

**PREVALENCE OF TUBERCULOSIS IN CENTRAL DIVISION OF WAJIR  
DISTRICT, NORTH EASTERN PROVINCE, KENYA**

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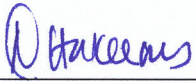
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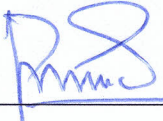
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## DEDICATION

To my parents and siblings and my dear wife Maryam Isir for their love, encouragement and patience. This also goes to my dear friends Hussein Noor and Mohamed Shariff.

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## **LIST OF ABBREVIATIONS**

AFB	Acid Fast Bacilli
AIDS	Acquired Immunodeficiency Syndrome
ARC	AIDS Related Complex
BCG	Bacille Calmette-Guerin
DOT	Directly Observed Treatment,
DTLC	District Tuberculosis and Leprosy Coordinator
GoK	Government of Kenya
HIV	Human Immunodeficiency Virus
IUTLD	International Union Against Tuberculosis and Lung Disease
KEPI	Kenya Expanded Programme on Immunization
KNTP	Kenya National Tuberculosis Programme
MOH	Medical Officer of Health
NGO	Non Governmental Organization
NLTP	National Leprosy Tuberculosis Programme
PHC	Primary Health Care
PTLC	Provincial Tuberculosis and Leprosy Coordinator.
PYAR	Persons – Year At Risk
SCC	Short-Course Chemotherapy
TB	Tuberculosis
WHO	World Health Organization

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SCC	Short-Course Chemotherapy
TB	Tuberculosis
WHO	World Health Organization

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## ABSTRACT

Tuberculosis is among the top ten global diseases in regards to mortality. It has been estimated that one-third of the world's population is infected with tuberculosis causing *Bacillus tubercular*. With 1.8 million people dying of the disease, approximately 88% of tuberculosis cases occur in 23 countries; with the highest incidence rates being found in Africa and South – East Asia. Tuberculosis situations worsened over the past two decades in Africa owing the HIV/AIDS pandemic, wars, famine /draught and following deterioration of health infrastructure.

The disease is a major cause of morbidity and mortality in Kenya. It affects people of all age groups but more so the economically productive age group of between 15 and 44 years. The advent of HIV/AIDS pandemic, urbanization, increasing poverty and declining social-economic trends have reversed the earlier declining trends of tuberculosis. In Kenya, an annual increase of 20% has been observed in the last years.

The study was carried out in Central Division of Wajir District between the period of July and October 2002. The aim of the study was to establish the percentage of undiagnosed tuberculosis in the community and to quantify the disease prevalence in the region. Research method employed was cross- sectional study that targeted all persons above 10 years and children of 0-5 years with no BCG scar. The information was gathered using structured questionnaires and laboratory results of sputum; especially for Acid- Fast *Bacilli* (A F B) Mantoux test results. Case finding was done by identification of persons with suspect pulmonary tuberculosis (i.e. persons with cough and/ or sputum for one month or heamoptysis of 3 weeks duration).

The study findings indicated that out of the respondents, 376 (94%) had knowledge of tuberculosis with 226 (56.5%) complaining of cough of more than three weeks, and

91.7% sought treatment at the hospital for the same. There was significant relationship between the level of education and duration of illness ( $P < 0.05$ ). 37 (9.2%) respondents tested positive for smear test and 58 (8.6%) of the children tested positive by Mantoux test.

In the field survey, out of 400-screened, 37 (9.2%) were smear positive. The positivity rate for males and females were not significantly different. These positive results suggest that the community has a high prevalence rate of tuberculosis.

BCG vaccination and mantoux positivity rates were done in the same community. Out of the 400 children tested, 342 (85.5%) had recorded BCG vaccination, and the remaining 58 children not vaccinated were subjected to Mantoux tests. Overall, positivity rate was 8.6% and it increased with age. In this study, a single interrogation of household heads identified a modest burden of undiagnosed tuberculosis in the community.

The setting up of a Primary Health Care system that would benefit the peripheral health infrastructure like health centers and dispensaries equipped with microscopy services would improve tuberculosis surveillance in the central division of Wajir District. In addition creating awareness among community members on the need to sought treatment early to avoid complication of the disease.

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# CHAPTER ONE

## INTRODUCTION

### 1.1 Back ground information

Bacterium belonging to mycobacterium tuberculosis complex, cause tuberculosis. The disease usually affects the lungs, although in up to one-third of cases other organs are involved (Harrison *et al.* 1998). It is one of the oldest diseases known to affect humanity and it was first reported by the finding of tuberculosis spinal disease in Egyptian mummies (Harrison *et al.*, 1998) dated back in the pre-Columbian era. The Greeks called the disease *Phthisis* (“consumption”), emphasizing the dramatic aspect of general wasting associated with chronic untreated cases. During the industrial revolution and the period of related urbanization in the seventeenth and eighteenth centuries tuberculosis became a problem of epidemic proportions. In Europe, the disease caused at least 20 percent of all deaths in England and Wales during the 1650 (Harrison *et al.*, 1998). In the Eastern part of the United States, the annual mortality rate from tuberculosis in the early nineteenth century was approximately 400 per 100,000 of the population (Harrison *et al.*, 1998).

Tuberculosis kills approximately 2 million people each year. The global epidemic is growing and becoming more dangerous (WHO, 2003). Each year about 1.6 million new cases and over 600,000 deaths occur as a result of tuberculosis in African region (WHO, 2003). While in Kenya 82,114 cases of which 81% are smear-positive, 10% of the tuberculosis patients are admitted in TB manyatta and live the nomadic areas of the country (NLTP, 2003).

The infectious etiology of tuberculosis was debated until Robert Koch's discovery of the tubercle bacillus in 1882 (Manson and Bell 1988). Improvement of socio-economic conditions and isolation of infectious patients in Sanatoria had a favorable impact on the epidemiology of tuberculosis in the first half of the twentieth century (Crofton *et al.*, 1992). In Europe and the United States, mortality rates began to decrease decades before the introduction of antimycobacterial drugs in the middle of the century (Manson and Bell 1988).

*Mycobacterium* belongs to family mycobacteriaceae and the Order Actinomycetales whilst the pathogenic species belongs to the *Mycobacterium tuberculosis* complex. The most frequent and important agent of human disease is *Mycobacterium tuberculosis*. This parasite is related to various other human pathogens belonging to genus *Mycobacterium*, such as the agent of leprosy (*M. leprae*) and *Mycobacteria* other than tuberculosis or non-tuberculous *Mycobacteria*. *Mycobacterium tuberculosis* is a rod-shaped, non-spore-forming, thin aerobic bacterium measuring about 0.5µm by 3µm. (Manson and Bell, 1988). *Mycobacteria* including *M. tuberculosis* do not stain readily and are often neutral on gram staining, but once stained the bacilli cannot be decolorized by acid alcohol. This is a characteristic justifying the classification as Acid-Fast Bacilli (AFB). Acid fastness is due mainly to the organisms' high content of mycobic acids, long-chain cross-linked fatty acids, and other cell wall lipids (Manson and Bell, 1988).

*Mycobacterium tuberculosis* is most commonly transmitted from patient with infectious pulmonary tuberculosis to other persons by droplet nuclei, which are aerosolized by coughing, sneezing, or spitting (Crofton *et al.*, 1992). The tiny

droplets dry rapidly and remain suspended in the air for several hours and may gain direct access to the terminal air passages (WHO, 2002). There may be as many as 3,000 nuclei per cough. In the past, a frequent source of infection was raw milk containing *M. bovis* from tuberculosis cows (Crofton *et al.*, 1992).

The probability of contact with a source case of *M. tuberculosis* infection, the intimacy and duration of that contact, the degree of infectiousness of the case and the environment of the contact are all important determinants of transmission (Schull, 1987). Close contacts have clearly demonstrated that tuberculosis patients whose sputum contains Acid Fast Bacilli visible by microscopy play the greatest role in the spread of infection (Manson *et al.*, 1988). The risk of acquiring *M. tuberculosis* is determined mainly by exogenous factors. Because of delays in seeking health care and in diagnosis, an estimated two or three contacts will usually be infected by each AFB-positive case before detection (Schull, 1987).

Methods used to assess the burden of tuberculosis in developing countries are imprecise (Grange, 1999). In many settings, tuberculin surveys of non-BCG vaccinated children have been used to determine the Annual Risk of Tuberculosis Infection (ARTI) (Pronky *et al.*, 2001). Active Case-Finding (ACF) and treatment are closely linked and are best considered as one programme activity (WHO, 2002). This is the activity that must have the highest priority in the entire TB control programme. Like *Bacille Calmette Guerin* (BCG) vaccination and chemoprophylaxis, case finding and treatment have the social objective of preventing suffering and premature deaths (WHO, 1988).

Sputum smear-positive individuals are the principle source from which new infections originate (Pronky *et al.*, 2001). Which is why they must be detected early by ACF and treated promptly. Persistently smear-negative but culture positive is less infectious. Therefore, it is feasible and rewarding to detect and treat cases before they become smear-positive (WHO, 1998). Active case finding by repeated mass X-ray examination of large population segments is expensive and unproductive in developed countries. For developing countries, it cannot be considered (WHO, 2002). However, efforts directed to carefully target high risk groups may be useful and should be considered on permanent case-finding activities and highly effective case holding established, and very high cure rate is achieved (WHO, 1988). This can be reversed by decentralized TB control services so that scaling down of high prevalence TB can be obtained and increased active case finding.

The prompt identification of smear-positive cases is as important as the detection of a large population of such cases (Pronky *et al.*, 2001). An indirect indicator of delay on the part of the patient or health services is the percentage of the patients who die of tuberculosis within a few weeks after they are found (WHO, 2002). A large percentage of patients detected after self-referral, at a higher-level facility, points to poor services and delay at the lower level (WHO, 1988).

The intensification of active case finding through the use of community volunteers can increase the number of suspects to be examined by sputum smear examination. This is theoretically desirable, but it must be recognized that as the number of such cases increases, the proportion of positive smears will probably decrease. Intensified

case finding thus yields diminishing returns and calls for a realistic appraisal of health services and capacity building of the staff (WHO, 2001).

## 1.2 Epidemiological situation of tuberculosis

World Health Organization (2000) declared TB as a global emergency at the time when it was estimated that a third of the world population was infected with *Mycobacterium tuberculosis*. The paradox of all this is that TB is increasing despite a great deal of knowledge about its etiology, transmission, diagnosis, cure and prevention. At some point it was assumed that TB was on the verge of being eliminated and this led to complacency and neglect of well-established control measures (WHO, 2000). This plus the advent of the disease promoted by the Human Immunodeficiency Virus (HIV) and probably rising poverty levels and social deprivations have contributed to the increase in global TB burden (Erhabor *et al.*, 2002).

Tuberculosis is a major health problem in tropical countries. Whereas the annual incidence of TB ranges from 15 to 50 cases per 100,000 inhabitants in Europe and North America, it reaches 100 to 500 cases per 100,000 inhabitants in most tropical countries (Manson and Bell, 1988). Of these cases, 50-60% are highly infectious cases (Pulmonary Tuberculosis, smear positive). The remaining cases are smear negative PTB cases (of which some are culture positive) or extra pulmonary TB cases (Manson and Bell, 1988).

The incidence of new infections defines the magnitude of the problem but it is probably accompanied by an estimate of the trend in past years. There appears to be a constant ratio between the annual risk of TB infections and the annual incidence of the sputum smear positive cases with every 1% of infections corresponding to 50 – 60 new smear positive cases of pulmonary TB per 100,000 populations (WHO, 1988).

Furthermore, for every case of smear positive pulmonary TB, there is usually at least one case of smear negative pulmonary TB or extra pulmonary disease. Based on this it is estimated that in the third world countries there are 4 – 5 million smear negative and extra pulmonary cases each year (WHO, 1988). Recent circumstances such as poor sanitation and HIV/AIDS pandemics, especially in Africa are bound to worsen TB morbidity, reducing or even canceling any benefits already gained. Widespread under-nutrition or even famine and the spread of the Human Immunodeficiency Virus (HIV) responsible for AIDS are likely to result in a higher incidence of clinical diseases among the infected population (WHO, 1988; Nunn *et al.*, 1992).

### **1.3 The Global burden of tuberculosis**

Globally, poverty has increased over the last decade (WHO, 2000). The number of less developed countries has doubled, and in some countries the national income (GNP) has decreased. More than 50 countries have per capita income lower than they were ten or more years back hence become vulnerable to TB (WHO, 2000). It has also led to a reduction in the resources available to tackle TB at a time when they are critically in need. Poverty is a major reason for the resurgence of this ancient disease, over crowded impoverished dwellings are their breeding grounds and TB thrives on

immune systems weakened by other chronic infections and by malnutrition (WHO, 2000).

