CHARACTERISTICS OF SPUTUM-POSITIVE PULMONARY TUBERCULOSIS PATIENTS WHO ARE NOT CURED IN THE COMMUNITY HEALTH CENTRES IN MOSES KOTANE SUB-DISTRICT, NORTH WEST PROVINCE IN SOUTH AFRICA

by

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DECLARATION

I declare that the Mini-dissertation hereby submitted to the University, for the degree of Master of Medicine (Family Medicine) has not previously been submitted by me for a degree at this or any other university; that it is my work in design and in execution, and that all material contained herein has been duly acknowledged.

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DEDICATION

This research is dedicated to my wife, Nenette Olenga Yoko. Her hours of work in loving our son Jordy Mazaba Yoko, enabled the hours of research, contemplation, and writing necessary to complete this research. She is my “excellent wife, worth more than jewels”.

This research is also indebted to Dr. Cila Kabongo, my godfather and mentor, who instilled in me a love of Family Medicine and who taught me to see the “smaller units of meaning”.
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Finally, to my loving, and supportive wife, Nenette Yoko: my deepest gratitude for all the encouragement.
LIST OF ACRONYMS AND ABBREVIATIONS

AIDS    Acquired Immunodeficiency Syndrome
ARVS    Antiretrovirals
CDC     Centres for Disease Control and Prevention
CD4     Cluster of Differentiation 4
CHC     Community Health Centre
DHIS    District Health Information System
DOT     Directly Observed Treatment
DOTS    Directly Observed Treatment Short course
DST     Drug Susceptibility test
EAC     East African Community
ETR     Electronic Tuberculosis Register
FNA     Fine needle aspiration
FPD     Foundation for Professional Development
HIV     Human Immunodeficiency Virus
ICD     International Classification of Diseases
IDP     Integrated Development Plan
LTBI    Latent Tuberculosis Infection
MDG     Millennium Development Goal
MDR     Multidrug Resistance
MDR-TB  Multidrug-Resistant Tuberculosis
MREC    MEDUNSA Research Ethics Committee
NDOH    National Department of Health
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<td>North West Province</td>
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<td>SD</td>
<td>Standard Deviation</td>
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<td>Statistical Analysis System</td>
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ABSTRACT

AIM: To identify characteristics of sputum-positive TB patients registered in 2010 who were not cured in CHCs in Moses Kotane Sub-District.

OBJECTIVES: To describe characteristics of all new smear-positive TB patients and characteristics of those who were not cured in 2010 in CHCs in Moses Kotane Sub-District, and to determine which characteristics contributed to the lack of cure among those who were not cured.

DESIGN: This was a quantitative cross-sectional study.

SETTING: This study was conducted in Moses Kotane, one of the five sub-districts of BOJANALA District, situated in the eastern part of the North West Province of South Africa, and consists of one District Hospital, five Health Centres, 44 clinics, 35 Mobile Health Points and four Health Posts.

RESULTS: Of the 229 new sputum-positive patients analysed, 176 were cured and 53 were not cured. The mean age was 35.8 (SD: ±13.02) years. 121 (52.84%) females and 108 (47.16%) males, ratio of 1.1:0.9. Ninety seven (97) females (55.1%) and 79 males (44.9%) were cured, while 24 (45.3%) females and 29 (54.7%) males were not cured, with a $P$-value of 0.214. One hundred and sixty (160) patients (69.87%) were unemployed; and 69 patients (30.13%) were employed. Among the unemployed patients, 120 (68.20%) were cured and 40 (75.5%) were not cured. Of the 69 patients with employment, 56 (31.8%) got cured and 13 (24.5%) failed to get cured, with a $P$-value of 0.394. One hundred and fifty two (152) patients (66.38%) had DOT Support, while 77 (33.62%) patients did not have DOT Support, a ratio of 2:1. Of the 176 cured patients, 130 (73.86%) had DOT support, while 31 (58.49%) of the 53 not cured patients did not have DOT support. The $P$-value was 0.00002. There were 154 (67.2%) HIV-positive and 75 (32.8%) HIV-negative patients, a ratio of 2:1. Among the HIV-positive patients, 119 (67.61%) got cured and 35 (66.04%) did not get cured, while of the 75
(32.8%) who were HIV-negative, 57 (32.39%) got cured and 18 (33.96%) did not get cured; the P-value was 0.8680.

**CONCLUSION:** The study has shown that DOT Support was a strong predictive characteristic for those patients’ outcomes. Thus, the majority of not cured patients did not have DOT Support, while the majority of cured patients had DOT Support. Female gender was more affected than the male, but the latter failed getting cured more than the female. The mean age was 35.8 (SD: ±13.02) years. The majority of those sputum-positive TB patients were HIV-positive and unemployed.
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CHAPTER 1
INTRODUCTION

1.1 Brief overview and relevance of the topic

1.1.1 Global situation regarding tuberculosis

Tuberculosis (TB) is a major public health problem in the World. Almost a third of the world’s population (more than 2 billion people) is infected with the TB bacilli, and one in every 10 infected people is estimated to become ill with active TB in their lifetime (World Health organisation, 2009).

TB remains the top infectious cause of mortality in the world and it is on the increase. In 2003, there were 8.8 million new cases of tuberculosis worldwide, with 1.7 million deaths (ed. Rakel, 2007); 9.2 million new cases of tuberculosis, with also 1.7 million deaths in 2006 (National Department of Health, 2009), and 8.6 million new cases of tuberculosis, with 1.3 million deaths in 2012 (WHO, 2013a).

1.1.2 Regional situation regarding tuberculosis

Over the past two decades, sub-Saharan Africa has seen a resurgence of this airborne disease, which disproportionately affects the poor. In Southern Africa, weak TB control combined with a spiralling Human Immunodeficiency Virus (HIV) epidemic, has resulted in multidrug-resistant TB which dramatically increases treatment costs, duration of treatment, and lowers chances of treatment success (World Bank, 2008).

1.1.3 Local situation regarding tuberculosis

South Africa’s TB situation has reached a crisis point in several provinces. The country has one of the highest estimated TB rates in the world, ranking fourth among the 22
WHO-determined high-burden countries, with an estimated 461 000 new cases reported each year (CDC Global Health, 2011).

The South African National TB Management Control data for 2006 shows that North West Province (NWP) has the fifth highest incidence of smear-positive TB, behind KwaZulu-Natal, Eastern Cape, Western Cape and Gauteng (NDOH, 2009).

1.1.4 TB outcomes

TB not being cured is a major cause of mortality, drug-resistant TB, and indeed ongoing transmission of the disease.

1.1.4.1 TB mortality

In 2012, there were 1.3 million deaths of the 8.6 million people who developed TB in the World. The estimated number of people falling ill with tuberculosis each year is declining, although very slowly, which means that the world is on track to achieve the Millennium Development Goal to reverse the spread of TB by 2015. The TB death rate dropped 41% between 1990 and 2011 (WHO, 2013a).

Africa as a region has more TB deaths than any other region of the world with a TB mortality of 74.0 per 100 000 of population in 2010, compared to South East Asia with 31.0 and the global mortality of only 21.0 (World Health Sciences, 2010).

TB continues to be the leading cause of death in South Africa. The World Health Organization (WHO) gives a figure of 25 000 deaths from TB in South Africa in 2011. This excludes people who had both TB and HIV infection when they died (WHO, 2013b). The number of TB deaths associated with HIV were 62 827 (11.6% of the total number of deaths) for 2010; 69 791 in 2009; and 75 281 in 2008 (NDOH, 2012).

1.1.4.2 MDR-TB/XDR-TB situation

The MultiDrug-Resistant Tuberculosis (MDR-TB) situation is of huge concern in the World. WHO estimates that there were about 0.5 million new MDR-TB cases (3.7% of
new TB patients) in the world in 2011. About 60% of these cases occurred in “BRICS” countries alone: India (66 000 cases), China (61 000 cases), the Russian Federation (44 000 cases), Brazil (11 000 cases), and South Africa (8 100 cases) (WHO, 2013b).

According to the South African National Department of Health (NDOH), the number of MDR-TB/XDR-TB cases have been increasing since 2006. There were 5 774 MDR-TB cases in 2006, 7 429 MDR-TB cases in 2007, 8 198 MDR-TB cases in 2008, 9 070 MDR-TB and 594 Extensively Drug-Resistant Tuberculosis (XDR-TB) cases in 2009, 7 386 MDR-TB and 741 XDR-TB cases in 2010 (NDOH, 2011).

1.2 Problem statement

In 2010, the researcher was working in Moses Kotane, one of the five sub-districts within the Bojanala District in North West Province (NWP), and was visiting 19 clinics among the 49 of this Sub-district. He noticed that the majority of the clinics including all five of their community health centres (Mabeskraal, Mogwase, Moruleng, Motlhabe and Pella) had a low cure rate – below 65% – compared to the WHO and national targets of a TB cure rate of 85%. In 2010 TB data for this Sub-district indicated a cure rate of 62,1%, a defaulter rate of 10,2%, a death rate of 6,7%, a treatment failure rate of 2,5%, and an MDR-TB rate of 0,3% (NWP-Electronic Tuberculosis Register.Net, 2010).

TB not being cured is a major cause of mortality, drug-resistant TB and indeed ongoing transmission of TB, as local data is showing.

The researcher was interested to find out the characteristics of sputum-positive TB patients registered in 2010 who were not cured in those five community health centres (CHCs). And the reason for choosing CHCs was because they are larger clinics that usually drain more patients and they are better equipped with staff and materials, enabling them to render better care than clinics.

1.3 Justification of the study
The researcher thinks that sputum-positive TB not cured leads to high mortality rates, high MultiDrug Resistance (MDR) rates and ongoing TB transmission in the local context. In addition, the researcher thinks that, with the epidemiology of pulmonary tuberculosis that keeps on changing over time from one area to another, even the clinical patients’ characteristics that were described in other places, provinces, countries or continents, had changed and may not be the same as in this Sub-District.
2.1 Epidemiology

2.1.1 Global situation

The WHO declared TB a global emergency in 1993. At the beginning of the new millennium the heads of state of the United Nations member countries determined eight Millennium Development Goals (MDG) with 18 targets (FPD, 2013: 37). Many of these goals are health-related; among them are the four principal targets for global TB control by the year 2015:

- To detect 70% of new smear-positive patients arising each year
- To cure at least 85% of these patients. Through reaching these targets, the goal is to:
  - halve TB prevalence
  - and death rates, as compared to those of 1990.

