nairobi Province for a period ending 30th March 2008.

You are advised to report to the Provincial Commissioner Nairobi and Provincial Medical Officer of Health Nairobi before commencing your study. On completion of your research, you are expected to submit two copies of your research report to this office.

Yours faithfully

[Signature]