Tuberculosis is among the top ten diseases that cause high global mortality (WHO, 2000; Murray et al., 1997). About one third of the world's population is infected with *M. tuberculosis*. In 1997, there were about 8 million new cases of TB and 2 million deaths worldwide (WHO, 2000). Tuberculosis kills more youth and adults than any other single infectious agent in the world today. The developing world is the worst affected with 95 percent of all TB cases, 98 percent of TB deaths and 75 percent of TB cases in developing countries being among those in their most economically productive years of between 15 and 45 (WHO, 1999).

Today, HIV is the most powerful factor known to increase the risk of progression from TB infection to disease. By 1997, more than 10 million people were concomitantly infected with TB and HIV. These people had a 50 percent chance of developing TB during their lifetime (WHO, 1999). Approximately 640,000 TB cases were attributed to HIV in 1997. In Africa, about 30 percent of all TB cases are now due to HIV. In some of the worst affected countries in sub-Saharan Africa, more than 60 percent of TB patients are HIV – positive (WHO, 1999).

#### **1.4 Tuberculosis situation in Kenya**

In Kenya 73,017 cases of all forms of TB were registered in 2002 with an average annual increase of 21% for all forms of TB. In 1998, about 49,000 cases of all forms of TB were registered (MoH, 2003). In the last decade, the number of reported TB cases has increased fivefold from 14,599 cases in 1992 to 73,017 cases in 2002

(NLTP 2003). This is an average annual increase of 20% for all forms of TB. Case Notification Rates (CNR) increased from 62/100,000 population for all forms of TB and 33/100,000 population for sputum smear –positive PTB cases in 1992 to 240/100,000 population and 103/100,000 population respectively in 2001 (NLTP, 2002). Kenya is globally ranked by estimates of number of cases as number 12 and regionally ranked as number 5 (WHO, 2002).

### **1.5.0 Control trends of tuberculosis**

Before the advent of HIV/AIDS, TB was generally low in frequency and almost forgotten in Northern Europe and North America, probably due to improved social conditions, low prevalence and incidence of HIV infection and AIDS as shown in Table1 (Petriew *et al.*, 1991; Nunn *et al.*, 1992). The incidence rates in poorer regions are higher than those in technically advanced countries, partly due to the difficulties encountered in these poorer regions in the implementation of modern and effective TB control program (WHO 2000).

#### **1.5.1 Trends of tuberculosis in Kenya**

In Kenya, tuberculosis is a major health problem characterized by considerable difference in incidence rates in various parts of the country (NLTP 2002). The Kenya Tuberculosis Programme was initiated in 1956 and it aimed at developing in every district-standardized approach to the two cardinal facets of tuberculosis. These were control-diagnosis and treatment on one hand, and prevention on the other (NLTP 2003). Large-scale efforts by the government to control the disease have apparently

made successful where 79 percent of new smear positive treated in the year 2001 (NLTP 2002) was achieved.

**Table 1: Industrial countries where TB cases are increasing**

Country	Increase (Percent)	Period of Time
Australia	5	1989 - 1990
Denmark	20	1986 - 1992
Ireland	9	1988 - 1991
Italy	27	1988 - 1992
The Netherlands	19	1987 - 1992
Norway	21	1988 - 1991
Spain	28	1990 - 1991
United Kingdom	5	1987 - 1991
USA	20	1985 - 1992

Source: WHO, 1994

The Government's main emphasis in the first incidence of tuberculosis was on treatment on a countrywide scale. This approach was assessed by the Kenya Tuberculosis Survey follow-up in 1964-66. It was reported to have had an overall treatment success of 63% (GoK, 1970). It was hoped that the treatment being effective to the general population, the tuberculosis patients would attend the available medical facilities earlier and more readily. This was to show a marked improvement in the 1:4 ratio of diagnosed incidence to real incidence would indicate. There was no marked improvement in this ratio which when assisted by WHO and UNICEF pilot projects in Murang'a and Machakos districts (GoK, 1977). This was aimed essentially at greater coverage and earlier diagnosis. Parts of the current national control programmes are channeled in this direction (Vogel, 1974).

The Kenyan Ministry of Health in collaboration with WHO and UNICEF mounted a countrywide BCG vaccination without prior tuberculin test directed towards the under 16-year age group (GoK 1969). 3.5 million children were BCG vaccinated in an eight-(8) year span running between 1962 and 1969 (GoK 1969). A second National Survey and follow-up was done to compare with the result of the previous one. The overall decrease in the estimated annual rate in the incidence of tuberculosis over a 10-year period was a modest but encouraging finding in a developing country. The increase in the older age groups suggests that it was not due to a decline in the standards of case finding or diagnosis. It was difficult to assess the role that the National BCG campaign played in reducing the annual incidence among the younger age groups, more so because records were incomplete (GoK, 1978).

The findings from the said follow-up showed that the standards of chemotherapy and TB application were good throughout Kenya and that in spite of the frequent administrative and personnel change over the years; the services maintained a satisfactory standard (GOK, 1979). The major problems that confronted the services were namely, the difficulty of keeping patients under observation, and that of organizing ambulatory chemotherapy. With the introduction of regimens that are of shorter duration (short-course chemotherapy) suitable for programme application were established (GoK, 1979). But the scenario wasn't the same because of the community under study who are Nomads and move from one area to the other, these were in need of Government will which was not offered and the low literacy rate.

The National Respiratory Disease Research Center (RDRC) in Nairobi organized in 1982, studies of case finding in various parts of the country using different methods. The aim of the studies was to explore the potential for case finding by identification of persons with suspected tuberculosis through careful screening of out patients attending district hospitals (Aluoch *et al.*, 1984) and community surveys. In the later approach, the possibility of increasing the yield of positive cases by case finding has been explored by using community leaders and household heads as informants (Aluoch *et al.*, 1978, Mzanzomohire, 1981). It was found that most patients who attended the district hospitals with chest symptoms very suggestive of tuberculosis had attended other peripheral health facilities. Where, unfortunately the health staff did not regard them as possible cases of tuberculosis, so no sputum was collected for microscopy or referral for radiological examination to confirm whether one has the disease (Aluoch *et al.*, 1984).

In view of the evidence that many patients eventually attended the main hospital of the district because of their chest symptoms, it was decided to investigate the possibility of concentrating case finding at the district hospital level (Aluoch *et al.*, 1984). There are certain advantages in under taking such measures. In Kenya, bacteriological and radiographic examinations can be carried out are at the district hospitals only. Which usually has a chest clinic with a clinical officer specialized Skin and Lungs (Aluoch *et al.*, 1984).

In general, people in developing countries like Kenya have a high individual susceptibility stress linked to living standards and nutritional levels, and the magnitude of initial infection is largely associated with housing and ventilation patterns (WHO 1974). In many developing countries, these factors are responsible for a prevalence of active pulmonary tuberculosis of the order of 1 per ten thousand cases every million people. This high prevalence is the most striking difference between the tuberculosis situations in poor countries as compared with rich countries. The other is the relatively advanced stage of the disease at the time of its initial diagnosis. This is due to a number of factors, among them being the insidious nature of the symptoms and the general lack of health consciousness on the people and few operational centers for tuberculosis treatment (WHO, 1974). The general need to sensitize the public on the symptoms and sign of the disease was lacking and this contributed to the high prevalence of the disease in the community.

Methods used to assess the true burden of TB in developing countries are imprecise (Pronky *et al.*, 2001). In many settings, tuberculin surveys of non-BCG-vaccinated children have been used to determine the annual risk of tuberculosis infection (ARTI)

(Stylbo *et al.*, 2002). This provides an estimate of probability of an individual being infected by *Mycobacterium tuberculosis* in a given year.

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## CHAPTER TWO

### LITERATURE REVIEW

#### 2.0 Active case finding and chemotherapy

##### 2.1 Case finding:

Case finding is an essential component of the control of TB and most other communicable diseases. Its object is to identify the source of infection in a community. In the case of TB, the method is used to determine persons who are discharging *tubercle bacilli* (AMREF, 1993). By rendering them non-infectious through chemotherapy, the chain of transmission may be cut. This case finding has little purpose unless it is followed by chemotherapy and that is why these two activities should be regarded as a single functional entity (Toman, 1979).

However, to find cases of infection is always easier than to treat them successfully. Thus, case finding activities sometimes outdo the treatment capacity of TB services, owing to lack of personnel, drugs or organizational problems (Crofton, 1997). To search for cases without being able to treat them properly after they have been unethical. It increases the patients' suffering and undermines confidence in the health care system (WHO, 1982). It is stated that for one case of TB diagnosed in Kenya, two others occur and remain undiagnosed. It is important to find out where the delays occur, and whether the patient or the health authority or both are the cause (MoH, 1999).

The possibility of expanding case finding by active measures at peripheral levels of health care has been reviewed and encouraged (WHO, 1999). As proved from the

few studies in the past (WHO, 1999), these methods can lead to the diagnosis of a high proportion of the smear positive cases in the community. Such innovations could become routine for primary health care workers (WHO, 1982). The principle of TB control involves case finding, case holding, appropriate and effective chemotherapy (WHO, 1999).

## **2.2 Diagnosis of tuberculosis**

Patients may present themselves with vague, or without history of close contact with a family member or close associate with a history of tuberculosis. Patients may also present with other diseases e.g. Diabetes mellitus, or other chronic illness. The following symptoms should arouse suspicion of pulmonary tuberculosis: cough persisting for three weeks or more; blood in the sputum (haemoptysis); chest pain; shortness of breath; loss of body weight; fever and night sweats (NLTP, 1995).

One of the best ways of diagnosing tuberculosis is by means of a direct sputum smear examination in the laboratory using the Ziehl-Neelsen (Zn) technique for acid-fast bacilli (Manson *et al.*, 1988). At least three early morning specimens must be examined. It is important that real sputum be produced and not just some saliva (AMREF, 1993). The diagnosis of tuberculosis in children is difficult because children seldom produce sputum. Diagnosis should be made primarily on history, clinical signs and symptoms, and the result of a tuberculin test (NLTP, 1995).

## **2.3 Chemotherapy of tuberculosis**

The main historical landmarks in the development of tuberculosis chemotherapy dates back to about only the last six decades. In 1940, the bacteriostatic effect of

sulphonamides in guinea pigs infected with *tubercle bacilli* (Harrison *et al.*, 1998). This was the first time it was demonstrated that a chemotherapeutic agent – a derivative of dapsone known as promin (glucosulfone sodium) was capable of arresting the progress of otherwise fatal tuberculosis in guinea pigs (Barry, 1964).

Major advances have been made in short duration chemotherapy. There are now a number of short course regimens of 6 – 9 months' duration that are very highly effective, of low toxicity, and well tolerated (WHO, 1982). Some are daily regimes, others intermittent after an initial intensive daily phase, and some are intermittent throughout. They are effective in patients whose strains are initially resistant to isoniazid, to streptomycin, or even to both drugs, as in patients with fully sensitive strains. Moreover, a high proportion of patients are cured even within the first 3 months of treatment, so that these regimens offer an important degree of protection against failure due to premature default from treatment. These potent regimes are based on an initial intensive phase of isoniazid, rifampicin, and pyrazinamide supplemented by a fourth drug (streptomycin or ethambutol), and isoniazid plus rifampicin in the continuation phase. There is a choice between 6-month regimes with rifampicin throughout, which are expensive, or cheaper regimens of 8 – 9 months' duration with the expensive drugs given in an initial intensive phase that is followed by a much less costly continuation phase (WHO, 1982).

The introduction of Direct Observed Treatment Short Course Chemotherapy (DOTS) in the 1990s is the most effective treatment strategy available for controlling TB and one of the most rapidly expanding and successful health interventions (WHO, 1998). DOTs were developed from the collective best practices, clinical trials and a

programmatic operation of TB control was initiated in the 1980's. The success of the strategy has been proven in both rich and poor countries under the most challenging conditions, including war-torn and economically devastated areas (WHO, 1998). DOTS can produce cure rates of up to 95 percent, even in the poorest countries. The strategy can be integrated successfully with existing general health services to achieve wide spread coverage. Also case detection through sputum microscopy is accurate, simple and reliable (WHO, 1998).

At present, short course chemotherapy is given to all registered tuberculosis patients. Different short course chemotherapy (SCC) regimes are used for the different types of tuberculosis. The first two months (initial phase of treatment) should be administered under direct observation of either a health care provider in a health facility or another member of the household or community (WHO, 2000). The relevant tools like drugs and mechanism for registration and reporting should be available before treatment is started (NLTP, 2000). As a general rule, when observed treatment cannot be ensured, or if the patient is too ill, such cases should be admitted. The continuation phase (4 to 6 months duration) is applied in principle in all government and most NGO health facilities. The patient collects a supply of drugs four-weekly for daily administration at home (NLTP 2000).