This 2015 MDG target of halting and reversing the incidence of TB has been achieved, with TB incidence falling globally for several years and declining at a rate of 2.2% between 2010 and 2011. Globally the TB mortality rate has fallen by 41% since 1990, and the world is well on track to reach the global target of 50% reduction by 2015 (FPD, 2013: 37).

Despite this encouraging progress, the global burden of tuberculosis remains huge, with an estimated 8.7 million new cases of tuberculosis and 1.4 million deaths from TB in 2012. Most of the cases occurred in Asia (55%) and in Africa (30%), with a small
proportions of cases in the Eastern Mediterranean Region (7%), the European Region (5%), and the Region of the America (3%) (FPD, 2013: 38-39).

Globally, 3.7% of new cases and 20% of previously treated cases are estimated to have MDR-TB. WHO estimates that there were about 0.5 million new MDR-TB cases in the world in 2011. About 60% of these cases occurred in “BRICS” countries alone (WHO, 2013b).

2.1.2 Regional situation

A decade ago the problem of TB in Africa attracted little attention. Part of the reason was that the incidence of TB was low and falling in most parts of the continent (Cauthen, Pio & Ten Dam, 2002). In 2006, the TB incidence in Africa was higher, at 363 cases per 100 000 population, compared to the global figure of 139 cases per 100 000 population (WHO, 2008). Almost 80% of TB cases among people living with HIV reside in Africa (WHO, 2012b).

Countries in the Southern African region in particular face a disaster as far as TB and HIV are concerned. Four of the highest-burden countries are in this region, contributing almost 40% to the burden in Africa (FPD, 2013: 39). The incidence rates of TB are the highest in Swaziland (1 257 cases per 100 000 population), South Africa (971), Namibia (693), Zimbabwe (672), Botswana (548) and Mozambique (539); however, in terms of the actual numbers of cases, South Africa is currently the highest, with 500 000 new cases, and contributes over 30% to the total burden of TB in SADC countries (WHO, 2012a).

About one-third of the population of sub-Saharan Africa were infected with M. tuberculosis (Dye et al., 1999). In the year 2000, an estimated 17 million people in sub-Saharan Africa were infected with both M. tuberculosis and HIV – 70% of all people co-infected worldwide (Corbett et al., 2003). The burden of TB in sub-Saharan Africa is becoming greater every day. According to the World Bank 2012 report, the region had an incidence rate of 271 cases per 100 000 population in 2010, and 283 cases in 2008 (WB, 2012). It is becoming increasingly evident that the joint impact of TB and HIV in
sub-Saharan Africa is set to become more devastating over the next few years than has been seen anywhere else in the world (FPD, 2013: 39).

### 2.1.3 Tuberculosis in South Africa

South Africa is one of the 22 countries globally, that are designated by the WHO as “TB hot spots”, due to the very high levels of TB infections they are experiencing. It is therefore a priority for the Department of Health in South Africa to ensure that adequate treatment is available at health services at district level, to ensure access to care for all. TB services are provided by the state, free of charge (FPD, 2013: 40).

In 2009, the incidence rate of TB in South Africa was 943 per 100 000 population per year. This was the highest incidence rate worldwide. In 2010, the incidence rate of TB in South Africa went up to 971 cases per 100 000 population, behind Swaziland who had 1 257 cases (WHO, 2012b).

The burden of TB is not uniformly spread throughout South Africa and rates vary considerably among the nine provinces. The highest rates of TB are reported from the Southern provinces, where incidence figures are more than double those reported from the central and Northern provinces. Viewed geographically, incidence rates are highest in the Northern and Western Cape, currently exceeding 900 per 100 000 population (FPD, 2013: 50).

A serious complication to the TB in South Africa has been the emergence of MDR-TB strains or XDR-TB of the organism or agent causing the disease. According to South Africa's NDOH, the numbers of MDR-TB/XDR-TB cases have been on the increase since 2006.

There were 5 774 MDR-TB cases in 2006, 7 429 MDR-TB cases in 2007, 8 198 MDR-TB cases in 2008, 9 070 MDR-TB and 594 XDR-TB cases in 2009, 7 386 MDR-TB and 741 XDR-TB cases in 2010 (NDOH, 2011).

The result is the need for prolonged and expensive treatment and a core group, who are not curable. This results in an additional burden being placed on the state and
emphasises the need for well-managed TB programmes that will reduce this problem (FPD, 2013: 42).

2.2 Transmission and pathogenesis of TB

2.2.1 Transmission

There are five closely related mycobacteria responsible for TB: Mycobacterium tuberculosis, M. bovis, M. africanum, M. microti and M. canetti. Mycobacterium tuberculosis, by far the most common, is transmitted between humans via the airborne route. There are no known animal reservoirs of M. tuberculosis. M. bovis may penetrate the gastrointestinal mucosa or invade the lymphatic tissue of the oropharynx when ingested in milk from diseased cows. Infection with the other organisms is relatively rare (NDOH, 2009).

Mycobacterium tuberculosis was discovered by Robert Koch in 1882. It causes TB that commonly affects the lungs, but may cause disease in any part of the human body (Ndjeka et al., 2008).

TB is usually spread from person to person through the air, by droplet nuclei that are produced when a person with pulmonary or laryngeal TB coughs, sneezes or sings. Droplet nuclei may also be produced by aerosol-producing investigations such as sputum induction, bronchoscopy and through manipulation of lesions or processing tissue or secretions in the laboratory. Micro-droplets, which are small particles 1 to 5 micro-millimetres containing 1-5 bacilli, are highly infectious. They are so small that air currents normally present in any indoor space can keep them airborne for long periods of time. These droplets are small enough to reach the alveolar spaces within the lungs, where the organism replicates itself.

The following factors determine the probability of transmission of M. tuberculosis:

- Susceptibility: Susceptibility of the exposed individual (immune status).
- **Infectiousness:** Infectiousness of the person with TB disease is directly related to the number of tubercle bacilli that the person expels into the air. Persons who expel many tubercle bacilli are more infectious than patients who expel few or no bacilli.

- **Environment:** Environmental factors that affect the concentration of *M. tuberculosis* organisms.

- **Exposure:** Proximity, frequency and duration of exposure.

One cough may produce 3,000 droplet nuclei and a sneeze up to a million droplets. Between 10 and 200 droplets can cause infection. The most infectious cases are those with smear-positive pulmonary TB, particularly with lung cavities. Smear-negative pulmonary TB cases are much less infectious, unless they have pulmonary TB as well. Extra-pulmonary cases are almost never infectious, unless they have pulmonary TB as well. Individuals with latent tuberculosis infection (LTI) are not infectious, as they do not have replicating bacteria and cannot transmit the organism.

Transmission generally occurs indoors, in dark, damp spaces where droplet nuclei can stay airborne for a long time. Direct sunlight quickly kills tubercle bacilli, but they can survive in the dark for several hours. Close contact and prolonged exposure increase the risk of transmission.

Once infected, the progression to active disease depends on the immune status of the individual. In those with normal immunity, 90% will not progress and only 10% will develop active disease (half of these now and half later on in life). The risk is highest in the first two years after infection, when half the cases will occur. Those most at risk include children younger than 5 years of age and the elderly.

People with suppressed immunity are more likely to develop active TB than those with normal immunity; 50-60% of HIV-positive people infected with TB will go on to develop active disease. Other immunosuppressive conditions such as silicosis, diabetes
mellitus, and where corticosteroids and other immunosuppressive drugs are used, also increase the risk of progression to active TB.

BCG immunisation gives variable protection against the progression of TB from infection to disease. The main benefit of BCG is the protection against the development of the serious forms of TB in children, such as TB meningitis and miliary TB (NDOH, 2009).

### 2.2.2 Pathogenesis of TB infection and disease

After droplet nuclei containing tubercle bacilli are inhaled, they enter the lungs and travel to the alveoli, where they multiply. A small number of tubercle bacilli enter the bloodstream and spread throughout the body. The bacilli may reach any part of the body, including areas where TB disease is more likely to develop (such as the lungs, kidneys, brain, or bone).

Within 2-10 weeks, the immune system produces special immune cells called macrophages that surround the tubercle bacilli. The cells form a hard shell that keeps the bacilli contained and under control (TB infection).

If the immune system cannot keep the bacilli under control, the bacilli begin to multiply rapidly (TB disease). This process can occur in different places in the body, such as the lungs, kidneys, brain, or bone (EAC, 2013).

#### 2.2.2.1 Progression of TB

People who are exposed to TB may or may not develop TB infection. People with TB infection may or may not develop TB disease. The risk of developing TB disease is highest in the first two years after infection. TB disease can develop very soon after infection or many years after infection. In other words, about 10% of all people who have TB infection will develop disease at some point. The remaining 90% will stay infected, but free of disease, for the rest of their lives (East African Community, 2013).
2.2.2.2 Complications of TB

The most serious outcome of untreated, active tuberculosis is death. For those who survive, tuberculosis can cause extreme pain and very serious health problems.

The following are some of the possible complications of untreated, active tuberculosis:

- **Development of drug-resistant tuberculosis.** Tuberculosis that goes untreated, or particularly tuberculosis that is not properly treated with a thorough regimen of antibiotics, may mutate into a drug-resistant form of tuberculosis.

- **Long-term damage to the lungs.** Without treatment, tuberculosis bacteria can rapidly multiply and spread throughout the body. The bacteria can quickly infect the lungs and cause serious damage, such as a collapsed lung. Many people may also begin coughing up large amounts of blood (haemoptysis) if tuberculosis continues to damage lung parenchyma close to a large vessel.

