

The Epidemiology and Diagnosis of Childhood Tuberculosis at a District Hospital in Kwazulu-Natal, South Africa

A Retrospective Audit of Clinical Practice

Dissertation submitted in partial fulfilment of the requirements for the degree
Master of Philosophy in Maternal and Child Health (M Phil MCH), University of
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Declaration:

I, Samantha Padayachee declare that this thesis embodies only my original work except where acknowledgement indicates otherwise and that no part of it has been or is being submitted for a degree at any other university.

Signature

The work for this thesis was done in the School of Child and Adolescent Health of the University of Cape Town.

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“The real voyage of discovery consists not in seeking new landscapes.... but in having new eyes.” Marcel Proust

And for my Dad, who was at the beginning and not the end

Abbreviations

AFB- acid-fast bacilli

AFB+- acid-fast bacilli positive

AIDS- acquired immune deficiency syndrome

ARV- anti retroviral

BCG- Bacille Calmette-Guerin

CSF- cerebrospinal fluid

CSO- community service officer

CT- computerized tomography

CXR- chest x-ray

DIO- District Information Officer

ENT- ear, nose and throat

FNA- fine needle aspiration

HAST- HIV, AIDS, sexually transmitted infections and tuberculosis

HIV- human immunodeficiency virus

IMCI- Integrated management of childhood illnesses

LIP- lymphoid interstitial pneumonia

LP- lumbar puncture

MTB- mycobacterium tuberculosis

NRP- non-resolving pneumonia

NTP- National tuberculosis program

OADP- Okhahlamba Area Development Plan

PCR- polymerase chain reaction

PCP- pneumocystis carinii/ jiroveci pneumonia

PHC- primary health care

PTB- pulmonary tuberculosis

PUO- pyrexia of unknown origin

RTHC- road- to- health card

SANTCP-South African national tuberculosis control program

StatsSA- Statistics South Africa

TB- tuberculosis

TBM- tuberculous meningitis

THAT'S IT- Tuberculosis, HIV and AIDS treatment support and integrated therapy

TST- tuberculin skin test

WHO- World Health Organisation

University of Cape Town

Executive Summary

Introduction:

TB was declared a priority disease in South Africa ten years ago. Despite efforts to manage this illness, South Africa ranks as one of 22 high burden countries globally. TB is an important cause of childhood morbidity and mortality, but much of the emphasis of the NTP is on smear positive (adult) TB, as this is perceived to be the greater public health problem. The presence of HIV infection exacerbates both the incidence of TB, and the progress of TB from infection to the development of disease in both children and adults.

The diagnosis of childhood TB has proved to be difficult and continues to challenge clinicians, despite technological advances in various spheres of medicine. Several guidelines and recommendations are available for diagnosing TB in children, including combinations of clinical criteria, special investigations, laboratory methods and score systems, but no gold standard exists.

It is not clear how well the SANTCP guidelines for diagnosis of childhood TB are being implemented at Emmaus Hospital, or whether these guidelines are still appropriate within the context of high HIV prevalence. Not enough is known about the epidemiology of childhood TB in the Okhahlamba local municipal area surrounding Emmaus hospital to guide optimal management of children. Given the likely magnitude of the problem of childhood TB in this

rural area and the difficulties of diagnosis, research into the epidemiology and diagnosis of childhood TB in this context is necessary.

Purpose:

The purpose of this study is to describe the epidemiology of childhood TB at Emmaus Hospital and the diagnostic problems encountered in order to make recommendations to improve current practice

Methodology:

A retrospective audit of clinical records of children less than 15 years diagnosed with TB at Emmaus Hospital between 1 January 2004 and 31 December 2006 was undertaken, using three different data sources.

Results:

A total of 2480 cases of TB were reported from Emmaus Hospital, during the study period January 2004 to December 2006. A total of 179 of these reports (7.2%) were of children less than 15 years, 83% (149/179) of which were retrieved for inclusion in the audit. Eighty-seven (58.4%) of 149 children diagnosed with TB were less than 5 years of age, and 62 (41.6%) were between 5-14 years. Based on mid-2005 population estimates, the age specific incidence rates were 159/100 000/year [95% CI: 110, 230] for children less than 5 years old and 50.2/100 000 [30, 80] for children 5-14 years old, a statistically significant difference ($p < 0.0001$). The HIV status of the majority of the children (77.2%) was unknown. Clinical staging of HIV is poorly documented, with only 2 (7.1%) children (of 28 HIV infected children) reported

being clinically staged. Forty-seven (31.5%) of 149 children were recorded as having weights <3rd centile and 34(22.8%) had unknown weight.

In the majority of children, 124 (83.2%), diagnosed with TB, a formal assessment (either using the TB score or the Modified WHO Criteria) as recommended by the SANTCP was not performed. The most frequent investigations used for diagnosis of TB were the CXR 77 (51.7%) and TST 69 (46.3%). Despite other investigative options being available at Emmaus Hospital to assist with the diagnosis of TB in children, relatively few of these are used. The management of the child with HIV/TB and the HIV uninfected child with TB, was difficult to assess as a result of the small number of patients documented to be in the HIV infected group.

Discussion:

TB in South Africa and locally, constitutes a serious public health problem.

The TB incidence during the study period for Emmaus Hospital and the Okhahlamba municipal area was calculated to be 573/100 000 population/year.

Childhood TB accounts for 7.2% (179/2480) of the total TB cases that was reported during the study period. This proportion is lower than that which is usually anticipated for children in a population and may allude to the possibility of under-diagnosis and or under-reporting of childhood TB in Okhahlamba. Younger children (less than 5 years) were found to have more tuberculosis diagnosed than children older than 5years. Age specific

incidence rates that were calculated yield disturbingly high occurrence of TB in children less than 5 years. This is concerning as younger children are more likely to develop the more severe disseminated forms of TB, which often carry a higher morbidity and mortality.

The SANTCP guidelines for the diagnosis of childhood TB are utilized very poorly at Emmaus Hospital. The reasons for this are unclear, however may include reluctance on the part of the health worker or unwillingness.

Health workers at Emmaus hospital tend to use the CXR and TST predominantly for diagnosis of TB in children. Both of these investigative techniques are known to have limitations particularly in a TB and HIV endemic area. It is also of concern that basic clinical symptoms and signs are not adequately assessed and investigations, which are accessible at district level are not being utilised.

Recommendations and Conclusion:

Important recommendations include improving the quality and quantity of existing childhood TB data, developing more reliable methods for the diagnosis of childhood TB, using the existing TB guidelines as a screening tool to identify children at risk, undertaking quality-improvement audits, and integrating the management of TB and HIV.

A dedicated, intersectoral effort is required at all levels of society to decrease the burden of childhood TB reflected in this study.

Chapter 1: Introduction

In 1993, the World Health Organisation (WHO) declared tuberculosis (TB) a global emergency, and in 1996 TB was declared a priority disease in South Africa (Blumberg, Ogunbanjo and Durrheim, 2003, pp38). According to the 2007 Global TB Control report (WHO, 2007, pp 137), South Africa is listed among the 22 high-burden TB countries. The global incidence in 2006 is estimated at 136/100 000 population/ year, whilst the national TB incidence in South Africa is 600/100 000 population/ year, according to the same report.

TB is an important cause of childhood morbidity and mortality in South Africa, and despite highly effective drugs being readily available, the burden of TB is increasing, fuelled largely by the human immuno-deficiency virus (HIV) epidemic (South African National TB Control Program [SANTCP] Guidelines, 2004, pp1). The failing immune system caused by HIV and the immature immune system of young children creates an environment of increased susceptibility to infections caused by *Mycobacterium tuberculosis* (MTB).

Children represent a high proportion of TB cases, and childhood TB places a burden on the health services in developing countries equal to that of adults (Iriso et al, 2005, pp716). Various organisations have therefore recognised the importance of including childhood TB in mainstream National TB Programs (NTP) (Gie, 2006, pp1067). Presently TB control programs are primarily directed at detecting and managing adult smear- positive TB, as this is perceived to be a greater public health priority. In addition monitoring and

evaluation indicators emphasize smear- positive TB (e.g. smear conversion rates, treatment completion/ treatment cure rates etc). Childhood TB is usually considered paucibacillary (low bacillary load in sputum/ gastric aspirates) and therefore less likely to be infectious and transmitted to others; children are therefore less likely to be a contributory factor to maintaining the epidemic (Marais et al, 2006, 1080).

The diagnosis of childhood TB has proved to be difficult and continues to challenge clinicians, despite technological advances in various spheres of medicine. Several guidelines and recommendations are available for diagnosing TB in children, including combinations of clinical criteria, special investigations, laboratory methods and score systems. However, no gold standard exists. Newer diagnostic tests e.g. PCR (polymerase chain reaction) and recovery methods, such as nebulised hypertonic saline induction of sputum and broncho-alveolar lavage, are available and have been well described (Eamranond and Jaramillo, 2001, pp597). However, the use of these tests in the diagnosis of childhood TB has not been evaluated. These tests are currently not available at district level in South Africa.

Clinical score systems have been recommended because of their cost effectiveness and ease of administration, particularly in resource-poor settings (Mehnaz and Arif, 2005, pp543). The present SANTCP guidelines recommend a score system and the Modified WHO Criteria for the screening and diagnosis of childhood TB. It is important to note that despite the cost effectiveness and ease of administration of these clinical score systems, they

are not as useful for diagnosis of childhood TB in the presence of malnutrition and HIV infection (Graham et al, 2004, pp651).

With increasing co-infections of TB and HIV, the challenge faced by health workers becomes more complicated. "HIV has changed the clinical, radiological and microbiological presentation of TB in adults, rendering diagnosis more difficult. Diagnosis of TB in children has always been difficult, but is now even more complex, owing to the similar presentation of other HIV-related lung diseases. Both over- and under-diagnosis are likely, depending on TB incidence in an area and the health worker's experience" (Wilson et al, 2005, pp275). It is becoming increasingly important to integrate the management of TB and HIV services, (Anderson and Maher, 2001, pp9, Coetzee et al, 2004, ppA15). At present there is little integration of the management of both illnesses, despite recommendations by the WHO and the benefits for each program and the clients they serve (Harries et al, 2006, pp1306).

The escalating burden of childhood TB, the aggravating co-epidemic of TB and HIV and the difficulty in diagnosing childhood TB creates a serious challenge for district and primary health care facilities.

Emmaus Hospital, a district hospital, provides the setting for this study (Appendix 8). The hospital is a 160-bed facility in the Okhahlamba local municipal area, which lies within the uThukela district municipality in northwestern KwaZulu-Natal. The hospital serves a population of 137 517, the

total population of the municipal area, of which 41% are children under 15 (Statistics South Africa [StatsSA], Census 2001). The hospital serves a population of predominantly rural Zulu-speaking people.

The Okhahlamba area adjoins the central Drakensberg Mountains, declared a World Heritage Site. Despite this recognition, little has improved for the local population. People are generally poor, with most households having no regular income. Environmental health is poor, as the majority of households have no access to piped water, do not use a pit or bucket latrine, do not have their own refuse dump, and do not have refuse removed (StatsSA, Census 2001).

In the Okhahlamba Area Development Programme (OADP) Baseline Survey, of August 2006 (World Vision SA, 2006), several socio-economic risk factors for childhood TB and HIV and other diseases were identified. These included household overcrowding, high levels of unemployment (68-76%), and the absence of one or both parents in almost a half of households. Food insecurity is prevalent with only 22-35% of mothers/caregivers having enough food every day for everyone throughout the year. Most children do not have a diverse diet, which may mean that they lack essential nutrients. Knowledge of the symptoms of TB and how to prevent transmission was good, but 33-40% of caregivers did not know what should be done with children in a household where someone had TB.

The District Information Officer (DIO) compiles quarterly and annual reports of TB statistics, with the emphasis on adult pulmonary TB, in particular smear positive TB. For the entire uThukela district municipality, cases of childhood TB diagnosed at all the health facilities made up between 7.5% and 15.5% of all TB cases seen per quarter in 2004/2005/2006 (Clarke J. District case finding summary 2007; personal communication; 16 January 2007). No statistics regarding category (new or re-treatment disease) or site (pulmonary or extra-pulmonary or both) of childhood TB or completion rates for children are available, as this information is not routinely collected.

When childhood TB is documented, it is usually reported upon as a single disease entity, despite representing a spectrum of pathology and prognosis which requires more accurate disease classification (Marais et al, 2006, pp732). The suggestion by Marais to include an accurately classified spectrum of childhood TB in the monitoring and evaluation tools of the NTP has yet to be implemented. The current WHO requirements (WHO 2006) for registration/ notification of childhood TB cases are:

- age: 0-4years and 5-14years,
- sputum smear positive, negative or not done
- pulmonary or extra-pulmonary TB
- HIV status
- new or previously treated TB

The South African Health Review 2007 (SAHR, 2007, pp252) reports that HIV prevalence in KZN is 16.5% and nationally 10.8%, according to the HIV

Household Survey of 2005. The antenatal survey of HIV prevalence in KZN is reported to be 39.1% and nationally 29.1% (SAHR, 2007, pp251). The incidence of all types of TB in 2006 is reported to be 1075.8 per 100 000 in KZN and 722.4 per 100 000 nationally (SAHR, 2007, pp238). Statistics particular to children are difficult to access and are usually based on extrapolates from adult TB and HIV.

Not enough is known about the epidemiology of childhood TB in the Okhahlamba local municipal area surrounding Emmaus hospital however, to guide optimal management. Furthermore, it is not clear how well the SANTCP guidelines for diagnosis of childhood TB are being implemented, or whether these guidelines are still appropriate within the context of high HIV prevalence. Given the likely magnitude of the problem of childhood TB in the Okhahlamba area, and the difficulties of diagnosis, research into the epidemiology and diagnosis of childhood TB in this context is necessary.

As children with TB represent the future burden of the disease, interventions appropriately directed could significantly reduce the overall global burden of TB in future (Nelson and Wells, 2004, pp636). It is imperative therefore that the diagnosis of childhood TB be made as rapidly and as accurately as possible, so as to institute timeous treatment and reduce associated morbidity and mortality.

Chapter 2: Literature Review

The following databases were searched for English language publications related to childhood TB and/or HIV, diagnosis of TB in childhood and the epidemiology of childhood TB: MEDLINE, AidsSearch, EMBASE, WHO. The databases were searched between May 2006 and June 2007. The search terms used included: childhood TB, paediatric HIV, diagnosis. These terms were used individually or in combination.

Electronic journals were accessed via the University of Cape Town off-campus access to UCT libraries (<http://www.ezproxy.uct.ac.za>). In addition, hand searches of journals, manuals, chapters from textbooks on TB and infectious diseases were performed. Reference lists from identified literature sources and cross-referencing was also performed and yielded several articles outside of the above sources.

2.1 Epidemiology of Childhood TB

The WHO estimates that childhood TB cases usually represent 10-20% of all TB cases (Iriso et al 2005, pp716). Accurate figures for the global childhood TB burden are not readily available however, due to the difficulty of accurately diagnosing childhood TB, inadequate health information systems in many developing countries, and the lack of importance accorded to childhood TB by TB control authorities (Donald, 2002, pp178). Donald further states that several sources arbitrarily attribute 10% of the TB burden to children, and that

available data suggest an exponential rise in the proportion of the childhood TB caseload as the incidence of TB rises.

In low-income countries the proportion of cases occurring in children is approximately 15%, compared with 6% in the United States and even lower percentages in some European countries (Nelson and Wells, 2004, pp636). In certain high incidence communities, children may constitute 40% of the caseload (Donald, 2002, pp178). The high incidence of childhood pulmonary TB in less developed countries may be attributed to higher notification rates, a younger overall population and poor socio-economic circumstances favouring higher transmission rates of *Mycobacterium tuberculosis* (MTB) (Eamranond and Jaramillo, 2001, pp595).

The TB incidence in children is a reflection of the incidence among their adult caregivers, as well as the failure to control adult TB. Failure to control adult TB is associated with a failure to control childhood TB, as the incidence of childhood TB is related to the reservoir of smear- positive adults within a population. The most effective way of controlling TB in adults is through rapid diagnosis by direct microscopy for acid-fast bacilli (AFB) or culture of MTB and initiation of correct treatment (Blumberg, Ogunbanjo and Durrheim, 2003, pp38). An effective control program for children should therefore aim at reducing the number of infective adult reservoirs.

TB control programs are primarily directed at identifying and managing sputum positive TB, as this is perceived to be a greater public health priority. In developing countries, the high incidence of disease following infection in young children, the shape of the population pyramid, and the high annual risk of infection mean that relatively large numbers of children become infected by MTB, develop TB disease and contribute to the burden that TB places on the struggling health systems of these countries (Donald, 2000, pp: 187). There may also be an underestimation of children being the source of infection (Donald, 2002, p.180). This points to a high probability that childhood TB is a significant contributor to the overall burden of disease and this has important implications for health systems. In the recent "Saving Children 2005: A survey of child healthcare in South Africa", TB (pulmonary and extra-pulmonary) accounted for 8.2% of the diagnoses of children who died, the 5th most common cause of death (Patrick and Stephen, 2007, pp: 9). In the mortality audit tool that is used to produce the "Saving Children Report", the cause of death is recorded as –"main cause of death" and "other cause/s of death" - TB as the main cause of death increased from 2.7% to 4.9% between 2004 and 2005.