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**Treatment regimen for new smear positive patients and other seriously ill cases of tuberculosis: 2ERHZ/6EH (E- ethambutol, R-rifampicin, H-isoniazid, Z-pyrazinamide)**

**Table 2**

Abbreviation of regimen	2ERHZ/6EH	
Phase	Intensive phase	Continuation phase
Duration	Daily supervised for two months	Daily self-administered for six months
Drugs used	Ethambutol (E), Rifampicin(R), Isoniazid (H), Pyrazinamide (Z)	Ethambutol (E), Isoniazid (H)

Source: NLTP 2000

**Table 3****Treatment regimen for nomadic new smear-positive patients and other seriously ill tuberculosis: 2ERHZ/2RHZ/3EH**

Abbreviation of regimen	2ERHZ/2RHZ/3EH		
Phase	Intensive phase	Continuation phase	
Where	TB manyatta	TB manyatta	Home
Duration	Daily supervised for 2 months	Daily supervised for 2 months	Daily self administered for 3 months
Drugs used	Ethambutol (E), Rifampicin(R), Isoniazid (H), Pyrazinamide (Z)	Rifampicin (R), Isoniazid (H), Pyrazinamide (Z)	Ethambutol (E), Isoniazid (H)

Source: NLTP 2000

## **2.4 Available tuberculosis interventions**

### **2.4.1 Diagnosis and treatment of smear-positive tuberculosis**

The main components of the WHO DOTS strategy have political commitments, case detection among self-reporting patients with symptoms using sputum smear microscopy. Short course chemotherapy under proper management, including directly observed therapy, assurance of regular drug supply, and a strong surveillance and monitoring system (Dye *et al.*, 1999; Kochi, 1997). The need for directly observed treatment as a universal requirement is controversial, since the success of some tuberculosis control programmes is attributed to other elements (Zwarenstein *et al.*, 1998; Walley *et al.*, 2001). The importance given to monitoring treatment outcomes is non controversial. The DOTs strategy aims at detecting at least 70% of new smear positive cases and successfully treating 85% of them (WHO, 2001).

### **2.4.2 BCG immunization**

The protective efficacy of BCG most widely used vaccine against pulmonary tuberculosis varies from 0% to 80% (Colditz *et al.*, 1998 and Wilson *et al.*, 1995). Explanation for this variability includes difference in the prevalence of infection with environmental *Mycobacteria* (Fine, 1995, Fine 2000; Wilson *et al.*, 1995) and differences between BCG strains (Behr *et al.*, 1999). BCG gives good protection of 75 – 80% against disseminated tuberculosis transmission that is probably minimal. BCG is given at birth or as soon as possible thereafter, and although the duration of protection is uncertain, it may not be longer than 15 years, thus limiting protection against infection of pulmonary tuberculosis, which occurs mainly in adults (Fine, 2000).

### **2.4.3 Diagnosis and treatment of smear-negative tuberculosis**

Most tuberculosis control programmes provide treatment to smear-negative patients (Toman, 1979). Unfortunately, the diagnosis of smear-negative tuberculosis is difficult. Chest X-ray is an important tool, but its interpretation has limited specificity and inter-reader dependability (Toman, 1979). Moreover, patients with HIV infection may have a normal chest X-ray despite active tuberculosis (Loube *et al.*, 2000; Harries *et al.*, 1998). Mycobacterial cultures are not widely available in high-burden. Thus, programmes often employ diagnostic algorithms, which require that tuberculosis suspects with a negative smear be first treated with antibiotics that are ineffective against tuberculosis. Only after this treatment has failed (or in critically ill-patients) is tuberculosis treatment started (WHO, 1997).

### **2.4.4 Active case finding and treatment of smear -positive tuberculosis**

Although active case finding has made only animated contribution to reducing tuberculosis transmission in Europe (Styblo *et al.*, 1984), mathematical models have suggested that it may have substantial benefits in high-prevalence countries (Murray *et al.*, 1998). The DOTS strategy focuses on patients who report to health services themselves because of symptoms, while active (or intensified) case finding involves a special report by the health service to detect cases, either in the general population, or in special risk groups such as prisoners or people in hyper endemic neighborhoods (Stylbo, 1984).

Population surveys using mass miniature radiography may detect approximately 90% of prevalent tuberculosis cases participating in the surveys. Using tuberculosis symptoms to screen patients are less costly to implement, but may detect only 70% of

cases (Gothi *et al.*, 1976), depending on the target groups and the methods used to elicit symptom (Elink *et al.*, 1996). Intensified case finding among outpatients with respiratory symptoms worked well during one study (Aluoch *et al.*, 1984).

#### **2.4.5 Preventive therapy in people with HIV infection**

HIV-infected people who are also infected by *M. tuberculosis* are at a strongly increased risk of developing active tuberculosis, depending on the extent of their immunodeficiency (De Cock *et al.*, 1992; Braun *et al.*, 1991; Antonucli *et al.*, 1995). Smear-positive tuberculosis cases with HIV infection may be slightly less infectious than those with no HIV infection but the difference is probably not large (Espinal *et al.*, 2000; Cauthen *et al.*, 1996). Primary prevention of HIV infection is therefore of major importance for tuberculosis control.

The risk of active tuberculosis among individuals with dual tuberculosis and HIV infection can be reduced by treatment for 6-12 months with isoniazid or for 2 months with rifampicin and pyrazinamide (Pape *et al.*, 1993; Whalen *et al.*, 1997). This treatment can also be administered to prevent recurrence in HIV-infected tuberculosis patients who have completed tuberculosis therapy. Protective efficacy is 60-80% in the short-term treatment (Whallen *et al.*, 1997). However, the duration of protection may be shorter in HIV-infected individuals depending on whether elimination of infection can be achieved and on the risk of infection. Loss of patients to the programme at every step from identification of those eligible to completion of therapy is a major concern (Hawken and Muhindi, 1999).

Antiretroviral therapy slows development of immuno-deficiency in HIV-infected persons, may result to immuno-competence and delays on the onset of tuberculosis (Girrahi *et al.*, 2000). However, it is unclear whether this treatment reduces the lifetime risk of tuberculosis to such individuals or whether specific anti-tuberculosis preventive therapy is required.

#### **2.4.6 Patients' therapy for contacts of tuberculosis patients and adults in the general population.**

Contact investigations identifying recent infection tend to be limited to children within the household, restricting coverage for this intervention (Cohen *et al.*, 2000). Preventive therapy with isoniazid reduces the risk of disease among recently infected children by 60 – 80%, and side effects are rare (Cohn *et al.*, 2000). Preventive treatment among adults with latent tuberculosis infection also has a protective efficacy in the range 60 – 80%, depending on the duration of therapy (Comstock, 1999). Effectiveness in routine practice may be limited by partial uptake and compliance.

## **2.5 Rationale of the study**

### **2.5.1 Statement of the problem**

Tuberculosis has re-emerged as a problem of great public health concern worldwide. Two thirds of the world's population is infected with TB and about 80 percent of the cases of TB are in sub-Saharan Africa, Kenya included (Solagberu *et al.*, 2000). With an incidence of 10 million cases of TB worldwide and about 10,000 cases of TB in Kenya, the disease is increasing alarmingly. Efforts have been made to control the disease after the discovery of tubercle bacilli, low cost of effective anti-TB drugs or even free TB treatment in Kenya and formation of TB control programs. Despite the above efforts, the epidemic appears to be getting out of control and TB is now killing more adults each year than any infectious disease in the world.

Despite availability of free and effective treatment regimens for TB and the government's commitment to control the disease in Kenya, the number of TB cases increases by above 21 percent annually (NLTP, 2003). Apart from the effect of HIV/AIDS and worsening socio-economic conditions; lack of adequate knowledge, irrational attitudes and negative practices about the disease among the community. These could contribute to the above threatening upsurge by delayed case finding, delayed treatment and improper application of short course chemotherapy.

The incidence of TB cases reported in health services statistics rarely reflects the actual situation. This is because reported incidence depends on the quality of services provided and their accessibility to the population. The risk of infection could therefore be directly proportional to the number of sources of infections in the community, regardless of whether these sources are identified, notified or not. It has

been estimated that annual risk of infection of 1% corresponds to an annual incidence of PTB (smear-positive) infections of 50 – 60 cases per 100,000 populations (WHO, 1999). In most tropical countries, the annual risk of infection lies between 1.5% and 4 % (WHO, 1999), as these rates can now be assessed with accuracy, quantitative objectives set out for case finding and treatment activities. In order to determine the prevalence of PTB in the population, this study investigated the actual active case and the burden of the disease in the community.

### **2.5.1.2 Research questions**

The study will seek to answer the following questions:

- (i) What is the prevalence of active TB in the general population of Central Division of Wajir District?
- (ii) What is the level of active case finding by household head interrogation?

### **2.6 Justification of the study**

The community under study is nomadic. Due to the hostile environment, the static health facilities that are capable of providing health services for tuberculosis patients are few and sparse. These makes people to seek treatment at later stages when the disease has grown too chronic for medical intervention.

Majority of the people in central division are illiterate. One of the aims of this study was to explore the potential of improving health literacy in the community so that the community can report to the health facility in good time for early diagnosis of tuberculosis. This would enable the reduction of the high morbidity and mortality associated with the disease in the district. The housing and ventilation patterns in this

community can enhance the spread of communicable diseases such as tuberculosis. This study aims at making certain recommendations on ventilation in houses, which could help boost control efforts

A study to determine the prevalence of tuberculosis had never been done in the study area before. Late self referral for tuberculosis patients has been noted by the health authorities in this district and therefore, the purpose of doing active case-finding in the community to compare the yield of positive sputum tuberculosis cases with the yield at the hospital records. Results from this study may provide new guidelines useful to the health teams managing tuberculosis patients to this community.

The global magnitude and trend of TB is that about a million new cases of TB are officially reported by the Ministries of Health each year and fewer than 200,000 deaths. These figures greatly under-estimate the magnitude of the problem because TB is now largely concentrated in the developing world where the means of detecting, diagnosing and reporting the disease are grossly deficient (WHO, 1988).

## **2.7 Null Hypothesis**

Active case finding for pulmonary tuberculosis by house-to-house survey cannot yield more cases than patients voluntary reporting to the hospital.

## **2.8 Objectives of the study**

### **2.8.1 General objective**

To determine the prevalence of tuberculosis in Central Division of Wajir District.

## 2.8.2 Specific Objectives

- (i) To identify high-risk tuberculosis subjects at selected locations using symptomatic criteria among subjects aged 10 years and above.
- (ii) To determine the proportion of sputum positive cases of pulmonary tuberculosis from the high-risk subjects identified.
- (iii) To determine the prevalence of Mantoux positivity and BCG vaccination status among children aged 0-5 years.