- **Organ damage.** Untreated tuberculosis can spread beyond the lungs and into other organs, causing damage that can affect functioning. The liver is commonly affected by tuberculosis, resulting in serious damage and liver function problems.

- **Joint damage.** Tuberculosis bacteria, unless treated, can spread outside the lungs and even into the bones and joints. Bacteria in the joints can cause extreme pain, swelling, and even abscesses in and damage to the joints, sometimes leading to arthritis.

- **Eye problems.** When TB bacteria spread into the eyes, the result can be redness, irritation, and swelling of the retina and other parts of the eye.

2.2.2.3 Side effects from tuberculosis treatments

Side effects from tuberculosis medications are very common and may sometimes be significant enough to keep people from taking them. However, they should never stop taking their medications.

The following are some common side effects and complications that may be caused by tuberculosis medications (Rodriguez, 2009):
• Skin rash (exfoliative dermatitis, Steven Johnson Syndrome, and toxic epidermal necrolysis)
• Dark (brown or orange) urine and tears
• Altered vision and hearing
• Gastrointestinal disturbances (nausea, vomiting, stomach cramping and anorexia)
• Pain or a tingling sensation in toes and fingers (peripheral neuropathy).

2.2.2.4 Vulnerability to TB

The following groups of people are especially vulnerable to contracting tuberculosis:

- Urban poor; poverty forces people to live in overcrowded conditions which increase the risk of TB transmission.
  - Refugees, internally displaced people and people living in complex emergency.
  - The Homeless.
  - People living with HIV/AIDS: People infected with HIV have up to 10% chance per year of developing active TB if not treated with ARVS (NDOH, 2009).

2.2.3 Diagnostic criteria and techniques of TB

2.2.3.1 Signs and symptoms of TB

- Persistent cough
- Chest pain
- Dyspnoea
- Haemoptysis
- Common systemic symptoms: fever, chills, night sweats, tiredness, anorexia, malaise and weight loss

- There may be remote manifestations unrelated to the site of involvement: haematological abnormalities (leucocytosis and anaemia), hyponatraemia and psychological disorders.

Symptoms of extra-pulmonary TB depend on the site affected: backache for TB of the spine, haematuria for TB of the kidneys, chest pain from tuberculous pleurisy, enlarged lymph nodes for TB lymphadenitis, convulsion and confusion for TB meningitis.

- Other medical conditions that may increase the risk of TB: HIV infection, Diabetes mellitus, Leukemia, Hodgkin’s disease, End-stage renal disease, Chronic malabsorption syndrome, Prolonged corticosteroid therapy or other immunosuppressive therapy, and silicosis.

2.2.3.2 Laboratory diagnosis of TB

The following are TB tests that are currently available and commonly used in South Africa:

- **Microscopy:** Identifies the most infectious cases of TB (sputum smear positive). Essential for diagnosis of TB and monitoring of treatment response. Sensitivity 30-60%. This sensitivity is reduced in patients with advanced HIV, although the actual bacillary load is generally high. In children with TB, cavitation is not usual; the bacillary load is usually relatively low and microscopy of sputa for acid fast bacilli is generally negative. Positive sputum is not seen in extra-pulmonary TB unless there is pulmonary TB as well.
- **Culture**: The culture of a sputum specimen for TB is more sensitive than microscopy (80%). It will allow approximately 20% more patients to be diagnosed with PTB than if direct microscopy alone is used.

- **Culture and drug susceptibility testing (DST)**: Essential for diagnosis and surveillance of drug resistance (MDR/XDR-TB).

- **Molecular techniques (Line probe assay, Gene Xpert)**: Rapid diagnosis of MDR-TB. Identification of mycobacterial species.

Gene Xpert is an instrument that is used to conduct rapid diagnosis of TB and detection of Rifampicin resistance in 2 hours. It is recommended by WHO to be used as the initial diagnostic test in individuals suspected of MDR-TB or HIV/TB. The test is 75% sensitive in people with smear-negative TB; a second test increases sensitivity by about 10% and a third test, by another 5%.

Line probe assay diagnoses TB and simultaneously detects resistance to Rifampicin and Isoniazid. It is only done on smear-positive specimens or smear-negative culture positive samples (FPD, 2013: 74).

### 2.2.3.3 Chest radiography

Pulmonary TB cannot be diagnosed by radiography alone. A number of other bacterial conditions (pneumonia or abscess) and non-bacterial processes (fungal disease, carcinoma, sarcoidosis, pneumoconiosis) may produce similar radiographic images. If a chest x-ray is suggestive of TB, bacteriological confirmation must be obtained. On the other hand, if the chest x-ray shows cavities but bacteriological examination is negative, the diagnosis of a condition other than active TB needs to be considered. Chest x-rays are useful for the diagnosis of TB in children.

The following are the radiographic features of pulmonary TB:
In primary TB: Middle or lower lung zone infiltrates often associated with enlarged lymph nodes at the hilar region of one of the lungs. Atelectasis (partial lung collapse) may result from the compression of the airways by these enlarged lymph nodes. Cavitation due to destruction of lung tissue may occur quickly as a result.

In HIV-infected patients the radiographic findings depend to a certain extent on the degree of immunosuppression produced by the infection. If TB occurs in the early course of HIV infection, the chest x-ray findings tend to be typical to the ones described above. With more advanced HIV disease, the radiographic findings become more atypical and cavitation is uncommon, and diffuse infiltrates and intrathoracic lymphatic nodes are frequently seen.

2.2.3.4 Histology

Tissue samples obtained by means of biopsy are examined for suspected TB. This is particularly useful in the diagnosis of extra-pulmonary TB.

2.2.3.5 Tuberculin skin testing (TST)

TST is not usually used in patients over the age of 12, as most will be positive. A positive TST does not establish a diagnosis and a negative TST does not exclude TB. Various conditions may cause a negative reaction (HIV infection, malnutrition, severe viral infection, cancer, immunosuppressive drugs, severe disseminated TB). Up to 25% of immunocompetent persons may have negative TSTs at the time of diagnosis of TB. In children TST is a valuable tool for establishing the diagnosis of TB (FPD, 2013: 87).

2.2.3.6 Diagnosis of extra-pulmonary TB

It will depend on the affected organ (NDOH, 2009):

- TB Lymphadenitis: Fine needle aspiration (FNA) and Lymph node biopsy
- Miliary TB: Chest x-ray and lumbar puncture if disseminated TB
- TB meningitis: Lumbar puncture (and CT scan where available)
- Pleural effusion (older children and adolescents): Chest x-ray, pleural tap for chemistry and culture
- Abdominal TB (peritoneal): Abdominal ultrasound and ascitic tap for chemistry and culture
- Osteoarticular TB: X-ray, joint tap, or synovial biopsy
- Pericardial TB: Ultrasound and pericardial tap.

2.3 Factors propagating TB

The following factors are conducive to propagating TB:

- HIV infection
- Silicosis
- Smoking
- Malnutrition
- Crowding
- Diabetes mellitus
- Other conditions: prolonged corticosteroid therapy and other immuno-suppressive therapy, haematologic and reticuloendothelial diseases, such as leukaemia and Hodgkin's disease, end-stage kidney disease, intestinal bypass, chronic malabsorption syndromes, vitamin D deficiency (Nnoaham & Clarke, 2008), and low body weight (CDC, 2003).
2.4 TB and HIV

HIV and TB form a lethal combination, each speeding up the other's progress (WHO, 2012d).

HIV promotes progression to active TB in people with recently acquired or latent M. tuberculosis infections (Raviglione et al. 1997). HIV is the most powerful risk factor for reactivation of latent TB to active TB. In the absence of HIV infection, only about 10% of people infected with M. tuberculosis become ill with TB during their lifetime. In people with HIV, about 50% will develop active TB disease at some stage (NDOH, 2009).

TB also accelerates HIV disease. TB is a leading cause of morbidity and mortality among people living with HIV. In 2009, there were 9,4 million new cases of TB, of which 1,2 (13%) million were among people living with HIV. Of the 1,7 million people who died of TB, 400 000 (24%) were living with HIV (WHO, 2011).

The dramatic spread of the HIV epidemic throughout sub-Saharan Africa has resulted in a rapid increase in the number of people with TB. In the Southern African region, South Africa and Swaziland recorded in 2011 the highest TB incidence in the world (WHO, 2012a). According to UNAIDS' report, it is estimated that 5,8 – 6,4 million people of South Africa are living with HIV, and 35 million people are living with HIV/AIDS worldwide (UNAIDS, 2012).

Comparing the treatment outcomes of new smear-positive PTB by HIV and Antiretroviral status in a TB/HIV Clinic in Malawi, Tweya et al. (2013: 8) found that HIV-co-infection was associated with poor TB treatment outcomes.

Looking at the increasing HIV and TB epidemics which have impacted significantly on already weakened public health services in South Africa (Coetzee et al. 2004), there may be benefits to integrating HIV and TB services. Karim et al. (2009: 921- 933) suggested that decisive action was needed to implement evidence-based priorities for the control of the HIV and TB epidemics.
2.5 National TB Control Programme in South Africa

2.5.1 Mission, targets and strategic objectives for TB control

The mission of the Department of Health is to prevent TB and to ensure that those who do contract TB have easy access to effective, efficient and high quality diagnosis, treatment and care that will reduce suffering.

According to the WHO, the TB control targets are:

- Case detection rate of 70%
- Cure rate of 70%
- Treatment success rate of >85%.

The TB control strategic objectives are:

I) To strengthen the implementation of the Directly Observed Treatment Short course (DOTS) Strategy which has five components:

- Political commitment with increased and sustained financing
- Case detection through quality-assured bacteriology
- Standardised treatment, with supervision and patient supporter
- An effective drug supply and management system
- A monitoring and evaluation system, and impact measurement.

II) To address TB, HIV, MDR-TB and XDR-TB

II) To contribute to health system strengthening
III) To work collaboratively with all care providers

IV) To empower people with TB as well as communities

V) To coordinate and implement TB research

VII) To strengthen infection control

2.5.2 The structure of the National TB Programme

The National TB Programme consists of four levels within the general health services:

- The National level functions through the NDOH to coordinate, facilitate and evaluate TB services countrywide.