Poor countries carry the bulk of the TB burden and TB is sustained in conditions of poverty and deprivation, where both exposures to MTB and progression from infection to disease are increased (Marais, 2006, pp1). The presence of a state of immune compromise, as occurs with HIV, contributes to the burgeoning TB epidemic. In children, malnutrition, chronic worm infestations and measles also contribute to a depressed immune response.

These conditions are prevalent in many poor countries and may therefore increase susceptibility to TB.

The management of TB is more complex than diagnosis and treatment. Several host and contextual issues need to be considered. The management of childhood TB includes improving socio-economic conditions, and adopting a children's rights perspective. "We have a moral obligation to diagnose and treat not only patients suffering from diseases that are cost-effective to treat, but also those diseases, such as TB, that place the most vulnerable individuals at greater risk of dying" (Eamranond and Jaramillo, 2001, pp600).

2.2 The natural history of TB in children

Understanding the natural history of TB in children has important clinical implications and affects the interpretation of investigations. This natural history of TB in children, according to Khan and Starke (1995, pp 115) exists along a "continuum" of 3 stages:

- i. **Exposure** refers to a child that has had recent and substantial contact with an adult/ adolescent with suspected or confirmed smear positive pulmonary TB (source case). The child's tuberculin skin test (TST) is non-reactive, the chest radiograph is normal and the child is asymptomatic. Some exposed children are infected with MTB, but the clinician cannot know immediately which exposed children are infected, as the development of delayed type hypersensitivity to tuberculin protein, as evidenced by TST, may take up to 3

months. In some exposed children, severe disease (meningeal and dissemination) can develop in less than 3 months and before the TST becomes reactive. In the exposure stage, provided active disease has been excluded, children should receive prophylaxis.

- ii. **Infection** is represented by a reactive TST. There are no clinical signs and symptoms, and the chest radiograph is either normal or may show fibrotic changes and/or calcifications in the lung parenchyma or regional lymph nodes. This stage is rarely discovered and almost never treated in developing countries.
- iii. **Disease** occurs when symptoms and signs and/or radiographic changes appear. These manifestations are probably related to host inflammatory reactions rather than to the number of organisms. In 40-50% of infants with untreated TB infection, disease develops in 1-2 years. The risk decreases among older children to 15%.

Primary and post-primary spread occurs in the vast majority of children. A small percentage of children have adult-type disease of reactivation TB (Coovadia and Wittenberg, pp 328). Because childhood TB is pauci-bacillary (low bacillary load in the sputum/ gastric aspirates), conventional microscopy is usually insensitive and sputum collection rarely successful in identifying AFB's (Blumberg, Ogunbanjo and Durrheim, 2003, pp43). It therefore becomes more difficult to diagnose active TB in children.

Another important diagnostic challenge is to identify those children that are likely to progress from primary infection to disease, a risk that is determined by the age and immune status of the child (Marais, 2006, pp2). Infection is common in high burden settings, and TB affects children of both sexes equally, as it does in adults. An increased risk of morbidity and mortality exists in the very young age group and in the elderly (Morcillo, 2007, pp525). This increased morbidity and mortality is likely to be related to immune immaturity (in the young) and an immuno-compromised state in the elderly. Children under 5 years infected with TB are at higher risk of developing TB disease as a consequence of immune immaturity. These children are also at higher risk for developing disseminated forms of TB e.g. miliary and tuberculous meningitis (TBM), which are frequently associated with higher morbidity and mortality (Nelson and Wells, 2004, pp637). In areas where Bacille Calmette-Guerin (BCG) coverage is higher there is lower incidence of severe forms of TB (WHO, 2006, pp23). Marais et al (2006, pp732) describe age-related differences and high-risk groups (under 3years of age and immune-compromised children) in the natural history of TB disease. These observations were described in pre-chemotherapy literature. Disease in children under 4years also "indicates recent and ongoing transmission" (Gie, 2006, pp1067) within a community. Infected and ill children are an "indirect and useful parameter" for assessing the impact of NTP activities (Morcillo, 2007, pp525).

2.3 Approaches to diagnosis of TB in children

Difficulties in making the diagnosis of TB in children have led to the development of different diagnostic approaches (Hesseling et al, 2002, pp1038-1045). These include:

- **Point score systems:** A numerical value is assigned to each characteristic in the score system e.g. South African National TB Control Program guidelines score (SANTCP 2004 pp48), Keith Edwards Score (Van Beekhuizen, 1998, pp156)
- **Diagnostic classifications:** characteristics are stratified into categories e.g. WHO classification of suspected, probable and confirmed TB (Houwert et al, 1998, pp1117), Modified WHO Criteria (SANTCP, 2004, pp49)
- **Diagnostic algorithms:** a stepwise approach, often in a diagrammatic form
- **Combinations of the abovementioned forms**

2.4 The diagnosis of childhood TB in practice:

According to Hussey (personal communication 20 May 2006), in practice the diagnosis of childhood TB is usually based on:

- **History:** of close contact with a smear positive adult or adolescent
- **Clinical criteria:** high index of suspicion, particular clinical presentation e.g. failure to thrive, chronic cough, lymphadenopathy, unexplained and/- or prolonged fever

- **Investigations:** TST, radiographic findings, lumbar puncture findings, ultrasound, gastric washings, induced sputum, fine needle aspiration (where clinically indicated).
- **Score systems:** These use a combination of history, clinical criteria and investigations. Several score systems are available. TB score systems, attempt to carefully and systematically collect information, assign different values to the information collected, and subsequently decide on the basis of the total score the likelihood of the child having TB. According to Hesselning et al (2002, pp1039), score systems have been used for diagnostic purposes in children, although they have rarely been evaluated or validated against a gold standard. Presently the WHO recommends that score charts be used as screening tools rather than diagnostic tools.

The SANTCP recommends the use of a score system and the Modified WHO Criteria for the assessment of childhood TB. The score system is recommended for both screening and diagnostic purposes, depending on the availability of other investigations, such as radiographs and the TST. In areas where the TST and radiography facilities are available, the score system should be used as a screening tool to identify children that might have TB and need referring for further investigation. In settings with limited availability of TST and chest radiographs however, the score system can be used as a diagnostic tool, although it may result in mis-diagnosis of TB in children. The guidelines emphasize that the score appears to have a high sensitivity and low specificity in the context of paediatric HIV, resulting in the over-diagnosis

of TB amongst HIV infected children (SANTCP, 2004, pp48). The Modified WHO Criteria, listed in the SANTCP guidelines, consists of a “Possible TB” and “Probable TB” assessment (SANTCP, 2004, pp 49). Chest radiography, the presence of a smear positive contact, symptoms of chronic disease, positive TST, and positive culture are used as distinguishing features.

The clinical presentation varies enormously, and children can present with a multiplicity of clinical signs and symptoms, as TB can affect virtually any organ system in the body. Clinicians need to be constantly vigilant and the diagnosis of TB should be considered in the differential diagnosis of any obscure or ill-defined clinical problem (Coovadia and Wittenberg, pp 326). “Extra pulmonary TB is less likely than pulmonary TB (PTB) to be confused with other diagnoses” (Graham, Coulter, Gilks, 2001, pp18). Liebeschuetz, Bamber and Ewer (2004, pp2197) state, “childhood TB often presents non-specifically and is a common differential diagnosis in high prevalence areas. Current diagnostic tools have poor sensitivity and cannot reliably exclude TB”.

HIV co-infection exacerbates the problem of diagnosis and accounts for an increasing proportion of paediatric TB worldwide. In the context of HIV, the clinical criteria used can be related to the disease process of HIV or TB or both problems concurrently. It is important, therefore that HIV testing be part of the management of the child with suspected TB and vice versa.

Despite the recommended guidelines, the diagnosis of childhood TB remains challenging. According to Schaaf et al (1995, pp 189) "in child health clinics and smaller district hospitals, the diagnosis (of childhood TB) is seldom confirmed by culture of MTB from any source, whereas even in secondary or tertiary care institutions the diagnosis is confirmed in no more than 30-40% of cases". Investigative techniques assist in diagnosis, but as no gold standard exists for the diagnosis of childhood TB, it is essential to consider risk stratification for guiding the diagnostic emphasis and therapeutic decisions (Marais, 2006, pp2).

2.5 Diagnostic Difficulties:

Despite investigative techniques being available, using these techniques in children is often difficult for a number of reasons:

- Up to 50% of children may be asymptomatic during the initial stages of disease (Eamranond and Jaramillo, 2001, pp596)
- Children are more likely to swallow sputum rather than expectorate voluntarily therefore obtaining sputum samples is difficult.
- Despite AFB stain of sputum yielding 75% specimens positive in adults with pulmonary TB, fewer than 20% of children with TB have a positive AFB smear of sputum or gastric aspirate (Khan and Starke, pp 119).
- Gastric aspirates may be difficult to perform at primary health care level and the necessity of an early morning fasting specimen further complicates specimen collection.

- While a non-reactive TST might imply a true absence of infection or ongoing immuno-suppression, it has also been reported in apparently healthy children exposed to open TB cases and in children who have been successfully treated (Osborne, 1995, pp370). Rosen (1982,pp26) concludes that there are problems with skin tests: it is unclear which skin test is most suitable for routine use; the high frequency of false negative results where TB is rife may result in failure to make the correct assessment; and BCG scars fade with time and make the interpretation of the TST more difficult. In an analysis of international data pertaining to TST response in BCG vaccinated populations, by Joos, Miller and Murdoch (2006, pp888), it was concluded that the TST performs poorly in BCG vaccinated children less than 2 years. In the same study results for 2- 14 year olds was highly variable. Present standard treatment guidelines (STG) (2006, pp267) recommend the interpretation of the TST together with the BCG history regardless of age.
- Weight loss associated with TB needs to be considered in the context of causes of poor weight gain. A difficult clinical decision in a malnourished child is excluding (pulmonary) TB as the primary disease and cause of weight deficit (Brewster, 2006, pp586). In developing countries, worm infestation and food insecurity need to be excluded (Marais et al, 2005, pp1165), as well as the presence of HIV infection. The Road to Health Card (RTHC) provides a “simple, cheap, practical and convenient way” (Tarwa and De Villers, 2007, pp15) of monitoring

weight and child health, but is generally not being used appropriately and to its full potential (Tarwa and De Villers, 2007,pp15).

- At many health facilities certain investigations such as chest radiography, ultrasound, fine needle aspiration cytology, biopsies, induced sputum etc may not be available. There may be difficulty in processing specimens and receiving results and in the interpretation of results. These issues, which are also part of a larger health system development issue, impact on quality of care.
- Chest radiography is perhaps the means by which the diagnosis of TB in childhood is most frequently supported. However, there is a lack of reliability in the interpretation of radiographs (Gie, 2003, pp1). Further, adenopathy may be subtle and present as a “prominence” that may be difficult to detect (Eamranond and Jaramillo, 2001, pp596). Findings from a study by Du Toit, Swingler and Iloni (2002, pp817) recommend that caution is necessary when basing clinical decisions on the presence or absence of lymphadenopathy, as these findings have direct implications for the diagnosis of childhood TB. It is important to note that the “presence of hilar adenopathy (or any other element of the primary complex) in isolation does not differentiate recent primary infection from disease” (Marais, 2006,pp3).
- Newer diagnostic methods (e.g. Polymerase chain reaction (PCR), high resolution computed tomography (CT), and serological tests) and newer recovery methods (e.g. Nebulised hypertonic saline-induced sputum, and broncho-alveolar lavage (Eamranond and Jaramillo, 2001, pp597)) are not currently available at district/ primary health care level.

Each of these methods has their own limitations, and therefore need further evaluation.

- Historical evidence of exposure to an adult with smear positive TB may be lacking as children have been left orphaned by the HIV pandemic. They are cared for by the extended family, taken into homes or shelters, or left to fend for themselves. A reliable caregiver with a clear history may not always be available. Furthermore, in an endemic area the exposure to TB may occur in public spaces such as churches or taxis and therefore cannot be recorded.
- High BCG coverage rates in developing countries have in part contributed to complacency about the occurrence of childhood TB among the public and health care workers (Osborne, 1995, pp373).

2.6 Diagnostic difficulties in HIV-infected children:

“TB and HIV are now considered a lethal weapon of willing partners, each aiding the other in multiplying and progressing clinically. The high mortality rate among HIV-infected infants and children with TB appears to be due to the progressive HIV infection rather than to TB, and therefore the degree of immuno-suppression is the most important predictor of survival in dually infected children” (Chintu and Mwaba, 2005, pp478). It is prudent that children suspected of having TB and /or HIV be investigated appropriately.

According to Swaminathan (2004, pp225-230), HIV-infected children are at increased risk of delayed diagnosis of TB and diagnostic errors. This occurs because of overlapping clinical and radiographic features associated with TB

and other HIV-associated lung diseases. Swaminathan concludes that TB manifestations are also more severe in HIV-infected children and progression to death is more rapid, than in HIV-uninfected children, but that the clinical and radiological manifestations do not differ significantly. However, there may be an increased tendency for extra-pulmonary disease and dissemination (Swaminathan, 2004, pp225-230). HIV infection adversely affects the outcome of TB in children with regard to response to treatment and survival (Jeena et al, 1996, pp437-443). It is therefore imperative that the diagnosis of TB is made as rapidly and as accurately as possible, so that treatment can be initiated early on to prevent significant morbidity and mortality.

HIV testing should be integral to the management of the child with TB, and TB investigations should be considered in the child infected with HIV. Therefore all children with TB who live in HIV-prevalent areas should have appropriate counseling and testing performed (WHO, 2006, pp8). Clinical staging of children is important, as the presence of Stage 3 or 4 disease determines immediate clinical eligibility for anti-retroviral therapy, which may lead to a better outcome.

Co-infection with TB and HIV poses several clinical challenges:

- Several HIV related pulmonary conditions present in a clinically similar way to pulmonary TB e.g. lymphocytic interstitial pneumonitis (LIP), bacterial pneumonias, bronchiectasis, pneumocystis jiroveci (carinii) pneumonia (PCP).
- The chest radiograph may show atypical features of TB and may be difficult to interpret.

- Chronic weight loss and malnutrition associated with the disease process of HIV or HIV-related chronic diarrhoea makes HIV-associated weight loss and malnutrition difficult to distinguish from that due to TB.
- Anergy or decreased cell-mediated immunity associated with HIV produces less reliable responses to tuberculin skin testing.
- The duration of illness for both HIV and TB tends to be for longer than 4 weeks. Using the chronicity of illness as a distinguishing feature may not be reliable.
- Fever (unexplained or prolonged) as a clinical symptom is often used in the assessments of TB patients. In immuno-compromised patients, as seen with HIV, fever may not always be present. However, a high diagnostic suspicion for mycobacterial disease should be maintained in TB prevalent areas when the clinical presentation in an HIV infected patient, is with fever (Hot et al, 2007, pp 1013).
- Lymphadenopathy as a clinical symptom may be present with TB or HIV, TB and HIV, or with other infections or malignancies.

It is becoming increasingly important to integrate the management of TB and HIV services (Anderson and Maher, 2001, pp9, Coetzee et al, 2004, ppA15), as both programs will benefit each other and the clients that they serve. However, despite the increasing benefits that are suggested in integrating both services, possible problems in the integration of these services also exist. These include the historical differences in how HIV/AIDS and TB are

dealt with i.e. that TB control programmes emphasize the public health approach with less attention to patient-centred issues, whilst HIV/AIDS programmes focus on an approach to individuals (Corbett et al, 2006, pp930). In addition both services run as vertical programmes with separate funding, administration and monitoring/ evaluation systems. The integration of these aspects is challenging.

2.7 Conclusion:

It is of ongoing concern that the burden of childhood TB is not accurately known, as reliable figures are not readily available. This is related to the difficulty of accurately diagnosing childhood TB, inadequate health information systems in developing countries, and the lack of importance accorded to childhood TB, by TB control authorities (Donald, 2002, pp178).

The present SANTCP guidelines recommend a score system and the Modified WHO Criteria for assessment purposes (screening and diagnosis) of childhood TB. It is important to note that despite the cost-effectiveness and ease of administration of these clinical score systems (Mehnaz and Arif, 2005, pp543), they are not as useful for diagnosis of childhood TB in the presence of malnutrition and HIV infection (Graham et al, 2004, pp651).

Radiography is included in the score system recommended by the SANTCP. Chest radiography is perhaps the means by which the diagnosis of TB in childhood is most frequently supported; however there may be significant variability between observers of the same radiograph (Gie, 2003, pp1). Newer

diagnostic tests and recovery methods are available and have been described in the literature (Eamranond and Jaramillo, 2001, pp597), but their use in the diagnosis of childhood TB has not been evaluated. These tests are currently not available at district hospital level in South Africa.

