

PERSPECTIVES OF BOTSWANA POLICY-MAKERS AND HEALTHCARE WORKERS
TOWARDS TUBERCULOSIS INFECTION CONTROL AND OCCUPATIONAL HEALTH
MEASURES: AN INTERPRETIVE DESCRIPTION STUDY.

by

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Abstract

Mycobacterium tuberculosis (TB) infection results in over 2 million deaths worldwide annually, with low and middle-income countries disproportionately affected. According to the World Health Organization, Botswana, a middle-income country, had a TB notification rate of 478 cases per 100 000 in the general population in 2012. High rates of TB in patients are directly correlated with a greater risk of infection in healthcare workers. The control of occupational TB is important as TB disease can lead to increased morbidity in healthcare workers, which can lead to compromised healthcare provision. The aim of our study was to explore perspectives of policy-makers and healthcare workers regarding formulation and implementation of occupational health and infection prevention measures used to control occupational TB.

Our nine-month data collection period was based in Botswana, in four health institutions (two public and one private hospital, and one administrative). We conducted semi-structured in-depth interviews with twenty-one personnel in leadership positions in areas of infection control, occupational health, and TB program coordination. We conducted five focus groups with healthcare workers who have direct contact with TB patients, to explore their perspectives towards implementing TB guidelines. Theoretical sampling was used in recruiting participants. We chose the qualitative methodology interpretive description to analyze participants' responses.

The primary findings were conceptualized under four major themes; occupational health services, infection control, guidelines and policies, and barriers to implementation. There was uniformity and agreement among policy-makers and program leaders that there were limited occupational health and infection control measures. Most were also of the perspective that if healthcare workers were diagnosed with TB, there was inadequate evidence to support nosocomial acquisition. Healthcare workers identified their challenges in preventing TB in their workplaces, some of the barriers were guideline related, while others were related to institutional structures. A concept original to this study, 'Armouring' revealed lack of communication and disparity of control measures between professional healthcare workers and cleaners and drivers. Evaluating the guidelines using the AGREE II tool demonstrated that the guidelines did not contain all the important elements that the AGREE II tool required to make up robust, effective and implementable guidelines.

Lay Summary

Every workplace has hazards that can potentially put the health of workers at risk. Hospital workers face a rather unique situation as in addition to the chemical, biological and physical hazards that may be in their work environment, the needed services they provide to patients with infectious diseases, increase their exposure and transmission risk. Our study was conducted in Botswana, where there is a relatively high prevalence rates of HIV/AIDS and TB. We sought to understand the perspectives of policy-makers and healthcare workers regarding working in an environment with high levels of TB and formulating and implementing TB policies and guidelines. The findings from this research will inform policy-makers about perspectives of healthcare workers as far as implementing TB infection prevention and occupational health control measures is concerned. Findings from the study will be shared with all institutions that participated, other major hospitals in Botswana and possibly other African countries.

Preface

Approval to conduct the study was granted by the University of British Columbia Behavioral Ethics Board, Ethics Application ID H12-00199. It was also approved by the Ministry of Health in Botswana, Princess Marina Hospital, Scottish Livingstone and Gaborone Private Hospital.

All data collection in the form of in-depth interviews, focus groups and guideline and policy instruments were collected by the author. All data analysis was conducted by the author.

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List of Abbreviations and acronyms

Cases

AGREE: Appraisal of Guidelines for Research and Evaluation	6
AIHA: American Industrial Hygiene Association	16
AIIR: Airborne Infection Isolation Rooms	14
ARV: Anti-Retro Viral	96
BCG: Bacillus Calmette-Guerin	106
BNTP: Botswana National TB Program	35
BSC: BioSafety Cabinet	101
CAQDAS: Computer Assisted Qualitative Data Analysis Software.....	60
CDC:Center for Disease Prevention and Control	13
CMS: Central Medical Stores (Botswana).....	88
DOTS: Direct Observed Therapy Short course	24
HCW: Healthcare worker	2
HEPA: High-Efficiency Particulate Air (filter)	14
HHEs: Health Hazard Evaluations.....	18
HIV/AIDS: Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome	1
ID: Interpretive Description	42
ILO: International Labour Organization	171
IPC: Infection Prevention and Control	20
LEV: Local Exhaust Ventilation.....	271
LMIC: Low and Middle Income Country.....	2

LTBI: Latent TB Infection.....	14
MDR-TB:Multi-Drug Resistant Tuberculosis	1
MTB: Mycobacterium tuberculosis	1
NIOSH: National Institute for Occupational Safety and Health.....	15
NTIC: Tuberculosis Infection control guidelines	202
OEH: Environmental and Occupational Health.....	166
OH: Occupational Health or Occupational Hygiene	20
OHS: Occupational Health and Safety	271
OSHA: Occupational Safety and Health Act.....	17
PBRS: Performance Based Reward System	113
PPD: Purified Protein Derivative.....	105
PPE: Personal Protective Equipment	18
RFLP: Restriction Fragment Length Polymorphism	12
TB: Tuberculosis.....	1
TBIC: TB Infection Control.....	25
TST: Tuberculin Skin Testing	14
UVGI: Ultraviolet Germicidal Irradiation	14
WHO: World Health Organization	2
XDR-TB: Extensively-Drug Resistant TB	1
Xpert MTB/RIF: GeneXpert for testing Mycobacterium tuberculosis and resistance to Rifampicin (RIF).....	124

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9. I thank God, through Jesus Christ, for sustaining me and finishing what He started (Philippians 1:6).

Dedication

For my children; Reitumetse Natasha, Isaac Jr and Elijah Maatla and the generations of
Gamontles and Phiris after me;

May your path be easier!

Chapter 1: Introduction

1.1 Global burden of TB

Mycobacterium tuberculosis (MTB) infection resulted in over 2 million deaths and over 10 million people (worldwide) contracted TB in 2016, with middle and low-income countries disproportionately affected (World Health Organization, 2017). According to Sepkowitz (Sepkowitz, 1994), tuberculosis (TB) infection and disease was a serious cause of death in the early 1900s, but the introduction of chemotherapy to treat TB substantially reduced the number of deaths as well as the gravity of TB as a public health threat (Cobelens, 2007). However, the increase in the number of global TB-related deaths in the past few decades undermines the strides that had been made in terms of reducing TB disease and deaths worldwide since the 19th century (Fairchild & Oppenheimer, 1998).

The emergence of HIV/AIDS infection in the 1980s is associated with an increase in the prevalence and incidence of TB (World Health Organization, 2017). This co-morbidity and a host of other factors such as the development of resistance to antibiotics, lack of rigor in prevention and control measures and others, have led to resurgence and outbreaks of TB, Multi-Drug Resistant TB (MDR-TB) and Extensively-Drug Resistant TB (XDR-TB) particularly in low-resource settings (World Health Organization, 2017). Tuberculosis is now the leading cause of death among adults surpassing other communicable diseases such as malaria and even Human

Immunodeficiency Virus (HIV), which was instrumental in the reemergence of TB (World Health Organization, 2016).

Healthcare workers (HCWs) are at the forefront of providing care for TB patients, which places them at a higher risk of TB occupational exposure compared to other occupational groups or the general population (World Health Organization, 2016). High prevalence of TB in patients are directly correlated to greater risk of infection in healthcare workers (Maloney et al., 1995) . In 2015, WHO estimated that the prevalence of TB among HCWs was more than double that of the general population, per 100 000 (World Health Organization, 2016).

Occupational TB exposures in high-income countries remain low because of resource-availability and rigorous implementation of infection control measures. The situation is different in low and middle-income countries (LMICs), which disproportionately have the highest burden of global TB (see Figure 1.1); 90% of those with TB are found in these countries (Joshi, Reingold, Menzies, & Pai, 2006; Owie HO, 2016). Due to limited resources, LMICs limit TB management, if any, to identifying TB cases, providing chemotherapy and reporting case rates. Population rates of TB in high-burden parts of Sub-Saharan Africa are well known but exposures and infection and disease rates in healthcare workers are increasingly being documented (Nathavitharana et. al., 2017; Harries et. al., 1997).

1.2 Healthcare worker TB burden in lower and middle-income countries

In response to the high incidence rates of TB in the general population, in 1999, WHO developed guidelines for implementation for the prevention of tuberculosis in healthcare facilities in resource-limited settings. These guidelines provided relatively inexpensive and easy to implement infection prevention measures which could be used in LMIC to reduce TB in healthcare settings (WHO,1999).

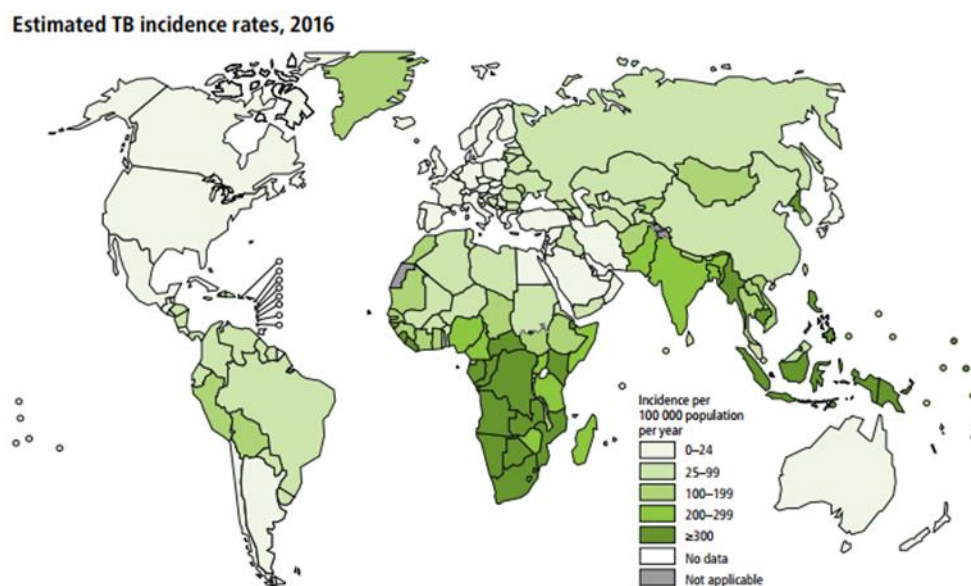


Figure 1.1 Global estimated TB incidence rates, general population, 2016 (Permission to use the figure granted under Creative Commons Attribution-NonCommercial-ShareAlike

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The effectiveness of the infection control methods has not been extensively evaluated in LMIC, however, there is an emerging body of evidence from LMIC on occupational TB among

healthcare workers as well as occupational health and infection control strategies pointing to increasing awareness (Agaya et al., 2015; Cobelens, 2007; Evans & Bekker, 2016; Harries, Nyirenda, Banerjee, Boeree, & Salaniponi, 1999; Matuka et al., 2015; Rothe, Schlaich, & Thompson, 2013; Sissolak, Marais, & Mehtar, 2011; Zelnick, Gibbs, Loveday, Padayatchi, & O'Donnell, 2013).

The majority of the above-mentioned studies are from South Africa. In neighboring countries like Botswana, there are limited studies for TB rates in the general population, as well as little information on incidence rates among healthcare workers or those pertaining to infection control or occupational health measures. Studies from the Sub-Saharan region rarely provide insights on perspectives of healthcare workers in regard to the implementation of infection control and occupational health measures. Equally missing are perspectives of policy-makers regarding the process of creating and implementing policies and guidelines for preventing TB among healthcare workers.

1.3 Justification of research

According to the WHO global tuberculosis report from 2017, Botswana had an estimated TB incidence rate of between 300- 499 cases per 100 000 per year (World Health Organization, 2017). One clinical study of tuberculosis in Botswana explored the molecular epidemiology of TB among the general population (Lockman et al., 2001). Another aimed to understand the risk factors of TB transmission from HIV positive patients (Kenyon et al., 2002). As in other Sub-Saharan African countries, the incidence and prevalence of TB in healthcare workers in Botswana has not been extensively studied.

There is one occupationally-oriented study which was conducted in Gaborone, Botswana at a US government office. This was a case-finding study as there had been an employee infected with laryngeal TB, and the researchers sought to understand whether other employees were exposed and infected (Kenyon, Copeland, Moeti, Oyewo, & Binkin, 2000). Another study by Emerson and colleagues (2016) evaluated TB infection control implementation in Botswana and Zambia. However, none of the studies mentioned above evaluated perspectives in depth of healthcare workers regarding infection control and occupational health measures, nor did they employ the use of a qualitative framework in their methodology or analysis. The current dissertation addresses both these research gaps.

1.4 Statement of objectives

The aims of the proposed study are: (1) using interpretive description qualitative framework, to explore in an in-depth manner, the nuances in the perspectives and attitudes of policy-makers , TB program leaders and healthcare workers towards formulating and implementing infection prevention measures that control occupational TB and (2) to evaluate, using the modified version of Appraisal of Guidelines for Research and Evaluation (AGREE) tool, the existing infection control and occupational health guidelines used to prevent occupational TB in three hospitals (2 public and 1 private) in Botswana.

1.5 General research questions

1.5.1 Research Question 1

What are the perspectives of policy-makers and hospital leaders towards infection control and occupational health policies and guidelines?

1.5.2 Research Question 2

What are the perspectives and attitudes of healthcare workers who have direct contact with TB patients, toward the process of implementing guidelines used in preventing exposure to occupational TB?

1.5.3 Research Question 3

What is the quality of the infection control and occupational health policies and guidelines used to minimize the risk of transmission of TB to healthcare workers as determined by the Appraisal of Guidelines for Research & Evaluation (AGREE) instrument?