- The Provincial level is responsible for implementation and budgeting.

- The District level is the key level for the management of primary health care and is the most peripheral unit of the health services administration. The districts are divided into sub-districts.

- The Facility level functions within a district to provide health care services. This level consists of rural hospitals, health centres, dispensaries and clinics (NDOH, 2009).

2.5.3 DOTS Strategy and the WHO TB Control Programme

The 44th World Health assembly held in 1991 recognised that TB was a global public health problem that required urgent attention. Control of the disease was sought through three dimensions: humanitarian, public health, and economic factors.

In 1993, WHO's Global TB Programme (GTB) declared TB a global emergency. After defining the nature and the size of the global TB problem through expanded monitoring
and surveillance, GTB began promoting a strategy in a technical and management package known as DOTS (Directly Observed TB Short Course).

DOTS, the brand name of a comprehensive TB management strategy, consists of five elements as described in section 2.5.1, which together form a successful strategy to control TB (FPD, 2013: 55 - 62).

Directly Observed Treatment (DOT) is an intervention that forms a crucial part of DOTS. It means that an observer watches the patient swallowing the tablets, in a way that is sensitive and supportive to the patient's needs. This ensures that a TB patient takes the correct drugs, in the correct doses, at the correct intervals. The observer may be a health worker, a patient's colleague at the workplace, a family member or close friend, or a trained and supervised community member (NDOH, 2009). Jombo et al. (2008: 61-66) found in the study which they conducted in a rural community of the Nigerian Niger Delta, that the outcome of DOT was impressive, and suggested that the programme should be extended to other rural communities.

In South Africa, the person responsible for implementing DOT is usually the District Communicable Disease Coordinator, who is usually a professional nurse. This person is responsible for coordinating training and monitoring the performance of the community health workers, while their day-to-day supervision is the responsibility of clinic staff. It is important to ensure that DOT is acceptable to the patient and that his/her privacy is protected. TB drugs should always remain with the treatment observer and only given to the patient at the time of intake.

DOT is required to ensure treatment adherence and therefore to improve the cure rate, as mentioned by Ntshanga, Rustomjee and Mabaso (2009: 571- 574).

DOT helps to reinforce a patient’s motivation to continue treatment and to counter the human tendency to interrupt treatment as soon as they feel better. It also ensures accountability of health care workers and helps to prevent the emergence of drug resistance. DOT is recommended for the entire period of treatment in South Africa. This
is to reduce the incidence of the disease as well as resistance to drugs and especially to Rifampicin (FPD, 2013: 59 - 62).

In a study conducted in the Bojanala health District of North West Province to evaluate DOTS for TB (Tumbo & Ogunbanjo, 2011), it was concluded that a strict implementation of DOTS in all patients undergoing TB treatment was a known strategy for improving the TB cure rate, and preventing recurrence and drug resistance.

2.6 Clinical and community health implications of poorly controlled TB

Poor management of TB programmes threatens to make a curable disease incurable. Today there are resistant TB strains in every country that has been surveyed, with some strains resistant to all major anti-TB drugs. In undeveloped nations, doctors sometimes prescribe the wrong medicine, do not treat with multiple drugs at one time, or their drug supply is unreliable. This leads to ongoing transmission of the disease, drug resistance and death (Perlin & Cohen, 2002).

Looking at the MDR-TB situation, WHO estimates that there were about 0,5 million new MDR-TB cases (3,7% of new TB patients) in the world in 2011. About 60% of these cases occurred in “BRICS” countries alone: India (66 000 cases), China (61 000 cases), the Russian Federation (44 000 cases), Brazil (11 000 cases), and South Africa (8 100 cases) (WHO, 2013b).

According to South Africa’s NDOH, the numbers of MDR-TB/XDR-TB cases have been on the increase since 2006. There were 5 774 MDR-TB cases in 2006, 7 429 MDR-TB cases in 2007, 8 198 MDR-TB cases in 2008, 9 070 MDR-TB and 594 XDR-TB cases in 2009, 7 386 MDR-TB and 741 XDR-TB cases in 2010 (NDOH, 2011).

Regarding TB mortality, in 2012, there were 1,3 million deaths of the 8,6 million people who developed TB in that year, all over the world (WHO, 2013a).

Africa as a region has more TB deaths than any other region of the world, with a TB mortality rate of 74,0 per 100 000 of population in 2010, compared to South East Asia with 31,0 and the global mortality rate of 21,0 (World Health Sciences, 2010).
TB continues to be the leading cause of death in South Africa. WHO gives a figure of 25 000 deaths due to TB alone in South Africa in 2011 (WHO, 2013b).
3.1 Aim of the study

The aim of this study was to determine the characteristics of sputum-positive TB patients registered in 2010 who were not cured in the CHCs in Moses Kotane Sub-District.

3.2 Objectives of the study

The objectives of this study were:

1. To describe the characteristics of all new smear-positive TB patients registered in 2010 in the CHCs in Moses Kotane Sub-District.
2. To describe the characteristics of all new smear-positive TB patients who were not cured in 2010 in these CHCs.
3. To determine which characteristics contributed to the lack of cure among those who were not cured.

3.3 Research question

What are the characteristics of sputum-positive TB patients registered in 2010 who were not cured in the CHCs in Moses Kotane Sub-District?

3.4 Study design

This was a quantitative cross-sectional study describing the characteristics of sputum-positive TB patients who were not cured in the CHCs in Moses Kotane Sub-District for the year 2010.
3.5 Study setting

This study was conducted in Moses Kotane, one of the five sub-districts of the Bojanala District, which is situated in the eastern part of the North West Province of South Africa, and consists of one District Hospital, five Health Centres, 44 clinics, 35 Mobile Health Points, and 4 Health Posts. The area is vast and has a poor road infrastructure.

Moses Kotane Sub-district consists of 5 215 square kilometres with a population estimate of 266 781 in 2010 (DHIS, 2010). It is 96%, rural with an unemployment rate of 60%, and with male population at 52% and female population at 48%. The mushrooming informal settlements next to the mines impact on increased unemployment, under- and malnourishment, alcohol and substance abuse, poor sanitation and low literacy levels. Generally, the levels of education are low. An estimated 18% of the population had no schooling in 2010, with only 6% of the population having obtained Grade 12. There is a significant school drop-out rate of pupils at primary and secondary school levels. This could be attributed to social and economic reasons (Municipal Integrated Development Plan 2010/2011).

3.6 Study population

The study population was all TB registered in Moses Kotane Sub-District in 2010, this being the latest year with complete TB outcome data when writing the protocol of this study.

There were 1 973 TB patients (NWP-ETR.NET, 2010) for 44 clinics and five Community Health Centres.

3.7 Sampling frame and sample size

From the study population of 1 973 TB patients, the five Community Health Centres had a total number of 518 of all types of TB registered that year. Considering the inclusion criteria of the study, the researcher recruited only 282 TB patients who were registered in the five community health centres as new smear-positive patients (ICD 10 CODE: xxxvii
Because 282 was considered a small study sample, sampling was not done and all were included. Among the 282, 35 were assessed at the end of six months of treatment as treatment completed; 14 were transferred-out and 4 were assessed as cured, but with missing data in the original files, and therefore they were all excluded. A total number of 229 patients were finally retained as sample size of for this study. Of the 229 patients, 176 were cured and 53 (eight treatment failures, 31 treatment defaulters and 14 deaths) were classified as not cured, in accordance with the definition of NOT CURED as detailed in the protocol of this study (see Figure 3.1).
Figure 1. Sampling Flow chart of the study

All types of TB registered in the Sub-District (1973 patients)

All types of TB registered in the CHCs (518)

Not – eligible (236): TB patients diagnosed with other method than sputum

Transferred out or moved out, treatment completed and missing data (53): excluded

Eligible (282): all new sputum positive TB patients registered in the 5 CHCs in 2010

229 patients were analyzed

176 patients cured

53 patients not cured

xxxix
3.8 Variables and definitions

For each patient recruited in this study, the folder containing the TB register and any other medical record of the patient were requested, and the following variables were sought:

- Demographic characteristics (age of the patient in years; gender male or female; the patient’s location, which was the Community Health Centre where the patient was registered; employment/unemployment of the patient, which was shown as Yes or No).

- DOT Support was checked, that is whether a patient had some form of support during treatment from a relative, parent, close friend, colleague or the community.

- Other medical conditions (HIV-positive or -negative; hypertension; diabetes mellitus; epilepsy; mental health; pregnancy or family planning for female patients).

Definitions

In order to facilitate the collection of the required data, all the definitions applied to the study were those defined in the South African Department of Health National Tuberculosis Management Guidelines 2009. The following are the definitions that are relevant to the study:

**New smear-positive pulmonary tuberculosis patient:** A tuberculosis suspect with at least one positive fast bacilli in at least one sputum smear examination.

**Cure:** Client who is smear-negative in the last month of treatment and on at least one previous occasion at least 30 days prior.
**Treatment failure:** Smear-positive client who remains or is again smear-positive at five months (for new) or 7 months (for retreatment) after treatment start date or whose DST shows MDR-TB at 2 or 3 months.

**Treatment completed:** Client who has completed treatment but who does not meet the criteria to be classified as cure or treatment failure.

**Died:** Client who dies from any cause during treatment.

**Treatment default:** Client whose treatment was interrupted for more than two consecutive months before the end of the treatment period.

**Transfer-out:** Client who has been transferred to another reporting unit (e.g. district) and for whom the treatment outcome is not known.

**Moved:** Client who has moved to another facility within the same district.

**Multidrug-resistant TB** (MDR-TB) is caused by organisms that are resistant to the most effective anti-TB drugs (Isoniazid and Rifampicin). MDR-TB results from either infection with organisms which are already drug-resistant or may develop in the course of a patient's treatment.