# CHAPTER THREE

## MATERIALS AND METHODS

### 3.1 Study area

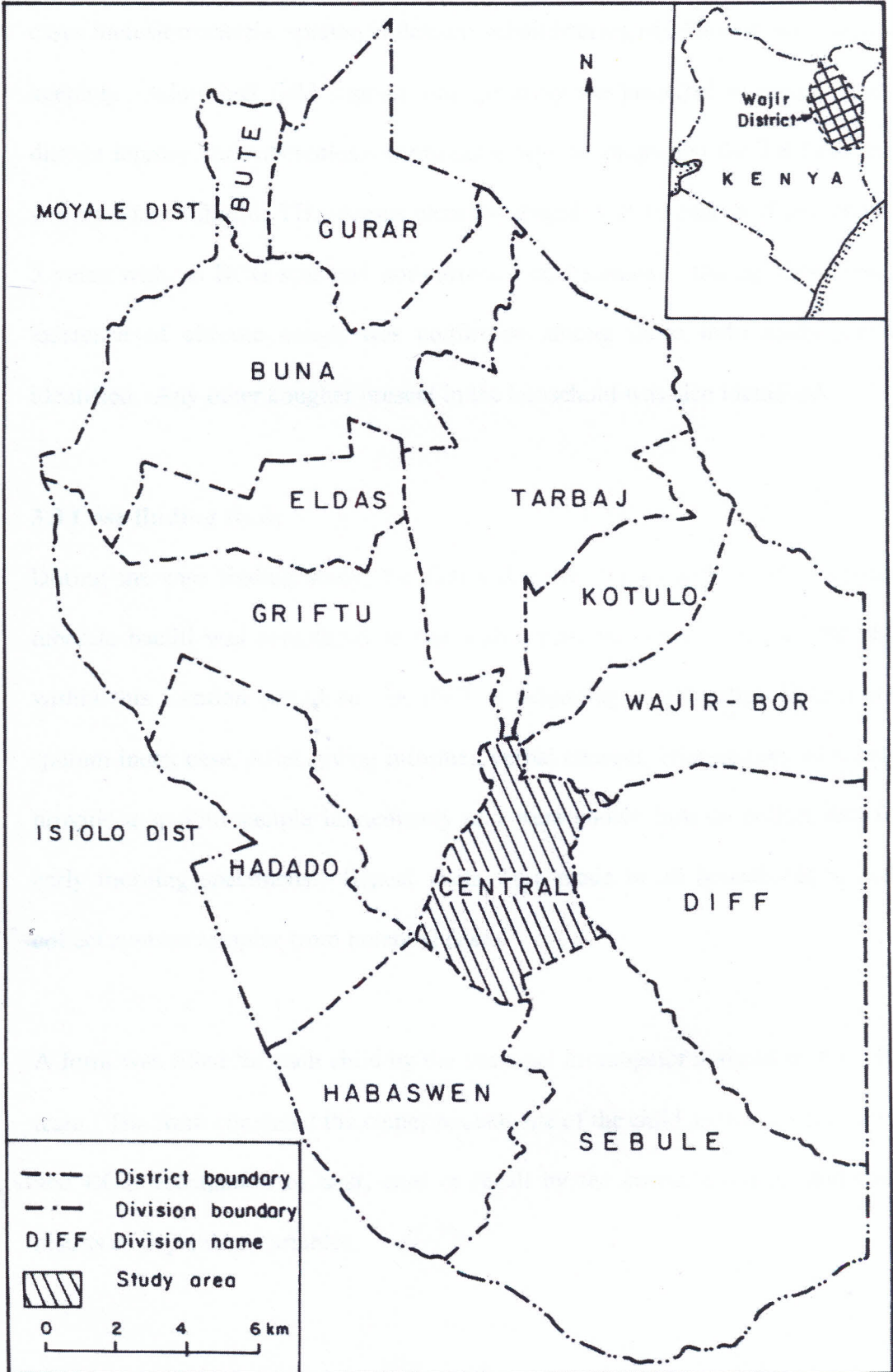
Wajir District is the largest district in the North Eastern Province of Kenya (GoK, 2002). Its maximum width (east-west) is 226 km while the maximum length is 350km. The district lies between latitudes 3° 20'N and 0° 60'N and between longitudes 30°E and 41°E (GOK, 2002). It borders the Republic of Somali to the East, Garissa District to the South, Isiolo District to the Southwest, Marsabit District to the West, Moyale District to the Northwest, Republic of Ethiopia to the North and Mandera to the Northeast (GoK, 2002). It has 13 divisions, 74 locations, and 102 sub-locations (Fig 1). The central division where the work was carried out covers an area of 2,673 sq. km with a population of 51,006 people (GOK, 2002). It hosts the district hospital, the TB Manyatta clinic, 15 private clinics and 3 mission clinics. The district is generally hot and dry all the year round. It has 1 main hospital, 1TB Manyatta clinic and 5 GoK Health Canters and 19 GoK dispensaries.

### 3.2 Study participants and training of research assistants

During the field study which was conducted from July to October 2002, heads of the 400 household visited were asked to identify individuals who had been experiencing a cough for more than 3 weeks and children below the age of 6 years who had no BCG scar. This screening question was posed during the study interviews lasting between 10 to 20 minutes. Training of research assistants consisted of a 3-hour workshop on the objective of the study and methods of data collection. This was followed by weekly meetings with the principle investigator during the period of study. Chronic cough as the cardinal symptom of tuberculosis was the focus.

FIGURE 1

Fig-1: The Location of the Study Area



Source: Wajir District Development Plan, 2002 - 2008.

Individuals identified as 'chronic coughers' were revisited the following day by a TB field team. The research assistant underwent 2 days of training in screening for active cases inclusion criteria, sputum collection, administering of Mantoux test and record keeping. Additional field support was given by the principal investigator and the district leprosy and tuberculosis coordinator who accompanied the TB field team on weekly basis. Eligible TB suspects were those aged over 10 years and children of 0 to 5 years with no BCG scar and not currently on treatment. During these visits, the existence of chronic cough was confirmed among those individuals previously identified. Any other cougher present in the household was also identified.

### **3.3 Case finding study**

During the case finding study, the first village (location) with positive sputum for tubercle bacilli was considered as one with a positive index case. All the children within this location would be classified as belonging to a location with a positive sputum index case. After giving informed verbal consent, interviewees were asked to provide a sputum sample immediately and were shown how to collect two further early morning specimens. Repeat visits were made to all households in order to collect sputum samples from potential cases.

A form was filled for each child by the principal investigator assisted by the TB field team. The form contained the name, sex and age of the child as independent variables and BCG vaccination by scar, card or recall by the parent/guardian, and mantoux results as dependent variables.

All hospitals use the NLTP recording and reporting system and report quarterly via the DLTC's and PLTC's to the central level. Registers have data on the name, age, sex, address and date of registration of TB cases, along side clinical details including final diagnosis, acid-fast bacilli smear and culture results and details of treatment and treatment outcome. Review of records from the TB registers of the TB clinic covering the period 31 December 2000 to 31 December 2001.

All patients in the TB registers who gave their address as being from the Central Division were identified. Village of residence was provided for over 99% of registrations. Registers were then investigated a second time by the District Records Officer and a volunteer from the local area to identify further addresses that fell within the study site but which had not previously been identified. Patients in reference to local landmarks report as their addresses rather than by village name, this second reader run was important in identifying all TB cases from the study site. Registers were crosschecked and evaluated thoroughly to ensure that individual new occurrences of TB had not been registered more than once.

### **3.4 Study design**

The initial study was the review of registered TB cases of the year 2001. The second part of the study was quantitative study aimed at screening the general population for pulmonary tuberculosis, BCG vaccination and Mantoux positivity rates. The research technique employed was a survey method.

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The method of sampling adopted was a cluster sampling, whereby the survey team moved from one household point to the other that were selected randomly. All the households in the cluster within the study area were covered.

### **3.5 Ethical consideration**

All participation was by informed verbal consent after all relevant authorities had also consented. Those found to be infected with tuberculosis were treated. Those found to be suffering from other illness were referred to the health facilities.

### **3.6 Study participants**

#### **3.6.1 Inclusion criteria**

The study included all cases that are 10 years and above willing to participate and also children of 0-5 years who had no BCG scar.

#### **3.6.2 Exclusion criteria**

The study excluded all those who declined to participate, those who had not stayed in the study area for the last six months and those on treatment.

### **3.7 Sample size and Sampling method**

The study was carried out in the four (4) of central Division of Wajir District with a Proposed sample size of 400 respondents. The sample size was obtained by using the Formula given by Fishers *et al.*, (1988) as shown in appendix IV. The method of sampling adopted was cluster sampling (Hickey *et al.*, 1986), whereby the research team moved from one household to the next. The starting points were selected at random. All the households in the cluster within the study area were covered.

### **3.8 Data collection techniques and procedure**

Data was collected in three ways: - structural questionnaire, sputum collected for laboratory test and administering of Mantoux test (Appendix I, II & III). The main data collection tool was pre-tested structural questionnaire which was prepared in English and verbally translated to Kiswahili and Somali whenever necessary.

#### **3.8.1 Examination of specimens**

Sputum specimens were collected and transported to the hospital laboratory for microscopy. Microscopy was performed using conventional Ziehl-Neelsen staining on unconcentrated specimens. Positive smears were quantified using IUALTD standards (WHO, 2000). A second reader confirmed positive slides.

#### **3.8.2 Mantoux positivity test**

Prepared tuberculin (Purified Protein Derivative) PPD RT 23 SSI for Mantoux test were out of stock in Wajir District and collected from the Garissa Provincial General Hospital. The Mantoux test were stored and transported in a cold box that contained ice packs to keep them under cold chain (MoH, 2001). While on the field, the vaccines that were not in use were stored at the hospital's Kenya Expanded Programme for Immunization (KEPI) stores that also keeps vaccines for immunization. The central refrigerator provided more ice packs in the cold boxes, which were used during the day and returned for further cold storage in the evening.

The site of administration for Mantoux test was the lateral aspect of the left volar surface of the forearm at the center of the proximal and middle third, while BCG at

the same dose of 0.1ml was injected on the same forearm but in the lateral aspect in the center of distal third.

The injection site was prepared by plain sterile water and allowed to dry. A 1ml graduated syringe with a short-beveled 25-gauge needle was used for administration slightly more than 0.1ml of the tuberculin test was drawn. The excess volume, as well as any air bubbles, was removed leaving exactly 0.1ml tuberculin PPD solution. The skin was slightly stretched at the needle-point (bevel upwards) and the needle was inserted in the superficial layer of the skin, after which the entire dose of 0.1ml was slowly injected (WHO, 2001).

### **3.8.2.1 Evaluation and interpretation of the Mantoux test**

For Mantoux test, the mean of the transverse and longitudinal diameters of indurations (swelling) was measured after 72 hours. A transparent firm ruler with millimeter graduation was used. This was considered positive if the mean diameter was 10mm or more (NLTP, 2001) as show below:

### 3.8.2.2 How to read a Mantoux test diameter of indurations in MM

Table 4

How to read a Mantoux test diameter of indurations in MM		
Negative	Positive	Strongly positive
0 – 8mm	10 – 14mm	15+ mm

Source: NLTP 2000

### **3.9 Data management and analysis**

Statistical data analysis was done using SPSS statistical package (Version 10.0). The data was entered into database. Inconsistency checks were done and anomalies against checked questionnaires. Frequencies were worked out to check for earlier figures and handled appropriately and where need be.

Analytical techniques were used depending on type of data and the variable to be analyzed. Independent variables such as sex, age, marital status, family size, education and income among others were matched with dependent variables measuring health service attendance, knowledge of tuberculosis, BCG scar immunization and tuberculin test. Differences were compared with the Chi-Square test level of significance fixed at 0.05 ( $P= 0.05$ ) (Taylor, 2001). Tables and graphs were used to display the regularities in data.

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# CHAPTER FOUR

## RESULTS

### 4.1.0 Review of records

#### 4.1.1 Demographic characteristic of the study participants

Overall, 400 persons over 10 years went through sputum examination and responded to the questions. They were 169 (42.3%) male and 227 (56.8%) females. Of these respondents 297 (74.3%) were married, 29 (7.3%) were single, 29 (7.3%), 9 (2.3%) and 35 (8.8%) were divorced, separated and widowed respectively as shown in Table 5.

#### 4.1.2 Registered tuberculosis cases

During the year 2001 there were 570-registered hospitalization for TB in the TB Manyatta clinic that serves a total human population of a round 356,340. Of these, 350 (61.4%) were from central division (Table 6). Hospitalizations for TB were distributed evenly throughout the year, with a slight excess of females. Of cases among the population age over 10 years, 96% were pulmonary tuberculosis.

### 4.2.0 Active case finding

The results of the active case finding study are detailed in Table 6. Data was available on the presence or absence of chronic cough from 400 members of the population over 10 years (100%). The field screening identified 171 persons (42.75%) with a cough more than 3 weeks.

**Table 5: Distribution of respondents by sex and marital status**

Marital status	Male	Female	Total
Married	108	190	297
Single	4	25	29
Widowed	26	9	35
Separated	-	9	9
Divorced	-	29	29
Total	138	262	400

**Table 6: Characteristics of 570 admission of tuberculosis among resident of Central Division in Wajir District in 2001**

Hospitalized with tuberculosis	All patients	< 10years	> 10years
No. Of hospitalization	570	47	523
Jan-March	127	16	111
April- June	143	15	128
July – Sept	175	21	154
Oct.- Dec.	125	14	111
Pulmonary cases	512 (89.8%)	21(4%)	491(96%)
Sputum results in PTB:			
Results available	570	21	491
Sputum positive cases	486(85.3%)	100%	465(94.7%)
Total population	51,006	14251	36755

Among the 400 confirmed suspects, sputum smear results were available from all individuals (100%). Thirty-seven cases (24 male and 13 female) of sputum positive disease were found among chronic coughers identified through the ACF process. In three early mornings sputum samples were collected from the respondents. Patients identified by ACF had a mean delay of 28 weeks between recognition of symptoms and diagnosis. Most had sought attention at the health services before being identified by the ACF study, but their condition had not been diagnosed as TB.