1.6 Structure of the dissertation

To respond to the research questions above the dissertation is divided into the following sections:

1.6.1 Chapter 2 - Literature review

The literature reviewed looks at the broad and global burden of TB, followed by the incidence of TB among healthcare workers in high-income countries. It narrows and focuses on TB burden among healthcare workers in lower and middle-income countries particularly Sub-Saharan Africa, followed by studies on infection control practices in the region. The literature review concludes by pointing out the gaps in the literature and how this dissertation proposes to address the gaps.

1.6.2 Chapter 3 - Research site description

This brief chapter describes the demographics and healthcare system of Botswana and the specific details where data collection for the current research took place.

1.6.3 Chapter 4 - Interpretive description

The qualitative methodology Interpretive Description is discussed in detail in this chapter, including its origins, how it has been applied in research thus far, as well as its pros and cons. The justification for selecting interpretive description and the approach to coding are detailed in this chapter.

1.6.4 Chapter 5- Perspectives of healthcare workers

Chapter 5 Describes the participant recruitment process, the demographics of participants and how the interviews and focus groups were conducted.

1.6.5 Chapter 6- Analysis of In-depth interviews and focus groups

The coding strategy including first and second cycle of coding is described and it is demonstrated how categories and themes were derived.

1.6.6 Chapter 7- Findings, in-depth interviews and focus groups

The four primary categories and the varying themes under each of them are described in detail.

1.6.7 Chapter 8 – Discussion, In-depth interviews and focus groups

The salient themes from findings are interpreted and discussed in light of the current and relevant literature.

1.6.8 Chapter 9- Evaluation of guidelines

This chapter covers a brief relevant literature review followed by evaluation of guidelines using a modified ‘Appraisal of Guidelines for Research and Evaluation.’ Findings from the evaluation and discussion are included.

1.6.9 Chapter 10 - Strengths, limitations, recommendations and future studies

The limitations of the methods and the overall research project are discussed in this chapter.

Recommendations based on the findings from chapters 5 and 6 are enunciated and future studies are proposed building on the findings of the current study.

1.6.10 Chapter 11- Conclusion

The final chapter synthesizes findings from all chapters and provides concluding remarks.

References and appendices are included in the unnumbered but titled last two sections of the thesis.

Chapter 2: Literature review

2.1 TB, exposure and disease

Tuberculosis disease is caused by *Mycobacterium tuberculosis*, an acid-fast, rod-shaped, gram-positive bacterium. The *Mycobacterium tuberculosis* cell wall has been shown, using electron microscopy, to comprise four layers; the inner plasma membrane, an electron-dense layer, and electron transparent zone and an outer dense layer (Crick, Brenman, & Mcneil, 2004). The electron dense layer contains peptidoglycans, while the outer layer consists of glucans, lipids proteins, mannans, xylan and possibly lipoarabinomannan (Crick et al., 2004). Overall, the structure of the cell envelope plays an important role in the uptake of the *M. tuberculosis* into macrophages; evasion of the immune system and its suppression, as well as its airborne transmission (Crick et al., 2004).

Tuberculosis (TB) has been considered contagious since the 17th century although this knowledge was contested during the 19th century (Nardell Edward & Sepkowitz Kent, 2004). Up until 1935, TB was considered to be transferred from direct contact between infected and uninfected persons. Between 1935 and 1942 William Firth Wells attempted to demonstrate the possibility of infection through the airborne route, however, because his experiments on measles were not able to be replicated, it was concluded that it is not possible for any contagious disease to be transmitted via the airborne route (Nardell Edward & Sepkowitz Kent, 2004). It was an 'experiment by Wells' student, Riley, which demonstrated that TB was

transmitted through the airborne route (Nardell Edward & Sepkowitz Kent, 2004). Riley et al., (1959) conducted their 2-year experiment between November 1956 and November 1958 in a 6-room tuberculosis ward which had a controlled and calibrated circuit ventilation system. A large animal chamber, 5 feet high and a diameter of 5 feet, was positioned in the outtake air duct of the ventilation system. Thirty-six cages housing 3-5 Guinea pigs each were placed in the the animal chamber and were exposed to the air from the ward (Riley et al., 1959). Out of a total of 373 guinea pigs placed in the chambers and exposed to air from the tuberculosis ward, 71 developed TB disease (Riley et al., 1959).

In his seminal work, Wells (1955) in his book, *Airborne contagion and air hygiene*, writes of experiments which demonstrated that some bacteria, commonly atomised via the nose and throat, were recovered in centrifuge tubes, and it was observed that these microbes could remain distributed throughout the room long after the occupants left. Wells (1955), using Raoult's law, inferred that because of the atomised droplets' large surface area, they evaporated relatively quickly, leaving a droplet nucleus which had a slower settling velocity. This mechanism is important in the transmission of the TB bacilli because the small TB droplet nuclei (in infection control) or respirable bioaerosols (in occupational hygiene lexicon) can remain in the air for hours, thus creating potential exposure.

There are two stages in the development of TB, infection and disease. A person's exposure and possible infection depend on the type of TB, with pulmonary TB being the most infectious of all

TBs (Enarson D.A., Chiang Chen-Yuan, Murray J.F., 2004). The persistence of tubercle bacilli in the environment plays a role in exposure; if there are no measures of removing the bacilli from the environment, then there will be a greater concentration, which can potentially increase the risk of exposure. The volume of aerosols generated by a person with TB, the proximity to and length of time near the infected (and particularly the untreated) person, and the potency of the bacilli (smear-positive), all play a role in determining exposure to TB (Enarson D.A., Chiang Chen-Yuan, Murray J.F., 2004).

A different set of factors determines whether a person exposed to TB develops disease. TB infection can be latent, or sub-clinical, and whether that state develops into active disease depends on various factors including: a person's age and the status of their immune system. (Enarson D.A., Chiang Chen-Yuan, Murray J.F., 2004; Ogunremi, Menzies, & Embil, 2014). Young children are at a greater risk of developing TB disease, as well as people whose immune systems have been weakened by other medical conditions, such as silicosis, diabetes mellitus, cancer and HIV (Enarson D.A., Chiang Chen-Yuan, Murray J.F., 2004). The latter is particularly important as the current study focus on the region of the world where there are known high incidence and prevalence of HIV.

2.2 Trends in TB occupational exposures of healthcare workers

Although TB is currently accepted as a nosocomial, occupational and compensable disease in some jurisdictions, for example North America, this classification was highly contested in the early 1900s, with opponents of this proposal stating that TB sanatoria were in fact the safest places as far as possible infection was concerned (Sepkowitz, 1994). By the 1950s, consensus was reached, and TB was then recognized as an occupational disease. Molecular techniques such as restriction-fragment-length polymorphism (RFLP) were used to demonstrate linkages between strains of TB detected in infected healthcare workers, to the patients they had contact with, which provided evidence that the healthcare workers were exposed in the workplace (Zaza et al., 1995).

The control of occupational TB is important as it can lead to increased morbidity and mortality in healthcare workers and loss of skilled labour which can ultimately lead to compromised healthcare provision (Joshi et al., 2006).

Traditionally, evaluation and control of occupational hazards is the domain of occupational hygienists and occupational health and safety professionals. However, the control of occupational TB among healthcare workers is unique because it takes place primarily in an occupational domain where the most common exposures are biological and infectious in nature. Another factor is that occupational TB exposures in healthcare workers are almost inextricably linked to patient care and nosocomial infections. This then puts the study of

occupational TB at the intersection of occupational health and infection control, and most studies do not attempt to make a distinct separation of whether their study follows infection control tenets (breaking the cycle of transmission) or those of occupational hygiene (hierarchy of controls). This confluence is crucial as it may mask what truly needs to be studied and by whom. For instance, there are limited occupational hygiene/health studies which pinpoint and compare healthcare worker tasks which may place workers at risk. However, more recent studies especially from Sub-Saharan Africa are beginning to note that lack of strong occupational health systems is a matter of concern and may contribute to the spread of TB and subsequent high incidence among healthcare workers (Nathavitharana et al., 2017; Owie HO, 2016).

A global resurgence of TB occurred in the 1980s due to (1) the emergence of HIV and HIV/TB comorbidity; (2) delays in TB diagnosis and treatment (3) inadequate infection control practices and (4) emergence of drug resistant TB strains (Jensen et al., 2005). In response to the increase in incidence of TB, governments in high-income countries developed various measures to curb this epidemic. For instance, in 1990, the United States Center for Disease Control (CDC), formulated Guidelines for preventing transmission of tuberculosis followed by *guidelines for preventing the transmission of mycobacterium tuberculosis in health-care facilities* in 1994 (Jensen et al., 2005; Maloney et al., 1995).

To prevent TB exposures in healthcare workers, the guidelines produced by CDC emphasized among other recommendations, engineering and environmental controls, administrative controls and personal protective equipment (respiratory protection) (Jensen et al., 2005).

2.2.1 Infection control measures in high-income countries

The Public Health Agency of Canada (Ogunremi et al., 2014) recommends number of infection prevention and controls for the hospital setting that are described in detail below.

2.2.2 Administrative controls

These include institutional policies and measures that aim to reduce the amount of time patients with active TB are placed in Airborne Infection Isolation Rooms (AIIR). Ogunremi et al., (2014) state that administrative measures include occupational health programs. Occupational health programs then initiate healthcare workers exposure prevention programs such as tuberculin skin testing (TST) for evaluating latent TB infection (LTBI).

2.2.3 Environmental (engineering) controls.

These measures seek to control and reduce the concentration of viable airborne *Mycobacterium tuberculosis* in hospital facilities. These include the use of ultraviolet germicidal irradiation (UVGI) which inactivate the bacilli and high-efficiency particulate air (HEPA) Filters which filter out the tubercle bacilli from the indoor air. Removal of the bacilli is particularly important if the air is to be recirculated back into the patient's room. Airborne Infection

Isolation Rooms are to be under negative pressure with 6 -12 air changes per hour, and to exhaust the air to the external outdoor environment.

2.2.4 Personal Protective Equipment

The final tier of the infection control paradigm is personal protective equipment (PPE). These create a barrier between the healthcare worker and infectious bacilli in the environment. A National Institute for Occupational Safety and Health (NIOSH)- certified, fit tested, half-face disposable respirator with a N95 filter is worn by healthcare workers. The patient with active TB wears a surgical mask to trap exhaled droplets that may contain the bacilli (Ogunremi et al., 2014).

2.2.5 Occupational hygiene/occupational health and TB exposures in the high-income countries

Occupational hygiene/industrial hygiene is a field specializing in recognizing, evaluating and controlling chemical, biological, physical, ergonomic hazards that have the potential to cause discomfort or ill-health to employees in the work place (Guidotti, Cowell, & Jamieson, 1989; Olishifski, 1980).

The American Industrial Hygiene Association (AIHA) defines industrial hygiene as:

“That science and art devoted to the anticipation, recognition, evaluation, and control of those environmental factors or stresses arising in or from the workplace, which may cause sickness, impaired health and well-being, or significant discomfort among workers or among the citizens of the community.” (Perkins, 2008).

Occupational hygiene falls within the umbrella of occupational health which comprises many individual fields such as occupational physician, occupational health nurse, safety engineer, rehabilitation counselor and others (Guidotti et al., 1989). The term occupational health is sometimes used synonymously with programs provided by any of the fields under the umbrella field/term, occupational health. In this dissertation, the use of the term ‘occupational health’ is interpreted through the lens of occupational hygiene.

As mentioned in section 2.2, the controls for TB both from infection control and occupational health paradigm within the hospital environment are intricately linked to a point where some infection control programs view occupational health controls as part of a grander scheme of infection control, an example of this being Ogunremi and colleagues including occupational health as part of the infection controls administrative controls (Ogunremi et al., 2014). It is interesting to note though that the regulatory approach to controls for occupational TB were originally drawn from industrial hygiene’s hierarchy of controls (McDiarmid et al., 1996). Classically, the engineering controls in occupational hygiene’s hierarchy of controls are

preferred over administrative controls, however, due to the need to promptly identify TB suspects and patients, isolate and provide treatment, administrative controls which include work practices and policies take precedence over engineering controls (McDiarmid et al., 1996)

In 1993 Occupational Safety and Health Act (OSHA) promulgated a memorandum, *"The OSHA Enforcement Policy for Occupational Exposure to Tuberculosis"* which outlined how TB healthcare exposures ought to be handled (Davis, McCray, & Simone, 1997; Decker, 1993). The policy based on OSHA's general duty clause, section 5(a)1 which states that; "shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees"(OSHA, 1970). The recommendations were based on the *"Guidelines for Preventing The Transmission of Tuberculosis in Healthcare Settings"* developed by the CDC and published in 1990 (Decker, 1993). The policy listed the following abatement methods:

- (1) Protocols for early identification of persons with active TB.
 - (2) Medical surveillance of HCWs, both baseline and follow-up TST.
 - (3) Evaluation and management of HCWs with positive TST.
 - (4) Placing patients with suspected or confirmed patients in isolation rooms.
 - (5) Training and education of HCWs about TB.
 - (6) Respirators with HEPA filter to be donned by HCWs entering isolation rooms
- (Davis et al., 1997; Decker, 1993).

In order to keep abreast with OSHA's policies, an occupational health research institute, NIOSH conducts health hazards evaluations (HHEs) at the request of employers. HHEs are known to assist employers and their workforce recognize and control hazards in the workplace using occupational hygiene's hierarchy of controls (Center for disease prevention and control, 2017). Below is an example of an HHE as described by (de Perio & Niemeier, 2014) when they conducted a NIOSH TB evaluation of exposure investigation at an Arizona hospital.

The Arizona hospital requested the HHE to specifically evaluate infection control and occupational health measures because a patient was diagnosed with TB disease in January 2011. Five months after a nursing assistant was confirmed to have active TB disease and after contact tracing, there were 11 tuberculin skin test (TST) conversions among employees suggesting workplace transmission (de Perio & Niemier, 2014).