**Extensively drug-resistant TB** (XDR-TB) is a form of TB caused by organisms that are resistant to Isoniazid and Rifampicin (i.e. MDR-TB), as well as any fluoroquinolone and any of the second-line anti-TB injectable drugs (Amikacin, Kanamycin or Capreomycin).

### 3.9 Data collection

#### 3.9.1 Data sources

The following data sources were used:

- ETR.NET: This is an electronic TB register which contains all the information on TB patients, including their demographic data, diagnostics criteria, treatment modalities and the outcomes.

- Patients’ registers, kept at the clinic.
- Patients’ files, also kept at the clinic.

3.9.2 Data collection tool

The tool used in this study had three components:

- Demographic characteristics of the patient (age, gender, location and employment)
- DOT support
- Other medical conditions associated with TB (HIV, diabetes mellitus, hypertension, pregnancy, epilepsy, mental health, family planning, corticosteroid therapy and chemotherapy).

The tool was developed from the 2011 National TB Control Programme patient Clinic/Hospital Card from the NDOH, which also contains the level of education among the demographic characteristics, as well as a component of behavioural characteristics such as alcohol, smoking and drug abuse. But the patients’ TB registers and files used in 2010 where the researcher had collected data, did not contain the level of education, alcohol, smoking and drug abuse. Hence those variables were not taken into account in this study.

3.9.3 Data collection procedures

First the researcher collected the data printout from Moses Kotane Sub-District TB Control Programme Coordinator, who had extracted it from ETR.NET.

Then the researcher extracted and categorised TB patients into sputum-positive, with their outcomes. An anonymous list was then generated by the researcher, of those patients diagnosed with sputum-positive from the five CHCs. This list was then given to the research assistant, who had been trained by the researcher on this protocol in each CHC. All research assistants were professional nurses and none of them requested any incentive for that assistance.
The research assistant then retrieved the files (marked with ICD 10 CODE 150) from the CHC. Data was extracted from patients’ files by the researcher at the CHC. Finally, the extracted data was captured by the researcher onto a data collection sheet which had been piloted.

3.10 Data analysis

All the data that was collected in the study was captured in an Excel spreadsheet by the researcher and was verified; a validity check was performed by the supervisor as part of the data cleaning process. The supervisor checked and confirmed that all data from data collection sheets were correctly reproduced in the Excel spreadsheet without any change.

All statistical procedures were performed by the statistician on SAS System, version 9.2 running under Microsoft Windows, from a personal computer.

Descriptive statistics were calculated for all variables using Fisher’s exact test and P-values were calculated. Continuous variable (age) was summarised by mean, median, standard deviation, minimum and maximum values, using the t-test procedure for CURED and NOT CURED patients, by the statistician. The data was mainly presented in the form of tables reflecting the variables of interest to the study.

3.11 Reliability and validity of study

To ensure reliability, the data collection sheet was piloted. The researcher supervised the retrieval of the files. Only the researcher transcribed the data from the files to the data collection sheet, ensuring consistency.

To ensure validity, the researcher collected only the data from the files of patients who met the inclusion criteria of the study. Patients who met the criteria but did not have all data in their original files, were excluded. The supervisor also did validity checks. He checked and confirmed that all data from data collection sheets were correctly reproduced in the Excel spreadsheet without any change.
3.12 Study bias

There were some biases in this study that needed to be acknowledged:

- **Selection bias:** Influences affecting the way the participants were assigned to study groups.

  To minimise this bias, the researcher included all 282 files of the patients diagnosed with sputum-positive in the five CHCs in 2010.

- **Researcher bias:** Also referred to as experimenter bias, refers to the process where the scientists performing the research influence the results, in order to portray a certain outcome.

  Being a Registrar working in that Sub-District, the researcher had some vested interest in the result. This bias was minimised by getting constant supervision by the supervisor.

- **Information bias:** This is a type of cognitive bias, and involves e.g. distorted evaluation of information.

  This was minimised by going back to the original files to look for missing data, and data that was not available in the original file was not used.

3.13 Ethical considerations

- All information obtained from patients’ medical records and TB registers and from the Sub-District TB Control Coordinator was kept confidential.

- To ensure anonymity, patients’ names were replaced by numbers.

- Permission for the study was obtained from Moses Kotane Health Sub-District Management Committee, and the North West Province Department of Health.
A Clearance certificate for ethical approval was obtained from MREC. Approval number: MRREC/M/28/2013: PG.
4.1 Characteristics and conditions of the 229 sputum-positive patients

4.1.1 Demographic characteristics

Of the 229 sputum-positive TB patients analysed, the age group between 31 and 40 years was the most affected, with 75 patients (32.75%), followed by the age group between 21 and 30 years, with 51 patients (22.27%), then the age group between 41 and 50 years, with 48 patients (20.96%). The age groups 51 to 60 and 11 to 20 years both had almost the same number of patients, with 23 (10%) and 22 (9.6%) patients respectively. There were 4 (1.75%) patients who were younger than 10 years, and one (0.44%) patient was 91 years old. The mean age was 35.8 years, with a standard deviation of 13.02 years. Of 229 smear-positive TB patients, the female gender was more affected than the male gender, with 121 (52.84%) females and 108 (47.16%) males included. The majority of these patients were unemployed; 160 (69.87%) unemployed against only 69 (30.13%) patients who were employed, gave a difference ratio of 2.3:1.
Table 1: Demographic characteristics of all sputum-positive TB patients registered in the CHCS in Moses Kotane Sub-District in 2010

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Gender</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10:</td>
<td>4 patients</td>
<td></td>
</tr>
<tr>
<td>11 - 20</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>21-30</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>31 - 40</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>41 - 50</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>51 - 60</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>61 - 70</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Over 70</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>35.8 years</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>13.02</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>229 patients</td>
<td></td>
</tr>
</tbody>
</table>

- Male: 108 (47.16%)
- Female: 121 (52.84%)
- Yes: 69 (30.13%)
- No: 160 (69.87%)
4.1.2 DOT Support and other medical conditions

Of the 229 sputum-positive patients analysed, DOT Support had a difference ratio of 2:1 among them. 152 (66.38%) patients were DOT-supported, while 77 (33.62%) patients did not have DOT Support during their treatment. HIV condition also showed the same difference ratio of 2:1 among those patients. 154 (67.25%) sputum-positive TB patients were HIV-positive, against 75 (32.75%) patients without HIV. Six (6) patients were on family planning; 7 of the 229 patients were hypertensives, 2 patients had diabetes mellitus, one patient had epilepsy, and one patient suffered from a mental illness. No patient was on corticosteroid therapy or on chemotherapy.

Table 2: DOT Support and other medical conditions of all sputum-positive TB patients registered in the CHCS in Moses Kotane Sub-District in 2010

<table>
<thead>
<tr>
<th>DOT support</th>
<th>HIV status</th>
<th>Family planning</th>
<th>Hypertension</th>
<th>Diabetes mellitus</th>
<th>Epilepsy</th>
<th>Mental health</th>
<th>Cortico- Steroid therapy</th>
<th>Chemo-therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes 152</td>
<td>Pos. 154</td>
<td>Yes 6</td>
<td>Yes 7</td>
<td>Yes 2</td>
<td>Yes 1</td>
<td>Yes 1</td>
<td>Yes 0</td>
<td>Yes 0</td>
</tr>
<tr>
<td>No 77</td>
<td>Neg. 75</td>
<td>No 115</td>
<td>No 222</td>
<td>No 227</td>
<td>No 228</td>
<td>No 228</td>
<td>No 229</td>
<td>No 229</td>
</tr>
<tr>
<td>Total 229</td>
<td>Total 229</td>
<td>Total 229</td>
<td>Total 229</td>
<td>Total 229</td>
<td>Total 229</td>
<td>Total 229</td>
<td>Total 229</td>
<td>Total 229</td>
</tr>
</tbody>
</table>
4.2 Characteristics and medical conditions of sputum-positive TB patients who were not cured

4.2.1 Demographic characteristics

The highest proportion of TB patients not cured were, as for all sputum-positive TB patients of the study, from the age group of 31-40 years, with 17 (32.08%) of 53 patients who were not cured. This age group was followed by the age group of 21-30 years, with 15 (28.30%) patients, then age group of 41-50 years with 10 (18.87%) patients. Then came the age group of 11-20 years with 6 patients, and 4 patients in the age group 51-60 years. And lastly, 1 patient of 62 years. The overall mean age of the 53 sputum-positive TB patients who were not cured was 34.0, with a standard deviation 11.41.

Among the not cured patients, the male sex was slightly dominant, with 29 (54.72%) patients, against 24 (45.28%) female patients. The employment status had a difference ratio of 3:1. Forty (40) (75.47%) patients were unemployed, against 13 (24.53%) employed patients.

Table 3: Demographic characteristics of sputum-positive TB patients who were not cured in the CHCs in Moses Kotane Sub-district in 2010

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Gender</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 - 20</td>
<td>6 patients</td>
<td></td>
</tr>
<tr>
<td>21 - 30</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>31 - 40</td>
<td>17</td>
<td>Male 29 (54.72%)</td>
</tr>
<tr>
<td>41 - 50</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>51 - 60</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>61 - 70</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>34.0 years</td>
<td>Female 24 (45.28%)</td>
</tr>
<tr>
<td>SD</td>
<td>13.02</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>53 patients</td>
<td>Total 53 patients</td>
</tr>
</tbody>
</table>
4.2.2 DOT Support and other medical conditions of sputum-positive TB patients who were not cured

Of the 53 patients who were not cured, DOT Support was used at a ratio of 2:3. There were 22 (41,51%) patients who had DOT Support during their treatment, while 31 (58,49%) patients did not have DOT Support.

There were 38 of the 53 not cured TB patients who were HIV-positive, and only 15 patients without HIV, which makes the difference ratio in respect of HIV status 2:1. Three (3) patients were on family planning and one patient was mentally ill. None of the 53 patients had hypertension, diabetes, epilepsy, and none of them was on chemo- or corticosteroid therapy.