Investigative techniques assist in diagnosis, but in the absence of a gold standard, it is essential to consider the risk stratification for directing the clinical diagnostic emphasis and guiding decisions regarding treatment (Marais, 2006, pp2).

“Considerable diagnostic confusion has been caused by the very similar clinical and radiological features of the two diseases, HIV and TB. Without more reliable diagnostic methods, it seems likely that many children with HIV infection and acquired immune deficiency syndrome (AIDS) who do not have TB will be placed on anti-TB therapy” (Donald, 2000, pp189). As there is the risk of over-diagnosis and unnecessary treatment, there is also the risk that “TB may be missed and therefore the opportunity to treat an HIV-infected child for a curable disease will also be missed” (WHO, 2006, pp1331). Thus, the result is under-diagnosis by some clinicians and over-diagnosis by others.

It is prudent therefore that HIV testing be an integral part of the management of the child suspected of having TB and that TB investigations are done in the child infected with HIV. Clinical staging of children is important to determine immediate clinical eligibility for anti-retroviral therapy.

The remaining challenge is to develop an affordable test that can accurately differentiate children with TB disease from those children who are latently infected (Marais, 2006, pp6).

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Chapter 3: Methodology

3.1 Purpose and objectives

The purpose of this study is to describe the epidemiology of childhood TB and the diagnostic methods used within the Emmaus Hospital district, in order to make recommendations to improve current practice.

The objectives of the study were therefore:

- a. To describe the characteristics of TB among children initiated on treatment
- b. To describe the methods used to diagnose childhood TB
- c. To evaluate how well the SANTCP guidelines for diagnosis of childhood TB are being implemented

3.2 Study Design and Population

The design of the study was a retrospective audit of clinical records of children diagnosed with TB.

The study population was all children under 15 years who were initiated on TB treatment at Emmaus Hospital and primary health care (PHC) clinics between 1 January 2004 and 31 December 2006, and who were entered into the TB register at these health facilities.

3.3 Data collection

Children with suspected TB can be managed as outpatients or inpatients at Emmaus Hospital. This is usually a clinical decision, depending on the severity of illness at presentation. Appendix 6 details a patient pathway at Emmaus Hospital for a child with suspected TB. Children with suspected TB may be diagnosed at the PHC clinic or referred to hospital for further investigation.

As children were managed both as in-and outpatients, three different sources were used to gather and crosscheck information. These were the TB register (at each of the health facilities- hospital and PHC clinics), in-patient records, and the GW20/12 form, which is completed on initiation of treatment (Appendix 7). The GW20/12 form includes patient data on demographics, site of TB, sputum results, Chest radiograph findings, date of initiation, regimen of treatment, weight assessment, clinical notes, and treatment administration.

The TB register was used to extract data on:

- Total number of patients on TB treatment
- Total number of children on treatment
- Category of patient (new/ re-treatment-after previous cure, completion, failure, interruption)
- Site of disease (pulmonary/ extra pulmonary)
- Number of children with miliary TB and TBM
- Regimen for treatment

In-patient records were used to extract data on:

- Nutritional status (weight for age)
- Investigations performed
- Method of diagnosis
- Contact identification
- HIV status

Data were extracted onto standardized data capture sheets (see Appendix 2).

The data capture sheet was first pilot-tested on a sample of five children's records, and no significant problems were experienced.

The researcher visited each of the outlying PHC clinics (Bergville, Dukuza, Oliviershoek, Mazizini and Busingatha Clinics), and the offices of the 3 Mobile clinics. The mobile clinics serve approximately 30 clinic points in the municipal area. The TB ward, the Gate Clinic (hospital PHC clinic), and the Records Department at Emmaus Hospital were also visited. These visits were used as an opportunity to gather data and to look at aspects of the TB information system and clinical management of patients. TB registers were available in the TB ward at Emmaus Hospital, hospital PHC clinic, the peripheral clinics and mobile clinics. Each mobile clinic team has 1 TB register for the specific mobile points they serve. Each of these health facilities submits quarterly statistics to the District Office in Ladysmith.

Pulmonary TB is defined as a chronic granulomatous infection of the lungs caused by MTB; should infection occur in a site outside of the lung this is referred to as extra-pulmonary TB (STG, 2006, pp266).

The Tine test was the TST used and was interpreted 48 to 72 hours later. The test was regarded as positive if confluent induration of papules was present in a child who had previously received BCG vaccination. If no BCG had been administered then a ring of induration was deemed to be a positive test result and no specific interpretation was recommended for an HIV infected or severely malnourished child (Standard treatment guidelines [STG], 2006, pp267).

Chest radiographs were performed at Emmaus Hospital. No radiologist is available on site to comment on chest radiographs. The attending medical practitioner performs this task. Experience varies between medical practitioners and there is no standardised method for the interpretation of chest radiographs.

3.4 Data entry and analysis

The data capture sheet was completed in as much detail as was possible with the available data. The data gathered from the capture sheets were entered into a computerised database and spreadsheet for analysis and computation of frequencies and means.

EpiCalc software was used to test the statistical significance of associations by means of the chi-squared test. A p-value of <0.05 was considered to be significant. 95% confidence intervals were used for incidence calculations.

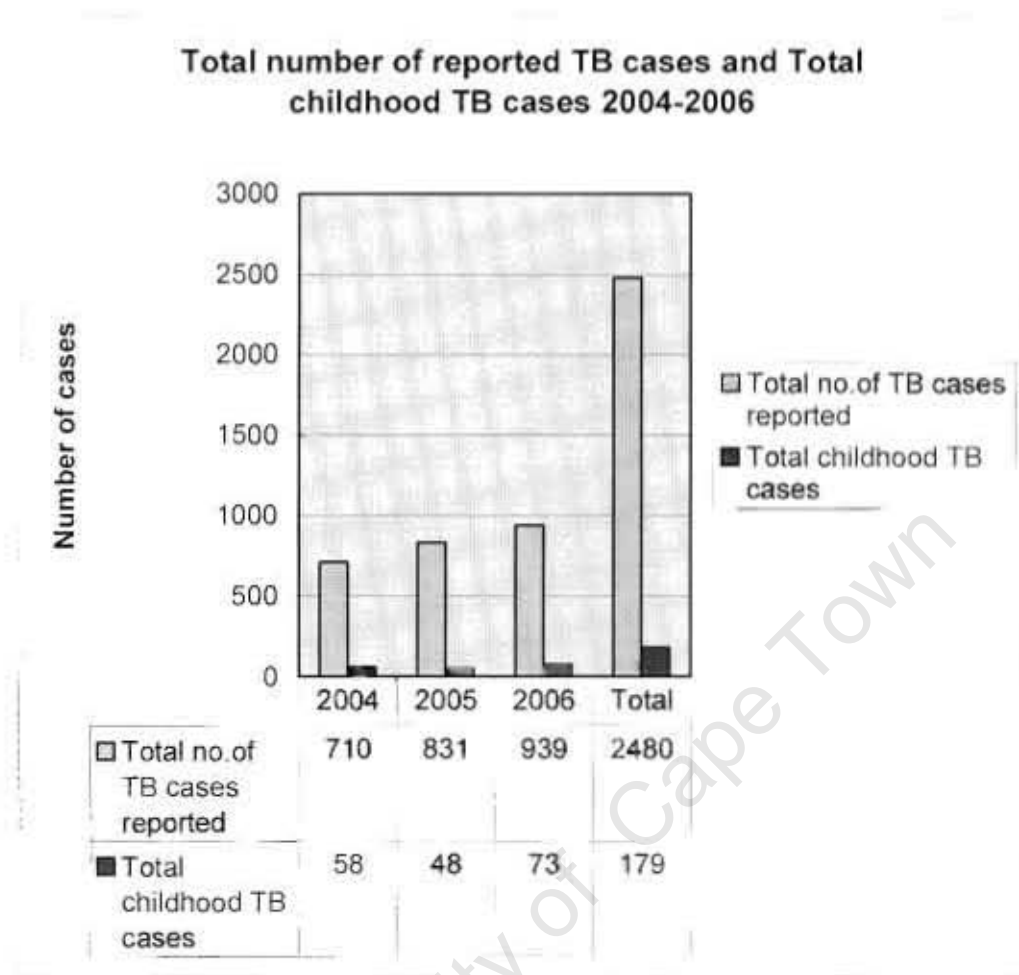
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Chapter 4: Results

4.1 Total TB cases and Total Childhood TB cases for 2004-2006

A total of 2480 cases of TB were reported from Emmaus Hospital and health facilities within the district during the study period January 2004- December 2006. Of these, 179 (7.2%) were children less than 15 years, a proportion that did not vary significantly by year (Figure 1). The incidence of TB for Okhahlamba/ Emmaus Hospital during the study period was estimated at 573/100 000 population/year [95% CI: 540; 610]. This was based on a numerator of an average 827 cases per year, and a denominator population in mid-2005, the midpoint of the study period, of 144289 for Okhahlamba, calculated by applying official annual population growth rates to the 2001 census population (StatsSA, 2001). The national incidence in South Africa is 600/100 000 population/ year, according to the 2007 WHO Global TB Report (WHO, 2007, pp: 137).

Figure 1: Total TB cases and total childhood TB cases



Records used to gather data included the TB register, GW20/12 and in-patient records. The majority of children diagnosed with TB were managed as outpatients. The GW20/12 was therefore used as the predominant data source. For children managed as in-patients, the in-patient record and GW20/12 were used to gather data. The TB register was used as an additional source of information for both in-and outpatients.

For the study period, 30 (16.8%) GW20/12 records were either not available at the health facilities, or the data recorded were insufficient to include the

patient in the study e.g. weight, and/or age and/ or investigations documented were incomplete. Where age only was omitted, the TB registers in addition to the GW20/12's and inpatient records (where applicable) were cross-referenced carefully to determine that the patient was a child. All in-patient records were retrieved. A total of 149 of children's records were therefore included in the study, or 83.2% of all childhood cases reported. (Table1).

Table 1: Records used for data collection

Year	GW20/12 available	In- Patient records available	Total records available	Total number of childhood TB cases	% records available
2004	39	9	48	58	82.8%
2005	35	1	36	48	75%
2006	60	5	65	73	89%
Total	134	15	149	179	83.2%

4.2 Demographic characteristics and health status of children with TB

As shown in Table 2, there were 73 (49%) male children diagnosed with TB, and 76 (51%) female. Eighty-seven (58.4%) children were less than 5 years of age, and 62 (41.6%) were between 5-14 years (Fig. 2). Based on mid-2005 population estimates, the age specific incidence rates were 159/100 000/year

[95% CI: 110, 230] for children less than 5 years old and 50.2/100 000 [95% CI: 30, 80] for children 5-14 years old, a statistically significant difference of 0.11% ($p < 0.0001$). These calculations were based on a numerator of 29 TB cases on average per year among children less than 5 years and a denominator of 18224 (mid-2005 population of children less than 5 years), and for children 5-14 years old, a numerator of 20.6 TB cases on average per year and a denominator of 41182. The denominator populations were calculated by applying growth rates from the census in 2001 (StatsSA).

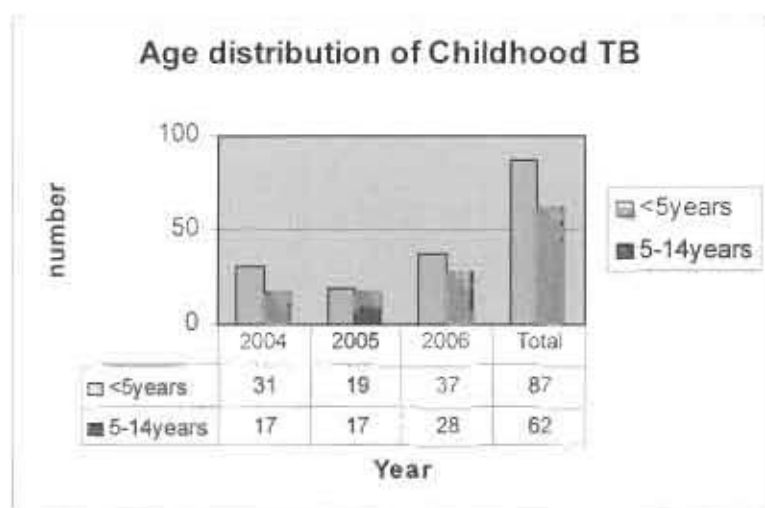
Forty-seven of the 115 children with documented weights (40.9%) were recorded as having weights $< 3^{\text{rd}}$ centile. The weight was not documented in 34 (22.8%) of the 149 children. Weight unknown increased from 6.2% in 2004 to 35.4% in 2006, which proves to be statistically significant ($p = 0.0012$).

The majority of children, 115 (77.2%) of 149 children, have unknown HIV status. Twenty-eight (18.8%) were reported to be infected, and 6 (4%) tested negative. The number of infected children reported in 2006 was almost double that in 2005. Clinical staging of HIV is poorly documented, with only two children reported to be clinically staged. Both these children were documented to be HIV infected.

Table 2: Demographic characteristics and health status of children with TB

	2004	2005	2006	Total
Number of children included in the study:	48	36	65	149
Sex: Male/Female:				
▪ Male	25(52.1%)	14(38.9%)	34(52.3%)	73(49%)
▪ Female	23(47.9%)	22(61.1%)	31(47.7%)	76(51%)
Age distribution:				
▪ < 5years	31(64.6%)	19(52.8%)	37(56.9%)	87(58.4%)
▪ 5-14years	17(35.4%)	17(47.2%)	28(43.1%)	62(41.6%)
Nutritional Status:				
▪ Weight <3 rd centile	19(39.6%)	14(38.9%)	14(21.5%)	47(31.5%)
▪ Weight ≥ 3 rd centile	26(54.2%)	14(38.9%)	28(43.1%)	68(45.6%)
▪ Weight unknown	3(6.2%)	8(22.2%)	23(35.4%)	34(22.8%)
HIV status and HIV clinical stage:				
▪ Unknown	40(83.3%)	28(77.8%)	47(72.3%)	115(77.2%)
▪ HIV +/- Infected	5(10.4%)	8(22.2%)	15(23.1%)	28(18.8%)
▪ HIV- /Uninfected	3(6.25%)	-	3(4.6%)	6(4.0%)
▪ Clinical stage	-	-	2 (13%)	2(7.1%)

Figure 2: Age distribution of childhood TB



4.3 New and Re-treatment Disease

New childhood TB refers to those diagnosed with TB for the first time, and re-treatment to those previously diagnosed who may or may not have completed a treatment course. According to the SANTCP guidelines, there is no re-treatment regimen for children under 12 years however, children 12 years and older are managed with adult re-treatment regimens.

The majority of childhood TB is classified as new disease in this study (96.4%). Of the 5 children with re-treatment disease, one was diagnosed with TB after a documented cure i.e. sputum negative after treatment, 3 completed a course of TB treatment (sputum results not documented or unknown), and one interrupted TB treatment and was therefore recommenced (Table 3).

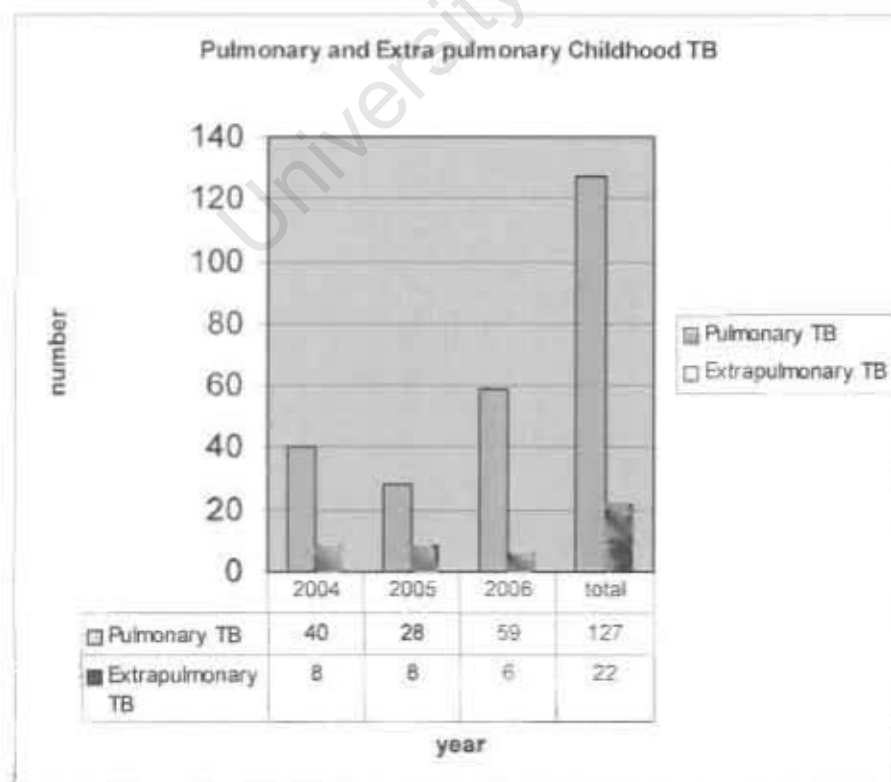
Table 3: New and Retreatment Disease

Category	2004	2005	2006	Total
Total no. of cases included in study	48	36	65	149
• New	46(95.8%)	33(91.7%)	65(100%)	144(96.46%)
• Re-treatment:	2(4.2%)	3(8.3%)	-	5(3.4%)

4.4 Site of Disease

Both pulmonary and extra pulmonary disease was diagnosed, with PTB being by far the most common manifestation (Fig. 3).