The purpose of the HHE was; (a) to determine the incidence of latent and active TB disease among the workers, (b) evaluate administrative, engineering and personal protective equipment(PPE), and to recommend ways in which infection control and occupational health controls could be improved (de Perio & Niemier, 2014). The evaluation comprised two elements; (1) confidential medical interviews with the hospital workers as well as reviewing relevant records and, (2) assessment of ventilation in the isolation rooms. Forty-one workers were interviewed on the knowledge of TB exposure and disease. The assessment of ventilation

included conducting a walk-through assessment to observe ventilation systems and to measure and visualize airflow from mechanical ventilation (de Perio & Niemier, 2014).

2.3 TB occupational exposures of healthcare workers in LMICs

Due to the rigorous implementation of the infection control measures mentioned in 2.2 tuberculosis disease among healthcare workers declined in high-income countries, but not in LMICs. In many countries, Sub-Saharan Africa countries in particular, the risk factors among healthcare workers remain unrecorded, and resulting exposures and disease incidence are only now beginning to be understood as described below.

2.3.1 Risk factors of HCW occupational TB in LMICs

Tudor and colleagues (2016) sought to explore the occupational risk factors for Tuberculosis among healthcare workers in KwaZulu-Natal, South Africa. They used a self-administered questionnaire to conduct a case control study of HCWs diagnosed with TB. One thousand four hundred and twenty-seven (1427) occupational health medical records were reviewed. There were eighty-three (83) TB cases and 224 Controls. It was found that HIV was the strongest independent risk factor for active TB. The duration of time HCWs spent with TB patients was also a risk factor. A HCW spending less than 8hrs with patients had 2-fold less risk of developing TB, than those spending over 8hrs. The majority of cases were nurses, while the risk of TB did not differ for other health professionals. Healthcare workers had twice the incidence of TB compared to the general population. According to the authors the findings strongly suggest

that infection prevention and control (IPC) and occupational health (OH) measures are not effective at preventing occupational TB (Tudor et al., 2016).

Similarly, Galgalo and colleagues (2008) sought to determine the risk of Tuberculosis among staff of a large public hospital in Kenya. They explored: (1) description of hospital staff; (2) an observation of infection control practices and (3) a case control study to identify risk factors. They found that two hundred and fifteen (215) HCWs were treated for TB between 1st January 2001 and 15th September 2005. The annual TB incidence rates among HCWs ranged from 645 to 1115 per 100 000. Seventy-one (33%) of the cases had medical charts for review and 46 out of the 71 (65%) were treated for pulmonary TB. Human Immunodeficiency Virus (HIV) results were found in 22/71 charts, and 19 out of 22 (86%) were HIV-positive.

The number of hours spent in the room with patients was greater for cases (7.4 hours, range 0-15 hours), while for the controls the time spent giving care to patients was 4.9 hours (range 0-14 hours). Cases were more likely than controls to live in a slum (17% vs 8%) or in hospital-provided low-income housing (25% vs 16%). Twelve cases (19%) was reported to have HIV infection, compared to 2 (1%) reported for controls (Galgalo et al., 2008).

2.3.2 Prevalence and incidence of TB among HCWs in LMICs

Prevalence and incidence HCW TB studies are common in Sub-Saharan Africa as researchers aim to estimate the magnitude of TB in healthcare workers.

Kayanja and colleagues (2005) explored Tuberculosis infection among healthcare workers in Kampala, Uganda. They conducted a cross sectional study to estimate the prevalence of TB among HCWs in 3 hospitals (one public and 2 private). The primary aim of the study was to estimate latent TB infection among healthcare workers.

Four hundred and eleven TST were evaluated, 15 HCWs did not return for the TST review. Seventy-nine percent (79%) had no history of contact with a TB patient outside the hospital. Fifty-seven percent (57%) of HCWs had TST $\geq 10\text{mm}$, which indicates that they tested positive for LTBI. Age and department were associated with higher likelihood of TST $\geq 10\text{mm}$; LTBI prevalence increased with age, 67% in older group and 45% in younger group. HCWs from laboratory and clinical departments had higher prevalence of LTBI compared to administrators.

In KwaZulu Natal, O'Donnell and colleagues (2010a) explored the high incidence of hospital admissions with Multidrug-resistant and Extensively Drug-resistant Tuberculosis among South African healthcare workers. They conducted a retrospective chart review of patients hospitalised for MDR and XRD-TB at King George V hospital in KwaZulu Natal. Two hundred and thirty-one (231) out of 4151 patients with MDR/XDR were identified as HCWs. Of the 231, 208

had MDR and 23 had been diagnosed with XDR, 78 were women, and the median age was 35 years. Similar proportions of HIV were observed between HCWs and non-HCWs (55% vs 57%); HIV status was more likely to be known for HCWs than for non-HCWs. Healthcare workers with drug-resistant TB were less likely to report previous antimicrobial treatment than non-HCWs (38% HCWs; 92% non-HCWs). Annual estimated incidence of hospital admissions for MDR-TB was found to be 64.8 per 100 000 for HCWs compared to 11.9 per 100 000 for the general population for an incidence rate ratio of 5.46 [95% CI, 4.75 to 6.28]. The annual estimated incidence of hospital admissions for XDR-TB was 7.2 per 100 000 HCWs compared to 1.1 per 100 000 in the adult general population, an incidence rate ratio of 6.69 [CI, 4.38 to 10.20] (O'Donnell et al., 2010).

Another South African study conducted across 8 public hospitals, showed that there was a high incidence of TB in healthcare workers in KwaZulu-Natal (Naidoo & Jinabhai, 2006). Seventy-six percent (76%) of healthcare workers in the study had pulmonary TB, while 3% had Multi-Drug Resistant TB. The mean Incidence of TB among healthcare workers for the study period was 1133/ 100 000 healthcare workers, which is much higher than the incidence of 649 per 100 000 in the South African general population, or of 25/ 100 000 as seen in some high-income countries.

At the time of the Naidoo study in 2006, South Africa did not have guidelines for controlling nosocomial TB despite WHO recommended guidelines. The Jensen (2005) CDC guidelines and

subsequent implementation demonstrated the importance of the guidelines and diligently implementing them. Some South African provinces have since developed guidelines to prevent TB in healthcare workers, but some studies point at the failure of TB control in South Africa as the primary cause, citing 'passive case finding' instead of 'active case finding'. (Luhailima, Netshandama, & Davhana-Maselesele, 2008; Wood, Lawn, Johnstone-Robertson, & Bekker, 2011). Passive case finding is the 'low-hanging-fruit' in the paradigm of assessment of TB in that healthcare systems investigate patients who are showing symptoms of TB and are already in the health facilities. Active case finding involves screening patients, using TST techniques and conducting regular TB surveillance. The WHO's strategy for TB control, Direct Observed Therapy Short (DOTS) course is also said to be insufficient in high HIV/AIDS burden like South Africa (Wood, Lawn, Johnstone-Robertson, & Bekker, 2011).

2.3.3 Infection control measures reported in LMICs

Similar to research on occupational TB risk factors and incidence and prevalence, there is an increase in research on HCW-TB prevention across sub-Saharan Africa.

2.3.3.1 Administrative controls

In Nigeria, Kuyinu and colleagues (2016) evaluated Tuberculosis Infection control measures in healthcare facilities offering TB services in the Ikeja local government area, Lagos, South West, Nigeria. The cross-sectional study was conducted over 5 months from March to July 2014 and included quantitative and qualitative aspects, which comprised a questionnaire, 4 focus groups with different healthcare workers, plus observation of Infection control practices.

A study by Kuyinu et al. (2016) looking at administrative control measures found that none of the 20 Directly Observed Treatment Short-Course (DOTS) units had a written TB infection control plan and only 30% had a TBIC committee/person. None of the facilities screened patients for TB upon arrival. Over half (60%) reported providing masks for coughing patients, but only 20% of the facilities were observed to provide masks to patients. Non-touch waste disposal for masks was only available at 35% of the facilities. Ninety-five (95%) of facilities reported that they provided cough etiquette health education, but only 45% displayed cough etiquette posters, and 55% occasionally provided health education (Kuyinu et al., 2016).

Even as evidence mounts for TB exposure prevention in healthcare workers, studies consistently point to inadequate infection prevention and control measures. Verkuil and Middelkoop (2016), reviewed studies carried out in 23 Sub-Saharan countries on occupational TB prevention, and they compared the infection controls in those studies to the four levels of infection control guidelines recommended by WHO. None of the 23 countries with high-burden

HIV/TB systematically collected data on TB infection control (TBIC), however some studies had been conducted regarding overarching managerial controls. A proportion of facilities had written TBIC plans: 22% were in Durban, South Africa; 8% in Nigeria, and 50% in Mozambique. A survey of TBIC measures was conducted in Benin, Togo, Cameroon and Ivory Coast. Fifty-eight percent (58%) had general IC or hospital hygiene in place, but only 4% were dedicated to TBIC.

Administrative control measures are the first line of defense, included HCW training, counselling and treatment, cough screening, cough etiquette, triaging patients, prompt diagnosis and treatment. Of the 51 primary healthcare clinics in South Africa, only 26% of facilities practiced triaging, 2% separated patients suspected to have TB, and 22% had respirators available (Naidoo, Seevnarain, & Nordstrom, 2012). Inadequate implementation of TBIC measures were reported.

In central Mozambique, 11% of hospitals separated patients suspected with TB, 62% fast-tracked these patients for diagnosis and treatment. In Nigeria, health facilities did relatively poorly when it came fast-tracking of patients; 17% did any cough-screening, and none did any fast-tracking. Of the 115 facilities in East African countries; less than 50% triaged patients. Only 20% separated infectious patients from the rest, however, 90% of facilities educated patients on cough-etiquette (Verkuijl and Middelkoop, 2016).

2.3.3.2. Environmental control measures

The purpose of environmental control measures (2nd line of defense) is to reduce the concentration of infectious bacilli in the air. Most studies evaluated the use of natural ventilation in healthcare facilities. A single South African study calculated air exchange air rate and over 50% of the facilities had less than the recommended 6-12 Air exchange per hour (Naidoo et al., 2012). A Ugandan study assessed the adequacy of ventilation using window/floor ratio – found that 50% had inadequate airflow (Buregyeya et al., 2013).

2.3.3.3 Personal Protective Equipment

If personal protective equipment (PPE) is fitted correctly it can reduce the exposure to inhaled bacilli. However, PPE is the third line of defense. Studies reported most HCW did not wear PPE even in high-risk situations due to discomfort and lack of knowledge of using them or PPE not available. Fit-testing was not available in South Africa health facilities (Verkuijl & Middelkoop, 2016).

The Verkuijl and Middelkoop (2016) review highlighted a case study of a municipal health facility in the Eastern Cape, South Africa and how it implemented the 4 levels of TBIC.

For managerial controls, the facility had a TBIC committee which had a representative from each department. The committee developed a TBIC plan based on the South African national TBIC guidelines, which was reviewed quarterly. The plan started with screening all patients on arrival. Patients identified by a screening tool as priority were marked as such, and they were

triaged and sent to a waiting room with good ventilation and taught good cough-etiquette. A clinician then saw priority patients in a consultation room with good ventilation. The clinician wore an N95 respirator during the consultation. After the patient was attended to, they went to a separate waiting room, the pharmacists brought them medication, and then the patient left the facility.

In terms of environmental control measures and PPE; all clinics used a mixture of both mechanical and natural ventilation. Three quarters of clinics had cross ventilation in patient waiting rooms, and only 35% had the same in the consultation rooms. In most centers, patients were given cups to produce sputum, but the procedure was unsupervised. Only 10% of clinics had designated sputum collection areas. None of the facilities used germicidal irradiation for decontamination of the air (Verkuijl and Middelkoop, 2016).

2.3.4 Qualitative research in occupational HCW TB exposure

In addition to the above-described quantitative studies from Sub-Saharan Africa, there is some research that uses qualitative methodologies to bring evidence that quantitative research may not capture. Qualitative studies often provide outcomes such as the lived experience of those affected by ill-health which can potentially assist address nuances in policy gaps (Thorne, 2016).

Qualitative studies on HCW occupational TB exposure and infection control measures are increasing in LMICs. There are studies such as the one by Kuyinu et al., (2016) which was a mixed methods study comprising a qualitative and quantitative aspects. However, there was no

explicit qualitative framework and little rigour in reporting of methods such as coding strategies or derivation of themes.

A grounded theory study on stigma within the healthcare system, described three themes; behaviour towards patients, attitudes towards TB work and administrative procedures and policies (Dodor & Kelly, 2010). Dodor and colleague describe how healthcare workers in their study expressed being fearful towards TB patients. This became evident in how they treated TB patients and how they avoided to work in areas where there might be TB patients (Dodor & Kelly, 2010). Although this was not research about HCW infected by TB themselves, it indirectly links to our study in that it mentions 'self-preserving' behaviours that HCWs in TB endemic areas may exhibit to avoid exposure.

Another study which had a qualitative aspect was by Emerson et al., (2016) and it was conducted in Botswana. Their process of evaluation involved a 3-day training of healthcare workers on IPC measures using a 14-minute video, a questionnaire to interview healthcare workers, slide presentations and risk assessment template which the HIV clinics could use to develop their own facility infection control plans (Emerson et al., 2016).

The risk assessment tool was used both at baseline and follow-up and the latter took place 6-months after baseline. Their results showed improvements in measures such as conducting a TB risk assessment and availing TB information for patients. However, other measures such as precautions taken by healthcare worker during sputum collection and availability and fit-testing

of N95 respirators did not improve as much. Emerson and colleagues concluded that there was improvement, but there also continued need for health infrastructure support and to ensure sustainability of TB infection control programs (Emerson et al., 2016). This study contributed to understanding of TB Infection practices in Botswana, however, similar to the Kuyinu (2016) study, Emerson et al., (2016) do not refer to any systematic qualitative methodology used in their study.