#### **4.2.1 Case finding for tuberculosis**

The population of the study area was 51,006 people and those who were interviewed were 400. The tuberculosis suspects according to the case definition included all the 400 sampled produced sputum on the spot then two (2) consecutive early morning sputum were collected for two (2) days.

The results of the medical records showing the distribution of PTB suspects by age and marital status are summarized in Table 6. The proportions of males and females among the 400 suspects were significantly different. The female were more because most of the women were housewives and stayed at their homes.

The marital status, which was considered, was: Married, single, widowed and separated. There were higher proportions of married women among the suspects than married men. This may probably be due to better response from women during the house-to-house survey.

#### **4.2.2 Distribution of respondents who heard of tuberculosis**

376 (94%) of the respondents had previous knowledge of tuberculosis and 24 (6%) did not have any knowledge of the disease. This is a clear indication that the community is aware of the existence of tuberculosis as shown in Table 7.

#### **4.2.3 Distribution of active TB cases by the duration of chest symptoms**

Distribution of active TB cases by the duration of the chest symptoms was analyzed in Table 8. All the 400 cases had a complaint of cough of variable duration. 226 (56.5%) had a complaint of cough of less than three months duration. Only 143 (42.2%) had a complaint of chest pain and 28 (51.9%) had complaint of haemoptysis. This seems to indicate that in active pulmonary tuberculosis cases, the main symptom manifest themselves during the first three months.

**Table 7: Proportions of respondents who hard of tuberculosis**

	Frequency	Percent	Cumulative percent
Yes	376	94	94
No	24	6	100
Total	400	100	

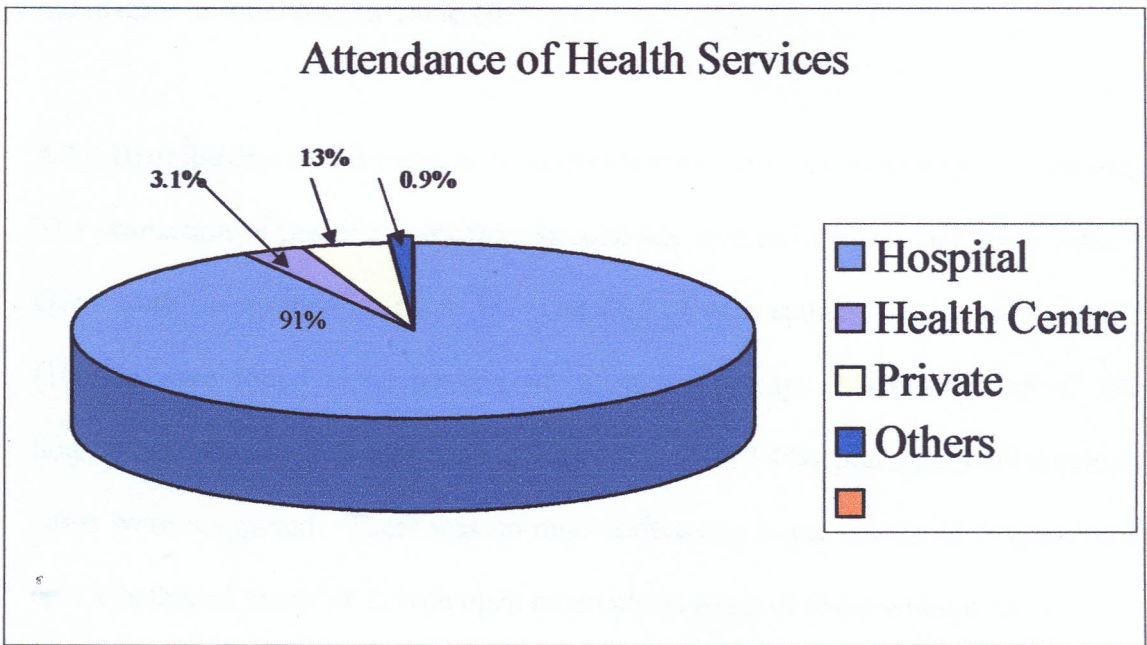
**Table 8: Distribution of active TB cases by the duration of chest symptoms**

Duration (months)	Cough	Chest pain	Haemoptysis (spitting blood)
1-3	226	143	28
4-12	83	129	26
12+	91	67	-
Total	400	339	54

#### 4.2.4 Previous attendance of Health Services

Out of the 400 respondents, 277 (91.7%) attended a hospital for similar complaints prior to the survey, 9 (3.1%) attended a health center. 13 (4.3%) attended private facility, while only 3 (0.9%) sought for spiritual and alternative medicine as shown in Figure 2. Considering the sparsely located static health facilities, lack of transport and the inaccessible topographical features of the district, it seems like these factors contributed to the delay and spread of the disease in seeking treatment.

Figure 2



#### **4.2.5 Number of respondents on TB treatment previously**

88 (22%) of the respondents had been on tuberculosis treatment, which indicates that the prevalence of tuberculosis in the district is of substantial significance as shown in Table 9.

#### **4.2.6 Proportion of sputum positive case among the 400 respondents**

400 pulmonary tuberculosis suspects were identified. All participated in the specimen examination through smear microscopy by sputum production and 37(9.2%) were confirmed positive, which indicates about 9% of the suspects screened population had the disease as tabulated on Table 10.

#### **4.2.7 Distribution of TB cases in households with index cases and those without**

The proportion of positive cases from households with index cases and those without cases were determined in Table 11. Out of 210 with sputum index cases only 23 (10.9%) were found to be positive on smear microscopy. Similarly, out of 190 households without a known case of open TB, 14 (7.4%) pulmonary tuberculosis cases were diagnosed. There was no much difference in the chance of diagnosing a case whether of households with open tuberculosis cases or those without cases.

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**Table 9: Number of respondents previously on TB treatment**

	Frequency	Percent	Cumulative percent
Yes	88	22	22
No	312	78	100
Total	400	100	

**Table 10: Proportion of sputum positive case**

	Frequency	Percent	Cumulative percent
Positive	37	9.2	9.2
Negative	363	9.8	100.0
Total	400	100	

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**Table 11: Distribution of TB cases in households with index cases and those without**

Disease	Results		
	Positive	Negative	Total
With index case	23	187	210
Without index case	14	176	190
Total	37	363	400

#### **4.2.8 Results of the prevalence of BCG vaccination among children aged 0 – 5 years**

Out of the 400 children examined for BCG vaccination 342 (85.5%) were found to be vaccination by scar. The results are summarized in table 12. It was observed that the majority of the children are BCG vaccinated before their first birthday 86% within this cluster studied.

#### **4.2.9 Prevalence of Mantoux positivity among aged 0 – 5 years**

Mantoux tests were administered on all children who had no BCG vaccination by presence of scar. One of 58 children tested, 5(8.6%) had positive Mantoux test (Table 13) The Mantoux positivity rates showed increase with advancing age, which is consistent with what is expected if the environment has tubercle bacilli.

#### **4.2.10 Results of BCG vaccination among children aged 0 – 5 by presence immunization card**

The presence of BCG vaccination card was to find out the number who really got their BCG immunization and the right close. The results shows that the immunization card is kept the first few months of the child in that 67(90%), 51(91.1%) and 32 (74.4%) of ages 0 – 11 months; 12 – 23; and 24 – 35 months respectively. Few produced at a later age of the child as low as 23 (43.4%). This shows that. There is high vaccination coverage of BCG immunization of 207 (70.2%).

**Table 12: prevalence of BCG vaccination among children aged 0 – 5 years:**

Age months	No screened (n)	BCG Scar Present	Scar rate % of n
0 – 11	85	80	94.1%
12 – 23	61	54	88.5%
24 – 25	107	92	86.0%
36 – 47	69	51	73.9%
48 – 59	78	65	83.3%
TOTAL	400	342	85.5%

**Table 13: Prevalence of Mantoux positivity of children aged 0 – 5 years**

Age months	Number	Results positive	% Positive
0 – 23	16	1	6.3%
24 – 47	19	2	10.5%
48 – 59	23	2	8.7%
TOTAL	58	5	

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**Table 14: Results of BCG vaccination among children aged 0 – 5 by presence of immunization card**

Age (months)	Number Screened (n)	Immunization card present	%
0 – 11	74	67	90.5
12 – 23	56	51	91.1
24 – 35	43	32	74.4
36 – 47	53	23	43.4
48 – 59	69	34	49.3
TOTAL	295	207	70.2

#### **4.2.11 Proportion of BCG scar to respondents with immunization card**

BCG coverage in the study area was high with 287 (83.7%) been immunized. This was by show of scar in the left hand of the child. While those who missed the immunization were 7 (12.5%). The immunization cards were well stored; this is shown by 97.6% had the immunization cards and only 11.5% lost their immunization cards as tabulated in Table 15.

#### **4.2.12 Proportion of chronic cough of respondents previously on treatment**

54.7% of the respondents had been previously treated of tuberculosis but also presented with chronic cough at the time of the study. This is an indication of high relapse of the disease. 84.3% with no previous history of treatment of tuberculosis were not identified with chronic cough as shown in Table 16.

#### **4.2.13 Proportion of respondents with chronic cough**

The results in Figure 3 indicate that out of the number, 2.7% of persons who presented with chronic cough, 0.7% tested positive. The majority of the respondents 99.3% tested negative to AFB.

**Table 15: Proportion of BCG scar to respondents with immunization card:**

			Immunization Card			Total
			Present	None	Lost	
	Present	Count	287	10	46	343
		BCG Scar	83.7%	2.9%	13.4%	100.0%
		Immunization Card	97.6%	17.2%	97.9%	86.0%
		Total	71.9%	2.5%	11.5%	86.0%
	None	Count	7	48	1	56
		BCG Scar		85.7%	1.8%	100.0%
		Immunization Card		82.8%	2.1%	14.0%
		Total	1.8%	12.0%	.3%	14.0%
Total	BCG Scar	73.7%	14.5%	11.8%	100.0%	
	Immunization Card	100.0%	100.0%	100.0%	100.0%	
	Total	73.7%	14.5%	11.8%	100.0%	

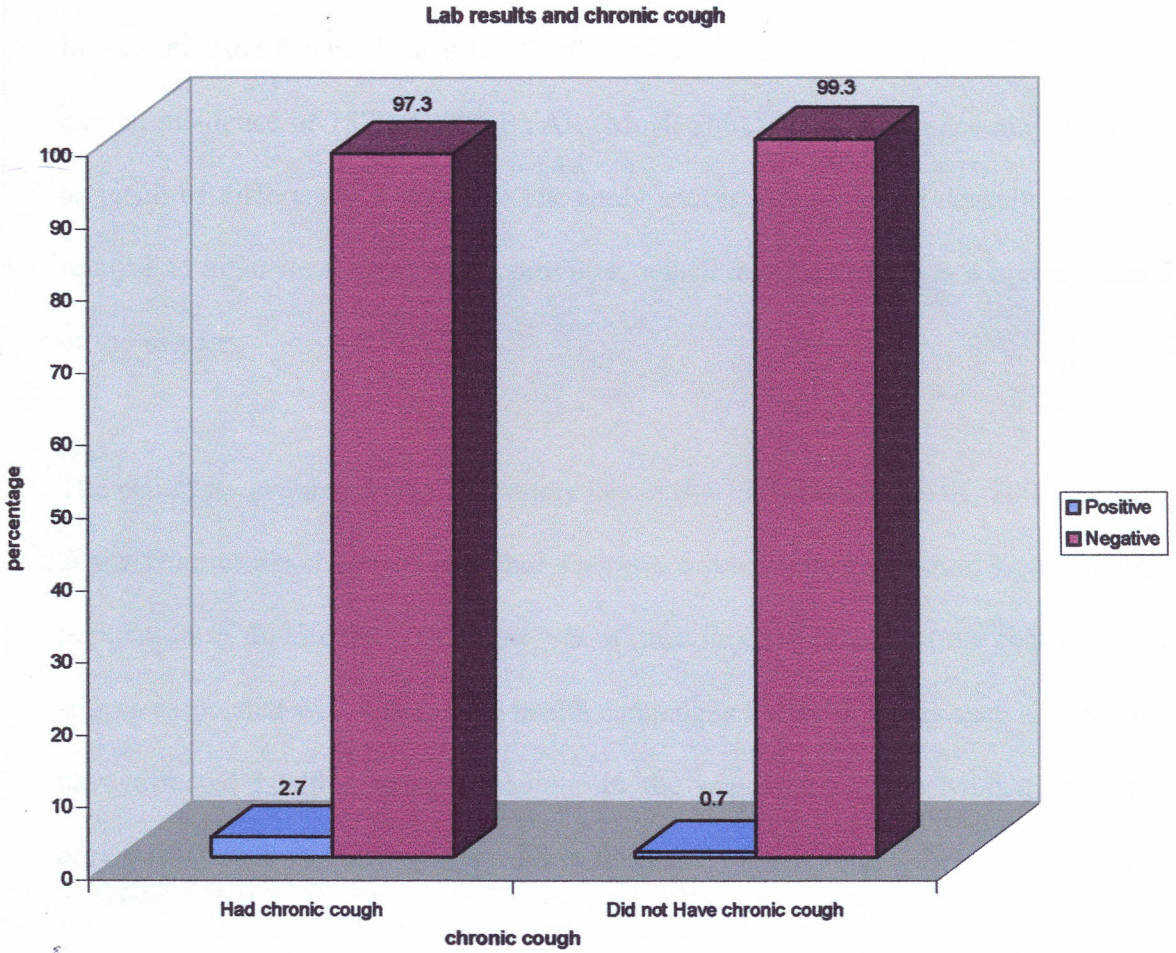
**Table 16: Proportion of chronic cough to respondents previously on treatment:**