Figure 3: Pulmonary and extra pulmonary TB



There was no significant association between age group and either diagnosis. The incidence of PTB was 87.4% (76/87) among children under 5 years compared to 82.3% (51/62) in the age group 5-14 years ($p=0.53$). The incidence of extra pulmonary TB was 12.6% in the under 5-year group and 17.7% in the age group 5-14 years ($p=0.53$).

TBM and pleural involvement are the common presentations of extra pulmonary TB (Table 4). No TBM was reported in 2005.

Table 4: Site of disease

Pulmonary / Extra-pulmonary	2004	2005	2006	Total
Pulmonary	40(83.3%)	28(77.8%)	59(90.8%)	127(85.2%)
Extra-pulmonary	22(14.8%)			22(14.8%)
▪ TBM	6(12.5%)	-	4(6.2%)	10(6.7%%)
▪ TB miliary	-	1(2.8%)	-	1(0.7%)
▪ TB pleura	-	5(13.9%)	2(3.1%)	7(4.7%)
▪ TB mastoid TB	-	1(2.8%)	-	1(0.7%)
lymph nodes	2(4.2%)	-	-	2(1.3%)
▪ TB bone	-	1(2.8%)	-	1(0.7%)

Despite pulmonary and extra-pulmonary TB being diagnosed, no children were documented to have co-existing pulmonary and extra-pulmonary TB.

The outcome of severely ill children transferred to tertiary and/ or quaternary facilities is unknown. Table 7 details the methods used for the diagnosis of PTB. According to the data 56.7%(72/127) children had a chest radiograph performed in order to assist in the diagnosis of PTB. Extra-pulmonary TB was

not documented in these children .The children diagnosed with extra-pulmonary TB, other than for those with pleural effusions appear not to have had chest radiographs performed. PTB was not documented in patients with extra-pulmonary TB. This occurrence may contribute to bias in the results.

4.5 The use of the SANTCP Guidelines

The SANTCP recommends a TB score and Modified WHO Criteria for the assessment of children with suspected TB

Table 5: TB assessments for diagnostic purposes as per SANTCP guidelines

TB assessment	2004	2005	2006	Total
TB Score: 25 (100%)	8(32%)	3(12%)	14(56%)	25(100%)
Modified WHO Criteria: 0 (0%)	-	-	-	-

Only 25 (16.8%) children were formally assessed as recommended by the SANTCP, using either the TB score or the Modified WHO Criteria. The TB score was the preferred method of assessment, as this was the only assessment documented by health workers. No children were assessed using the Modified WHO Criteria. Of the 25 (16.8%) children assessed using the TB score, 23 were diagnosed with PTB and 2 with extra pulmonary TB (1 TB pleura, and 1 TBM).

4.6 Diagnostic investigations and other diagnostic criteria

Table 6 details some of the investigations that can be performed at Emmaus Hospital. More specialized investigations such as CT scans are done at the referral hospital. The laboratory at Emmaus is able to process all specimens except those for TB culture and biopsies, which are sent away to Durban/ Pietermaritzburg. Culture reports take between 3-6 weeks, and histology of biopsy results takes approximately 2 weeks.

Table 6: Diagnostic investigations and diagnostic criteria

Investigation	2004	2005	2006	Total
Sputum Microscopy	4(8.3%)	4(11.1%)	11(16.9%)	19(12.8%)
Gastric Aspirate:	0	0	0	0
Sputum/ gastric aspirate culture	0	0	0	0
Chest radiograph	20(41.7%)	23(63.9%)	34(52.3%)	77(51.7%)
TST	2(4.2%)	11(30.6%)	30(46.2%)	69(46.3%)
Abdominal ultrasound	0	0	1(1.5%)	1(0.7%)
Lumbar puncture	4(8.3%)	0	4(6.2%)	8(5.4%)
Fine needle aspiration/ Biopsy	2(4.2%)	0	0	2(1.3%)
Other investigations				
Pleural aspirate	0	0	2(3.15)	2(1.3%)
CT Scan	3(6.3%)	0	1(1.5%)	4(2.7%)
Other diagnostic criteria				
Referral from regional/tertiary hospital	1(2.1%)	2(5.6%)	1(1.5%)	4(2.7%)
Non-resolving or recurrent pneumonia:	3(6.3%)	6(16.7%)	0	9(6%)
Pyrexia of unknown origin (PUO)	0	1(2.8%)	0	1(0.7%)

The most frequent investigations used for diagnosis of TB were the chest radiograph 77 (51.7%) and TST 69 (46.3%). All tine tests were documented to be positive. More children had chest radiographs than TST. The chest radiograph was performed at Emmaus Hospital and the attending medical

practitioner interpreted the chest radiograph. Only 69 (46.3%) of the 149 children were documented to have had a tine test done.

Despite other investigative options being available, relatively few investigations are used. Pleural aspirates were performed in 2 (28.6%) of the 7 children diagnosed with TB pleural effusions. It appears that chest radiograph was used to make the diagnosis. Gastric aspirates, culture of sputum/gastric aspirates, abdominal ultrasound, and fine needle aspiration/biopsies are rarely or not used at all as diagnostic methods.

Non-resolving or recurrent pneumonia was also used as a basis to initiate pulmonary TB treatment. Neither of these terms (non-resolving/ recurrent pneumonia) has been defined, and therefore different doctors could possibly have different thresholds for diagnosing TB and initiating TB treatment.

The one child documented to have PUO was not adequately investigated. No blood, stool or urine cultures were done, and an LP, although clinically indicated from the records, was not performed. The child responded clinically to TB treatment and this was continued.

4.7 Methods used for diagnosis of childhood pulmonary TB

The majority (21 or 16.5%) of the 127 children diagnosed with pulmonary TB were diagnosed on chest radiograph and history of contact, TST and history of contact [20 (15.7%)], and chest radiograph only [18 (14.1%)]. Eight (6.3%) children were diagnosed with TB based on the TST only and on the presence

of a contact only. No other investigations were performed on these children.

The clinical presentation of these children is unclear from the data, as this was not clearly documented.

Table 7: Methods used for diagnosis of pulmonary TB

Investigation	2004 n=40	2005 n=28	2006 n=59	Total n=127
chest radiograph only	4	5	9	18(14.1%)
TST only	3	1	4	8(6.3%)
Contact only	3	3	2	8(6.3%)
chest radiograph & TST	4	1	7	12(9.4%)
TST & contact	10	4	6	20(15.7%)
chest radiograph & contact	3	9	9	21(16.5%)
chest radiograph & TST & contact	4	2	3	9(7.1%)
TB score & chest radiograph	0	1	1	2(1.6%)
TB score & TST	0	1	1	2(1.6%)
TB score & chest radiograph & TST	2	0	0	2(1.6%)
TB score & TST & contact	2	0	7	9(7.1%)
TB score/ chest radiograph/TST/contact	4	0	4	8(6.3%)
Sputum microscopy	1	0	7	8(6.3%)

4.8 Diagnostic methods for TB in the HIV infected child

There was poor documentation of HIV results; only 28 children were reported to be infected. Based on these figures it is difficult to conclusively assess the impact of HIV on TB and vice versa.

4.9 Outcome of Treatment

For the purposes of this study, children who completed treatment were those documented as such in the TB register at the facility where they were being followed up. Children not documented in the register were deemed to have defaulted, unless otherwise stipulated e.g. death having occurred.

Table 8: Outcome of treatment

Outcome	2004	2005	2006	Total
Completed	32(66.8)	21(58.3%)	29(44.6%)	82(55%)
Defaulted	9(18.8%)	12(33.3%)	17(26.2%)	38(25.5%)
Died	2(4.2%)	-	1(1.5%)	3(2%)
On Treatment	-	-	16(24.6%)	16(10.7%)
Transferred out	5(10.4%)	3(8.3%)	2(3.1%)	10(6.7%)

According to the figures, only 82 (55%) children completed treatment, 38 (25.5%) children were classified as having defaulted treatment, and 3 died. There are instances where children completed their course of TB treatment but were not registered as such. This reflects an omission on the part of the health worker. It is also unclear if other deaths were missed, and recorded as defaulted treatment or not recorded at all. Sixteen (10.7%) children were still on treatment at the time of writing, and 10(6.7%) children were transferred to facilities outside the municipal area.

4.10 Reported contact

Identification of a contact with TB is used in both the SANTCP TB score (“family history of TB”) and in the Modified WHO Criteria (“smear positive household contact”) to assist in the diagnosis of childhood TB. The reported contacts refer to household contacts.

Table 9: Reported Household Contact

Contact	2004	2005	2006	Total
Present	28(58.3%)	21(58.3%)	40(61.5%)	89(59.7%)
No contact	20(41.7%)	15(41.7%)	25(38.5%)	60(40.3%)

The majority of children diagnosed with TB are reported to have a documented household contact (59.7%), although the time of contact, duration of contact, whether the contact was sputum positive, or whether the contact was subsequently followed-up, is unknown.

4.11 Data collection and the TB information system

Several deficiencies in the TB information system were noted during the data collection process of the study.

Outpatient records (GW20/12) were generally available at all the facilities with some exceptions. Transfer of documentation (GW20/12) between the hospital and clinic was considered to be problematic however, as forms did not arrive at the clinic and a new GW20/12 was then started at the clinic.

There is no system for storing these records at any of the health facilities. At some clinics they are kept in a box, in a cupboard or in the store- room. The records are stored in no obvious order-chronologically, alphabetically or otherwise. Storage of records is therefore dependant on local initiative and is not standardised across all health facilities. Records from 2004 and 2005 accounted for a higher percentage of records being unavailable. This is likely to be related to no formal storage and retrieval system for older records at the health facilities.

All in-patient records were retrieved, although the retrieval process was time consuming and frustrating. The children managed as inpatients were first identified from the TB register, the date of initiation of treatment was used to determine when the child was admitted to the ward, and then the admission number could be identified in order to access the files from the registry. Despite a system of record storage being in place, the process of finding the actual inpatient record was frustrating. Records had not been filed, records had been borrowed and not returned, and staff were inadequate in number and ability to perform the task requested. It is important to note that the inpatient admission number is different from the outpatient number, which is different from the TB register number. An attempt is being made to enter the inpatient/outpatient number in the register as well, but this is not always consistent or legible and is dependant on particular health workers. This has implications for trying to retrieve data.

There has been a move away from the patient-retained record system at the hospital. A system of introducing facility-retained records for all patients was introduced in the latter part of 2006. At times there is still a continuation with the patient-retained record system. There are no clear guidelines as to when each is to be used. Furthermore, there have been regular intervals when there are no patient-retained and/ or facility-retained records because the printers have been unable to supply the hospital. Depending on the availability of records different records may be used on different occasions. As the hospital has opted to use the facility-retained record, a patient presenting to a clinic after having been seen at the hospital has no information as to what was done at the hospital.

Confusion between the use of the patient- retained records and facility-retained records has produced much duplication of work and a breakdown of communication between the health facilities i.e. hospital and clinics. In a study that was piloted in a neighbouring district, Kerry (2006, pp16) concluded that patient-retained records are “especially useful in improving the standard of health care, as well as the continuity of care between the district hospitals and the clinics and community health centers that the hospital supports”. Within the context of the district health system it is imperative that hospital management make attempts at streamlining the existing record system in order to improve the quality of care received by patients.

Follow-up visits are initiated by the patient presenting to the facility when he/ she needs more medication. HAST (HIV, AIDS, STI and TB) nurses have

been employed at all the facilities to manage these patients. This process has been slow to translate into action however. Two TB tracers are available to assist with following up patients in the community should a request be made from one of the clinics. However, as the system of follow-up functions very poorly, it is unclear how well the resource of the TB tracers is being used or whether this resource is sufficient to cover the entire municipal area.

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Chapter 5: Discussion

This study describes the epidemiology of childhood TB and the methods used to diagnose childhood TB at a district hospital that serves a TB and HIV endemic area.

5.1 The Epidemiology of Childhood TB at Emmaus Hospital

The Global TB Control Report - 2007 (WHO, pp137) reveals that South Africa in 2006 is classified as one of 22 high burden TB countries. According to the same report, South Africa's national TB incidence (in 2006) is reported to be 600/100 000 population/year, whilst the global incidence is said to be 136/100 000 population/year. The calculated TB incidence for Emmaus Hospital, which serves the Okhahlamba municipal area, is 573/100 000 population/year. The incidence of all types of TB in 2007 is reported to be 1075.8 per 100 000 in KZN and 722.4 per 100 000 nationally (SAHR, 2007, pp238).

The South African Health Review 2007(SAHR, 2007, pp252) reports that HIV prevalence in KZN is 16.5% and nationally 10.8%, according to the HIV Household Survey of 2005. The antenatal survey of HIV prevalence in KZN is reported to be 39.1% and nationally 29.1% (SAHR, 2007, pp251). Statistics for childhood TB and HIV are not readily available.

Childhood TB accounts for 10-20% of all TB cases, according to the WHO (Irigoien et al, 2005, pp716) and other estimates cited (Nelson and Wells, 2004, pp636; Eamranond and Jaramillo, 2001, pp595). It is important to note that despite efforts to document childhood TB more accurately and rigorously,

figures for the childhood TB burden in the world are not readily available. The finding that 7.2% of total cases during the study period in Okhahlamba were childhood TB appears to be lower than estimates in recent literature (Marais et al, 2007, S76). In the context of the Okhahlamba area this may be related to under- diagnosis or under-reporting.

5.2 Demographic characteristics of childhood TB

Children with TB can be considered as indicators of ongoing and recent transmission in a community (Gie, 2006, pp1067), and therefore the number of infected and diseased children can be used as a useful indicator of the impact of NTP activities (Morcillo, 2007, pp525). Despite recommendations by the WHO and experts (Gie, 2006, pp1067) to integrate childhood TB into the NTP, nationally and locally initiatives to implement this strategy are inadequate. The priority remains adult smear-positive TB, as this group is perceived to pose a more significant public health problem than children with TB. Part of the integration of childhood TB into the NTP would include recording childhood TB statistics, but at present district quarterly and annual TB reports do not include them.

WHO (2006, pp22) recommended recording and reporting for childhood TB includes documenting all cases of childhood TB, registration of all childhood TB for treatment and subsequently documenting the outcome of treatment. As treatment evaluation of smear positive pulmonary TB is used as an indicator of the NTP quality for adult patients, treatment evaluation of childhood TB provides an indication of the quality of the program for child TB patients.

Indicators that may be useful to measure according to WHO (2006,pp22) include proportion of TB cases which are children, proportion of pulmonary and extra-pulmonary TB in children, proportion of children who are cured (smear positive TB) or complete treatment (smear negative PTB or extra-pulmonary TB) and the proportion of children with miliary and TBM.

During the study period, there was no difference in the sex of children diagnosed, which is consistent with the literature (Morcillo, 2007, pp525). The progression from infection to disease is dependent on the age and immune status of the child, rather than the sex.

The age distribution of childhood TB is highlighted, as younger children are at higher risk of developing disease once infected, and of developing severe forms of TB because of their immature immune systems (Nelson and Wells, 2004, pp637). In this study, younger children (<5years) were diagnosed with TB disease more frequently than children 5-14years. Based on mid-population estimates during the study period, the age specific incidence rates were 159/100 000/year [95% CI: 910; 230] for children less than 5 years old and 50.2/100 000/year [95% CI: 30; 80] for children 5-14 years old. A study from Cape Town, a highly TB endemic area in South Africa (Marais et al, 2006, pp 734), also found that younger children (<4 years in this study) contributed to a higher proportion of cases.

The diagnosis of TB in younger children is especially difficult and is usually made by combining a number of features that suggest a probable but not confirmed diagnosis of TB (Graham et al, 2004, pp650). Both over-and under-

diagnosis of childhood TB are likely, depending on TB incidence in an area and the health worker's experience (Wilson et al, 2005, pp275). The higher proportion of cases of younger children with TB during the study is perhaps a reflection of health worker experience and diagnostic difficulties at Emmaus. As no gold standard exists for the diagnosis of childhood TB, it is difficult to predict with certainty the true incidence or prevalence of TB.

5.3 HIV status:

HIV status is poorly documented in the records that were assessed; 77.2% (115/149) of children diagnosed with TB have unknown HIV status. It is unclear whether this reflects poor recording (as no specific details are requested on the GW20/12) or that tests are not being offered or are being declined by caregivers. There appears to be a gradual increase in the number of children reported to be infected, but the numbers are too small to rule out a chance finding. The barriers to HIV testing and documentation in children therefore requires further investigation.