Table 4: DOT Support and other medical conditions of the sputum-positive TB patients who were not cured

<table>
<thead>
<tr>
<th>DOT support</th>
<th>HIV status</th>
<th>Family planning</th>
<th>Hypertension</th>
<th>Diabetes mellitus</th>
<th>Epilepsy</th>
<th>Mental health</th>
<th>Cortico-Steroid therapy</th>
<th>Chemo-therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes 22</td>
<td>Pos. 35</td>
<td>Yes 3</td>
<td>Yes 0</td>
<td>Yes 0</td>
<td>Yes 0</td>
<td>Yes 1</td>
<td>Yes 0</td>
<td>Yes 0</td>
</tr>
<tr>
<td>No 31</td>
<td>Neg. 18</td>
<td>No 50</td>
<td>No 53</td>
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<td>No 53</td>
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</tr>
<tr>
<td>Total 53</td>
<td>Total 53</td>
<td>Total 53</td>
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<td>Total 53</td>
<td>Total 53</td>
<td>Total 53</td>
<td>Total 53</td>
<td>Total 53</td>
</tr>
</tbody>
</table>
4.3 Characteristics associated with the outcomes (cured and not cured) of the 229 sputum-positive patients

The analyses were performed on the 229 new sputum-positive tuberculosis patients registered in 2010 in the five CHCs of the Moses Kotane Sub-District, with 176 cured and 53 not cured patients, giving to the five CHCs a cure rate of 76.86%. This is better than the overall cure rate (62.1%) of the Sub-District in 2010 (NWP, ETR.NET 2010), but not better enough to meet the MDG target of a tuberculosis cure rate of 85%.

The mean age for cured patients was 36.4 years and 34.0 years for not cured patients, with standard deviations of 13.45 and 11.41 respectively, and a P-value of 0.195.

Table 5: Variable age for cured and not cured patients

<table>
<thead>
<tr>
<th></th>
<th>Cured</th>
<th>Not cured</th>
<th>T-test, P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>176</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>36.4</td>
<td>34.0</td>
<td>0.195</td>
</tr>
<tr>
<td>Std. deviation</td>
<td>13.45</td>
<td>11.41</td>
<td></td>
</tr>
</tbody>
</table>

It was noticed, concerning the gender, that 97 (55.1%) female patients and 79 (44.9%) male patients were cured, while 24 (45.3%) female patients and 29 (54.7%) male patients were not cured; the P-value was 0.214.
Table 6: Variable gender for cured and not cured patients

<table>
<thead>
<tr>
<th>Gender</th>
<th>Cured (%)</th>
<th>Not cured (%)</th>
<th>Fisher Exact test, P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>97 (55.1)</td>
<td>24 (45.3)</td>
<td>0.214</td>
</tr>
<tr>
<td>Male</td>
<td>79 (44.9)</td>
<td>29 (54.7)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>176 (100)</td>
<td>53 (100)</td>
<td></td>
</tr>
</tbody>
</table>

Of the 229 patients analysed, 160 (69.87%) were unemployed and 69 (30.13%) were employed, as it was written in their original files. Among those who were unemployed (160), 120 (68.20%) were cured, and 40 (75.5%) were not cured. Of the 69 patients with employment, 56 (31.8%) got cured, and 13 (24.5%) failed to cure, with a **P-value of 0.394**.

Table 7: Variable employment for cured and not cured patients

<table>
<thead>
<tr>
<th>Employment</th>
<th>Cured</th>
<th>Not cured</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>120 (68.2%)</td>
<td>40 (75.5%)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>56 (31.8%)</td>
<td>13 (24.5%)</td>
<td>0.394</td>
</tr>
<tr>
<td>Total</td>
<td>176 (100%)</td>
<td>53 (100%)</td>
<td></td>
</tr>
</tbody>
</table>
With regard to DOTS Support, 130 of 176 cured patients were DOTS supported and 46 were not, while 31 patients among those who were not cured did not have DOT support, even though 22 had; \textit{P-value 0.00002.}

Table 4.8: Variable DOT Support for cured and not cured patients

<table>
<thead>
<tr>
<th>DOTS Support</th>
<th>Cured</th>
<th>Not cured</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>46 (26.14%)</td>
<td>31 (58.49%)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>130 (73.86%)</td>
<td>22 (41.51%)</td>
<td>0.00002</td>
</tr>
<tr>
<td>Total</td>
<td>176 (100%)</td>
<td>53 (100%)</td>
<td></td>
</tr>
</tbody>
</table>
Looking at other medical conditions among all the analysed TB patients, it was found that 154 (67.2%) were HIV-positive, and among them 119 (67.61%) got cured; 35 (66.04%) did not get cured, while 75 (32.8%) who were HIV-negative recorded 57 (32.39%) cured and 18 (33.96%) not cured patients; P-value 0.8680. See Table 4.9.

There were also two patients with diabetes mellitus, seven patients with hypertension, one patient with epilepsy, and seven female patients were on family planning. These patients were all cured. Only one patient, who had a mental health problem, was not cured.

Table 4.9: Variable HIV status in cured and not cured patients

<table>
<thead>
<tr>
<th>HIV</th>
<th>Cured</th>
<th>Not cured</th>
<th>Total</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>57</td>
<td>18</td>
<td>75</td>
<td>0.8680</td>
</tr>
<tr>
<td></td>
<td>(32.39%)</td>
<td>(33.96%)</td>
<td>(32.75%)</td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>119</td>
<td>35</td>
<td>154</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(67.61%)</td>
<td>(66.04%)</td>
<td>(67.25%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>176</td>
<td>53</td>
<td>229</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(100%)</td>
<td>(100%)</td>
<td>(100%)</td>
<td></td>
</tr>
</tbody>
</table>
5.1 Findings

The main findings of this study were as follows:

5.1.1 Demographic characteristics, DOT Support and other medical conditions

Regarding the demographic characteristics of all the sputum-positive TB patients in the CHCs under study, the highest proportion of them (75 out of 229) were aged between 31 and 40 years old. Female patients were slightly more affected than male patients (121 against 108), giving them a female-male ratio of 1:0,9 – which does not indicate a significant difference. The figures regarding (un)employment were 160 unemployed against 69 employed patients, with a ratio of 2,3:1 between them. The DOT Support and versus no DOT Support ratio was 2:1; 152 patients had DOT Support, while 77 patients did not have any. The HIV-positive and HIV-negative ratio was also 2:1, with 154 (67,25%) patients being HIV-positive and 75 (32,75%) patients being HIV-negative.

Many studies across the world had shown that in countries where males and females presumably have equal access to health care, a two-to-one male-to-female ratio in TB incidence rates were observed (Jimenez-Corona et al., 2006; FPD, 2013: 47). However, in this study, females were only slightly more affected than man. The male-female ratio was 0,9:1. This supports what WHO found, namely that in many high-prevalence HIV countries the ratio of 2:1 has changed to 1:1 (WHO, 2012c); this may have been the case in the CHCs under study, even though the study did not look at the gender difference ratio of the TB-HIV-positive patients. The study found that the age group of 31-40 years was the most affected, followed by the age groups of 21-30 and 41-50 years. And the mean age was 35,8 years, with a standard deviation of ±13,02 years. These are age groups of people who are very active and mobile; they may be working
or looking for work here and there, travelling or migrating to different places, thus increasing their risks of contracting TB. These three age groups recorded 76% of the total number of sputum-positive TB patients in those CHCs. This is in line with the Indian study (Sinha, 2011), where 70% of their TB patients were under the age of 50. In this study, employment was among the major risk factors for those patients with a ratio of 2.3:1 between the unemployed and employed patients. That was also found in a Russian study (Coker et al., 2006), where they said that among the risk factors for pulmonary TB, unemployment was associated with a substantially increased risk.

In this study the majority of patients had DOT Support: 152 with support, against 77 patients without DOT Support, a ratio of 2:1. However, the WHO and all other TB programmes recommended the use of DOTS to all patients as an important strategy for TB delivery (FPD, 2013: 56). With DOTS, besides encouraging people to be screened for TB, DOTS supporters provide advice and support to TB patients and, crucially, ensure that they complete their course of medication. This intervention is vital; as many TB suffers do not complete the full course of their medication. Once they start feeling better, they stop, which leads to the development of MDR-TB, which is extremely difficult to treat. DOTS is an effective means of administering anti-TB drugs. Efforts should be channelled towards developing strategies for implementing DOTS in a more efficient way for all TB patients (Erhabor et al., 2003).

The results of this study are showing that two-thirds or 67.25% of the patients were HIV-positive, and one-third or 32.75% were HIV-negative, which means the ratio was 2:1 (see Table 4.2). HIV drives TB incidence and in some African countries, 70% of persons with TB also have HIV infection (Granich et al., 2010). This finding is not very far from the result of this study, with 67.25% of HIV-positive patients. This is why there is a growing imperative to improve the coordination and collaboration of tuberculosis (TB) and HIV health care services, in response to escalating rates of TB/HIV co-infection. (Daftary & Padayatchi, 2012).
Co-morbidity of TB and diabetes mellitus was also found in this study, even though the result was not clinically significant, with only two TB patients having the disease.

But another interesting clinical finding of this study, even though statistically not significant, was the co-morbidity of systemic hypertension among those TB patients. This is not really described in the literature as a risk factor or a vulnerable condition for TB, unless the systemic hypertension is secondary to renal tuberculosis.

5.1.2 Characteristics regarding those who were not cured

For the 53 patients who were not cured the mean age was 34,0, but still the same three age groups discussed above were of concern. This time males were slightly more than females (29 against 25), with a ratio of 1,2:1. The ratio in respect of unemployed versus employed was 3:1; 40 patients were unemployed and 13 were employed. The majority of not cured patients were not under DOT Support (31 out of 53). The HIV-positive versus HIV-negative ratio was also 3:1, and the only patient with mental illness did not get cured; he actually died.