			Chronic cough		Total
			Yes	No	
Ever been on Tuberculosis treatment	Yes	Count	47	39	86
		Ever been on Tuberculosis treatment	54.7%	45.3%	100.0%
		Chronic Cough	42.0%	15.7%	23.9%
		Total	13.1%	10.8%	23.9%
		No	Count	65	209
	Ever been on Tuberculosis treatment		23.7%	76.3%	100.0%
	Chronic Cough		58.0%	84.3%	76.1%
	Total		18.1%	58.1%	76.1%
	Total		Ever been on Tuberculosis treatment	31.1%	68.9%
		Total	31.1%	68.9%	100.0%

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**3.2.13 Proportions of respondents who presented with chronic cough and the laboratory results.**

**FIGURE 3:**



# CHAPTER FIVE

## DISCUSSION

The incidence of hospitalized tuberculosis cases among the study population of Wajir District was 212 case/100,000 persons – year at risk (PYAR) during 2001. This is higher than the reported rates for North Eastern Province, which is estimated at an annual incidence of 187/100,000 PYAR (MoH, 2001). The difference may be partly as result of differential reporting. The study area is also poor and densely populated relative to other rural areas in the province, which may contribute to a higher burden of the disease.

The estimates generated from this study lies in the 1999 census (GOK, 2002) and the Wajir District development plan that provides a precise denomination figure for the population of the district area. However, it must be considered that the change of the stigma associated with TB and the health campaigns of health issues such as TB, may have affected health-seeking behaviour in the population. The Ministry has not previously conducted any work on TB in this area.

The assumption that TB cases are drawn from the permanent population does not fully reflect the complexity of patterns of migration, an important phenomenon in the current population. It is not known to what extent the pastoralists are represented among the TB cases identified in hospital. But it has been postulated that individuals who were away from home for long periods were unlikely to feature significantly in either the numerator or the denominator of the study (GOK, 2002). If this assumption is correct, the figures presented for the prevalence and incidence should accurately reflect diseases occurrence among the population. However, given known patterns of

health service utilization, it is unlikely that a significant proportion of treated cases went undetected in the current study setting.

It is also recognized that the estimation of duration of treatment used to generate point prevalence in these analyses are likely to be imperfect, despite the fact that register data are thought to be relatively accurate (NLTP, 2000). Treatment compliance is a complex phenomenon and is not well described by the use of a single 'average' for duration of treatment. Nevertheless, this figure is useful in allowing comparison of the generated in the two parts of the study.

Data on point prevalence have been presented to compare the numbers of patients being treated for TB by the health system and patients with undetected TB in the community. The study found that for every nine members of the permanent population being treated for sputum positive pulmonary TB, there are likely to be two with undiagnosed pulmonary cases identified by ACF. Coughing for an extended period may contribute disproportionately to the duration of infectiousness in the community. Additionally, most of the patients had often previously sought treatment for their condition from a recognized health provider. As such, it seems that delay in presentation to and diagnosis by health services of undiagnosed TB in this community. In further work the study investigated delays in presentation of symptoms and diagnosis of hospitalized tuberculosis patients in South Africa (Pronky *et al.*, 2001).

It is important to underscore methodological differences in assessing the strengths and limitations of a particular ACF approach. In this study, active case finding is centered

on chronic cough screening, household questionnaire, and BCG and Mantoux positivity. Studies done in other parts of Kenya employing diverse ACF strategies have suggested this method to be the most successful in identifying active cases in the community (Aluoch *et al.*, 1982). In a review of hospital outpatients, the presence of weight loss and/or cough of between 1 and 12 months were found to be particularly sensitive (Aluoch *et al.*, 1985). Strategies to identifying TB suspects from other countries have differed widely, and have included multiple interrogation of village leaders, survey of household heads contact tracing among registered patients and TB suspects and public broadcast messages (Aluoch *et al.*, 1982; Aluoch *et al.*, 1985; Elink *et al.*, 1996). A variety of screening methodologies have been employed including purified protein derivative (PPD) testing, chest radiography, or surveillance for cardinal symptoms including cough (of 2 – 4 weeks) haemoptysis, weight loss and/or generalized weakness. (De Lourdes *et al.*, 2000; and Tupasi *et al.*, 2000) Sampling approaches varied from population based approaches to cluster designs (Tupasi *et al.*, 2000). Diagnostic mortalities such as chest radiography, sputum smear assessment, and culture collection have all been employed (Tupasi *et al.*, 2000). Unfortunately, researchers have reported differences between patients who have already been identified by the health services and those previously undiagnosed inconsistently.

### **5.1 Active Case Finding**

Case finding for pulmonary tuberculosis may be passive or active. The passive method is when the patient voluntarily presents himself to the health facility with symptoms of pulmonary tuberculosis while the active method involves the participation of the health personnel to screen suspects of pulmonary tuberculosis.

The current scarcities of financial resources have warranted the adoption of passive approach where TB suspects present themselves to health facilities for necessary screening. The observation from this study is that although this approach is more cost-effective than the ACF method, TB suspects do not seek medical help early enough. The few who were diagnosed at the hospital had had the duration of symptoms of over a year. This late reporting to health facilities may increase the morbidity and mortality of tuberculosis in the community.

The active case finding method carried out by the TB field team was time consuming and expensive. But the fortunate part was that there was 100% response of the respondents. The diagnosis of tuberculosis employing a cheap diagnostic procedure yielded a high proportion of positive cases among those who gave the sputum specimens for microscopic examination (WHO, 2002).

It could be argued that if the positivity rate was equal in proportion among the suspects. The procedure of active case finding 9%, which is an emergency, in World Health Organization standards. States that an infection rate of more than 1% should be international notified and classified as an epidemiological emergency (WHO, 1998). Besides the bad situation of the outcome, none of the suspects had reported to any health facilities for treatment of their chest symptoms. This could mean that the community's health consciousness is low.

The ratio of active cases and chronic cough to the population sampled has significant implications in terms of the cost and feasibility of ACF programmes. Based on the data, 1% of the individuals were identified as TB suspects using the chronic cough as

the cardinal symptom to the household heads. This is low compared to the finding from studies conducted in Papua New Guinea, which stood at 22% (Past, 1982) other parts of Kenya and Uganda where 5% has been reported (Aluoch *et al.*, 1982; Smith *et al.*, 1977). The ratio of TB suspects to sputum positive cases was 11:1 in the study. This is higher than acknowledged in the literature, where a ratio of 100 suspects per reported case is generally cited (Aluoch *et al.*, 1985; Murray *et al.*, 1998). While screening for a chronic cough is unlikely to miss cases with sputum positive disease, the advent of HIV has prompted calls for a more comprehensive screening protocol to detect sputum negative disease (Murray *et al.*, 1998).

Besides the poor infrastructure the Somalis may have other social and cultural reasons for underutilizing the health services. A variety of herbal and animal products are used as remedies for almost any illness or condition mentioned such as worms, ulcers, and chest infection and skin conditions. Self-medication with medicine bought from shops is commonly practiced. It has not been possible to know how the traditional healers treat tuberculosis patients. Within the Somalis the 'ayana' or magico-medical practitioners and 'dagin' – the black eye/evil eye, mix pastoralism with other significant pursuits. The 'ayanlee' who are mainly involved in the supernatural are highly respected for possessing specialized knowledge and powers on treating physical and spiritual nature. They are also active in determining the time and place of rituals and ceremonies and informing the group and individuals of the causes, course and outcomes of future events. They also prescribe ways of preventing magical and herbal preparation to be taken to prevent or cure illness. This has faded away but has reemerged with the advent of HIV/AIDS whereby people see the disease as mysterious and seek for the consultation and thus cause the delay in timely

detection, diagnosis and treatment of the ailment. To say the least, this in-built cultural component could severely restrict early attendance of even severe cases of tuberculosis from attending the available health services.

The response from men as heads of households was lower (17.5%) than that from women (52.4%). This observation was consistent with other studies in this country and elsewhere where women are always the majority in the use of health services. Like other women groups within the country, the Somali women could be a target groups to assist the medical teams in the surveillance of communicable disease like tuberculosis in this community.

## **5.2 Case finding at the tuberculosis Manyatta clinic**

This was observed as the most cost effective approach because it is part of the basic health services incorporated into the hospital's infrastructure. This could be possible through effective system of registration and interviews of adults presenting themselves to the health facility as suspected tuberculosis patients. This could necessitate thorough screening of the suspects to diagnose the tuberculosis cases earlier. The study reveals that more cases can be diagnosed in the household survey within a shorter time than self-referral in the hospital.

The advantage with case finding at the hospital is that one has more diagnostic tools such as culture and X-rays while the field survey employs only smear microscopy. The 100% compliant observed in the study and the hospital is the increased awareness of the disease and effective therapy. But the insidious nature of the symptoms of the disease hinders early detection.

At the TB clinic a significantly higher proportion of males than female suspects attended the hospital. Since it was observed that the disease affects both sexes equally, this may mean that women in this community seek medical assistance from the available health facilities. This is probably due to family commitments, the distance from health facilities and other topographical factors. In the household survey, more women TB suspects and cases were significantly higher than men. This social structural differences in health care seeking among sexes calls for provision of both static and mobile services in the control of tuberculosis in this community.

Existing strategies for the control of tuberculosis emphasize case detection among symptomatic individuals presenting to the health services, and treatment completion through directly observed therapy, short course DOTS (WHO, 1994). Critics argue, however, that this approach was developed well before the HIV/AIDS era, and takes no account of the dynamic epidemiology of HIV-related tuberculosis (De Cock, 1999). In high prevalence settings, particularly those in sub-Saharan Africa, TB caseloads have increased by 200 to 300% over the past decade (Drobniewski, 1997). Even countries with model DOTS programmes, such as Tanzania, Thailand or Botswana, have witnessed increasing TB transmission, largely as a consequence of high rates of co-infection with HIV (De Cock *et al.*, 1999; Ravigollane *et al.*, 1997).

De Cock and Chaisson (1999) note that given a growing prevalence of undiagnosed active TB in HIV-Positive persons, ACF strategies might be considered as a means to interrupt ongoing transmission. They advocate this approach in all setting that concentrate HIV infected persons' such as hospitals and prisons, and a more

widespread application in areas of high HIV-Positive TB patients (De Cock *et al.*, 1999).

In a review of four model approaches to active case finding, Murray and Solomon (1998) concluded that when coupled to an effective DOTS strategy, ACF could reduce tuberculosis mortality by one-quarter to one third over the next several decades. It also has the potential to yield enormous benefits in high prevalence regions such as sub-Saharan Africa (Murray and Solomon 1998).

In this study, a single interrogation of household heads identified a modest burden of undiagnosed TB in Central division of Wajir, with a low HIV prevalence. Furthermore, to what extent would their time to presentation influence the dynamics of transmission in the community? In industrialized countries ACF strategies have largely been dismissed, on the basis that while such interventions might diagnose active cases at an earlier stage, most individuals nevertheless access health services and get detected (Toman, 1979). This study detected 37 previously undiagnosed cases of tuberculosis among a population of 51,006. While contributing disproportionately to the duration of infectiousness in the community, most had accessed health services at some point during their illness.

### **5.3 Prevalence of BCG vaccination and Mantoux positivity**

The prevalence of BCG vaccination in the household survey (85.5%) was quite high compared to other areas in the country. The last BCG vaccination coverage in Kenya may be used in comparison (GoK, 1985). The vaccination coverage in the group eligible for the mass campaign for all children was 78%, similar to the calculated

average during the campaign of 1972. Considering the provincial results from school surveys, Eastern and Central had the highest coverage and North Eastern province the lowest, 87.4% and 42.3% respectively. Estimates from home survey show a similar picture.