Clinical staging of HIV is very poorly documented, with only 2 of 28 infected children documented to be clinically staged. The diagnosis of pulmonary TB in an HIV- infected child implies that the child is clinical stage 3 disease according to the WHO (Interim revised) Clinical Staging of HIV/AIDS for infants and children (McKerrow, Stephen and Reddy, pp10), and based on this clinical criterion is eligible for anti-retroviral (ARV) therapy. Evidence has revealed that the outcome with regards to survival and response to treatment is poor in dual HIV/ TB infected children (Swaminathan (2004, pp225-230),

Jeena et al, 1996, pp437-443). Failure to stage a child is therefore a barrier to accessing ARV therapy and a potentially better outcome.

HIV testing is integral to the management of the child with TB, and TB investigations should be considered in the child infected with HIV. All children with TB who live in HIV-prevalent areas should have appropriate counseling and testing performed (WHO, 2006, pp8). Clinical staging of children is important, as the presence of Stage 3 (PTB) or 4 disease (EPTB) determines immediate clinical eligibility for anti-retroviral therapy, which may lead to a better outcome.

In the recent "Saving Children 2005: A survey of child health care in South Africa " report (Patrick and Stephen, 2007, pp16), it was found that 42% of children who died in health facilities in South Africa were not clinically staged, as health workers were "unable or unwilling" to clinically assess children. This problem of inadequate HIV assessment is mirrored at Emmaus Hospital. The inability or unwillingness to properly manage arguably two of the most important diseases in South Africa, HIV and TB, requires urgent investigation. The importance of HIV testing cannot be emphasized more. It is absolutely paramount that all children with suspected TB be tested for HIV.

5.4 Nutritional status:

The initial and subsequent weight recording is an integral part of the management of the child with TB, as it is used to determine the drug dosages and the response to therapy as indicated by the weight gained over the

course of treatment. Although an isolated weight reading may not provide an adequate clinical assessment, it does provide some indication of the child's initial nutritional status. Weight readings therefore need to be considered in the context of the individual child, and trends over time provide a valuable indication of response to treatment.

TB is known to be associated with weight loss and /or poor weight gain. Weight loss associated with TB, however, needs to be considered in the context of general causes of poor weight gain.

Approximately one third of children were recorded with weights less than the 3rd centile, and approximately a quarter had no weight recorded. In addition, the number of children with unknown weights increased significantly during the study period. This of extreme concern, as weight recording is a basic part of any paediatric examination and provides invaluable clinical information. Drug doses for TB treatment are based on weight calculations and response to treatment is also gauged by weight changes. It may be that health workers experience the documentation of weight on the RTHC and on the GW20/12 as a duplication of work, and therefore do not document this, or that weights are not routinely checked and plotted in all children. The use of the RTHC and general documentation of clinical notes requires exploration, as do the causes of low weight (less than the 3rd centile). Some possibilities for children with low weight include TB disease itself, HIV co-infection, malnutrition from poor social circumstances, or low birth weight.

5.5 Site of disease

PTB (86.6%) was found to be a more common manifestation of TB than extra pulmonary TB (13.4%) during the study period in both age groups, due to the pathogenesis of the disease process. However, extra pulmonary TB is less likely than PTB to be confused with other diagnoses (Graham, Coulter and Gilks, 2001, pp18). The statistics for extra pulmonary TB are likely to be a more reliable reflection of the occurrence of TB as the diagnosis is based on more specific clinical signs, laboratory and special investigations e.g. the cerebrospinal (CSF) changes of TBM are usually that of very high protein, low sugar, no growth on routine culture, CT scan is likely to reveal a basal enhancing exudate and/or features of hydrocephalus or the presence of a tuberculoma. The assessment of PTB is more difficult and complex relying on health worker experience in interpreting symptoms, clinical signs and investigations.

Pulmonary TB, despite recommendations on which to base the diagnosis, can be a more subtle clinical and diagnostic process, which is largely dependent on the health workers' expertise in interpreting the chest radiograph. The services of an experienced radiologist are usually not available at district level, and this is the case at Emmaus Hospital. Both over-and under-diagnosis is therefore likely to continue occurring until more reliable diagnostic methods are developed.

No children were documented to have co-existing pulmonary and extra-pulmonary TB. This requires further exploration as treatment regimens may

differ for different forms of TB. Also, it is unclear if health care workers actively looked for TB both pulmonary and extra-pulmonary TB in individual children. The low number of miliary TB cases and absence of TBM cases (in 2005) may be explained by the possible transfer of severely ill children who subsequently died or who received complete treatment outside the area.

It is imperative that children are appropriately and adequately investigated in order to confirm the diagnosis of TB. Attempts at making the diagnosis of extra pulmonary TB are apparent at Emmaus, but in certain circumstances investigations were not appropriately or adequately performed. The reasons for this remain unclear. Possibilities include health worker inexperience or reluctance to investigate appropriately, difficulty in interpreting results, problems with accessing laboratory results, or the delays in receiving laboratory results.

For both PTB and extra pulmonary TB, diagnosis was never confirmed by culture in the study population. Schaaf et al (1995, pp189) conclude from their study that at child health clinics and district hospitals the diagnosis of childhood TB is seldom confirmed by culture of MTB from any source, and that in secondary and tertiary care institutions the diagnosis is confirmed in no more than 30-40% of cases. This finding at Emmaus is therefore consistent with the literature. However why doctors, practicing in a country with a massive TB epidemic, enormous clinical experience and expertise, lack the capacity or willingness to assess and manage childhood TB requires further investigation. It is possible that health workers in a TB endemic area, such as

Okhahlamba, commit to treating the child for a minimum period of 6 months, and do not consider a trial of TB treatment. They therefore start TB treatment indiscriminately because the investigations and follow-up are time consuming, and thus create a greater burden for the already fragile district health system.

5.6 The Use of the SANTCP Guidelines:

A clinical score system and a diagnostic classification are recommended in the SANTCP guidelines. Clinical score systems have been recommended because of their cost effectiveness and ease of administration, particularly in resource-poor settings (Mehnaz and Arif, 2005, pp543). Score systems, however, are not as useful for diagnosis in the presence of malnutrition and HIV infection (Graham et al, 2004, pp651).

Both malnutrition and HIV occur in Okhahlamba, and therefore the guidelines need to be used with caution. It is important to note that despite score systems being unreliable in the presence of HIV and malnutrition, they can be of value to assist paramedical and other health workers (Graham et al, 2004, pp651) to identify children at risk and refer where appropriate. In the district and primary health care setting of Okhahlamba this aspect needs emphasis, particularly as the TB score is an easily administered and cost effective tool.

At Emmaus Hospital, adherence to the SANTCP guidelines for diagnosis is very poor. In the majority of children diagnosed with TB during the study period, a formal assessment (either using the TB score or the Modified WHO Criteria) as recommended by the SANTCP was not performed. Only 25

(16.8%) children were formally assessed. When an assessment was performed, the TB score was the preferred method of assessment. No children were assessed using the Modified WHO Criteria. As the SANTCP guidelines are the recommended tools for TB management, it is still unclear why some health workers use the SANTCP and why some choose not to. This may be related to health workers' perceptions that the guidelines in use are out-of-date (they were published in 2004), and that evidence in the literature suggests that score systems are unreliable in the context of HIV.

Both chest radiograph and TST (tine test) are available at Emmaus Hospital. The most frequently performed investigations for diagnostic purposes during the study were the chest radiograph and the TST. More children had chest radiographs [77 (51.7%)] than TST's [69 (46.3%)]. It is difficult to draw accurate conclusions from this as the TST recording may have been omitted from the records had it been non-reactive. It is also difficult to present accurately which children treated for TB had reactive versus non-reactive tine tests, for the previous reason listed. There appears to be an increase in the recorded TST results according to the data – from 4.2% (2004) to 46.2% (2006). The reasons for this increase are not clearly evident however may be attributed to better documentation of results, better case management of childhood TB or slightly more records being available for analysis in 2006.

The majority of children diagnosed with PTB were diagnosed on chest radiograph and history of contact [21 (16.5%)], TST and history of contact [20(15.7%)] and chest radiograph only [18 (14.1%)]. Eight children were

diagnosed with TB on TST only and on the presence of a contact only. No other investigations were performed on these children. The clinical presentation of these children is unclear from the data, as this was not clearly documented. Presumably these children presented with clinical symptoms and signs, which subsequently lead the health worker to consider other investigations for TB. The children with a reactive TST only and contact only and TB contact/ TST reactive received TB treatment and not prophylaxis. From the documentation it is unclear whether these children were infected with TB only or whether they had TB disease. Establishing the difference between infection and disease determines whether the child receives TB prophylaxis or treatment and is an important clinical scenario that requires emphasis.

The chest radiographs and TST as investigations have their own limitations and need to be interpreted in the context of the individual patient. Despite an easily administered and cheap test being available, the interpretation requires more careful consideration. Presently at Emmaus Hospital there are no standardised guidelines for the interpretation of chest radiographs should TB be suspected. The interpretation is wholly observer (medical practitioner) dependent and creates opportunities for both over- and under-diagnosis.

It is important to note that the presence of hilar adenopathy (or any other element of the primary complex) in isolation does not differentiate recent primary infection from disease (Marais, 2006, pp3). Chest radiographs, despite being accessible and easy to perform at Emmaus Hospital, require

some skill in interpretation. It is difficult to conclusively comment on the skills required to interpret child chest radiographs and whether these skills are present at Emmaus, but none of the doctors at Emmaus have had any special training in radiology. Whether there was indeed over-diagnosis and/or under-diagnosis of TB based on chest radiograph findings is also difficult to conclude. However, the study does show that the chest radiograph was the more common investigation used when childhood TB was diagnosed.

Wilson et al (2005, pp275) note that the threshold for diagnosis of TB depends on the health worker's experience. Working in an endemic area may also contribute to the varying threshold for diagnosing childhood TB, amongst doctors. Until more reliable diagnostic methods are made available, it appears likely that many children with HIV infection and AIDS who do not have TB will be placed on anti-TB therapy (Donald, 2000, pp189). As there is the risk of over-diagnosis and unnecessary treatment, there is also the risk that TB may be missed and therefore the opportunity to treat a curable disease will also be missed (WHO, 2006, pp1331). Thus, the result is under-diagnosis by some clinicians and over-diagnosis by others. This is likely to be the situation at Emmaus Hospital as well.

It is evident that other modalities of investigation available at Emmaus, such as gastric aspirates, culture of sputum and gastric aspirates, FNA's/ biopsies, pleural aspirates, and abdominal ultrasound, are used infrequently or not at all. It is unclear why this is so, but it may be related to complacency on the part of the health worker because there is no gold standard for diagnosis. This

aspect of not performing investigations when appropriate needs to be addressed. A concerning finding is that the basics of TB diagnosis are neglected; there is incomplete recording of weight/ weight faltering, symptoms, and HIV testing, and too few available investigations are done to make a better diagnosis e.g. chest radiographs, cultures, FNA.

5.7 The use of other diagnostic approaches:

An attempt was made during the study to identify other approaches being used by health workers to diagnose TB, as current guidelines may not be appropriate and because of the general difficulties of diagnosing childhood TB. The findings included referral to regional/tertiary health facilities of these children, the use of clinical criteria of non-resolving/ recurrent pneumonia, and PUO.

The children referred to other health facilities were diagnosed with extra pulmonary forms of TB (TBM, mastoiditis, and bone). The terms “non-resolving pneumonia/ recurrent pneumonia” were not clearly defined. It has generally been accepted that a cough for more than 21 days should alert one to the diagnosis of TB (WHO, 2002, pp2), although the child with TB can also present acutely. As there were no specific definitions for these terms, the diagnosis of TB may be questioned. The use of these criteria is largely health worker dependent. In HIV endemic areas, the diagnosis and management of infants presenting with acute severe chest infections who do not respond to standard antibiotic therapy, or older children with chronic respiratory disorders, are daily clinical problems (Graham, Coulter, Gilks, 2001, pp12).

Clinical and diagnostic proficiency may assist health workers to make the diagnosis, although diagnostic inaccuracy is still likely.

Pyrexia of unknown origin (PUO) has also been used to diagnose TB in the study. It is necessary to take a comprehensive history, detailed physical examination and appropriate laboratory investigations (Coovadia and Wittenberg, pp242-245) before labeling a child "PUO". In the single case of the child diagnosed with TB/PUO, it was evident from the clinical records that the child was not adequately investigated.

5.8 Treatment completion:

According to the study, only 82 (55%) children completed treatment. Thirty-eight (25.5%) were classified as having defaulted treatment. It is important to note that at the time of completion of data collection, 10.7% of children were still documented to be on treatment.

It is of concern that only 55% of children complete treatment and this requires further investigation. Children are dependent on an adult caregiver for collecting and administering medication. There may be several reasons for children defaulting treatment, and some possible reasons include being too ill to take treatment, side-effects from medication, the caregiver being ill, no consistent caregiver, and belief around illness and Western medicine. Data on completion rates for children are not routinely collected by the NTP, therefore it is difficult to comment. It is of concern however, that nearly half the children diagnosed with TB and initiated on treatment do not complete the course of

treatment. This is an area that requires further exploration, although the literature does not yield any norms for completion rates in children.

5.9 Contacts and prophylaxis

The majority of children (89 or 59.7%) diagnosed with TB have a documented contact, but details were unavailable about the time, duration, and sputum status of the contact, and whether the contact was subsequently followed-up. More active tracing and screening of contacts of both adult and childhood TB is necessary if reduction in TB transmission and better management of TB is to be achieved. In order to improve the service that is presently being offered, a rigorous effort needs to be made to identify children at risk of developing disease following exposure and/ or infection and to manage these children appropriately and adequately. This may be neglected due to resource constraints (staffing) or the high incidence of adult TB, accounting for a shift in resources toward the management of adult TB cases.

5.10 Limitations of the study:

The retrospective study design affects the quantity and quality of the available data. As no gold standard exists for the diagnosis of childhood TB, an assumption was made that all children diagnosed with TB and commenced on treatment actually had TB. Despite the assessment of investigations performed and the use of the SANTCP guidelines, the clinical presentation of children could not be accurately assessed. This is significant as the clinical presentation is likely to influence a health worker's decision with regards the diagnosis of TB.

The comparison in management of HIV infected and HIV uninfected children with TB was a further limitation to the study because of the small number of documented cases of HIV infected children.

Children transferred to tertiary and/ or quaternary facilities and who either died or completed their treatment elsewhere were not included in the statistics for childhood TB in Okhahlamba, as their outcomes were unknown. The absence of these children in the study therefore may contribute to the apparent reduced numbers of children with TB and under reporting of childhood TB.

The study included a small number of patients at a single site potentially limiting the generalisability of the study. There are no comparable district level statistics and consequently it is difficult to draw conclusions. The findings are representative of the experience at Emmaus Hospital and provide a reflection of the situation at a district hospital. The problems identified and lessons learned, although not necessarily generic for all district hospitals, might provide useful information that can assist other district hospitals and TB program managers to improve their services.

Chapter 6: Recommendations and Conclusion

6.1 Disseminate findings and recommendations of research project

Report on findings of research project to Emmaus Hospital Management, District Office Management, and District TB Co-coordinator. A presentation will also be made to health workers at the regular Journal Club meeting.

6.2 Improve the quality and quantity of childhood TB data

Childhood TB accounts for approximately 7% of reported cases in Okhahlamba, yet statistics for childhood TB are not included in the routine district dataset. It is therefore recommended that childhood TB data be reported upon in the quarterly and yearly TB reports. This does not require a significant amount of work, as all children with TB have been recorded in the health facility's TB register and the district database. It will involve extracting these data and including it in reports. These data will provide valuable information on the quality of the care received by children with TB.

6.3 Improve the effectiveness of the existing program

The present TB Control Program in Okhahlamba has several components. Indicators for monitoring and evaluation are determined by the NTP. Despite health facilities generating statistics and indicators being calculated, little has improved in the battle against TB. The co- epidemic of TB and HIV exacerbates the situation. This is true for both adult and childhood disease. Specific plans of action need to be developed for high-risk groups such as children or re-treatment disease. It is the responsibility of TB Control

managers to assess on an ongoing basis the effectiveness of the TB program. Responsibility and accountability needs to be engendered. Ideally a situation analysis should be performed and a core group of health and allied personnel, be tasked with improving the program and the care that is received by patients. The district TB co-ordinator should lead this process.

6.4 Use the existing guidelines as a screening tool

The SANTCP guidelines are used very poorly as diagnostic tools for childhood TB. The majority of children was not diagnosed with the use of a TB score or modified WHO Criteria as recommended by the guidelines from the National Department of Health. Recent evidence does not recommend the TB score for the diagnosis of childhood TB in the context of HIV and/ or malnutrition. Nevertheless, the score can be used as a screening tool by paramedical and other health workers to identify children at risk who require more formal evaluation and referral (Graham et al, 2004, pp651). In the context of Emmaus Hospital and the local health facilities, this is a useful recommendation for PHC nurses and community health workers who are the primary contact for many children.