2.4 Justification for the study

There is an increasing number of studies from across Sub-Saharan Africa which show disproportionately high incidence and prevalence rates of TB among healthcare workers compared to the general population. However, there are countries in the region where there is little research on occupational exposures in general, and TB in healthcare workers in particular, including Botswana. Even in South Africa where studies continue to be published on TB exposures in healthcare workers, it is often from the clinical and infection control perspective and less often from the occupational hygiene perspective. Most importantly and equally relevant to the current study, the majority of studies are quantitative in nature with fewer studies using the qualitative methodologies.

In this project, we focused on Botswana and sought to understand the perspectives of TB policy-makers and healthcare workers, around occupational health and infection control measures and implementation guidelines for occupational TB. A qualitative methodology, interpretive description, was used to explore what varying professional levels of healthcare

workers understood about their exposure to TB, as well as the enablers and barriers they encountered in preventing and controlling their exposure to TB. We conducted in-depth interviews with policy-makers and TB program leaders and focus groups with frontline healthcare workers including nurses, radiology and laboratory technicians and cleaners and hospital drivers.

Findings from the study will be shared with Botswana National TB program, the department of Environmental and Occupational Health, hospital TB coordinators to potentially address any identified policy gaps. There will also be research findings sessions for hospital leaders and healthcare workers at all the sites which participated in the research in order to afford them the opportunity to integrate the findings in their daily TB control practice. Three hospitals and a health administration facility were evaluated in our proposed study, but results will be applicable to other major hospitals in Botswana and other African countries with similar healthcare infrastructure as Botswana.

2.5 Research Questions

2.5.1 Research Question 1

What are the perspectives of policy-makers and hospital leaders towards the formulation and monitoring of infection control and occupational health policies and guidelines used in the prevention of occupational TB?

2.5.2 Research Question 2

What are the perspectives and attitudes of healthcare workers who have direct contact with TB patients, toward the process of implementing guidelines used to prevent exposure to occupational TB?

2.5.3 Research Question 3

What is the content of the infection control and occupational health policies and guidelines used to control TB in healthcare workers as determined by the Appraisal of Guidelines for Research & Evaluation (AGREE) instrument?

Chapter 3: Research site description

3.1 Botswana and its healthcare system

The republic of Botswana is a landlocked country in Southern Africa, which shares borders with South Africa (South to East), Namibia (West), Zambia (North) and Zimbabwe (North East). It has a population of about 2 million and an area of 582,000 square kilometers, with most of the population concentrated on the South-Eastern region of the country. Gaborone is the capital city and has a population of approximately 208,411. Other notable towns, size and demographic-wise, include Francistown (population 89,979), and Molepolole (63,248) (World Atlas, 2018). Botswana is a former British colony which obtained its independence in 1966. The economy of Botswana relies mostly on diamond mining which comprises 40% of the real gross domestic product. Botswana has a publicly funded healthcare system with a small but growing number of private clinics and hospitals. The healthcare system is divided into tertiary (or referral), district hospitals, clinics and health posts. There are 26 public hospitals and many clinics (Botswana Government, 2011). The Ministry of Health through departments such as Clinical Services and Public Health is responsible for the provision of healthcare services, distribution of human resources (medical doctors, nurses, allied health, support staff, cleaners and ambulance drivers) and management of all the public hospitals and clinics in the country.

The Botswana healthcare system has three different types of hospitals; primary, district and referral hospitals. Primary hospitals provide generic health services and basic intervention for most injuries and diseases. District hospitals provide care for people living in each of Botswana's 10 districts, and they provide broader and more intensive healthcare compared to primary hospitals. Referral hospitals are equipped with relatively better medical equipment and human resources to provide specialist care for patients referred from primary and district hospitals if and when those hospitals do not have required capacity for needed services.

3.2 Sites included in this research

Purposive sampling was used to select hospitals and research participants included in this study. Purposive sampling is used where selected sample of participants will directly address identified research questions (MacDougall & Fudge, 2001). The selected hospitals represent the hospital types that are most relevant to the research questions in the context of Botswana's healthcare system. Two public (Hospital A and B) and one private (Hospital C) hospital in Botswana were included.

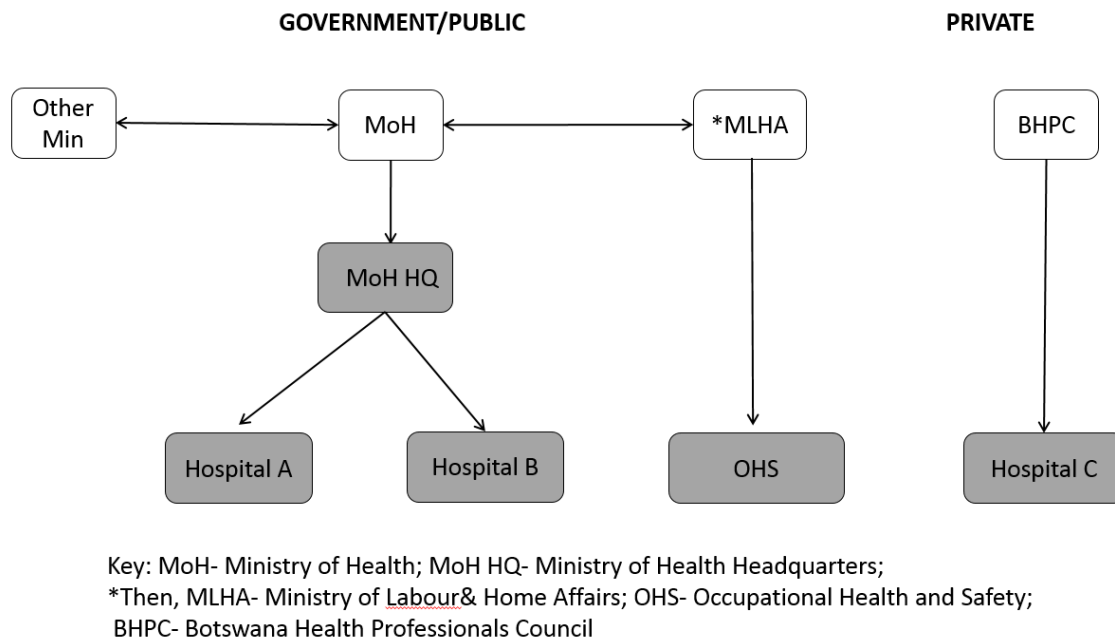


Figure 2 Research sites

Three other organizations were also included: Botswana National TB program as it deals with TB related issues; the Ministry of Labour - Department of Occupational health and Safety as it is responsible for workplace and labour issues; and Ministry of Health-Environmental and Occupational health division, as it formulates worker exposure and control policies.

Hospital A is located in Botswana's capital city, Gaborone, has approximately 700 beds, serves thousands of patients annually, and has over 1000 healthcare workers. Hospital A is one of Botswana's first public hospitals and it is regarded as a tertiary hospital which in theory means it serves patients transferred from Gaborone and neighbouring towns and villages who are in need of specialist care. In practice, it serves the majority of local patients because of a tendency

for patients to seek 'better' care at Hospital A. Hospital A is managed by a hospital superintendent, a physician who is answerable to the permanent secretary of the Ministry of Health.

Hospital B is located in Molepolole, a smaller town, situated about 50km South West of Gaborone. Hospital B is considered a district hospital and serves one of Botswana's districts (equivalent of Canadian provinces), Kweneng. Molepolole is the epi-center or capital town of Kweneng. Hospital B operates over 500 beds and is led by a Chief Medical officer who is responsible to the permanent secretary of the Ministry of Health.

Hospital C is located in Gaborone and is owned by Life Healthcare, a private company based in South Africa. Life Healthcare operates 63 other facilities in its native South Africa (Life Healthcare, 2017). Hospital C, like the public hospitals, has foreign and Botswana-born healthcare workers. Private hospitals are responsible for employing their own human resources. It operates more than 200 beds.

The Botswana National TB Program (BNTP) is housed at the Ministry of Health headquarters under the department of Public Health in Gaborone. It is responsible for formulation of TB guidelines, programs and their monitoring across institutions in the whole country. The Division of Environmental and Occupational health is partially responsible for overseeing programs that aim to improve occupational health in healthcare workers and is based in the Ministry of Health

headquarters and is also overseen by the Department of Public Health. The Division of Occupational Health within the Ministry of Labour and Home Affairs is responsible for worker exposure and control.

3.3 Ethics Review Process

The author contacted the Ministry of Health's research unit in order to begin the ethics application process. Contact was also made with one of the leading physicians at hospital A; the hospital superintendent at hospital B and hospital matron at hospital C. Approval to conduct the study was granted by the University of British Columbia research ethics board, The Ministry of Health in Botswana, and Princess Marina, Scottish Livingstone and Gaborone Private Hospitals.

Chapter 4: Interpretive Description; definition and justification

4.1 Qualitative paradigms and traditions

Qualitative research in general concerns itself with questions of understanding and meaning of their participants. Scholars from applied fields such as nursing and allied health sciences, use qualitative methodologies primarily because there is a need to 'locate' the researcher within a known paradigm to gather data which is more nuanced than quantitative methods can produce (Thorne, 2016). Traditional qualitative methodologies have strict rules of application that have to be followed and if this process is not properly adhered to, a researcher could be accused of method "muddling" (Morse, 1991). The disagreements between those Atkinson (1995) refers to as method 'purists' and those who seek to liberate qualitative methods from their requirements to rigidly adhere to specific rules is an ongoing debate Atkinson (1995). However, the debate has resulted in leeway for health researchers to use the traditional methodologies in their fields in a manner that is useful for them (Starks & Brown Trinidad, 2007). In an attempt to position 'paradigm' a term coined by Kuhn in 1967(as cited by Atkinson 1995) as a less 'purist' and more dynamic concept, Atkinson (1995) described paradigms as frameworks for justifying research activities rather than systems that determine actions. Brief and condensed descriptions of grounded theory, discourse analysis, and phenomenology, frameworks commonly used in qualitative health research, are provided in Table 1 (Creswell & Poth, 2018; Starks & Brown Trinidad, 2007)

Table 1: Some common qualitative methodologies and their functions

	Grounded Theory	Discourse Analysis	Phenomenology
Origins	Sociology (from symbolic interactionism)	Linguistics, literary criticism, semiotics	Early 20 th century European philosophy
Premise	Meaning is created and understood through interacting with others in social contexts which have explicit and implicit code of conduct.	Language and words out of context are meaningless; it is the communally-shared and agreed upon language and words which create meaning.	Truth is subjective and knowable through embodied experience.
Objective	To study social processes in their environmental contexts then develop theory which explains those processes.	To explore and understand how people use language in specific contexts and circumstances. To explore how evolution of language influences societal practices.	To understand the phenomenon through the lived experience of participants. To seek commonalities between lived experiences of those interviewed.
Methodology	Selecting cases for interviews or focus groups which contribute to the generation of theory (theoretical sampling) until saturation.	Interviews are commonly used to understand the subject's language and how it is influenced by external events and other discourses.	Purposive sampling of participants who have experienced phenomenon being studied. Interviews/focus groups can be used to collect data.
Analysis	Constant comparative analysis is used during open, axial and selective coding for theory generation	Coding which is iterative and inductive to identify themes, roles and relationships as they manifest themselves in language and word use.	Iterative, interpretive and inductive process, which decontextualises data using coding, then recontextualises it.
Product	Theory	Texts that highlight how language is used.	Themes which describe lived experience.

Although qualitative researchers in the health field use frameworks such as grounded theory, some health researchers assert that epistemological assumptions within these traditional theorizing methodologies render them less than ideal in some applied scholarly settings (Thorne, Kirkham, & MacDonald-Emes, 1997; Thorne, 2016). In some instances, the assumptions of the traditional methods stand in diametric opposition to scholarship in the applied fields (Thorne, 2016).

Nursing researchers then sought to “build methods that are grounded in our own epistemological foundations, adhere to the systematic reasoning of our own discipline and yield legitimate knowledge for our practice” (Thorne et al., 1997, p. 172). This is the origin of interpretive description.

Interpretive Description draws from some inductive methodologies, particularly grounded theory. The latter is a philosophical constructivist methodology commonly utilized in sociology, while interpretive description came out of nursing, but affords researchers in the general health field a chance to use this methodology which affords those researched to express their health or ill-health (Thorne et al., 1997).

Interpretive description can then be described as “...an analytical, inductive approach designed to create ways of understanding human health and aspects related to the experience of a

disease, that have consequences for the clinical context and practice in health...”(Teodoro et al., 2018).

The objective of interpretive description is to provide a framework which scholars in the applied health fields can use to ensure rigorous qualitative processes equal to those used in more traditional methods, at the same time providing room for the scholar to design variations to the methodology that are defensible and are suitable to the specific intent, context and situation of interest (Thorne, 2016).

As an example, if a health researcher chooses to use grounded theory as their framework, it follows that they will use theoretical sampling as a method of recruiting participants. For analysis, they must use constant comparative analysis during coding and they are expected to have open, axial and selective coding. Their analysis must culminate in theory generation; if they only arrive at conceptual thematic descriptions, their research product may not be termed grounded theory as it fails to fulfil all the criteria (Starks & Brown Trinidad, 2007). In contrast, a researcher who chooses to use interpretive description may scaffold their research design according to the needs of their project. They may use purposive sampling, a method common to various qualitative designs, they may then choose to use constant comparative analysis during their coding and frame the end product of the research as themes.