The high BCG vaccination coverage in this area was provided by the MoH and World Vision Outreach Programmes that carry out complete immunization coverage. The Maternal Child Health (MCH) centers and other Non-Governmental Organization clinics serve central division.

The prevalence of Mantoux positivity among the children tested showed 18.7% of children below two years, which is quite high. In an age set of five years, the mantoux positivity increased with age. This may mean that there is actual exposure of these children to tubercle bacilli.

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# CHAPTER SIX

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusion

- a) Lack of adequate health facilities and the few facilities have huge problems of service delivery.
- b) Poor health seeking behaviour due to denial and stigma associated to the disease.
- c) Low level of community involvement and participation in case finding and control of tuberculosis.
- d) There exists many socio-cultural practices, other than the nomadic lifestyle which not only hamper TB control but more seriously enhance the spread of the disease.
- e) Tuberculosis control lacks linkages with other key health sectors and the community.
- f) Lack of integration of Primary Health Care to tuberculosis programme because TB is only centred in diagnosis and treatment.
- g) Poor staff attitude to the patients and lack of commitment and dedication towards the control of the deadly disease.
- h) The District Health Management team focuses on other issues and gives TB control the least priority.

## **6.2 Recommendations**

### **6.2.1.0 Short-term recommendations:**

The treatment of tuberculosis takes long up to a period of seven (7) months. Owing to the fact that supervision and follow-up of chemotherapy are difficult due to the scarcity of health facilities in this arid district and the nomadic lifestyle of the population. Therefore there is need for such patients to have proper and detailed documentation to be kept in the department of health records for the TB center. If this is not possible due to the high cost of stationary, the progress reports recorded in the original in-patients register can be used. These files should be returned for safe keeping in the records department. This requires the personnel at the chest clinic to have the tuberculosis appointment dairy so that the original documents of patients can be collected from the records office before the start of the clinic. The current system of recording the clinic progress and issue of drugs on the patient's own duplicate notes in the file, which is kept in the records department, should accompany TB cards. Secondly, since the TB patients keep cards for long time in a nomadic environment, they should be laminated with long lasting material.

### **6.2.1.1 Health education**

The community is in urgent need of the basic knowledge and information of tuberculosis cause, transmission, prevention and early detection of the symptoms. Basing on the study observations here, there exists a gap of information in the community. Apart from the health talks in the TB centre, home visiting and follow up for the defaulters and contact tracing should be done. Social mobilization in bringing

together all feasible and practical stakeholders to raise awareness by applying health education models in knowledge, attitude, behaviour, and practice changes.

#### **6.2.1.2 Coordination within the health sectors**

The district hospital and the TB Mayantta clinic should improve their coordination in the health services. The approach proposed here would be to incorporate the district leprosy TB clinic and TB centres into the existing health management team (DHMT) so that they can plan and map out area of coverage by the hospital. In fact, there locations within the district are very favourable for this type of approach because one is centrally located while the others are distantly positioned at the periphery of the district. Other medical teams operating in the district include the Non-governmental organizations like OXFAM, World Vision International and African Muslim Agency and these too need to incorporate into the DHMT to improve the efficiency in health care coverage. This would also prevent duplication of health services in some areas.

#### **6.2.1.3 Pre-packing drugs**

Drugs for tuberculosis patients should be pre-packed on routine basis at the hospital. This will save time for the patient queuing and staff. The present system of issuing drugs for one month should be reviewed so that the patients who are likely to migrate to distant places for search for water and pasture for livestock can be given drugs to last them for a season, even if it means issuing drugs to last three months. This would reduce defaulting rate as nomadic lifestyle contribute to high defaulting. The drugs should be packed in pilaster packs so that during adverse weather conditions they are safe.

### 6.2.2 Intermediate recommendations

- (i) Active Case-Finding should be routine at the outpatient departments of health facilities if the health personnel is to adopt simple criteria for identifying potential patients of PTB. This would yield more cases of PTB patients and treatment started early enough to alleviate their suffering and render them free of infections. This should be accompanied by screening close contacts of these patients for TB.
- (ii) Urine tests should be performed at the chest clinics and on surprise home visits to assess whether the patients are taking drugs regularly. This would enable the health personnel to give more health education to defaulters.
- (iii) Mantoux tests especially among children living with open cases should be done to diagnose this disease at an early stage in children. All children in the community who have not received BCG vaccination should be screened and vaccinated or tested to prevent the morbidity and mortality of childhood disseminated tuberculosis.
- (iv) The chest clinic personnel to assess the patients' response to treatment should do routine microscopy during re-attendance selectively. This also means that there should be specific days of the week for bookings where the DLTC has no other duties except the chest clinic. It was observed that many patients reported to the chest clinic without bookings only to discover that the clinical officer in charge had gone to other duties out of the hospital. Systematic and regular booking days would improve the situation.
- (v) Having deputy personnel at the chest clinic to serve these patients in the absence of the one in-charge is proposed. Before more are trained, a general clinical officer or a community nurse could handle the situation.

## **6.2.3 Long Term recommendations**

### **1) Primary Health Care**

The communities that are remote from the main hospitals would benefit if the peripheral health infrastructure like health centres and dispensaries would be improved to have microscopy services for tuberculosis. This would involve the setting up of PHC system, where currently the constraints are to get enough trained personnel who can supervise and motivate the peripheral staff cadres, particularly the Community Health Workers (CHW).

### **2) Short – Course Chemotherapy**

The problems observed in managing tuberculosis patients in this community are manifold. They include nomadic lifestyles, harsh environment and climatic conditions, defaulting or absconding from treatment among others. Therefore, It is proposed that full compliance of the WHO recommendable TB control strategy (DOTS), be implemented fully.

The aim of the above is also to avoid moving away the TB patients from there nomadic community. This could be achieved by constructing local modified houses having enough ventilation with the help of the health personnel.

### **3) Harmonising of Government Expenditure**

Wajir District is among the few districts with sparse population, which is mainly nomadic. In order to achieve the desired goal within the health sector, it is proposed that the economic planners do the trimming of Government Expenditure selectively so that adequate funds could be allocated to mobile health teams.

### 6.3 SUGGESTIONS FOR FURTHER WORK

- 1) To determine on Annual risk of infection
- 2) To research on the impact of HIV/AIDS and Tuberculosis
- 3) To research on patients of Multi drug resistance tuberculosis
- 4) The presence of Bovine TB in human and the livestock.

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## REFERENCES

- Alouch J A, Edwards E A, Stott H, Fox W, Sutherland I (1982).** A study of the case-finding methods for pulmonary tuberculosis in Kenya.  
*Transactions Royal School Tropical Medicine and Hygiene*  
76:679-691.
- Alouch J A, Edwards E A, Stott H, Dardysire J H, Fox W, et al., (1984).** Study of case-finding for pulmonary tuberculosis in out patients complaining of chronic cough at a district hospital in Kenya.  
*American Review of respiratory Disease* 129: 915-20.
- Alouch J A, Karuga W K, Nsanzumuhire H, et al., (1978).** A second study of the use of community leaders in case finding for pulmonary tuberculosis in Kenya. *Tubercle* 59 233- 245.
- Alouch J A, Swai O B, Edwards E A, et al (1985).** Studies of case finding for pulmonary tuberculosis in outpatient at four district hospitals in Kenya.  
*Tubercle* 66: 237-249
- AMREF, (1993):** Control of Communicable diseases Africa Medical Research Foundation Pg. 314-318.
- Antonucci G, Giradi E, Raviglione MC. (1995)** Risk factors for tuberculosis in HIV-Infected persons. A prospective cohort study. The Gruppo Italiano di studio Tuberculosis e AIDS (GISTA). *Journal of the American Medical Association* 274:143-8
- Barry, V.C. (1964):** Development of the chemotherapeutic agent for tuberculosis  
In: Barry, V.C., (ed). *Chemotherapy of tuberculosis*, London, Butterworth, pp. 46.

**Behr MA, Wilson MA, Gill WP, Salamon H, Schoolnik GK, Rane S: (1999)**

Comparative genomic of HCG vaccines by whole-genome DNA micro array *Science Lacent* 4:1520-3.

**Cauthen MM, Badi N, Ryder RW, Baende E, Mukadi Y, Nsuami M: (1996)** A

retrospective cohort study of tuberculosis among women of childbearing age with HIV infection in Zaire. *American Review of Respiratory Disease*; 143:501-4.

**Cohen DL, El-Sadr WM. (2000):** Treatment of latent tuberculosis infection. In:

Reichman LB, Hershfield ES, editors. Tuberculosis – a comprehensive international approach. New York: Marcel Dekker; pp 471-502.

**Colditz GA, Brewer TF, Berkry CS, Wilson ME, Schoolnik GK, and Brundick E.**

(1998) Efficacy of BCG vaccine in the prevention of tuberculosis. *Journal of the American Medical Association* 271:698-702.

**Comstock G W (1999).** How much isoniazid is needed for tuberculosis among

Immunocompetent adults? *International Journal of Tuberculosis and Lung Disease* 3:847-50

**Crofton J N, (1997):** Respiratory Disease. London, Edinburgh, Blackwell. pp 243.

**Crofton J N, Horne N, Miller F (1992).** Clinical Tuberculosis. *International Journal*

*of Tuberculosis and Lung Disease* 5:884-89.

**De Cock K M, Soro B, Coulibaly IM, Lucas, SB, (1992):** Tuberculosis and HIV

infection in Sub-Saharan Africa. *Journal of the American Medical Association*; 268:1581-7.

**De Cock K M, Chaisson R E (1999).** Will DOTS do it? A reappraisal of

tuberculosis control in countries with high rates of HIV infection.

*International Journal of Tuberculosis and Lung Disease* 3:457-

465

**De Lourdes Garcia-Garcia M A, Palacios-Martinez M, Ponce-de-Leon A, et al.,**

The role of core groups transmitting *Mycobacterium tuberculosis* in high prevalence community in southern Mexico. *International Journal of Tuberculosis and Lung Disease*; 4:12-17.

**Dye C, Scheele S, Dolin P, and Pathania V, Raviglione MC. (1999):** Consensus

statement. Global burden of tuberculosis: estimated incidence, prevalence, and mortality by country. WHO Global Surveillance and Monitoring Project. *Journal of the American Medical Association* 282:677-86.

**Dye c. (2000);** Tuberculosis 2000-2010: Control, but not elimination. *International*

*Journal of Tuberculosis and Lung Disease*; 4(suppl 2): S146-52.

**Elink schuurma MW, Srisaenpang S, Pinitsoontom S, Bijleved I, (1996):** The

rapid village survey in tuberculosis control: *International Tuberculosis and Lung Disease* 77:549-54.

**Espinal DW, Desvarieux M, Severe P, Joseph p, Johnson WD, Jr, Pape JW,**

(2000) Effect of post-treatment isoniazid on prevention of recurrent tuberculosis in HIV-1-infected individuals: a randomised trail. *Lancet*; 356:1470-4.

**Erhabor, G. E.; Agawam, H. S.; Usuph, M. Y.; Adebayo, R. A.; Arogundade, F.**

**A and Omidiora, A. (2002):** Factors Influencing Compliance with patients with TB on DOT at ILE-IFE, Nigeria. *East African Medical Journal* **79**: 235-239.

**Fine PE. (1995)** Bacilli Calmette-Guerin vaccines: a rough guide. *Clinical Infectious Diseases* **20**:11-4.

**Fine PEM. (2000):** BCG vaccination. In: Reichman LB, Hershfield ES, editors. Tuberculosis—a comprehensive international approach. New York: Marcel Dekker: pp 50-3-22.

**Fisher A. Andrew; Laing E. John; Townsend W. John, (1998):** Handbook for Family Planning Operations Research Designs. 2<sup>nd</sup> edition. Population Council, USA pp.36

**Grange J M, (1999):** The global burden of tuberculosis. In: porter J D H, Grange J M, eds. Tuberculosis-an interdisciplinary perspective. London: Imperial College: pp 3-32.

**Girrachhi E, Antonucci G, Vanacore P Libanore M, Errante I, Matteeli A, (2000):** Impact of combination antiretroviral therapy in the risk of tuberculosis among persons with HIV infection. *AIDS*; **14**:1985-91.