6.5 Implement regular clinical audits

Clinical management of children needs to be evaluated formally and regularly. Audits of child morbidity and mortality can contribute significantly to improving clinical management. The Child Health Problem Identification Program, an audit tool, has recently been introduced at Emmaus Hospital. This will be an

avenue to tackle possible in-patient diagnostic and clinical dilemmas, adherence to protocols and evaluations of existing and new guidelines.

It is important to emphasize to health workers that TB may mimic many illnesses and that one has to be consistently vigilant, particularly in young children (immune- immature) and immuno-compromised children.

6.6 Improve supervision and support for all health workers

Supervision and support for health workers needs to be improved and emphasized. Regular health facility visits by TB program managers is recommended. Particular attention needs to be afforded to administrative and clinical issues. Record keeping, collation of statistics, clinical problems that arise, and problems with procurement of drugs and documentation need to be addressed as a matter of urgency. Staff performance needs to be assessed regularly and formally, and consideration should be given to the appointment of more health workers at health facilities.

Particular detail with regards differentiation of the child with TB infection and the child with TB disease needs to be addressed, as this determines the difference between prophylaxis against TB and a full treatment course. Basic examination, including weight assessments, needs to be emphasized.

6.7 Integrate the care of children infected and affected with TB and HIV:

It is becoming increasingly important to integrate the management of TB and HIV services, (Anderson and Maher, 2001, pp9, Coetzee et al, 2004, ppA15),

despite the challenges and problems that may be experienced including the differing philosophies of both services and the vertical- nature of each programme with separate funding, administration and monitoring/ evaluation systems. The development and integration of TB/ HIV services is still in its infancy in the Okhahlamba area. At the time of writing, a collaborative project between the local department of health, local non-governmental organization and the Medical Research Council named "THAT'S IT" (TB, HIV and AIDS Treatment Support and integrated Therapy) is being piloted. It is hoped that this project will strengthen the link between TB and HIV care in the municipal area.

Failure to thrive, weight faltering and other evidence of malnutrition needs to be assessed rapidly and appropriate action taken immediately regarding the presence of HIV infection and/or TB infection. HIV testing and TB screening for the parents and siblings of children who are at risk also needs to be considered. A more holistic approach is recommended.

HIV infection or exposure is poorly documented in the records assessed during the study. There may be several reasons for this that requires further investigation. Clinical staging is also poorly documented. All health workers should be encouraged to document HIV infection/ exposure and clinical staging where appropriate.

6.8 Actively trace contacts and initiate prophylaxis for children

It is of concern that completion rates are as low as 55%. Contacts are reported in the vast majority of children, but further details are required on the sputum status, duration of contact, type of TB, and follow-up status.

More active tracing of contacts and screening of both adult and childhood TB suspects are necessary for better management of TB. Part of this process includes specific supervision of tracing teams.

Prophylaxis for children under 5 years exposed to adult source cases needs to be considered in a systematic way. This may be neglected due to resource constraints (staffing) or the high incidence of adult TB in the area. However, it is an integral part of the TB program that is not being implemented at present.

6.9 Improve the record keeping system at health facilities

The storage and retrieval of records at the health facilities needs to be improved, as the present situation is not optimal for patients and health care workers. There appears to be a duplication of facility- and patient- retained records, and neither system functions well at present. The patient-retained record system was used previously with good effect. Clear guidelines need to be developed for storage of facility- retained records, in-patient records and GW 20/12's. The issues pertaining to the facility-retained record are not purely issues related to the management of childhood TB, but all illnesses. Therefore all patients presenting to a health facility are affected and potentially would

benefit from a more streamlined system. It is recommended that management consider these systems issues carefully and develop workable solutions.

6.10 Address community barriers to quality care

Community issues which impact on medical care of children with TB that require attention include non-adherence to TB treatment, support for caregivers of children with TB and/or HIV, reasons for defaulting/ not completing TB treatment and barriers to testing children for HIV.

6.11 Implications for Further Research

The study has generated several issues that require clarification and further investigation. The following is a list of further research to be considered:

- Investigate why health workers do not follow guidelines
- Evaluate knowledge of health workers around childhood TB and its diagnosis
- Develop more reliable childhood TB diagnostic tests that are available at district health facilities
- Develop childhood TB guidelines for different levels of care, with variable resource constraints
- Undertake a situation analysis of the local TB program
- Assess the function and effectiveness of TB tracers
- Investigate the barriers to HIV testing among children
- Determine the social, economic, and medical causes of malnutrition in Okhahlamba and ways to improve the outcome for these children

- Describe the administrative and clinical issues in integrating HIV and TB programs
- Determine the reasons for non-compliance and/or poor completion rates amongst children
- Investigate the traditional Zulu perceptions of the western diagnosis of TB

Conclusion

As one of 22 high TB burden countries, South Africa needs to prioritize both adult and childhood TB. The calculated total TB incidence for Emmaus Hospital is 573/100 000 population /year. The proportion of childhood TB cases is 7.2%, far less than is anticipated for the total population. This may be an indication of under-diagnosis and/or under-reporting.

The SANTCP guidelines for the diagnosis of childhood TB are utilized very poorly at Emmaus Hospital. The reasons for this are unclear, but may include reluctance or inability on the part of the health worker. The present guidelines require revision, as the recommended tools are not reliable in the context of HIV and malnutrition. Despite the need for a revision of the existing guidelines, the TB score can be recommended for use as a screening tool to identify children at risk.

Health workers at Emmaus hospital tend to use the chest radiograph and TST predominantly for diagnosis of TB in children. Both of these investigative techniques are known to have limitations, particularly in a TB and HIV endemic area. In addition there is no standardized interpretation for chest radiographs in the child with suspected TB. Several other investigations are available at Emmaus Hospital, but are seldom used, and diagnosis is seldom confirmed by culture. Attention to basic clinical examination needs to be re-emphasized

There is at present no gold standard for the diagnosis of childhood TB. Until more reliable methods become available and accessible at district level facilities, the risks of over-diagnosis and under-diagnosis will remain.

Clearly a dedicated effort, engendering responsibility and accountability, needs to be made by all role players, including politicians, managers, health workers and communities, in order to decrease the burden of childhood TB. The challenge remains to integrate childhood TB into the NTP and to develop guidelines that are appropriate for different levels of care with variable resource constraints.

References:

Anderson SR and Maher D, 2001, "An analysis of interaction between TB and HIV/Aids programs in sub-Saharan Africa, WHO, retrieved 09/01/07, from: <http://who.int/gtb>

Blumberg L, Ogunbanjo G and Durrheim D, 2003, "TB: Current Issues on diagnosis and management", *South African Family Practice Journal*, volume: 45, number: 2, pp: 38-43

Brewster DR, 2006, "Critical appraisal of the management of severe Malnutrition: 3. Complications", *Journal of Paediatrics and Child Health*, volume: 42, number 10, pp 583-93

Coetzee D, Hilderbrand K, Goemaere E, Matthys F and Boelaert M, 2004, "Integrating TB and HIV care in the primary care setting in South Africa", *Tropical Medicine and International Health*, volume: 9, number: 6, pp: A11-A15 (supplement June 2004)

Coovadia HM and Wittenberg DF (eds), *Paediatrics and Child Health: A Manual for Health Professionals in Developing Countries*, Oxford University Press, Cape Town, pp 328, 342-345

Corbett EL, Marston B, Churchyard GJ, De Cock KM, 2006, "Tuberculosis in sub-Saharan Africa: - opportunities, challenges and change in the era of

antiretroviral treatment", *The Lancet*, volume: 367, pp: 926-937

Chintu C and Mwaba P, 2005, "TB in children with human Immunodeficiency virus infection", *International Journal of TB and Lung Disease*, volume: 9, number: 5, pp: 477-484

Du Toit G, Swingler G and Iloni K, 2002, "Observer variation in detecting lymphadenopathy on chest radiograph", *International Journal of TB and Lung Disease*, volume: 6, number: 9, pp: 814-817

Donald PR, 2000, "Childhood TB", *Current Opinion in Pulmonary Medicine*, volume: 6, number: 3, pp: 187-192

Donald PR, 2002, "Childhood TB: out of control?" *Current Opinion in Pulmonary Medicine*, volume: 8, number: 3, pp: 178-182

Eamranond P, Jaramillo E, 2001, "TB in children: reassessing the need for improved diagnosis in global control strategies", *International Journal of TB and Lung Disease*, volume: 5, no: , pp:594-603

Gie RP, 2006, "Childhood TB mainstreamed into National TB Programmes", *International Journal of TB and Lung Disease*, volume: 10, number: 10, pp: 1067

Gie RP, 2003, *Diagnostic atlas of intrathoracic TB in children –a*

Guide for low-income countries, International Union against TB and Lung Disease, France, pp: 1

Graham SM, Gie RP, Schaaf HS, Coulter JB, Espinal MA and Beyers N, 2004, "Childhood TB: clinical research needs", ", *International Journal of TB and Lung Disease*, volume: 8, number: 5, pp: 648-657

Graham SM, Coulter JB, Gilks CF, 2001, "Pulmonary disease in HIV-infected African children", *International Journal of TB and Lung Disease*, volume: 5, number: 1, pp: 12-23

Hot A, Schmulewitz L, Viard JP and Lortholary O, 2007, "Fever of unknown origin in HIV/AIDS patients", *Infect Dis Clin North America*, volume: 21, number : 4, pp: 1013-1032

Harries AD, Boxshall M, Phiri S, van Gorkom J, Zachariah R, Squire SB, Makhombe SD, Kwanjana J and Gondwe M, 2006, "Providing HIV care for TB patients in sub-Saharan Africa", *International Journal of TB and Lung Disease*, volume: 10, number: 12, pp1306-1311

Hesseling AC, Schaaf HS, Gie RP, Starke JR and Beyers N, 2002, "A critical Review of diagnostic approaches used in the diagnosis of childhood TB", *International Journal of TB and Lung Disease*, Volume: 6, number: 12 pp: 1038-1045

Houwert KA, Borggraven PA, Schaaf HS, Nel E and Donald PR, 1998, "Prospective evaluation of WHO criteria to assist diagnosis of TB in children", *Eur Resp Journal*, volume: 11, number: 5, pp: 1116-1120

Iriso R, Mudido PM, Karamagi C and Whalen C, 2005, "The diagnosis of childhood TB in an HIV-endemic setting and the use of induced sputum", *International Journal of TB and Lung Disease*, volume: 9, number: 7, pp: 716-726

Jeena PM, Mitha T, Bamber S, Wesley A, Coutsoudis A and Coovadia HM, 1996, "Effects of human immunodeficiency virus on TB in children", *TB and Lung Disease*, volume: 77, number: 5, pp: 437-443

Joos TJ, Miller WC and Murdoch DM, 2006, "Tuberculin reactivity in bacilli Calmette-Guerin vaccinated populations: a comparison on international data", *International Journal of tuberculosis and lung disease*, volume: 10, number: 8, pp: 883-891

Kerry TP, 2006, "Improving the use of patient-held records in the Emtshezi Subdistrict", *South African Family Practice*, volume: 48, number: 1, pp: 16

Khan EA and Starke JR, 1995, "Diagnosis of TB in children: increased need for better methods", *Emerg. Infect. Dis.*, volume: 1, number:

4, pp: 115-123, retrieved: 03/04/06 from
<http://www.cdc/ncid/eid/vol1no4/starke2.htm>

Liebeshuetz S, Bamber S, Ewer K, Deeks J, Pathan AA and Lavani A, 2004,
"Diagnosis of TB in South African children using a T-cell-based
assay: a prospective cohort study", *Lancet*, volume: 364, pp: 2196-2203

Marais BJ, Gie RP, Obihara CC, Hesselning AC, Schaaf HS and Beyers N,
2005, "Well defined symptoms are of value in the diagnosis of childhood
pulmonary TB", *Archives of Disease in Childhood*, volume:90,
number: 11, pp:1162-1165

Marais BJ, Obihara cc, Warren RM, Schaaf HS, Gie RP and Donald PR,
2005, "The burden of childhood TB: a public health perspective",
International Journal of TB and Lung Disease, volume: 9, number:
12, pp1305-1313

Marais BJ, Gie RP, Hesselning AC, Schaaf HS, Lombard C, Enarson DA and
Beyers N, 2006, "The spectrum of Disease in children treated for TB
in a highly endemic area", *International Journal of TB and Lung
Disease*, volume: 10, number: 7, pp: 732-738

Marais BJ, Gie RP, Schaaf, HS, Beyers N, Donald PR and Starke JR, 2006,
"Childhood pulmonary tuberculosis- old wisdom and new challenges",

American Journal of Respiratory and Critical Care", volume: 173, pp1078-1090

Marais BJ, Graham SM, Cotton MF and Beyers N, 2007, "Diagnostic and Management challenges for childhood tuberculosis in the era of HIV", *Journal of Infectious Diseases*, volume: 196, pp: S76-85

McKerrow NH, Stephen CR and Reddy R, 2006, "Step- by-step Guide for the management of children on ART" Dept of Paediatrics, Pietermaritzburg Metropolitan Hospitals Complex, KwaZulu Natal

Mehnaz A and Arif F, 2005, "Applicability of scoring chart in the early detection of TB in children", *J.Coll.Physicians Surg.Pak*, volume: 15, number: 9, pp: 543-546

Morcillo N, 2007, "TB Textbook", pp: 525, retrieved 16/03/07
from: <http://www.TBtextook.com>

Nelson LJ, Wells CD, 2004, "Global epidemiology of Childhood TB", *International Journal of TB and Lung Disease*, volume8, no: 5, pp: 63-647

Okhahlamba Area Development Programme (OADP) Baseline Survey, August 2006, World Vision- South Africa, Project number: 173116, pp: 5-8

Patrick ME and Stephen CR (eds), 2007, "Saving Children: 2005- a survey of child healthcare in South Africa", Medical Research Council Unit for Maternal and Infant Care Strategies, pp:9

Rosen EU, 1982," The problems of diagnosis and treatment of childhood pulmonary TB in developing countries", *South African Medical Journal*, supplement to November 17, 1982, pp: 26-28

Schaaf HS, Beyers N, Gie RP, Nel ED, Smuts NA, Scott FE, Donald PR and Fourie PB, 1995, "Respiratory TB in childhood: the diagnostic value of clinical features and special investigations", *Paediatric Infectious Diseases Journal*, volume: 14, number: 3, pp: 189-194

South African Health Review 2007, Health Systems Trust, retrieved: 18/12/07 from: <http://www.hst.org.za/publications/711>

South African National TB Control Program [SANTCP] Guidelines, 2004, National department of Health, pp1

Standard Treatment Guidelines and Essential Drugs List, 2006, National Department of Health, pp267-272

Statistics South Africa [StatsSA], Census 2001, retrieved: 15/03/07 from: <http://www.statssa.org>

Swaminathan S, 2004, "TB in HIV-infected children", *Paediatric Respiratory Review*, volume: 5, number: 3, pp: 225-230

Tarwa C and De Villiers FPR, 2007, "The use of the Road to Health Card in monitoring child Health", *South African Family Practise*, volume: 49, number: 1, pp: 15

World Health Organisation (WHO), 2002, "Integrated management of childhood illnesses- KZN Guidelines", pp: 1-37

World Health Organisation (WHO), 2006, "Guidance for National TB Programmes on the management of TB in children", Retrieved: 15/09/06 from http://www.stoptb.org/wg/dots_expansion/assests/documents/TBChildGuide.pdf

World Health Organisation (WHO), 2006, "Management of TB in the HIV-infected child", *International Journal of TB and Lung Disease*, volume: 10, number: 12, pp: 1331-1336

WHO, 2007, Global TB Control Report

Van Beekhuizen HJ, 1998, "TB score chart in children in Aitape, Papua New Guinea", *Tropical Doctor*, volume: 28, number: 3, pp: 155-160

Wilson D, Naidoo S, Bekker LG, Cotton M and Maartens GJ, 2005, *Handbook*

of HIV Medicine, Oxford University Press, pp: 275- 283

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University of Cape Town

Research Proposal

The Epidemiology and Diagnosis of

Childhood TB at a District

Hospital in Kwazulu-Natal, South Africa

A Retrospective Audit of Clinical Practice

Submitted by Dr Samantha Padayachee

As a requirement for the MPhil (Maternal and Child Health)

November 2006

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1. Introduction:

TB (TB) is an important cause of childhood morbidity and mortality in South Africa. At no time in recent history has TB been as great a concern as it is today. In 1993, the WHO (WHO) declared "TB to be a global emergency and in 1996 TB was declared a priority disease in South Africa" (Blumberg, Ogunbanjo and Durrheim, 2003, pp38). "Despite highly effective drugs being readily available, morbidity and mortality due to Mycobacterium TB (MTB) is increasing, a phenomenon that is largely fuelled by the HIV (HIV) epidemic" (South African National TB Control Programme [SANTCP] Guidelines, 2004, pp1).