While many studies in the World had found poor TB outcomes in advanced age, that is over 55 years (Vasankari et al., 2007; Munoz-sellar et al., 2010), this study showed that the mean age of patients who were not cured was 34,0 (SD: ±11,41) years. The male sex, HIV co-infection and lack of DOT Support were contributing factors among the 53 patients who were not cured, and the same findings were mentioned in the Potchestroom study in North West (Mnisi, Tumbo & Govender, 2013). Unemployment, which was another contributing factor toward failing to get cured for those 53 patients, was also found in the study done in Nigeria (Salami & Oluboyo, 2003) into the management outcome of pulmonary TB, and also in an Ethiopian study (Berhe, Enquselassie & Aseffa, 2012).

There was only one patient who had a mental illness and he was not cured of his TB. Research has found that there is a high rate of mental problems such as depression and anxiety among TB patients, which are most likely related to social stigma and inadequate social support, as well as the physiological impact of chronic diseases.
These psychosocial factors do complicate adherence to TB treatment, leading to poor outcomes (Pachi et al., 2013).

5.1.3 Characteristics associated with outcomes (comparison between cured and not cured)

The study found that the mean ages in years between the cured and not cured patients were 36.4 and 34.0 respectively, two-sample t-test, P-value 0.195. Altogether 97 females (55.11%) and 79 males (44.9%) were cured, and 24 females (45.3%) and 29 males (54.7%) were not cured, Fisher Exact Test with P-value 0.214. 68.2% of cured and 75.5% of not cured patients were unemployed, and 31.8% of cured and 24.5% of not cured patients were employed, Fisher Exact Test, P-value = 0.394. 32.39% patients among the cured group and 33.96% among the not cured group were all HIV-negative, and at the same time 67.61% of the cured and 66.04% of the not cured patients were all HIV-positive (P-value 0.8680). 73.86% of the cured and 41.51% of the not cured patients were DOTS-supported, while only 26.14% of the cured and 58.49% of the not cured patients did not have DOTS support during their treatment (P-value 0.00002).

Looking at the P-value of each characteristic described above, none of them was statistically significant, meaning that none of them had an influence on the outcomes (between the cured and not cured patients), except for the DOT Support. There was a statistically significant difference in terms of DOT Support among the patients in those CHCs, with a P-value of 0.00002.

The results of this study (see Table 4.8) demonstrate that the majority of those who got cured (130/176) had DOT support, while at the same time, the majority of those who were not cured (31/53) were not under DOT support. This illustrates the importance of having all TB patients under DOT Support during their treatment, so as to increase their cure rate, as this is supported by many studies done across the world. In one, namely China’s meta-analysis study (Li et al., 2013) it was found that, “due to the implementation of directly observed treatment strategy (DOTS), China has achieved
a significant success in the past decade in tackling the tuberculosis (TB) epidemic”.

For Daniel and Alausa (2006: 222-6), the option of a community-based TB programme, using volunteers or family members to supervise the administration of anti-TB drugs so as to ensure adherence to TB treatment, may be considered to improve the treatment outcome for TB/HIV patients.

DOTS Support is an important strategy which, if appropriately implemented, will enhance the TB treatment adherence, thereby reducing the default and failure rates and preventing the drug resistance, as mentioned by Tumbo and Ogunbanjo in a study (2011: 191- 194) to evaluate DOTS for TB in BOJANALA Health District, in North West Province. In the Nigerian study (Erhabor et al., 2003), it was found that DOTS was an effective means of administering anti-TB drugs, as 571 patients were treated during this period. The rate of cure/treatment completed was 86,1%, and the compliance rate was 93,8%. Integration of the DOTS strategy for TB control with an existing HIV/AIDS home care programme, in Ndola, Zambia, led to improved TB programme performance (Miti et al., 2003). George (2008: 81-99) found that DOTS supervisors enhanced patients’ ability to comply with their TB treatment by providing enablers, education, and supportive relationships.

5.2 Limitations of the study

This study was limited by its descriptive and retrospective cross-sectional study design, which relied on previously collected demographic characteristics, other medical conditions and DOTS support information on the patient’s file for analysis.

Some other factors propagating TB or making TB patients not to be cured were not tested, such as poverty, low level of education and behavioural characteristics (smoking, alcohol, drug abuse), making it difficult to have a complete view of the problem under study.

The study was also limited to the Community Health Centres of Moses Kotane Sub-
District; therefore, the findings from this study are not applicable beyond this Sub-District.
CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

This study has shown that DOT Support was a strong predictive characteristic for the outcomes of those TB patients during their treatment. Thus, the majority of not cured patients did not have DOT support, while the majority of cured patients had. There was a statistically significant difference of DOT support among these two groups, highlighting the importance of having an appropriate implementation of DOTS Strategy to improve the rate of TB cure. The mean age of the sputum-positive TB patients in those CHCs was 35.8 (SD ± 13.02) years. The female gender was slightly more affected than the male, while among patients who were not cured; the male gender took the lead. The majority of those patients were HIV-positive and unemployed.

6.2 Recommendation

From the results of this study, it will be recommended that DOT Support should be strengthened in order to increase the cure rate of TB in Moses Kotane Sub-District.
LIST OF REFERENCES


District health information system. 2010. Population estimate of Moses Kotane Sub-District.


Municipal integrated development planning. 2011. Levels of education in Moses Kotane Sub-District.


North West Province. 2010. ETR.NET outcome report.


MEDIUNSA RESEARCH & ETHICS COMMITTEE

CLEARANCE CERTIFICATE

MEETING: 02/2013
PROJECT NUMBER: MREC/M/28/2013: PG
PROJECT:
Title: Characteristics of sputum positive pulmonary TB patients who are not cured in the community health centres in Moses Kotane sub-district, North West Province in South Africa
Researcher: Dr JLM Yoko
Supervisor: AB Mills
Co-supervisor: Dr CD Kabongo
Hospital Superintendent: Mr KS Bukenyo (Moses Kotane sub-district)
Department: Family Medicine & PHC
School: Medicine
Degree: MMed Family Medicine

DECISION OF THE COMMITTEE:
MREC approved the project.

DATE: 07 March 2013

PROF PGD RAUTENBACH
DEPUTY CHAIRPERSON MREC

The Medunsa Research Ethics Committee (MREC) for Health Research is registered with the US Department of Health and Human Services as an International Organisation (OIRG00004319), as an Institutional Review Board (IRB00005122), and functions under a Federal Wide Assurance (FWA00009419)

Expiration date: 11 October 2016

Note:
1) Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee.
2) The budget for the research will be considered separately from the protocol.
PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.

Finding Solutions for Africa
BOJANLA PLATINUM DISTRICT
MOSES KOTANE SUB DISTRICT

TO : Prof. S Mda
Chairperson: SREC
University of Limpopo
Tel: 012 521 4307
Fax: 012 521 58 11

FROM : Mrs. J Sebole
Training Coordinator
Moses Kotane Health Sub-District


SUBJECT: WHAT ARE THE CHARACTERISTICS OF SPUTUM POSITIVE PULMONARY TUBERCULOSIS PATIENTS WHO ARE NOT CURED IN THE COMMUNITY HEALTH CENTERS IN MOSES KOTANE SUB-DISTRICT, NORTH WEST PROVINCE.

Permission has been granted by the Sub-District Manager for Dr. MJL Yoko to further his studies with University of Limpopo for research on tuberculosis in the Sub-District as stated in the subject.

Hope you find this in good order.

Yours Sincerely,

RECOMMENDED BY:
Mr. OE Serape
AD Admin

APPROVED BY
Mr. KS Boikanyo
Sub-District Manager
RESEARCH PROTOCOL

STUDENT: DR JEAN LOUIS M. YOKO

TITLE: CHARACTERISTICS OF SPUTUM POSITIVE PULMONARY TUBERCULOSIS PATIENTS WHO ARE NOT CURED IN THE COMMUNITY HEALTH CENTRES IN MOSES KOTANE SUB-DISTRICT, NORTH WEST PROVINCE IN RSA.

SUPERVISOR: DR A.B MILLS

CO-SUPERVISOR: DR C.D KABONGO

DEPARTMENT: FAMILY MEDICINE AND PRIMARY HEALTH CARE, UNIVERSITY OF LIMPOPO – MEDUNSA CAMPUS.
INTRODUCTION

Tuberculosis (TB) remains the top infectious cause of mortality in adults, with an estimated 1.7 million deaths globally in 2004. Almost a third of the world’s population (more than 2 billion people) are infected with the TB bacilli, which cause TB, and one in every 10 infected people is estimated to become sick with active TB in their lifetime\(^1\).

TB is a major public health problem in South Africa, with the country recently having been ranked fifth on the list of 22 high-burden TB countries in the world. According to the Global TB Report 2009 of the World Health Organization (WHO), South Africa had nearly 460 000 new cases in 2007, with an incidence rate of an estimated 948 cases per 100 000 population – a major increase from 338 cases per 100 000 population in 1998\(^2\).

South Africa National TB Management Control data for 2006 shows that North West Province (NWP) is the fifth province with high incidence of smear positive TB behind Kwazulu-Natal, Eastern Cape, Western Cape and Gauteng\(^3\).

In 2010, the Researcher was working in Moses Kotane, one of the 5 sub-districts of Bojanala District in NWP and was visiting 19 clinics among the 49 of this Sub-district. He noticed that majority of the clinics including all their 5 community health centers (Mabeskraal, Mogwase, Moruleng, Mothabe and Pella) had a low cure rate below 65 % against the Millennium Development Goal (MDG) target of TB cure rate of 85 %. The current 2010 data are showing that this Sub-District had a global cure rate of 62.1 %\(^4\).

The researcher is interested to find out the characteristics of sputum positive TB patients registered in 2010 who were not cured in those 5 community health centers (CHCs). And the reason for choosing CHCs is because they are bigger clinics that usually drain more patients and they are better equipped in staff and in equipments enabling them to render better care than clinics.

The results of this study may help the Sub-District Management to identify local characteristics of their TB patients and address them so that they can improve the cure rate therefore to meet the MDG target of TB cure rate of 85 %.
RESEARCH QUESTION

What are the characteristics sputum positive TB patients registered in 2010 who were not cured in the CHCs in Moses Kotane Sub-District?