**GoK (2002):** Wajir District Development Plan (2002-2008). Office of the Vice President Kenya and Ministry of Planning and National Development. Government Printers, Nairobi, p 3-4

**GoK (1985):** National Immunization coverage 1984. Ministry of Health, Nairobi, Kenya, p12-15

**GoK (1978):** National Survey on BCG coverage 1977. Ministry of Health, Nairobi, Kenya.

**GoK (1979):** National Survey on immunization coverage 1977. Ministry of Health, Nairobi, Kenya.

**GoK (1970):** Prevalence of tuberculosis in five (5) Provincial hospitals. Ministry of Health. Nairobi, Kenya.

**GoK (1967):** National tuberculosis survey. Government of Kenya 1965-1966.

**Gothi GD, Narayan Nair SS, Chakraborty AK, Srikanataramu N, (1976):**

Estimation of prevalence of bacillary tuberculosis on the basis of chest X-ray and / or symptomatic screening. *Indian Journal of Medical Research;* 64:1150-9.

**Harries AD, Maher D, Nunn P, (1998)** An approach to the problems of diagnosing and settings in sub-Saharan Africa. *Bulleting of the World Health Organization* 76:651-62.

**Harrison T.R; Anthony S Fauci; Equene Braunwald; Kurt J. Isselbacher; Jean D.Wilson; Joseph B. Martin; Dennis L. Kasper; Stephen. Hauser; Dan L. Longo, (1998):** Harrison's principle of internal medicine.14<sup>th</sup> Edition.

**Hawken MP, Muhindi DW, (1999):** Tuberculosis preventive therapy in HIV infected persons: feasibility issues in developing counties. *International Journal of Tuberculosis and Lung Disease;* 3: 646-50.

**Kochi A, (1997):** Tuberculosis control—is DOTS the health breakthrough of the 1990s,? *World Health forum* 18: 225-23

**Lobue PA, Perry S, Catamaran A, (2000):** Diagnosis of tuberculosis in Reichman LB, hershfield ES, editors. Tuberculosis a comprehensive International approach; New York: Marcel Dakar; pp.341-75.

**Manson, P.E.C., Bell, D.R. (1988);** Manson's Tropical diseases. Nineteenth Edition Macmillan Press Limited London. Pg. 987 – 997.

KENYATTA UNIVERSITY LIBRARY

**MoH, (1999):** National leprosy and TB program, Annual report Ministry of Health  
Pg. 18-21.

**MoH, (2001):** National leprosy and TB program, Annual report Ministry of Health  
Pg. 12-14.

**Murray CJL, Salomon JA, (1998):** Modelling The Impact of tuberculosis control  
strategies; *Proceedings of the National American Academy of Science of  
the United States of America.* **95:**13881-6.

**Mzanzomohire H, (1981):** A fourth study of case finding methods for pulmonary  
tuberculosis in Kenya. *Transactions of The Royal society of Tropical  
Medicine and Hygiene* **76:**679-91.

**NLTP (1995):** The National Leprosy and TB Program; Manual for NTLTP staff –  
second edition National Leprosy and TB Program pp. 52-54.

**NLTP (2000):** The National Leprosy and TB Program; Manual for NTLTP staff –  
second edition National Leprosy and TB Program pp. 35-41.

**NLTP (2001):** The National Leprosy and TB Program; Manual for NTLTP staff –  
second edition National Leprosy and TB Program pp. 55-58.

**NLTP (2002):** The National Leprosy and TB Program; Manual for NTLTP staff –  
second edition National Leprosy and TB Program Pg.24-27.

**Nunn, P. P., Gicheha, C. and Hayes, R. (1992):** Cross sectional survey of HIV  
Infection among patients with TB in Nairobi, Kenya. *Journal of Tubercle  
and lung Disease*, **73:** 45 – 51.

**Pape JW, jean SS, Ho JL, Hafner A, Johnson WD Jr, (1993):** Effect of isoniazid  
prophylaxis on incidence of active tuberculosis and progression of HIV  
infection. *Lancet* **342:**268-72.

- Petrie J H, Mukadi Y, and Nunn P P. (1991).** Tuberculosis and HIV infection  
Implications for Africa AIDS: *Supplement 5* : 127-133
- Pronky P M, Makhubele M B, Hargreaves J R, Tollman S M, Hauser H P (2001).**  
Assessing health-seeking behaviour among tuberculosis patients in rural  
South Africa. *International Journal of Tuberculosis and Lung Diseases.*  
5: 619-627.
- Pust R E (1982).** The risk factor approach to sputum smear diagnosis. *World Health  
Forum.*3: 78-80.
- Raviglione M C, Drobniewski F, Palbos-Mendez A.** Epidemiology of tuberculosis  
in the world. *Seminars Respiratory Critical Care Medical*; 18:419- 429.
- Schull, K. A. (1987).** How contagious is tuberculosis? *Clinical Infectious Disease*  
23:954-962
- Smith, D. T., Martin, D. S., Conant, N. F., Beard, S. W., Taylor, G., Kohn, H. J.  
And Poston, M.A., (1948):** *Mycobacterium tuberculosis and tuberculosis.*  
Oxford Medical Publications, London pp. 375 – 403
- Smith P G, Revill W D (1977).** The prevalence of persistent coughs in a rural  
community in the Lango district of Uganda. *Tubercle.* 58: 157-159bb.
- Solagberu, B. A. and R. O. Ayorinde (2000):** *Global tuberculosis burden: The East  
African Medical Journal.* 77:197 –199.
- Styblo K, Van Geuns H A, Meijer J (1984).** The yield of Active case finding in persons  
with inactive tuberculosis of fibrotic lesions. *Tubercle*; 65:237-51
- Styblo K, Mathew, P, Kuo, Y.-H., Vazirani, B, Eng, R. H. K, Weinstein, M. P.  
(2002).** Are Three Sputum Acid-Fast Bacillus Smears Necessary for  
Discontinuing Tuberculosis Isolation?. *J. Clin. Microbiol.* 40: 3482-3484

KENYATTA UNIVERSITY LIBRARY

**Taylor, S. (2001):** Business statistics, A complete one semester course 1<sup>st</sup> ed.

Chippenharm. UK, pp 291-295.

**Toman, K. (1979):** Tuberculosis case finding and chemotherapy: Questions and Answers World Health Organization, Geneva pp. 3 - 4.

**Tupasi T E, Radhakrishna S, Quelapio M I D (2000).** Tuberculosis in the urban poor settlements in the Philippines. *Intrenational Journal of Tuberculosis and Lung Diseas.* 4: 4-11.

**Vogel, JN. (1974):** Pathology, diagnosis, management and prevention. Pulmonary Tuberculosis: Brief historical introduction third edition. Oxford Medical Publications, Amen House, London, E. C. pp. 3-5.

**Walley JD, Khan MA, Newell JN, Khan MH, (2001):** Effectiveness of the direct observation component of DOTS for tuberculosis: a randomised trial in Pakistan. *Lancet*; 357:664-9.

**Whalen CC, Johnson JL, Okwera A, Hoom DL, Buebner, Mgyenyi P.A, (1997):** Trail of three regimens to prevent tuberculosis in Uganda adult infected with the Human Immunodeficiency virus. *New England Journal of Medicine*; 337:801-8.

**WHO (1982):** Tuberculosis control report, WHO/CDS/TB/82.081 Geneva.

**WHO (1988):** Tuberculosis control as an integral part of primary health care WHO/CDS/TB/88.189. Geneva, pp. 18 – 22.

**WHO (1998):** Report of the ad hoc committee on the tuberculosis epidemic. London, 17-19 March 1998, World Health Organization, Geneva.

**WHO (1997):** Treatment of tuberculosis guidelines for national programmes. Geneva: World Health Organisation.

- WHO (1994):** Tuberculosis a global emergency. World Health organization report  
TB epidemic.
- WHO (1999):** Status of tuberculosis in the 22 high burden countries,  
WHO/CDS/CPC/TB/99.270. Geneva, pp. 8 -11.
- WHO (2000):** The World health report 2000 – Health Systems: Improving  
performances WHO/CDS/TB/2000.290. Geneva, pp. 49 – 51.
- WHO (2000):** The world health report 2000-Health systems: improving  
performance. Geneva: World Health organization.
- WHO (2001):** Global tuberculosis control, WHO/CDS/TB/2001.207 Geneva  
pp. 70 – 73.
- WHO (2002):** Reducing TB mortality in developing countries. *The International  
Journal of Public Health*; **80**:3; 217-227
- Wilson ME, Fineberg HV, colditz GA, (1995):** Geographic latitude and the efficacy  
of Bacille Calmette-Guerin vaccine. *Clinical Infectious Diseases*; **20**:982-91.
- Zwarenstein M, Schoeman JH Vundule C, Lombard CJ, Tetley M, (1998):**  
Randomised controlled trail of self-supervised and directly observed treatment of  
tuberculosis. *Lancet*; **352**:1340-3

# APPENDICES

## APPENDIX I

### Household questionnaire

Name of the investigator \_\_\_\_\_ Research No: -----

Name of District \_\_\_\_\_ Division: \_\_\_\_\_

Location: \_\_\_\_\_

Household Number: \_\_\_\_\_

Date of study: Day \_\_\_\_\_ Month \_\_\_\_\_

Year \_\_\_\_\_

(Tick where appropriate)

1. Name of the case-----

2. Age in years \_\_\_\_\_

3. Sex: Male \_\_\_\_\_ Female \_\_\_\_\_

4. Marital status:

Married

Single

Divorced

Separated

Widow

5. Number of people in the household.

1 - 3

4 - 6

7 - 9

9 and over

6. Occupational status

Housewife

Salaried

Businessman

Farmer

7. Educational level

0 – 3

4 – 8

9 – 12

13 and above

8. Have you heard of TB? Yes  No

9. Duration of symptom (insert relevant figures in the columns provided)

	Days	Weeks	Months	Year
Cough				
Chest pain				
Blood spitting				

10. Have you ever been on Tuberculosis treatment: Yes  No

11. If yes for how long?

1 month:

3 months:

6 months

Completed treatment

12. Medical treatment sought:

Hospital:

Health center:

Dispensary:

Private clinics:

Others specify \_\_\_\_\_

13. Is there anyone in the family who suffers?

Chronic cough      Yes       No

Chest Pain      Yes       No

Spitting blood      Yes       No

14. If yes for how long?

3 weeks

One month

3 months

More than 3 months

15. Has the person been treated?      Yes       No

16. Where was the treatment sought?

Hospital

Health center

Dispensary

Private clinic

Others specify \_\_\_\_\_

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## APPENDIX II

### Questionnaire for children under five (5) years of age BCG and Montoux

1. Name of child: \_\_\_\_\_

2. Age of child: \_\_\_\_\_

(Tick where appropriate)

3. Sex: Male:  Female:

4. BCG Scar: Present:  None

5. Immunization Card: Present:  None:  Lost:

6. Tuberculin test result: Positive:  Negative

7. Remarks: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

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# APPENDIX III

## Sputum – smear examination request form

Location \_\_\_\_\_ Reg. No \_\_\_\_\_

Name: \_\_\_\_\_ Age \_\_\_\_\_ Sex \_\_\_\_\_

Address: \_\_\_\_\_

New Patient

Follow-up examination

Requested by: Name \_\_\_\_\_

Signature \_\_\_\_\_

### RESULT

(a) Appearance:

Specimen	1	2	3
Blood stained			
Muco-purulent			
Saliva			

(b) Microscopy:

Specimen	1	2	3
Date			
Serial No.			
Negative			
Positive			
Examined by			

## APPENDIX IV

### Questionnaire For Health Workers:

1. What is the prevalence of TB in Central Division by age and sex?

Age	Sex	
	M	F
0 – 6		
7 – 14		
15 – 29		
30 – 44		
45 and above		

2. What types of drugs are the patients given in the treatment of TB?

---

3. What are patterns of TB treatment?

---

4. What is the length of treatment?

---

5. What method of TB diagnosis do you use?

---

6. What confirmatory tests do you use to verify the diagnosis?

---

7. Are there any cases of patients defaulting treatment?    Yes       

8. If yes, how do you trace for such cases?

---

---

9. Do you think defaulters contribute to the high prevalence of TB?

Yes  No

10. If yes, what are the solutions?

---

11. Are there cases of HIV/AIDS related TB infections? Yes  No

12. If yes, how many?

---

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## APPENDIX V

### Sample size determination

Sample size was determined using the formula as used by Fisher *et al.*, (1998)

$$n = \frac{Z^2 pqD}{d^2}$$

Where n – Sample size

Z – Standard normal deviance (1.96) that corresponds to 95% confidence level (CI)

P - Proportion of the target population estimated to have a particular characteristic = 0.5

q -  $1 - p$  (1-0.5)

d - Degree of accuracy = 0.05

D - Design effect = 1

$$\text{Thus } n = \frac{1.96^2 \times 0.5 \times 0.5}{0.05^2}$$

$$= 384 \approx 400$$