The diagnosis of childhood TB has proved to be difficult and continues to challenge clinicians, despite technological advances in various spheres of medicine. With increasing co-infections of TB and HIV, this challenge becomes more complicated. "HIV has changed the clinical, radiological and microbiological presentation of TB in adults, rendering diagnosis more difficult. Diagnosis of TB in children has always been difficult, but is now even more complex, owing to the similar presentation of other HIV-related lung diseases. Both over- and under-diagnosis are likely, depending on TB incidence in an area and the health worker's experience" (Wilson et al, 2005, pp275).

Several guidelines and recommendations are available for diagnosing TB in children, including combinations of clinical criteria, special investigations, laboratory methods and score systems. However, no gold standard exists. Clinical scoring systems have been recommended because of their cost effectiveness and ease of administration, particularly in resource-poor settings (Mehnaz and Arif, 2005, pp543). However, scoring systems are not as useful

for diagnosis in the presence of malnutrition and HIV infection (Graham et al, 2004, pp651).

As children represent the future burden of TB disease, interventions appropriately directed could "significantly reduce the overall global burden of TB in years to come" (Nelson and Wells, 2004, pp636). It is imperative therefore that the diagnosis of childhood TB be made as rapidly and as accurately as possible, so as to institute timeous treatment, thereby reducing associated morbidity and mortality.

2. Literature Review

Epidemiology of Childhood TB

The prevalence of childhood TB is related to the reservoir of smear- positive adults within a population. The most effective way of controlling TB (in adults) is through rapid diagnosis by direct microscopy for acid-fast bacilli (AFB) or culture of MTB and initiation of correct treatment (Blumberg, Ogunbanjo and Durrheim, 2003, pp38). An effective control programme for children should aim, therefore, at reducing the number of infective adult reservoirs.

"Accurate figures for the childhood TB burden in the world are not readily available. This is because of the difficulty of accurately diagnosing childhood TB, inadequate health information systems in developing countries, and the lack of importance accorded to childhood TB by TB control authorities" (Donald, 2002, pp178). Donald further states that several estimates use an arbitrary calculation of 10% of TB burden to children and that available data also suggests an exponential rise in the proportion of the TB caseload caused

by children, as the incidence of TB rises. In certain high incidence communities, children may constitute 40% of the caseload. The TB incidence in children therefore reflects the incidence among their adult caregivers as well as the failure to control adult TB, particularly in countries afflicted by HIV/AIDS. Failure to control adult TB is associated with a failure to control childhood TB.

Nelson and Wells (2004, pp636) state that in 1989 the WHO estimated that there were 1.3 million annual cases of TB in children <15years of age, and 450 000 deaths. In 1994 it was estimated that there were 7 500 000 total TB cases of which 650 000 (9%) occurred in children. In low-income countries the proportion of cases occurring in children is approximately 15%, compared with 6% in the United States and even lower percentages in some European countries.

The natural history of TB in children

According to Khan and Starke (1995, pg 115) the natural history of TB in children exists along a "continuum". 3 stages can be considered:

- **Exposure:** refers to a child that has had recent and substantial contact with an adult/ adolescent with suspected or confirmed smear positive pulmonary TB (source case). Exposed children may be identified during follow-up investigations of the source case. The child's tuberculin skin test (TST) is non-reactive, the chest radiograph is normal and the child is asymptomatic. Some exposed children are infected with *Mycobacterium* TB, however the clinician cannot know immediately which exposed children are infected, as the development of delayed type hypersensitivity

to tuberculin protein, as evidenced by a positive tuberculin skin test (TST), may take up to 3 months. In some exposed children, severe disease (meningeal and dissemination) can develop in less than 3 months and before the TST becomes reactive. In the exposure stage, provided active disease has been excluded, children should receive prophylaxis.

- **Infection:** This is represented by a reactive TST. There are no clinical signs and symptoms, and the chest radiograph is either normal or may show fibrotic changes and/ or calcifications in the lung parenchyma or regional lymph nodes. This stage is rarely discovered and almost never treated in developing countries.
- **Disease** occurs when symptoms and signs and/ or radiographic changes appear. These manifestations are probably related to host inflammatory reactions rather than to the number of organisms. In 40-50% of infants with untreated TB infection, disease develops in 1-2 years. The risk decreases among older children to 15%. 25-35% of children develop extra-pulmonary TB, which is more difficult to diagnose.

Primary and post-primary spread occurs in the vast majority of children. A small percentage of children have adult-type disease of reactivation TB (Coovadia and Wittenberg, pp 328). Because childhood TB is pauci-bacillary, conventional microscopy is usually insensitive and sputum collection rarely successful (Blumberg, Ogunbanjo and Durrheim, 2003, pp43).

“Children <5yrs that are infected with TB are at higher risk of developing TB disease. This is probably related to immature cellular immunity. In addition, these children are also at higher risk for developing disseminated forms of TB,

including miliary and tuberculous meningitis (TBM), which are frequently associated with higher morbidity and mortality” (Nelson and Wells, 2004, pp637). In areas where BCG coverage is higher there is lower incidence of severe forms of TB (WHO, 2006, pp23).

Approaches to diagnosis of TB in children

Difficulties in making the diagnosis of TB in children have led to the development of the different diagnostic approaches (Hesseling et al, 2002, pp1038-1045). These include:

- **Point score systems:** A numerical value is assigned to each characteristic in the score system e.g. South African National TB Control Programme guidelines score (SANTCP 2004 pp48), Keith Edwards Score (Van Beekhuizen, 1998, pp156)
- **Diagnostic classifications:** characteristics are stratified into categories e.g. WHO classification of suspected, probable and confirmed TB (Houwert et al, 1998, pp1117), Modified WHO criteria (SANTCP, 2004, pp49).
- **Diagnostic algorithms:** a stepwise approach, often in a diagrammatic form
- **Combinations of the abovementioned forms**

The diagnosis of childhood TB in practice:

According to Hussey (2006), the diagnosis of childhood TB in practice, is usually based on:

- **History:** of close contact with a smear positive adult/ adolescent
- **Clinical criteria:** high index of suspicion, particular clinical presentation e.g. failure to thrive, chronic cough, lymphadenopathy, unexplained and/ or prolonged fever
- **Investigations:** tuberculin skin test (TST), radiographic findings, lumbar puncture findings, ultrasound, gastric washings, induced sputum, fine needle aspiration.
- **Scoring systems:** approximately 15-20 score systems are available, using a combination of history, clinical criteria and investigations. TB score systems, attempt to carefully and systematically collect information, assign different values to the information collected, and subsequently decide on the basis of the total score the likelihood of the child having TB. According to the WHO (2006) score systems have been used for "the diagnosis of TB in children" although they have rarely been evaluated or validated against a gold standard. Presently the WHO recommends that score charts be used as screening tools rather than diagnostic tools.

The SANTCP recommends the use of a scoring system and the Modified WHO criteria for the management of childhood TB. In addition, the scoring system is recommended for both screening and diagnostic purposes, depending on the availability of other investigations, such as radiographs and

the TST. In areas where the TST and radiography facilities are available, the score system should be used as a screening tool to identify children that might have TB and need referring for further investigation. In settings with limited availability of TST and chest radiographs however, the score system can be used as a diagnostic tool, although it may result in mis-diagnosis of TB in children. The TB score appears to have a high sensitivity and low specificity in the context of paediatric HIV, resulting in the over-diagnosis of TB amongst HIV infected children (SANTCP, 2004, pp48).

The modified WHO criteria, listed in the SANTCP guidelines consists of a "Possible TB" and "Probable TB" assessment (SANTCP, 2004, pp 49). Chest radiography, the presence of smear positive contact, symptoms of chronic disease, positive TST and culture positivity are used as distinguishing features.

The clinical presentation varies enormously, and can present with a multiplicity of clinical signs and symptoms, as TB can affect virtually any organ system in the body. Clinicians need to be constantly vigilant and the diagnosis of TB should be considered in the differential diagnosis of any obscure or ill-defined clinical problem (Coovadia and Wittenberg, pp 326). Liebeshtentz, Bamber and Ewer (2004) state, "childhood TB often presents non-specifically and is a common differential diagnosis in high prevalence areas. Current diagnostic tools have poor sensitivity and cannot reliably exclude TB, so over-diagnosis is common. HIV co-infection exacerbates this problem and accounts for an increasing proportion of paediatric TB worldwide". It therefore appears that because of the poor sensitivity of diagnostic tools and because of the high prevalence of TB, clinicians err on the side of over-diagnosis. In the

context of HIV, the clinical criteria used can be related to the disease process of HIV or TB or both problems concurrently.

Despite objective tests being available, making the diagnosis of TB in children is often fraught for a number of reasons:

- Children are more likely to swallow sputum rather than expectorate voluntarily. Obtaining sputum samples is difficult.
- Despite acid fast bacilli (AFB) stain of sputum yielding 75% specimens positive in adults with pulmonary TB, fewer than 20% of children with TB have a positive AFB smear of sputum or gastric aspirate (Khan and Starke, pp 119).
- Gastric aspirates may be difficult to perform at primary health care level and the necessity of an early morning specimen further complicates specimen collection.
- Interpretation of tuberculin skin tests. Rosen (1982) concludes that there are 3 problems with skin tests- it is unclear which skin test is most suitable for routine use, the high frequency of false negative results where TB is rife may result in failure to make the correct assessment, as BCG scars fade with time-the interpretation of the skin test therefore becomes difficult.
- Difficulty in accessing and performing certain investigations e.g. chest radiography, ultrasound, fine needle aspiration cytology, biopsies etc and difficulty in interpretation of results.
- Chest radiography is perhaps the means by which the diagnosis of TB in childhood is most frequently supported. However, there is a large

"intra- and inter-observer variability in the interpretation of radiographs".
(Gie, 2003, pp1).

- Historical evidence of exposure to an adult with smear positive TB may be lacking as children have been left orphaned, by the HIV pandemic. They are cared for by the extended family, taken into homes/shelters or left to fend for themselves. A reliable caregiver with a clear history, may not always be available

TB in HIV-infected children and the difficulties of diagnosing TB in HIV-infected children:

According to Swaminathan (2004, pp225-230), HIV-infected children are at increased risk of delayed diagnosis of TB and diagnostic errors. This occurs because of overlapping clinical and radiographic features, associated with TB and other HIV associated lung diseases. Also TB manifestations are more severe in HIV-infected children and progression to death is more rapid, as compared to HIV-uninfected children. The clinical and radiological manifestations do not vary significantly from those who are HIV uninfected, however, there may be an increased tendency for extra-pulmonary disease and dissemination. HIV infection adversely affects the outcome of TB in children with regards to response to treatment and survival (Jeena et al, 1996, pp437-443). It is therefore imperative that the diagnosis of TB is made as rapidly and as accurately as possible, so that treatment can be initiated early on to prevent significant morbidity and mortality.

The occurrence of TB and HIV concurrently poses several clinical challenges:

- Several HIV related pulmonary conditions present in a clinically similar way to pulmonary TB eg. lymphocytic interstitial pneumonitis (LIP), bacterial pneumonias, bronchiectasis, pneumocystis jiroveci (carinii) pneumonia (PCP).
- The chest X-ray (CXR) may show atypical features of TB and may be difficult to interpret.
- Chronic weight loss and malnutrition associated with the disease process of HIV itself or associated chronic diarrhoea makes HIV associated weight loss and malnutrition difficult to distinguish from TB.
- Anergy or decreased cell-mediated immunity associated with HIV produces less reliable responses to tuberculin skin testing.
- The duration of illness for both HIV and TB tends to be for longer than 4 weeks. Using the chronicity of illness as a distinguishing feature may not be reliable.
- Fever (unexplained or prolonged) as a clinical symptom is often used in the assessments of patients. In immunocompromised patients, as seen with HIV, fever may not always be present.
- Lymphadenopathy as a clinical symptom may be present with TB, HIV, TB and HIV or other infections or malignancies.

3. Motivation for the study

Emmaus Hospital is a 160-bed district hospital in the Okhahlamba local municipal area, which lies within the uThukela district municipality in northwestern Kwazulu-Natal. The total population of the municipal area is 137

517, and children under 14 constitute 41% of this total. The hospital serves a population of predominantly rural Zulu-speaking people who live in tribal areas (80%), on adjoining freehold land (10%) or on commercial farms (10%). The Okhahlamba area adjoins the central Drakensberg Mountains, declared a World Heritage Site. Despite this recognition, little has improved for the local population. People are generally poor, with most households having no regular income. Environmental health is poor, as the majority of households have no access to piped water, do not use a pit or bucket latrine, do not have their own refuse dump, and do not have refuse removed (StatsSA, Census 2001).

In a recent survey (Okhahlamba Area Development Programme [OADP] Baseline Survey, August 2006) several socio-economic risk factors for childhood TB and HIV and other diseases were identified. These included household overcrowding, high levels of unemployment (68-76%), and the absence of one or both parents in almost a half of households. Food insecurity is prevalent with only 22-35% of mothers/caregivers having enough food every day for everyone throughout the year. Most children do not have a diverse diet, which may mean that they lack essential nutrients. Knowledge of the symptoms of TB and how to prevent transmission was good, but 33-40% of caregivers did not know what should be done with children in a household where someone has TB.

The District Information Officer (DIO) compiles quarterly and annual reports of TB statistics, with the emphasis on adult pulmonary TB, in particular smear

positive TB. For the entire uThukela district municipality, cases of childhood TB diagnosed at all the health facilities made up between 7.5% and 15.5% of all TB cases seen per quarter in 2004/5 (Clarke J. District case finding summary 2006; personal communication; 23 October). No statistics regarding type of childhood TB or completion rates for children are available, as this information is not routinely collected.

Not enough is known about the epidemiology of childhood TB in the Okhahlamba local municipal area surrounding Emmaus hospital however, to guide optimal management. Furthermore, it is not clear how well the SANTCP guidelines for diagnosis of childhood TB are being implemented or whether they are still appropriate within the context of high prevalence rates of HIV infection.

Given the likely magnitude of the problem of childhood TB in the Okhahlamba area, and the difficulties of diagnosis described in the literature, research into the epidemiology and diagnosis of childhood TB in this context is therefore urgently needed.

4. Purpose of research:

The purpose of the research is to describe the epidemiology of childhood TB at Emmaus Hospital and the diagnostic problems encountered in order to develop appropriate clinical guidelines that will improve current practice.

5. Objectives:

- d. To describe the epidemiology of childhood TB at Emmaus Hospital:
 - i) To determine the proportion of total TB cases that is children
 - ii) To determine the proportion of children with pulmonary and extra-pulmonary TB
 - iii) To determine the spectrum of extra-pulmonary TB in children
 - iv) To determine the proportion of children who are cured or complete treatment
 - v) To determine the HIV status of children diagnosed with TB
 - vi) To determine the nutritional status of children diagnosed with TB
- e. To establish the extent to which the SANTCP guidelines for diagnosis of childhood TB are being implemented
- f. To identify other approaches being used to diagnose childhood TB

6. Methods:

a) Study Design

Retrospective descriptive audit of hospital records of children diagnosed with TB.

b) Study Population

All children < 15 years [Standard WHO category for children] initiated on TB treatment, at Emmaus Hospital from 01/01/2004 to 31/12/2006 will be included in the study. The TB register will be used to identify these children.

c) Data collection and analysis

A child with suspected TB may be managed as an outpatient or an inpatient, usually depending on the severity of illness at presentation. Appendix 1 details a patient pathway at Emmaus Hospital for a child with suspected TB.

The following sources of data will therefore be used for the audit:

- The TB register
- In-patient records
- The GW20/12 (Appendix 2)

The TB register will be used to extract data on:

- Total number of patients on TB treatment
- Total number of children on treatment
- Category of patient (new/ retreatment-after previous cure, completion, failure, interruption)
- Site of disease (pulmonary/ extra pulmonary)
- Number of children with miliary TB and TBM
- Regimen for treatment

In-patient records will also be used to extract data on:

- Nutritional status (weight for age)
- Investigations performed
- Method of diagnosis
- Contact identification
- HIV status

The GW20/12 “blue TB form” (completed on initiation of treatment), in order to extract data on:

- As for in-patient records
- Should in-patient records be unavailable the GW20/12 can be used to collect the abovementioned data/ to verify above
- The above data for children managed as outpatients

The data will be extracted onto standardized data capture sheets (see Appendix 3) and entered into a computerised database / spreadsheet for analysis and computation of frequencies and means.

The data form will first be pilot-tested on a sample of five children in order to check for any omissions or necessary corrections.

d) Presentation of findings

The findings of the study will be presented in the form of a report to the medical staff and management at Emmaus Hospital and District Office (District Manager, Communicable Diseases Co-ordinator, District Information Officer) in order to obtain their input on recommendations for improving practice.

Final recommendations will be incorporated into clinical guidelines for use in the hospital and district.

7. Logistics and time schedule:

Time allocated for the various stages in the research process is presented in broad terms. This may be subject to change as potential stumbling blocks are difficult to predict or anticipate.

Pilot Study: 1 week

Literature review: 2 months

Data extraction and synthesis: 2 months

Final analysis and interpretation: 2 months

Integrating results and writing the dissertation: 2 months

8. Ethics:

Approval will be sought from management at Emmaus Hospital.