Thorne describes the cognitive process required during qualitative analysis of an interpretive description project. She describes the following elements that comprise the process:

comprehending, synthesizing, theorizing and recontextualizing (Thorne, 2016). During comprehension the researcher learns everything about the experience of participants and the setting. This is done without judgement, with the intent of absorbing what is being studied (throughout the study). Synthesizing occurs when the qualitative analyst merges various cases to describe composite patterns within the data. At this point, data are merged and decontextualized from their individual cases and reported and seen more as part of the whole. This is done by observing and naming common features in the data and what makes them vary. In interpretive description, theorizing or conceptualizing happens when the researcher begins to develop best “guesses” about explanations. At this juncture it is permissible for one to use insights from other theoretical or empirical sources to ask additional questions. The final step of recontextualizing is achieved when what has been synthesized – the commonalities and variances in data - are articulated in a form that can be applied to other settings and contexts.

While interpretive description enables borrowing approaches and in essence mixing and matching different components of qualitative research, all the above-named steps must demonstrate rigour and trustworthiness which are discussed later in this chapter. As Thorne describes “Indeed, a robust, mature program of interpretive description research may ultimately draw inspiration from techniques devised from a wide range of these [varying qualitative] approaches, including those that may seem methodologically incompatible.” Thorne (2016), page 170. However, Thorne warns that these techniques that are ‘borrowed’ from other methodologies must be critically examined prior to being applied to an ID program.

Even though the researcher may not rigidly adhere to the way the traditional methodology is applied in its original framework, they must be diligent in accounting for the technique and how it is utilized in the generation of knowledge (Thorne, 2016).

4.2 Rationale for using interpretive description

The rationale for using Interpretive Description (ID) in the present study is that it was developed specifically to answer research questions that emanate from a healthcare setting and can be adapted to specific research aims. Grounded theory might have been a suitable framework for our research project, except the purpose of our study was not to generate theory. Interpretive description, with its flexibility to use rigorous methods and strategies from other frameworks, was the most suitable framework for this project.

According to Thorne et al., (1997), interpretive description was created specifically to inform clinical understanding or to be used in evaluating research outcomes, conceptualizing these themes in a way that can inform evidence-based practice in a healthcare setting.

Even though ID was the method best suited for our research, we were aware of some of its strengths and shortcomings. Hunt (2009b) describes some of the strengths that led to us selecting ID for our research project such as relevance to hospital-based research. One of the main shortcomings that Hunt describes is that ID is a relatively new methodology. As much as the resources written by Thorne (1997, 2016) are clear in how to conduct an interpretive description study, they are the only ones that exist. However, since the study by Hunt (2009a),

there have been other studies that have used interpretive description (Dhamani, Paul, & Olson, 2011; Olsen, Bradley, Lomborg, & Nortvedt, 2013).

In aligning our research with the precepts of interpretive description, we used coding techniques from Saldana (2009) and Miles, Huberman and Saldana (2014) to analyse data and to present our findings (Miles, Huberman, & Saldana, 2014; Saldana, 2016)

4.3 Situating the researcher.

Our study crossed disciplines as research questions focused on an area which is by its nature inter-disciplinary; occupational exposures among healthcare workers. This area of study and practice can be claimed by many including health policy researchers, hospital epidemiologists, but especially infection control and occupational health practitioners such as occupational hygienists. The author trained and practiced as an occupational therapist prior to transitioning to the formal study of occupational hygiene. Even though the findings also highlighted infection control, the focus here is on the principles of occupational hygiene. This situating of self is important to the research process as the researcher may be influenced by the world view of their training, and it is crucial in qualitative health research to understand what could influence findings.

The motivation to pursue research in occupational TB exposures, came primarily came from the researcher being an occupational health practitioner at hospital A after completing Master of Public Health (Environmental and occupational health). One of the activities the researcher was tasked with was to conduct N95 fit testing for HCWs. During that time, the author pondered on HCW TB exposure and sought to pursue more knowledge in this area. Prior to pursuing Ph.D.,

the author conducted the following research studies as a requirement for completion of Master of Public Health: Gamontle B.M. (2007) Identification and Communication of Environmental and Occupational Health Hazards in a Hospital Setting, Gaborone, Botswana. (Internship report for Master of Public Health (MPH) University of Arizona, not published). Gamontle B.M. (2008) Descriptive analysis of the financial burden of back injury and other musculoskeletal disorders at University Medical Centre utilizing workers' compensation data (Research Project report towards MPH, University of Arizona, not published). In addition to seeking to know more regarding HCW TB exposures, the author's broader research interest center around healthcare worker occupational exposures.

4.4 Conceptualization and presentation of findings

Thorne asserts that there are two ways to present findings from an interpretive description research project namely, description and interpretation (Thorne 2008; Thorne 2016). What a researcher chooses depends on the balance between description and interpretation in conceptualizing the results. For a project where there is a higher level of conceptualization, the researcher can organize the findings within an overarching conceptual framework. The elements that constitute the conceptual claim then become the organizing structure for the pieces that make up the whole and assist in understanding the whole. Research projects with abstract concepts that can be used to represent the findings can be set up as a coherent sequenced organizing framework that will allow them to relate the story to their audience (Thorne, 2016).

Thorne does indicate that a high level of conceptualization is much easier to achieve in a larger project. For smaller projects, Thorne suggests that conceptualization may not be as complex, as the density of the data may not lend itself to such a level of abstraction. Another factor that may influence the depth of conceptualization is the experience of the qualitative researcher, with more experienced researchers having greater ability to wrestle with greater amounts of data and to pull highly abstract concepts from the data (Thorne 2008; Thorne 2016).

Due to the relatively smaller size of our study and the fact that the researcher had limited experience with qualitative research prior to this project, we aimed for the highest level of conceptualization but in practice we considered our study to have an intermediate level of conceptualization, which falls between descriptive and abstract. We considered it so because of the size of the study, we could not have the highest level of abstraction, at the same time we did not simply describe categories, these came about as a result of synthesis.

The overall aim of the findings of this qualitative project is to present the synthesis of points of views rather than just singling out quotes from certain in-depth interviews that confirm what we initially sought to find (Thorne, 2016). In order to present a balanced view, a researcher cannot “cherry-pick” quotes that only confirm their research questions. Instead there also has to be a presentation and inclusion of views that the researcher may not have expected and that were perhaps surprising or contradictory to initial thoughts.

The analysis in our research sought to have themes and categories “emerge” from the data. In the initial stages, the commonalities and variabilities between the data were grouped and given labels using phrases derived from data. Ultimately, the final categories were named using the primary keywords from the research questions as these were more descriptive of the concepts that emerged from the data. The final categories and themes were a result of a synthesis of interviews and focus groups rather than looking at single cases.

Miles, Huberman and Saldana (2014) describe that in the second cycle, also known as ‘pattern coding’ similar codes are clustered together into categories. Relationships between categories are constructed to develop higher level analytic meanings for key assertions. Abstraction can emerge from paying particular attention to ideas, behaviours, actions, relationships and norms that are repeatedly observable throughout coded segments of data.

4.5 Trustworthiness

There are concepts and techniques that are recommended by methodologists in order for findings to be considered credible and trustworthy. Thorne (2016) discusses study elements necessary to ensure quality and credibility. These elements are discussed below in general and as applied to this study.

4.5.1 Representative credibility

Representative credibility is achieved when theory, concepts and themes from a study are consistent with the sampling techniques that were used, ie. when it is clear that themes and concepts derive from the focus groups and other methods used. Thorne (2016) purports that this type of credibility is enhanced when there is triangulation; a process of using different methods which all aim to answer the same question. We had three research questions which were all essentially pointed at understanding the central question of perspectives of healthcare workers as far as occupational TB exposures are concerned. We used semi-structured in-depth interviews, focus groups and the AGREE tool to understand this central question. In this sense our study has representative credibility.

4.5.2 Analytic logic

Analytic logic is an inductive process of wrestling through the data to arrive at the findings, the process of which the researcher must make explicit. Throughout our study we kept memos which made explicit the thoughts and questions the researcher had. Most importantly we demonstrated how codes at first and second levels of coding were derived and how categories and themes were formed. Throughout the transitional levels of this study, I shared my thoughts with my primary supervisor Professor Karen Bartlett, who was a sounding board and assisted in reflecting back ideas that were peripheral and the ones that needed further development. In this regard, we adhered to the standard of analytic logic throughout the study.

In order to ensure consistency in synthesizing the data, I kept memos throughout the data collection and analysis stages where I recorded my thinking process on why I employed certain strategies and I noted the questions I asked myself and anything that stood out for me. I also communicated with my supervisor throughout the process to ensure that an experienced researcher assisted me with my cognitive process. Throughout the research and each stage, I referred to Thorne's interpretive methodology textbook for guidance and attended a workshop on the methodology. I also began data analysis with what Thorne refers to as epistemological integrity where one ensures that they are aligned with the tenets of their primary field.

4.5.3 Interpretive authority

Interpretive authority speaks to the researcher's ability to recognize her own biases and to distinguish between those and actual external truths. The process of situating the self which we did throughout the research process, included the use of memos as previously mentioned in analytic logic; this permitted a growing understanding of personal perceptions and biases versus what was truly emerging from the data.

4.6 Studies that have used Interpretive Description

Although interpretive description is a new methodology compared to phenomenology and grounded theory for example, it has been both used and critiqued by researchers around the world. Some of the studies that have used interpretive description are described below.

4.6.1 Moral experience of Canadian healthcare professionals in humanitarian work (Hunt, 2009)

Hunt sought to explore how Canadian healthcare professionals participated in humanitarian efforts in low-resourced countries affected by natural disasters and other emergencies, and how they navigated and moralised public health ethics that manifest in these usually volatile and unstable environments. Hunt (2009a) conducted 18 semi-structured in-depth interviews with 15 healthcare professionals; nine doctors, five nurses and one midwife. Coding was used to analyse data and five central themes were derived from the data.

4.6.2 Evidence based practice in clinical physiotherapy education: a qualitative interpretive description (Norway). (Olsen et al., 2013)

The objective of this study was to explore the beliefs and experiences about evidence-based practice among third year physiotherapy students. The sampling methods used were six focus groups, two focus groups with clinical instructors and another focus group with visiting teachers. One-on-one interview and one-on-two interviews were also held with clinical instructors. Data were coded and analysed using constant comparative analysis and four themes were derived from the data.

4.6.3 Tanzanian nurses understanding and practice of spiritual care. (Dhamani et al., 2011)

Dhamani et al., (2011) proposed to understand how Tanzanian nurses conceptualized and practiced spirituality and spiritual care in their patient care. They used purposive sampling to

select 15 nurse practitioners of varying ages, clinical experiences and religious backgrounds for semi-structured face-to-face in-depth interviews. For analysis, the researchers used coding as guided by Creswell's 'generic steps of data analysis' and they grouped findings under headings. The researchers stated various activities such as journal writing, field notes which they undertook to ensure representative credibility of the study, a process which demonstrates trustworthiness as suggested by Thorne (2016).

Chapter 5: Methods – In-depth interviews and focus groups

This chapter explored the perspectives of healthcare workers as far as occupational health and infection control measures towards their exposure to TB is concerned. The processes of conducting in-depth interviews and focus groups are described as well as the coding strategy. The emerging themes and categories are discussed in the findings while the discussion explores the categories and themes in light of the current literature. Collected data is summarized in Table 2.

5.1 Methods: In-depth interviews and focus groups

Table 2: Summary of data collected from research sites

Activity	Health Admin.	Hospital A	Hospital B	Hospital C	Other dept.
Ethics application	Research Unit	Ethics Committee	Ethics Committee	Hospital Superintendent/matron	Head of OHS Unit
Participant Recruitment	*P/T sampling	P/T sampling	P/T sampling	P/T sampling	P/T sampling
Guidelines	TB Rx. OHS manual	TB IPC	TB/HIV policy	SLH IPC plan	OHS policy draft
In-depth Interviews	8	5	3	5	1
Focus Groups	0	2 (14)	2 (18)	1(10)	0

Total: In depth interview participants: 21 Focus groups individual participants: 42

*Purposive/Theoretical Sampling

5.1.1 In-depth interviews; Participant recruitment

The author contacted leaders in the three hospitals before she left for Botswana in order to share the study proposal and to gauge interest. Following her arrival in Botswana and approval of ethics, the author met these leaders in person and provided more information about the study. The leaders, the hospital matrons, got in touch with ward leaders who in turn requested workers in their respective wards to participate in the study.

We gave information flyers to selected hospital leaders and some were pinned on notice boards in wards that had healthcare workers who provided care for TB patients (e.g. medical wards). Participant recruitment was done primarily in the first month of the study, but relevant participants were recruited throughout the study. Some of the participants were recruited via snowball sampling where an interviewed participant recommended another potential participant they believed would have information pertinent to the study. There were 21 in-depth interview participants and 42 focus groups participants (Figure 3).

Participants for in-depth interviews were recruited from those involved in TB policy development, and from those in leadership positions, namely: TB program coordinators; physicians specializing in TB management; hospital administrators; nursing care managers; infection control professionals; and occupational health practitioners. Focus group participants were recruited from: nurses; radiographers; laboratory personnel; cleaners; and drivers.

Participants were requested to complete informed consent forms before commencement of research. A small honorarium (equivalent to \$10) was initially provided to acknowledge participation, but the Hospital A Institutional Review Board (IRB) paused the data collection process for a week, then requested the author to cease providing the honorarium, as this was against their guidelines.

Theoretical and purposive sampling allowed us to recruit participants whose responses had the potential to contribute to the ultimate generation of key statements and concepts. The hospital leaders were instrumental in contacting the first participants who took part in our study.