LITERATURE REVIEW

Tuberculosis (TB) is contagious and airborne. It is a disease of poverty affecting mostly young adults in their most productive years. 95% of TB deaths are in the developing world\textsuperscript{5}. The global burden of Tuberculosis remains huge with an estimated 8.7 million new cases of tuberculosis (of which 13 % represent co-infections with HIV) and 1.4 million deaths from TB in 2011 (of which 430 000 deaths were among people who were HIV positive). But the report shows that there was a fall of TB mortality at a rate of 2.2 % between 2010 and 2011 and a total decreased mortality rate of 41% since 1990. Overall, while the world is on track to achieve the global target of a 50% reduction by 2015, African and European regions are not, the report notes that their overall decline in tuberculosis incidence is too slow to expect elimination in this century\textsuperscript{6}.

In Shaanxi Province (China) study evaluating factors associated with low cure rate of TB, it was found that 153 (23.2 %) over 659 patients were not cured and not only treatment interruption was strongly associated with non-cure but also other independent risk factors like low education level, co-morbidity and lack of treatment observer contributed. It was then suggested that an appropriate patient education and support, and treatment of co-existing diseases may increase compliance, prevent interruption of treatment and hereby increase the cure rate\textsuperscript{7}.

According to the WHO report 2002, in Africa HIV is the single most important factor determining the increased incidence and the decreased cure rate of TB in the past 10 years, and poorly managed TB programmes are threatening to make TB incurable\textsuperscript{8}.

A study done in Burkina Faso in 2007 to assess the conversion rate at two-month follow-up of smear-positive TB patients noted that the conversion rate was declining because of patients’ associated conditions (HIV, malnutrition) and poor drug management (ineffective administration of drugs even under DOT, insufficient dosages, resistance)\textsuperscript{9}.

South Africa National TB management Control data shows that over the last five years TB case notification has increased by a massive 81%, from 188,695 cases in 2001 to
341,165 in 2006, and the treatment outcomes have improved with new smear positive
cure rates of 58 % and treatment success rates of 71 %in 2005 compared to rates of 51
% and 66% respectively in 2004. The poor documentation of the cure, defaulter rates
over 10% and large numbers of cases not evaluated are indicative of poor systems at
health facilities and contribute to the failure to reach programme targets\textsuperscript{10}.

Ermelo Hospital study (Mpumalanga Province -RSA) to describe patients with
recurrence of pulmonary TB found that the majority of the retreatment TB patients were
male patients with an average age of 41, and they were unemployed. 98 % (169/172) of
patients tested had a HIV-POSITIVE status\textsuperscript{11}.

In a study that was conducted in BOJANALA HEALT DISTRICT of North West Province
to evaluate DOT for TB, they concluded that a strict implementation of DOT in all
patients undergoing TB treatment was a known strategy for improving TB cure rate and
preventing recurrence and drug resistance\textsuperscript{12}.

**METHODOLOGY**

**DEFINITIONS**

According to WHO, **sputum positive tuberculosis** is a suspect with at least 1+
acid-bacillus in at least 1 sputum smear examination.

**Cure**: Client who is sputum negative in the last month of treatment and on at
least one previous occasion at least 30 days prior.

**Treatment failure**: Smear positive client who remains or is again smear-positive
at 5 months (for new) or 7 months (for retreatment) after treatment start date
or whose DST shows MDR-TB at 2 or 3 months.

**Treatment default**: Client whose treatment was interrupted for more than two
consecutive months before the end of the treatment period.

**AIM**

To identify the characteristics of sputum positive TB patients registered in 2010 who
were not cured in the CHCs in Moses Kotane Sub-District.
OBJECTIVES

- To describe the characteristics of all new smear-positive TB patients registered in 2010 in the CHCs in Moses Kotane Sub-District.

- To describe the characteristics of new smear-positive TB patients registered in 2010 who were not cured in those CHCs;

- To determine which characteristics contributed to the lack of cure among those who were not cured TB.

STUDY DESIGN

It will be a quantitative cross-sectional study describing the characteristics of sputum positive TB patients who were not cured in the CHCs in Moses Kotane Sub-District for the year 2010.

STUDY SETTING

This study will be conducted in Moses Kotane, one of the 5 sub-districts of BOJANALA District in NWP of South Africa, a rural area with a population of 266,781 in 2010*.

*Bojanala Platinum D, Pivot source pop.data 2011.

STUDY POPULATION

The study population will be all TB patients with sputum positive results registered in those 5 CHCs in 2010, they were 1973^.

STUDY SAMPLE

The study sample will be formed by all sputum positive TB patients (282) registered in 2010 in those 5 CHCs with outcome as cured and not cured: those who remained sputum positive at the end of their 5th month on TB treatment.

For the purpose of the study, all sputum positive clients who defaulted treatment and those who had treatment failure or died during treatment will be included in the study and considered as not cured.
DATA COLLECTION

- The researcher will use a data collection sheet. (See appendix A)
- A trained researcher assistant will be used in each CHC to help with data collection.
- Inclusion criteria: Only sputum positive TB patients registered in those 5 CHCs in 2010 who were not cured will be included in this study, 2010 being the latest year of complete data on ETR.NET as at the time of writing this protocol.
- Exclusion criteria:
  - All TB patients registered in 2010 in those 5 CHCs diagnosed with other method than sputum
  - All TB patients with sputum positive registered in 2010 in those 5 CHCs but whom sputum were not done at the end of their 5th month of TB treatment.
  - All TB patients with sputum positive registered in 2010 in those 5 CHCs but transferred out.
- Data will be collected from medical records and the TB registers

Characteristics (variables) to be considered:

Demographic: Age, sex, location, employment, level of education

Behavioral: Smoking, alcohol and drug abuse

Other medical conditions: HIV, pregnant, hypertension, epilepsy, diabetes, chemotherapy, mental health, corticosteroids.

Directly observed treatment (DOT) or no DOT supporter.

- The summary of the outcome of all sputum positive TB patients registered in 2010 will be obtained from the Coordinator of Moses Kotane TB Control Program. He will use the Sub-District pass-word to retrieve that summary through the ELECTRONIC TUBERCULOSIS REGISTER (ETR.NET).
DATA ANALYSIS

All data that will be collected in the study will be captured in an Excel spreadsheet. Data collection will be verified and validity checks will be performed as part of the data cleaning process.

Descriptive statistics will be calculated for all variables. Continuous variables will be summarized by mean, median, standard deviation, minimum and maximum values.

Categorical variables will be summarized by frequency counts and percentage.

The statistical analysis will focus on the objectives of the study as described in this protocol.

A logistic regression analysis will be performed with TB outcome (cure and lack of cure) as dependent variable and the demographic characteristics of age, sex, location, education and employment as predictor variables. The model that will be analyzed will be for “lack of cure”.

A second logistic regression analysis will be performed with TB outcome (cure and lack of cure) as dependent variable and the DOT and the behavioral characteristics of smoking, alcohol and drug use as predictor variables. The model that will be analyzed will be for “lack of cure”.

A third logistic regression analysis will be performed with TB outcome (cure and lack of cure) as dependent variable and the other medical conditions (HIV, diabetes, hypertension, pregnancy, epilepsy, mental health, chemotherapy, family planning) as predictor variables. The model that will be analyzed will once again be for “lack of cure”.

Ninety-five confidence intervals will be calculated for mean values and percentages as appropriate. Results will be illustrated graphically as appropriate.

All statistical procedures performed on SAS, Release 9.2 or higher, running under Microsoft Windows from a personal computer.
RELIABILITY AND VALIDITY

Reliability refers to the consistency of measurements or the degree to which an instrument measures the same way each time it is used under the same condition with the same subjects.

The reliable standard laboratory test of sputum for mycobacterium tuberculosis, which is approved by WHO is used for diagnosis.

To ensure the reliability of the data the Researcher will cross check all the files and registers of all sputum positive TB patients registered in 2010 in this Sub-District to make sure the trained researcher did not leave out or add other data during collection.

Validity refers to the scientific rigor that is determined by the study procedures and study participants.

To ensure validity of this study, participants will only be TB patients who will meet the inclusion criteria as mentioned in this protocol. All characteristics found will be clearly explained. All participants will be accounted and numbers will be added up.

Some biases are likely to be encountered but the researcher will try to minimize them.

- Selection bias: This is because the researcher will only use 2010 data and not other years.

- Researcher bias: The researcher is a Registrar working in this Sub-District and has some interest on the result. To minimize this bias, a trained research assistant will be used in each CHC for data collection.

- Information bias: This will be minimized by going back to the original files to find missing data. And if missing data are not available in the original file or the original file is also missing, those data will not be used to avoid inaccurate results.
ETHICAL CONSIDERATIONS

- All information obtained from patients' medical records and TB registers and from the Sub-District TB Control Coordinator will be kept confidential.

- To ensure anonymity, patients’ names will be replaced by numbers.

- A permission for the study will be obtained from Moses Kotane Health Sub-District Management Committee, the Northwest Province Department of Health.
  
  – Ethical approval will be obtained from MREC.

IMPLEMENTATION

As soon as this protocol is approved by the MREC, the following stages of implementation will be carried out:

<table>
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<tr>
<th>STAGES</th>
<th>DURATION</th>
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<tbody>
<tr>
<td>1. Data collection</td>
<td>Five (5) weeks</td>
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<td>2. Data analysis</td>
<td>Three (3) months</td>
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<td>3. Writing up of data</td>
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BUDGET

Statistician ------------------------------- R 3000
English editing ---------------------------- R 1000
Computer upgrading ------------------------ R 2000
Photocopying ----------------------------- R 400
Binding x6 copies -------------------------- R 800
Travel expenses ---------------------------- R 2000
Trained research assistant --------------- R 1500
Total------------------------------------- R 10700

The researcher shall bear the costs of this research personally.
REFERENCES

DATA COLLECTION SHEET

This was developed from patient Clinic/Hospital Card from National TB Control Program.

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<th>Alcohol</th>
<th>Drug use</th>
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### OTHER MEDICAL CONDITIONS

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