Approval will be sought from the Research Committee of the School of Child and Adolescent Health, University of Cape Town.

Ethical approval will be sought from the Research Ethics Committee (Health Sciences Faculty) University of Cape Town.

9. References:

Coovadia HM and Wittenberg DF (ed) 1998, Paediatric and Child Health, A Manual for Health Professionals in the Third World, Oxford University Press, Cape Town

Blumberg L, Ogunbanjo G, Durrheim D, 2003, "TB: Current issues on diagnosis and management", SA Family Practice, vol: 45 no: 2 pp38-43

Donald PR, 2002, "Childhood TB: out of control?", Current Opinion in Pulmonary Medicine, vol: 8, pp178-182

Gie R, 2003, Diagnostic Atlas of Intrathoracic TB in Children- a guide for low income countries, International Union against TB and Lung Disease, Paris

Graham SM, Gie RP, Schaaf HS, Coulter JB, Espinal MA, Beyers N, 2004 "Childhood TB: clinical research needs", International Journal of TB and Lung Disease, vol:8, no:5 pp648-657

Hesseling AC, Schaaf HS, Gie RP, Starke JR, Beyers N 2002 "A Critical Review of Diagnostic Approaches used in the Diagnosis of Childhood TB", International Journal of TB and Lung Disease, vol: 6

no: 12, pp1038-1045

Houwert KAF, Borggreven S, Schaaf HS, Nel E, Donald PR, Stolk J, 1998,
“Prospective evaluation of World Health Organization criteria to assist
diagnosis of TB in children”, European respiratory Journal, vol:11,
pp1116-1120

Khan and Starke JR, 1995 “ Diagnosis of TB in Children:
Increased need for better methods”, Journal of Emerg Infect. Dis. Oct-Dec
vol:1 no: 4, pp115-123. Retrieved: 03/04/06 from
<http://www.cdc.gov/ncidod/eid/vol1no4/starke2.htm>

Jeena P, Mitha T, Bamber S, Wesley A, Coutsooudis A, Coovadia HM
1996 “Effects of the human immunodeficiency virus on TB in
children”, TB and Lung Disease, vol: 77 no: 5 pp437-443

Liebeshentz S, Bamber S, Ewer K 2004, “Diagnosis of TB in SA children with
T-cell based assay- a prospective study”, Lancet, Dec 18-31', vol: 364
no: 9452, pp2196-2203

Nelson LJ and Wells CD 2004 “ Global Epidemiology of Childhood
TB”, International Journal of TB and Lung disease vol:8
no: 5, pp636-647

Mehnaz A and Arif F 2005 “Applicability of scoring chart in the early detection

of TB in children", Journal of college of physicians and surgeons-
Pakistan, vol:15, no:9 pp543-546

Okhahlamba Area Development Programme Baseline Survey, World Vision
South Africa, August 2006, Project no:173116 WVUS

Rosen EU 1982, South African Medical Journal "The problems of diagnosis
and treatment of childhood pulmonary TB in developing countries",
special issue 17 November, pp26-28

South African TB Control Programme Practical Guidelines, 2004
The National Department of Health

Statistics South Africa- StatsSA, Census 2001, Population statistics for
Okhahlamba Municipal Area. Retrieved: 30/10/06 from
<http://www.demarcation.org.za>

Swaminathan S, 2004 "TB in HIV-infected children", Paediatric
Respiratory Review vol: 5 no: 3, pp225-230

Van Beekhuizen, 1998 "TB score chart in children in Aitape, Papua
New Guinea", Tropical Doctor July; vol: 28 no: 3, pp155-160

WHO 2006 "Guidance for National TB
Programmes on the management of TB in Children" retrieved

15/09/06 from

http://www.stoptb.org/wg/dots_expansion/assessments/documents/TBChildGuide.pdf

Wilson D, Naidoo S, Bekker L, Cotton M, Maartens G (ed) 2005, Handbook of HIV Medicine Oxford University Press, Cape Town SA Chapter 31 pp275

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Appendix 2: Data capture sheet

Patient			In-patient (IP)	Outpatient (OP)
Data source	GW20/12	IP record	GW20/12 & IP	No records available
Sex			Male	Female
Age			0-4 years	4.1-15yrs
Nutritional status Weight for age			Below 3 rd centile	Above or on 3 rd centile Unknown
Was a TB Assessment Documented?			Yes	No
Was the TB Score Used?			Yes	No
Was the Modified WHO criteria used?			Yes	No
What investigations were Used to make a diagnosis?				
a) Sputum for microscopy				
b) Sputum for culture				
c) Gastric aspirate for microscopy				
d) Chest X-ray				
e) TST				
f) Abdominal ultrasound				
g) Lumbar puncture				
h) Fine needle aspiration of lymph nodes/ masses				
i) Lymph node biopsy				
Other diagnostic methods:				
a) Non-resolving pneumonia only				
b) Referral to regional level				
c) Trial of TB treatment				
d) Other-list				
Pulmonary or Extra-pulmonary TB			Pulmonary	Extra-pulmonary
If, extra-pulmonary, site: Pleura, lymph nodes, meningitis, bones, pericardium, military, other organs				
Treatment completed?			Completed	Defaulted
Was a TB contact identified?				
HIV status:			Yes	No
Laboratory:				
a) Negative				
b) Exposed				
c) Infected				
d) No result				
e) Not tested				
f) Unknown				
Clinical:				
a) Not staged				
b) Stage 1/2/3/4				
c) Unknown				

Appendix 3: Budget

ITEM	UNITS	COST	TOTAL
A. Personnel			R0.00
Personnel Total			R0.00
B. Non-Personnel			
1. Travel: Researcher (clinic visits)	500kms/month	@ R 2.41 / km = R 1205 x 1 month	R 1205
2. Equipment: Laptop		R7495	R7495
Carrying case		R240	R240
3. Consumables: Office supplies			R 400
Printing/copying			R 300
Non-Personnel Total			R9640
C. Administrative			
Postage/ Courier services		R500	R500
Administrative Total			R500.00
TOTAL			R10 140

Proposed Budget for "The Epidemiology and Diagnosis of Childhood Tuberculosis at a District Hospital in Kwazulu-Natal, South Africa- A retrospective audit of clinical practice"

Appendix 4 – Letter from Emmaus Hospital Management



HEALTH
KwaZulu-Natal

EMMAUS HOSPITAL

Cathedral Peak Road
Private Bag x 16 , Winterton, 3340
Tel: 036 488 1570, Fax.: 036 488 1330
E- mail.: h030504@dohho.kzntl.gov.za

Enquiries : Mr L.T. Mazibuko
Telephone : (036) 488 8203

07 November 2007

Dr Samantha Padayachee
P.O. BOX 49
WINTERTON
3340

REQUEST FOR PERMISSION TO CONDUCT CLINICAL AUDIT FOR RESEARCH PURPOSES

Your letter dated 18 October 2006 2007 refers.

In the interest of effective service delivery and self development for the future benefit of our institutional context and health services at large, your request around the research topic titled “ The Epidemiology and Diagnosis of Childhood Tuberculosis at a District Hospital in Kwazulu-Natal South Africa” is hereby approved and supported.

Permission is granted to access relevant records in line with the records management regulatory framework.

With hope that your research will yield good results.

MR L.T. MAZIBUKO
HOSPITAL MANAGER

UMnyango Wezempilo . Departement van Gesondheid

Fighting Disease, Fighting Poverty, Giving Hope

Appendix 5: Ethical clearance letter

FROM

(WED) AUG 22 2007 8:51/ST. 9:50/No. 7506042188 P 1

UNIVERSITY OF CAPE TOWN



Health Sciences Faculty
Research Ethics Committee
Room E52-24 Groote Schuur Hospital Old Main Building
Observatory 7925
Telephone (021) 406 6338 • Facsimile (021) 406 6411
e-mail: research@curiv.uct.ac.za

06 February 2007

REC REF: 049/2007

Dr S Padyachee
c/o Mr J Islam
SCAH
UCT

Dear Dr Padyachee

PROJECT TITLE: THE EPIDEMIOLOGY AND DIAGNOSIS OF CHILDHOOD TUBERCULOSIS AT A DISTRICT HOSPITAL IN KWAZULU NATAL, SOUTH AFRICA.

Thank you for submitting your study to the Research Ethics Committee for review.

I have pleasure in informing you that the Ethics Committee has formally approved the above mentioned study:

This serves to confirm that the University of Cape Town Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Convention on Harmonisation Good Clinical Practice (ICH GCP) and Declaration of Helsinki guidelines.

The Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 312.61 and 312.62.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

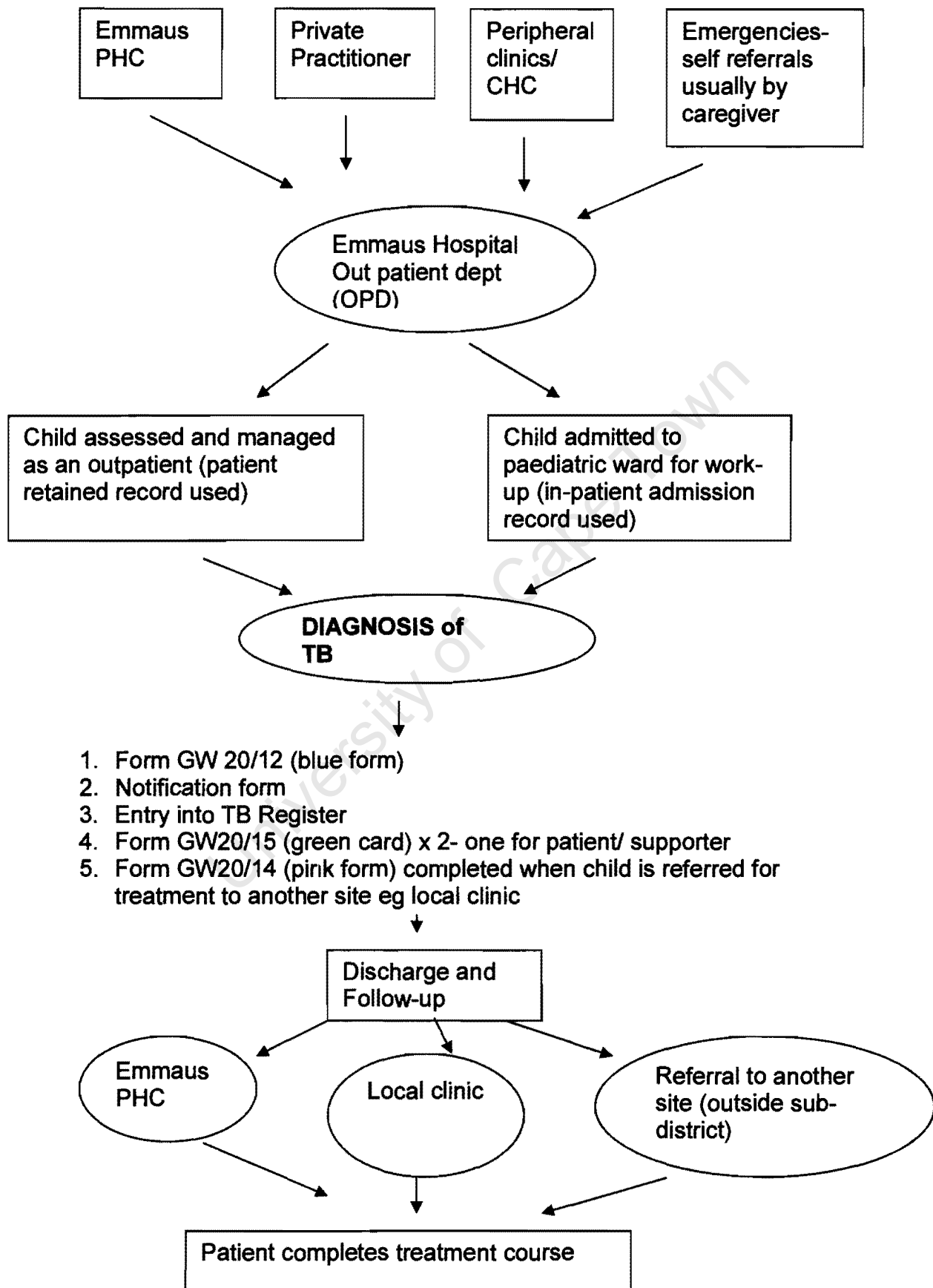
Please quote the REC. REF in all your correspondence.

Yours sincerely

PROF. M. BLOCKMAN
CHAIRPERSON, HSF HUMAN ETHICS

lsc/jed

Appendix 6: Clinical pathway for child with suspected TB at Emmaus hospital



Appendix 7: GW20/12 (SANTCP Guidelines, 2004, pp 93-96)

**SOUTH AFRICA
NATIONAL TUBERCULOSIS CONTROL PROGRAMME
PATIENT CLINIC/HOSPITAL CARD**

y y y y

Registration number cccc/cccc Transferred/ c N = Newly registered.
Moved? M = Moved in from facility in this district
T = Transferred in from facility in another district

d d m m y y y y

Registration date cc/cc/cccc

Health District _____ Clinic/Hospital _____ Treatment point _____

Surname _____ Full name (s) _____

Home address _____
(First) _____

Work address _____

Telephone (H) _____ Telephone (W) _____

Home address _____
(New) _____

Work address _____

Telephone (H) _____ Telephone (W) _____

Race c 1 = African/Black Gender c M/F Age cc Years
2 = Coloured d d m m y y y y
3 = Indian/Asian Date of birth cc/cc/cccc
4 = White
5 = Unspecified/Other

PATIENT CATEGORY

c (N) New Patient c (RF) Retreatment after failure
c (RC) Retreatment after previous cure c (RI) Retreatment after interruption
c (RAC) Retreatment after previous completion

INTERNATIONAL CODE FOR DISEASE

cA16.2 TB PULMONARY cA16.7 TB primary cA18.8 TB other organs
cA16.3 TB lymph nodes cA17.0 TB meningitis cA19.9 TB miliary
cA16.5 TB pleura/other resp org cA18.0 TB bones/joints

NOTIFICATION INFORMATION

Has patient been notified? cYes cNo Date of birth cc/cc/cccc

Completed by _____ Telephone number _____

SPUTUM RESULTS

Pre - Treatment		End of intensive Phase (2/3 months)		Discharge		Culture **		
Smear Date(s)	Smear Result(s)	Smear Date(s)	Smear Result(s)	Smear Date(s)	Smear Result(s)	Specimen Date(s)	Culture Result	Suscept Results

** Non-converters and retreatment cases

REGIMEN AND DOSAGES

Treatment start date

Regimen 1 - New adult c Regimen 2 - Retreatment adult c Regimen 3 - Children c cc/cc/cccc

a. INITIAL INTENSIVE PHASE

Other drugs (specify)

Drug	RHZE	RHZ	S					Weight at Diagnosis
Number tabs								kg.

H = Isoniazid

R = Rifampicin

Z = Pyrazinamide

E = Ethambutol

S = Streptomycin

* The use of fixed-dose combinations is a central part of national TB Programme guidelines.

Use one of the following symbols in the upper space of the appropriate box and initial in the lower space after the drugs have been administered:

u= Medication taken under supervision at clinic.

X = Patient did not collect medication.

O = Patient did not have to collect medication (e.g. weekend).

- = Medication collected for self-administration or supervision elsewhere; draw horizontal line (-) to indicate number of days supply was given.

	Day																																	
Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			

b. CONTINUATION PHASE

Drug	RH	E						Weight at Diagnosis
Number tabs								kg.

	Day																																	
Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			

TREATMENT SUPERVISOR

c Relative c Employer c Teacher c Community health worker c Clinic nurse c Other

Name

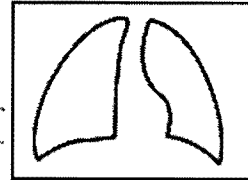
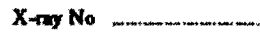
Address

Telephone No.

Code

Draw in pre- and post-treatment chest X-ray pictures if taken

X-ray No for records please attach to this document before it is filed



Notes

[illegible]

PATIENT CONTACTS

Name and Surname	Relationship	Age	Sputum		X-ray		Tuberculin test	
			Date	Result	Date	Result	Date	Result
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Number of contacts traced cc

Number of contacts treated cc

TREATMENT OUTCOME

- c(C) Cured; Patient who is smear-negative at, or one month prior to, completion of treatment and on at least one previous occasion
- c(TC) Treatment completed without bacteriologic proof of cure
- c(TF) Treatment failure, patient remains, or becomes again smear-positive at 5 months or later during treatment
- c(D) Patient died (any reason)
- c(TI) Treatment interrupted for 2 or more months
- c(TRAN) Patient transferred to another district: treatment outcome unknown
- c(MVD) Check here if patient MOVED to another facility in the SAME district

COMMENTS

d d m m y y y y

Discharged by (print name) _____ Date of discharge cc/cc/cccc

Appendix 8: Health facilities in Okhahlamba