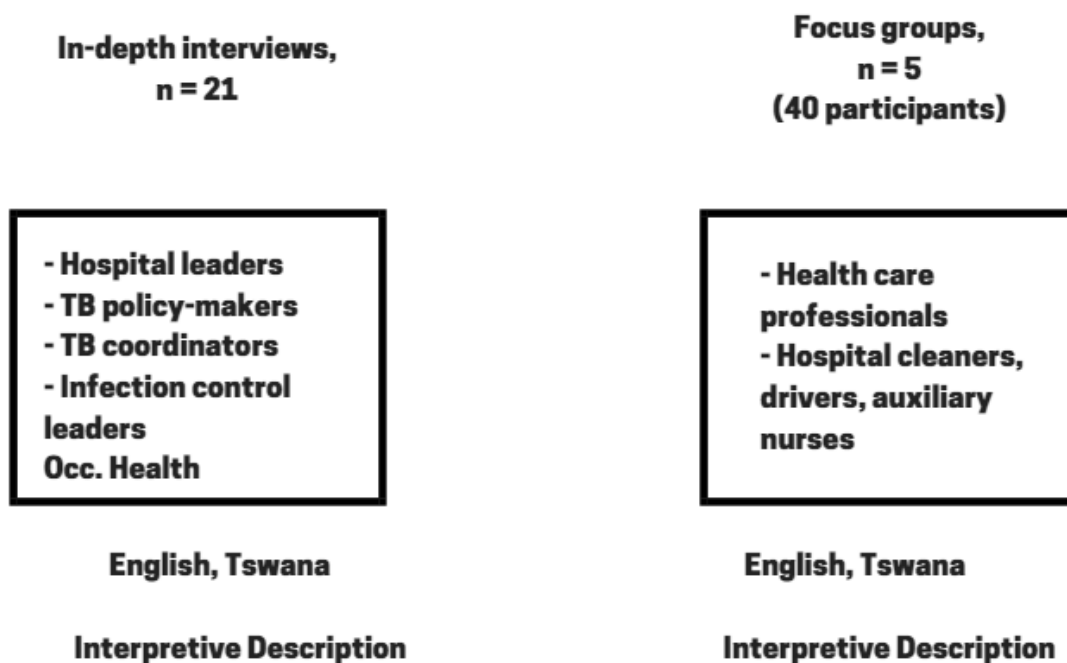


Figure 3: Details of conducted interviews and focus groups

5.1.2 In-depth interviews scripts

Semi-structured in-depth interviews were selected as a method that would yield information from participants. Information from participants would contribute towards the generation of themes and key statements. The semi-structured open-ended questions were developed prior to the interviews based on information from literature review. The initial set of questions were adopted from the WHO 2009 *policy on TB infection control in health-care facilities, congregate settings and households* (Figure 4). They were modified as more in-depth interviews were conducted and understanding was gained as to which questions were relevant to the research questions. The core interview questions remained unchanged after the third interview. The questions were divided into four primary categories, namely; (1) Policy/guideline formulation and implementation for policy-makers outside the hospital environment; (2) Policy/guideline formulation and implementation for policy-makers within the hospital environment; (3) Infection prevention and control; and (4) occupational health – healthcare worker exposure control. The questions are recorded in [Appendix A](#).

Box 1 Set of activities for national and subnational TB infection control
The national and subnational managerial activities listed below provide the managerial framework for the implementation of TB infection control in health-care facilities, congregate settings and households.
1. Identify and strengthen a coordinating body for TB infection control, and develop a comprehensive budgeted plan that includes human resource requirements for implementation of TB infection control at all levels.
2. Ensure that health facility design, construction, renovation and use are appropriate.
3. Conduct surveillance of TB disease among health workers, and conduct assessment at all levels of the health system and in congregate settings.
4. Address TB infection control advocacy, communication and social mobilization (ACSM), including engagement of civil society.
5. Monitor and evaluate the set of TB infection control measures.
6. Enable and conduct operational research.

Figure 4: Initial interview questions based on WHO activities for national/subnational IPC

5.1.3 In-depth interview settings

Twenty-one (21) individuals participated in the in-depth interviews at a time and place that was convenient for them. All in-depth interviews were held in locations selected by the participant which was mostly their offices or a location near their office and within their health facility. Prior to commencing the interview, the participants were informed about the researcher, the aims and objectives of the study and the potential benefits. They were also informed that they were free to terminate the interview at any time. Participants were also given the choice to have the interview conducted in English or Setswana/Tswana. The process of consent was explained to them after which they were requested to sign consent forms. All the interviews were audio-recorded. The interviews took between 30 and 90 minutes. Following interviews, the audio recorders were kept in a locked and safe place to ensure participant confidentiality.

5.2 Methods – Focus groups

Table 3 Focus groups conducted at research sites

Health Institution	Number of participants	Occupational Composition	Sex
Hospital A, Group 1	9	5 Cleaners 2 Healthcare Auxiliary 2 Hospital Orderlies	9 females
Hospital A, Group 2	5	2 radiographers 1 Principal Medical Technologist 1 Senior Registered Nurse 1 Nurse	2 males 3 females
Hospital B, Group 1	12	2 Drivers 10 Cleaners	2 males 10 females
Hospital B, Group 2	6	1 Senior Radiographer 2 Nurses 1 Senior Registered Nurse 1 General Nurse 1 Medical Lab Scientist	2 females 4 males
Hospital C	10	1 Healthcare auxiliary 4 Nurse Aides 1 Healthcare Assistant 4 Nurse Auxiliary	10 females

5.2.1 Focus groups process description

Focus group participants were invited to participate by the hospital leaders, matrons at all 3 hospitals. Focus groups were segregated into sections based on the hierarchical roles of participants; those with industrial/daily rate workers such as hospital cleaners and drivers, and those with health professionals such as nurses, medical lab technologists and radiographers. The focus groups with the professionals were conducted in English while the ones with industrial/daily rate workers were conducted in Setswana/Tswana. The researcher explained

the purpose and aims of the study. There was a challenge in building rapport with one of the focus groups due to a then-recent healthcare strike and uncertainty regarding healthcare workers losing their jobs. There were suspicions that the researcher might actually be an intelligence officer, and as such may report their views to the government and have their jobs terminated. The researcher had to show IDs including that of the University of British Columbia to prove that she was indeed a student. Focus groups ran for between 45 minutes and 2 hours.

The researcher asked a single question then allowed the participants to converse amongst themselves regarding the question. The researcher prompted the participants when necessary using pre-scripted questions ([Appendix A and B](#)) to allow a dialogue which was engaging. An audio recorder was passed to the participant who was speaking. This way, only one participant spoke at a time and this allowed the digital audio recorder to capture the voices of the participants clearly. To keep the identities of the participants confidential, participants were requested to identify as their “occupation and number”; for instance, for hospital C, where there were 4 nurse auxiliaries, the participants would introduce themselves as; nurse auxiliary 1, nurse auxiliary 2, nurse auxiliary 3 and nurse auxiliary 4. The participants were encouraged to introduce themselves by the same title each time they spoke into the audio recorder. This was done so that it would be easy to recognize the participants during the analysis stage.

Chapter 6: Analysis of In-depth interviews and focus groups

6.1 Summary

All in-depth interviews and focus groups were audio recorded by the author and were transcribed verbatim by the research assistant. In-depth interviews were conducted primarily in English though some participants spoke an occasional Tswana/Setswana word. Two of the 5 focus groups were recorded in Setswana, the author then translated to English all the transcripts that were written in Setswana. All data was stored and managed using the software Nvivo 10. The coding strategies by Miles and colleagues (2014) were used to break down data and synthesize it to form categories and themes. Figure 5 illustrates the process of analysis.

All in-depth interview and focus group scripts were analysed using the interpretive description framework. All research-related documents were stored in a lockable and secure office and filing cabinet to preserve confidentiality of the participants. All the material will be destroyed five years after dissemination of results.

The software NVivo was used to store and manage all the data. Codes were developed from the data and used to code all the other scripts. Coding began with open form of coding followed by constant comparative analysis. Constant comparative analysis originates from Grounded Theory but is used in many qualitative coding methods. It was used to explore codes throughout each interview, then interviews from one institution were evaluated to identify the patterns and

variations. The latter was then extended to evaluating the differences and similarities among different institutions.

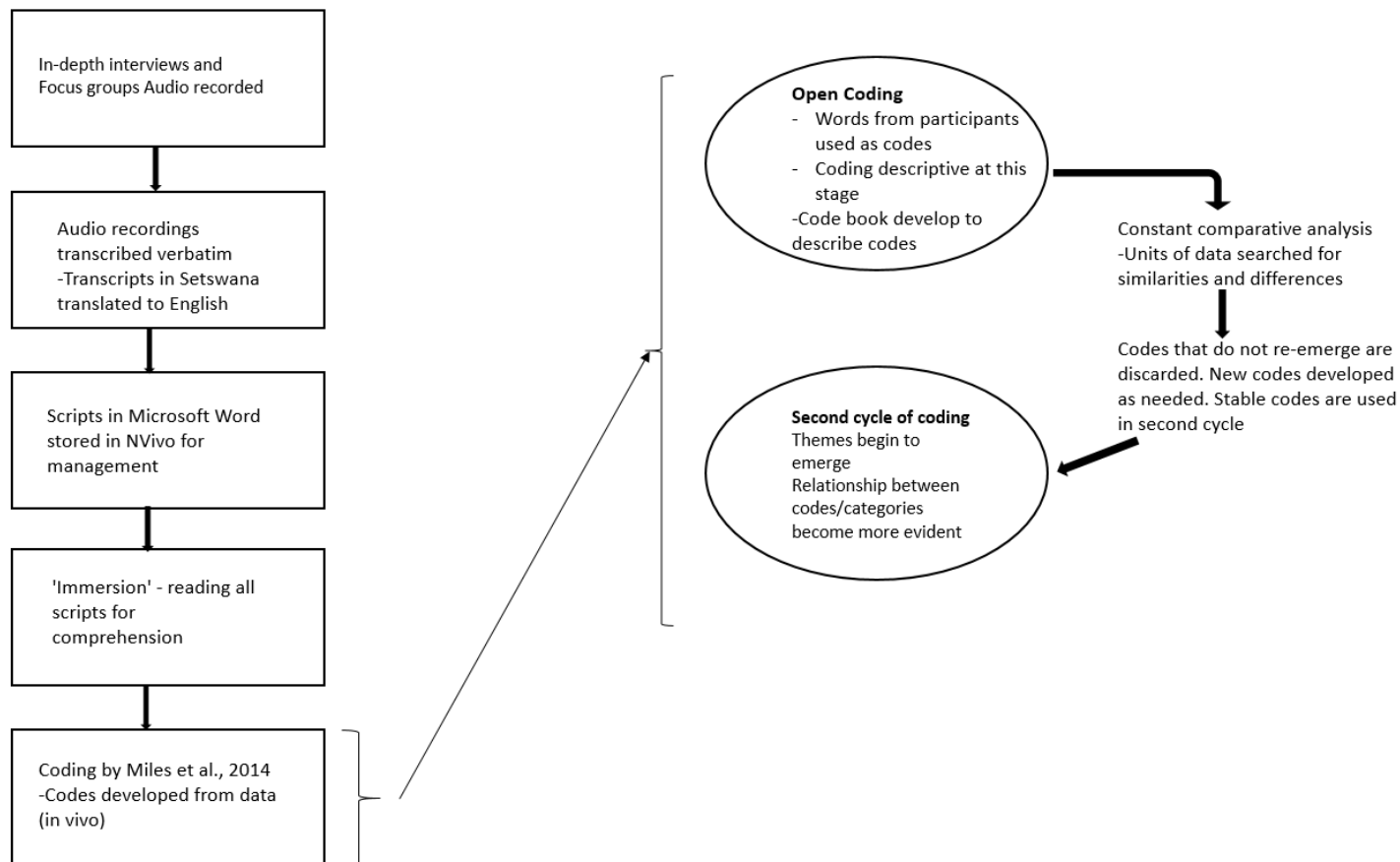


Figure 5 Diagram showing main stages in the process of analysis.

6.2 Computer Assisted Qualitative Data Analysis Software, NVivo

The audio recordings of the interviews and focus groups were transcribed verbatim into scripts.

All the scripts that were in Setswana/Tswana were translated to English by the author. All the transcripts were transferred into the Computer Assisted Qualitative Data Analysis Software

(CAQDAS) NVivo 10 (QSR International Pty Ltd, 2012). Within the NVivo software, all scripts saved as Microsoft Word documents were imported to “Sources” and in-depth interview scripts recorded in one place were saved under one file. For example, all in-depth interviews from Hospital A were saved under the file “Hospital A in-depth interviews”. Focus groups transcripts were also differentiated and saved by the location they were recorded at.

The CAQDAS assisted during the analysis stage, to breakdown data using codes, then putting it back again into categories in preparation for analysis. Figure 6, shows an example of how data was organized inside NVivo.

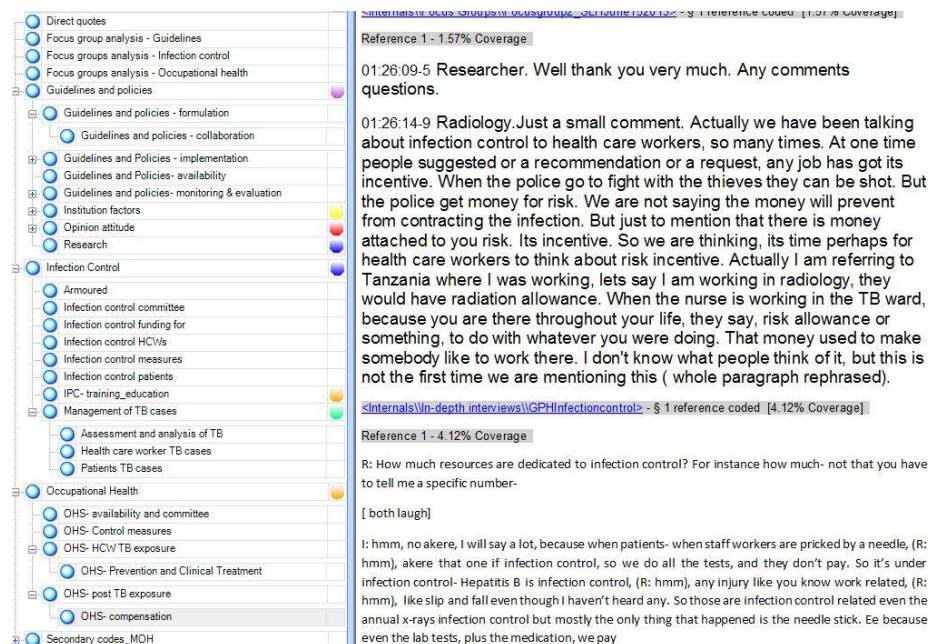


Figure 6 CAQDAS - Exploration, First cycle of coding

To begin the process of analysis, the researcher immersed herself in the data by reading through each of the scripts to gain insights about the overall data. At this point, no judgments were made about the data. The author made personal, methodological, and theoretical notes (also referred to as memos) throughout the data collection and analysis processes. This was done to note any potential sources of bias, and to record any questions and rudimentary concepts that formed earlier in the analysis process, so that the researcher could go back and develop these further if they proved worthwhile to the developing narrative and to the overall study. Although some qualitative methodologies, in particular phenomenology, encourage bracketing (going into the research environment like a 'blank slate'), Thorne (2016) acknowledges that this is not necessarily possible as human beings will always have preconceived notions about phenomena. Instead, one could be cognizant of their preconceptions, as they pertain to a certain subject or situation, and record sources of potential bias.

For this study, the author paid particular attention to the fact that the research environment she was collecting data from was her previous workplace. Having worked for Hospital A and the Health Administration, she was familiar with the general function of the public hospital system and she noted how such knowledge could be a strength in the study, but also how this could limit a new way of exploring data if unacknowledged.

In order to begin exploring the data, Thorne (2016) suggests that we ask ourselves broad questions such as (a) what ideas are core to what we are studying? These are ideas that play a fundamental role in our understanding of the phenomenon about which we have asked questions; (b) which ideas are useful as context? These may be common and even important but are essentially part of another story, i.e. they answer a different question. Thorne (2016) encourages that as we explore the data we use the following framework by Srivasta & Hopwood (2009) to better understand the big picture painted by our data.

1. What are the data telling me?
2. What is it that I want to know?
3. What is the dialectical relationship between what the data are telling me and what I want to know?

As we explore the data and begin to recognize emerging patterns, it is crucial to test these patterns in order to ensure that the relationships that we are witnessing are indeed valid. According to Thorne (2016), to test the validity of the emerging patterns and relationship we can use the following questions as a guide:

“How else might I understand this aspect of the data?” Or “If I decide to think about it in this way, what possible aspects of an issue might I be missing?” “What might I not be seeing?”
“What else might there be to see and how would I know that?”

6.3 Coding

A code is “A word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data” (Saldana, 2013, pg 3). During coding, the researcher uses classification reasoning and intuitive senses to determine the data that ‘look’ and ‘feel’ alike (Saldana, 2013). We coded text and then explored patterns and variations in sections of text to which the same codes were applied.

Codes were derived from the responses of the participants as well as from keywords of the research (*in vivo*). Coding started during data collection. A codebook was developed during the coding process, and the codebook recorded: (1) the name and descriptions of codes; (2) the properties of the code; and (3) inclusion and in some cases, exclusion criteria to demonstrate the criteria that the text had to fulfill in order to be coded or excluded. Though all the interview and focus group scripts were carefully read, only the data that were deemed necessary for the research were coded. In-depth interviews and focus groups were coded with similar codes to allow comparisons between different interviews, and between interviews and focus groups.

Saldana (2013) outlines the many and varied types of coding that are available for analysis of any data. He further indicates that in any single study it is permissible to use one or an eclectic mixture of types of coding that are contextual for that study (Saldana, 2013). For our study, we utilized the following types of coding as they were relevant and fitting for the purpose of our study.

- Initial coding: The first major open-ended stage that is primarily used in grounded theory. This type of coding breaks down data into separate and distinct parts, closely examines them, then compares and contrasts them for similarities and differences.
- Descriptive coding: A label is assigned to the selected chunk of data and the label summarizes the data in a word or short phrase, mostly a noun.
- In vivo coding: Uses words or phrases taken directly from interview scripts and as spoken by participants. These may be in the participant's native language.
- Focused coding: This type of coding usually follows 'Initial coding' or 'In vivo' coding. The researcher searches for the most frequent or significant 'Initial codes' to develop categories.
- Process coding: Uses gerunds (words ending in "-ing") to capture conceptual and observable action in the data. Process also refers to actions occurring over time, such as things that change or occur in particular sequences.
- Axial coding: May be the next step after initial and focused coding. It describes a category's characteristics, properties and dimensions and explores how categories relate to one another. Properties and dimensions refer to interactions, conditions, contexts and outcomes of process.

Data were coded over two cycles, from open coding until categories were clearly formed and until there were no new variations observed and conceptualization had occurred. To organize

and adequately synthesize data, in the second cycle of coding, codes were broken down to sub-codes to reduce the data into manageable chunks. The sub-codes were then read through once again then synthesized.

In adherence to the guideline, we followed the process of coding as described by Saldana (2013). As Saldana warns the process of coding is not a linear one but an iterative process in which the researcher may move from coding to themes and back again.

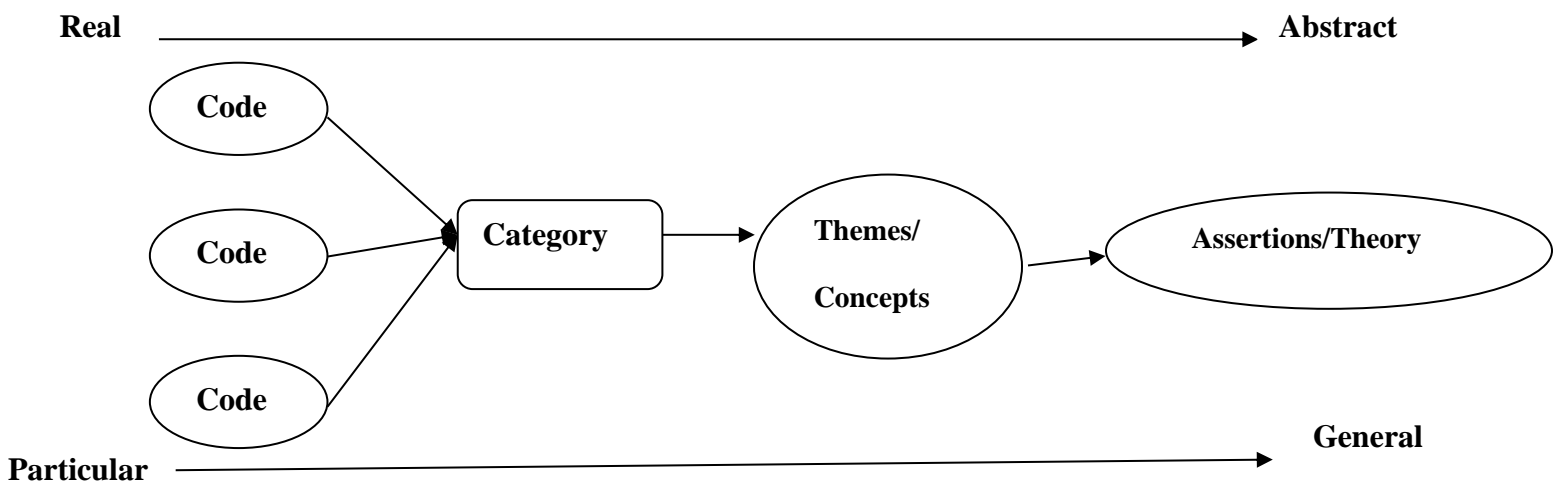


Figure 7 Data analysis stages

Adapted from Saldana J. (2013) The coding manual for qualitative researchers. Sage. Los Angeles

Following the coding techniques from Saldana (2013), in-depth interviews and focus group transcripts were coded paragraph by paragraph, and we used constant comparative analysis to evaluate the similarities and differences between in-depth interviews and focus groups. During the process of coding we employed the question “What am I seeing here?” per Thorne’s recommendation for researcher reflection. Saldana also lists a set of questions, described by Emerson and colleagues (2011) that can guide analysis, and we employed these questions during coding:

- 1 What are people doing? What are they trying to accomplish?
- 2 How, exactly, do they do this? What specific means and/or strategies do they use?
- 3 How do members talk about, characterize, and understand what is going on?
- 4 What assumptions are they making?
- 5 What do I see going on here?
- 6 What did I learn from these notes?
- 7 Why did I include them?

Saldana adds a question at all the cycles of coding, of “What strikes me?” He also offers another set of questions that are suggested by Sustain and Chiseri-Strater (2007), which may stimulate additional observations:

- What surprised me? (to track assumptions)
- What intrigued me? (to track positionality)

- What disturbed me? (to track tension within belief and value systems)

We utilized all these questions during the coding process in order to unpack what the participants were discussing and how the researcher was viewing and incorporating those observations.

The intention of coding and subsequent constant comparative analysis was to move beyond obvious and superficial links among data points, to engage in activities that shift attention from individual cases to the whole data set. This took place as the researcher observed similarities within coded data as well as differences between one case and others.

As coding became more abstract (high-order groupings), relationships were forged between data groupings that initially seemed disparate, and some initial groupings were deconstructed to form new ones (Thorne 2008)

Analysis was done in the following manner: In-depth interviews conducted within one facility were searched for differences and similarities; in-depth interviews were compared across health facilities between similar roles - for instance a TB infection control from Hospital A was compared to that of a TB infection control from Hospital B and C, in cases where that role existed in all the research sites. If a role was not available, then comparison was made to the role that is closest in similarity and specific job tasks.

6.3.1 Open coding or first cycle coding as described by Saldana (2013)

During open coding, words derived from the dialogues and research keywords were used as codes. Coding was predominantly descriptive at this level, so as not to conceptualize categories and themes prematurely. The first three interviews were used in the iterative process of developing codes, and codes would later be modified or left as they were depending on whether they continued to be used or proved to be obsolete. As more codes were inductively formed from the data, a code book was developed to record all the codes, how they were developed and were eventually modified. A description of the codes was also kept which showed the criteria any piece of data had to fulfill to be coded with a specific code. As coding progressed, the codes and how they were organised became less rudimentary, with their titles becoming less descriptive and moving towards more abstract and conceptual dimensions.

6.3.2 Examples of coding

Examples of codes and their criteria are annexed in appendix G.

Guidelines and policies	Infection control funding for
Guidelines and policies – formulation	Infection control HCWs
Guidelines and policies – collaboration	Infection control measures
Guidelines and Policies – implementation	Infection control patients
Challenges to implementation	IPC- training/education
Guidelines and Policies- availability	Assessment and analysis of TB
Guidelines and policies- monitoring & evaluation	Healthcare worker TB cases
Institution leadership	Patients TB cases
Institution- multiple roles	OHS- availability and committee
Institution physical structure	OHS- Control measures
Outsourcing	OHS- HCW TB exposure
Private	OHS- Prevention and Clinical Treatment
Opinion/attitude – policymaker	OHS- post TB exposure
Opinion/attitude- HCW	OHS- compensation
Opinion/attitude- public	
Recommendations, accolades and comments	
Research Infection control committee	

Table 4 Initial codes

Primary open codes were transformed from mere descriptions to abstract dimensions through a process called constant comparative analysis, and constant comparison drove the transition between first and second cycles of coding. Constant comparison and second cycle of coding are described below.

6.3.3 Constant Comparative Analysis

The technique of comparative analysis was used to identify variations, similarities and patterns at different levels, namely; (1) within interview/focus group; (2) contrasting one interview/focus group summary with another from the same institution – the so called cross case analysis by Miles, Huberman and Saldana (2014); (3) comparing the essence of the interviews/focus groups from one institution to another and finally, (4) the most significant themes from all interviews and focus groups.

The CAQDAS software NVivo allowed for chunks of data to be coded with a single code that could be retrieved and analysed independently from their mother text, but it also allowed different codes to be collapsed into a single and more general code. The software also afforded the researcher the chance to perform constant comparative analysis by enabling simultaneous opening of more than one window. Codes which were later found to be similar were merged, and others were discarded. If codes and themes were not recurring or strongly manifesting from the data, they were eventually discarded. Miles, Huberman and Saldana (2014) concur that the point in time where the transformation of codes takes place does not matter much, as

long as there is a structure that unifies the codes. Examples of how the analysis from the above-mentioned levels was carried out are provided in appendix G.2

6.3.4 Second cycle of coding – Miles, Huberman and Saldana

This dimension of coding is also known as pattern coding as this is where the researcher begins to witness emergent themes and more meaningful relationships and patterns between the codes developed in the first cycle of coding. Pattern coding is less a precise science and more an interpretive art because two independent researchers may observe the same pattern but label it differently (Miles, Huberman and Saldana, 2014). During the first cycle, codes are assigned to chunks of data to detect recurring patterns. In the second cycle, similar codes are clustered together to create a smaller number of analytic units or categories, Relationships between categories are constructed to develop higher level analytic meanings for key assertions. The higher realms of abstraction can emerge from ideas, behaviours, actions, relationships and norms that are repeatedly observable throughout coded segments of data. According to Miles, Huberman and Saldana (2014), pattern codes are identifiable because they usually consist of the following inter-related summarizers:

1. Categories and themes
2. Causes/explanations
3. Relationships among people
4. Theoretical

For our study, codes from the first cycle of coding, which were mostly *in vivo* codes (taken directly from the words of the participants), were merged.

During open coding some of these codes were made into sub-codes, for example:

Guidelines and policies

Guidelines and policies – formulation

Guidelines and policies – collaboration

Guidelines and Policies – implementation

Figure 8 Codes

The sub-code “guidelines and policies – formulation” was rendered unnecessary because there were not many participants who discussed it in a manner that was deemed substantive. In instances where it occurred it was found to be intertwined with implementation, which potentially shows a relationship between these two codes. “Guidelines and policies – collaboration” and “guidelines and policies – implementation” were also found to be related because in some instances different policy-implementing departments or even policy-making stakeholders collaborated for the sake of improving implementation of guidelines. Or in some instances, implementation seemed to be inadequate because of limited collaboration. For example:

*There was a concern about people who are pregnant on the working in TB wards, but I think at the end of the day some of these things we try to discuss at hospital level, but they don't get anywhere else. **Because some of these things at the end of the day we feel, people feel that Ministry has nothing in place umm to say that if you are pregnant you can't work in TB ward for- from when err or looking at the fact that you can't force people to disclose their HIV status,** so if someone who knows that they are HIV+ they won't come to you and say because of I'm immune-suppressed and I can't work in TB ward, it's such a challenge and how do you go about it. OHS personnel,*

Hospital B

Sub-codes were collapsed within the CAQDAS, NVivo, in order to merge them with more general codes and to form more abstract and overarching secondary codes. The codes were merged as shown in Figure 8. Another technique used in transitioning from first cycle codes to pattern codes is using analytical memos to demonstrate how this transition took place. Below is an analytical memo by the researcher which demonstrates one of the struggles she initially had when developing the pattern codes "Occupational health" and "infection control". Ultimately, the two codes were distinguished as demonstrated in figure 8.

As I code, it is clear that some paragraphs are co-coded infection control occupational health. How do I separate these two in a meaningful manner? what about infection control? Occupational health and wellness? Perhaps I should explore this relationship further. Perhaps even write a ?position paper on it?

The author's analytical memo, written during coding

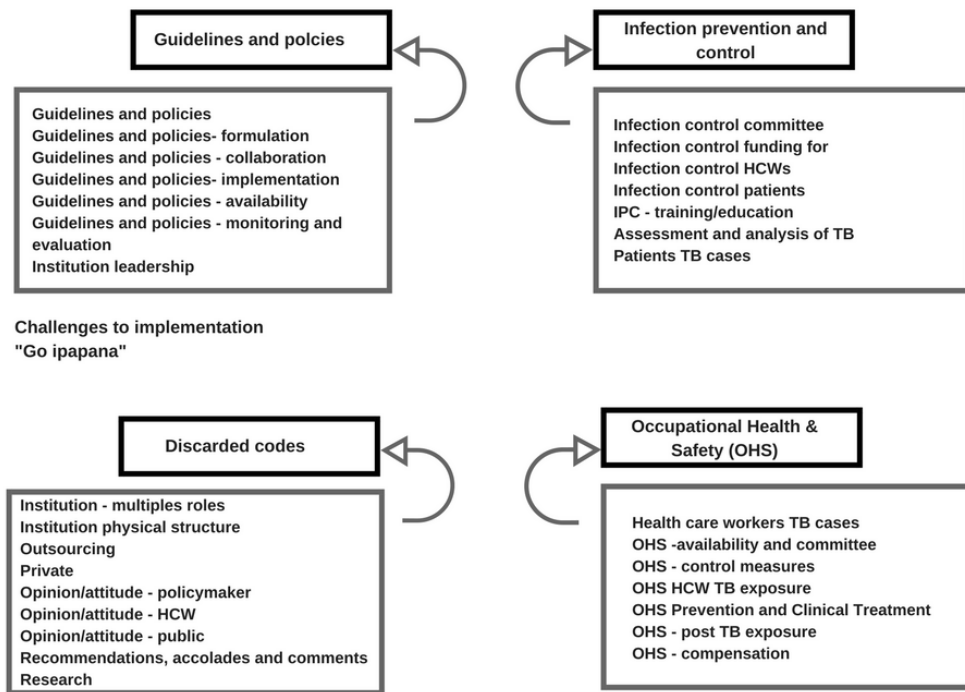


Figure 9 Set of Final codes

The diagram above shows how different codes, using the principles of pattern coding, were collapsed and merged into high and more abstract categories. From 33 codes we ended up with four primary categories


Chapter 7: Findings – In-depth interviews and focus groups

Twenty-one participants, as shown in table 5, took part in in-depth interviews, while 40 participated in 5 focus groups. We aimed to use Interpretive Description (Thorne, 2016) as an over-arching qualitative framework and to use specific techniques from Miles, Huberman and Saldana (2014) to observe patterns, categories and themes from the information we obtained from the in-depth interviews and focus groups. The final categories as derived from themes and codes are shown in Table 6 and detail on each is provided in the text that follows.

Table 5 In-depth interview participants in the order they were interviewed

Hospital/ Institution	Job Title	Sex
Hospital A	Medical officer	Female
Hospital C	Hospital Matron	Female
Hospital A	TB Coordinator	Female
Health Administration	Public Health Specialist	Male
Health Administration	TB Coordinator	Male
Health Administration	Wellness Officer	Female
Health Administration	Former Wellness Coordinator	Female
Health Administration	Former Wellness Coordinator	Female
Hospital B	Nurse	Female
Hospital A	Infection Control Nurse	Female
Hospital B	OHS Committee Chairperson	Male
Hospital A Affiliation	Physician	Female
Hospital A	Pharmacy technician/IPC Focal Person	Male
Hospital B	Matron	Female
Health Administration	Nurse/District TB Coordinator	female
Health Administration	Physician	Male
Hospital B	Principal Registered Nurse	Male
OHS Administration	Principal Health and Safety Officer	Male
Hospital C	Physician/Internal Medicine Specialist	Male
Hospital C	Deputy Hospital Matron/IPC Coordinator	Female
Hospital B	Principal Registered Nurse/TB coordinator	Female

Table 6: Final categories and themes

Final Categories	Final Themes	All themes	All codes
Occupational health Services	<ul style="list-style-type: none"> -Occupational health services - Evidence of occupational TB 	<ul style="list-style-type: none"> -OHS -availability and committee - OHS - compensation- OHS - control measures -OHS - post TB exposure - Healthcare workers TB cases OHS Prevention and Clinical Treatment -OHS HCW TB exposure 	<ul style="list-style-type: none"> Assessment and analysis of TB Healthcare worker TB cases Patients TB cases OHS- availability and committee OHS- Control measures OHS- HCW TB exposure OHS- Prevention and Clinical Treatment OHS- post TB exposure OHS- compensation
Infection Control	<ul style="list-style-type: none"> -Awareness and acknowledgement of importance of IPC -Some IPC measures implemented -Hospital structures not conducive for IPC -IPC identified as inadequate 	<ul style="list-style-type: none"> Infection control committee Infection control funding for Infection control HCWs Infection control patients IPC - training/education Assessment and analysis of TB Patients TB cases 	<ul style="list-style-type: none"> Infection control committee Infection control funding for Infection control HCWs Infection control measures Infection control patients IPC- training/education
Guidelines and policies	<ul style="list-style-type: none"> Origin of guidelines Formulation of guidelines Availability of guidelines Implementation of guidelines Factors influencing implementation Changes brought about by guidelines 	<ul style="list-style-type: none"> Origin of guidelines Formulation of guidelines Availability of guidelines Implementation of guidelines Factors influencing implementation Changes brought about by guidelines 	<ul style="list-style-type: none"> Guidelines and policies Guidelines and policies- formulation Guidelines and policies - collaboration Guidelines and policies- implementation Guidelines and policies - availability Guidelines and policies - monitoring and evaluation Institution leadership
Challenges/Barriers to implementation	<ul style="list-style-type: none"> Guideline-related factors Patient-related factors Healthcare worker-related factors Institutional/systemic 'Amouring' Environmental factors 	<ul style="list-style-type: none"> Guideline-related factors Patient-related factors Healthcare worker-related factors Institutional/systemic 'Amouring' Environmental factors 	<ul style="list-style-type: none"> Challenges to implementation

7.1 Occupational Health Services

This category includes practices, measures and services that pertain to reducing exposure, infection and TB disease among hospital workers. There were two major themes that were found under this category:

1. Occupational health services in the hospitals
2. Evidence of Occupational TB among healthcare workers

7.1.1 OHS -The national and ministerial level

The field of OH is a relatively young one as it started in the country in 1973 with the promulgation of the “Factories Act” under the Ministry of Labour and Home Affairs. Part of the history of OH was related by some of the participants and it is represented as a timeline in figure 10 below. The Factories Act ([copy annexed in Appendix C](#)) focused on safety issues within factory settings, and the interaction the department had with hospitals was limited to occupational exposure assessments among hospital boiler operators and laundry workers. However, under the same Act, other public workers could be designated to assess and intervene in an occupational health situation if necessary. As such, occupational physicians and other public health officials could be called upon if needed to assess and make decisions regarding occupational health within hospitals.

Interviewee: ee[yes], my role ke[is] [sic]- I am the health and safety officer. Responsible for both prevention and promotion ya(of) occupational health and safety (R: ee(yes)) and industrial areas, (R: ee) and as indicated in our act, it says that we are looking at our health, safety and welfare of all employees, employed there-in and issues that are incidental to occupational health and safety of employees. Ee

Researcher: Ee rra [yes sir] you mentioned industries, err does that include hospitals?

Interviewee: Well for the time being the act does not cover, yes it does cover hospitals, but only workshops and boiler houses

Researcher: Ok, ok. Within hospitals?

Interviewee: Yes within hospitals that's when we will, pre-empt our coverage. No no. the laundries, the boiler house, laundries and workshops.

.....

Researcher: So they also operate under the act that this unit operates in?

Interviewee: No they don't operate under it, what I am saying is that they are designated, there is a provision in the act that says you can designate any public officer (**Researcher:** hmm). So that section has been used to designate an occupational doctor and occupational nurses in the past- to be able to go in to industry to be able to deal with the issues that are health related (**R:** hmm).

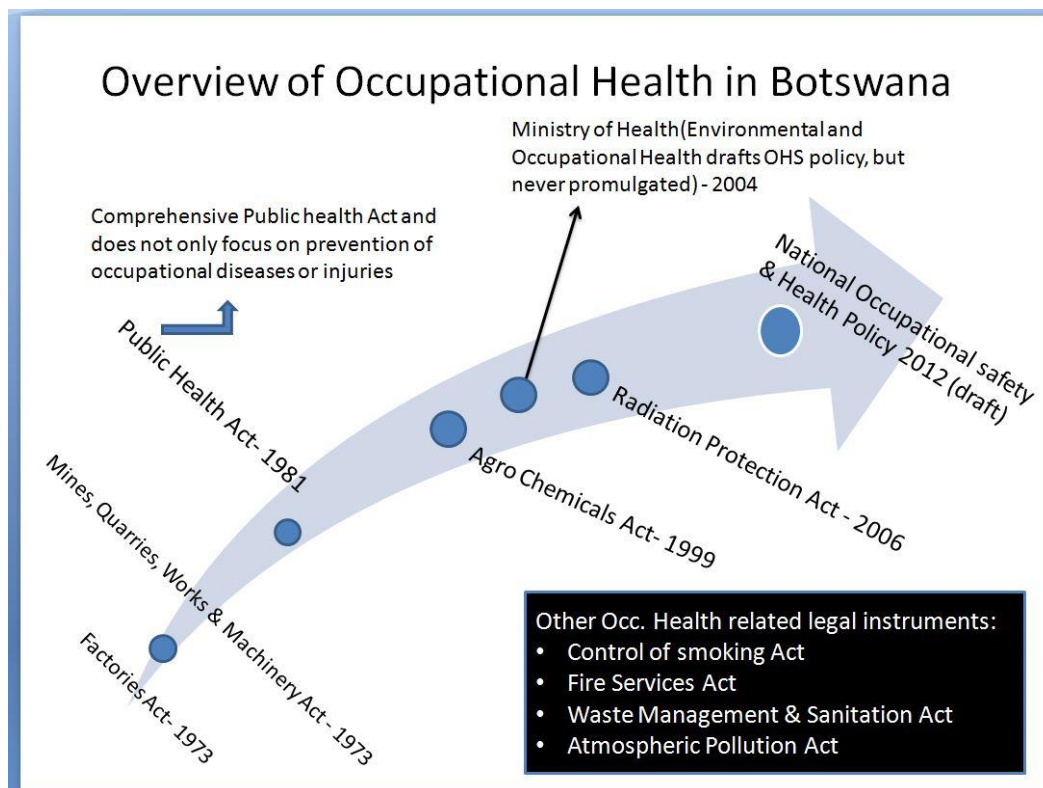


Figure 10 A summary of legal instruments related to OHS

Even though occupational health professionals could be delegated to evaluate, assess and control hazards within the health field, the Factories Act did not authorize them to operate, at the hospital level, and so there were no occupational health officers as officially instituted by the national health body, the Ministry of Health. Some of the participants were acutely aware of what the lack of proper occupational health structures meant for healthcare workers as a collective.

*“In terms of [pages flipping] you see in terms of healthcare workers, even you know, there is always a general need that at times the interest of the healthcare worker is not looked at specifically, **we certainly do know that as an occupation you know there is a lot of occupational hazards for healthcare workers, and there is a tendency in other to look at other workers like in the mining industry and so forth but without paying much attention to healthcare workers. So yes, I generally feel that healthcare workers in this country, certainly in the various institutions are short-changed.** There isn’t enough time, there is generally yes there are but – limit their unionisation but there is this thing that limits their unionization, because their skills are limited and they are required skill and at times their needs and interests are not met.* Physician, Hospital C

7.1.2 Occupational health services in the hospitals

Some in-depth interview participants from both private and public hospitals observed that there were limited occupational health services within the hospitals. The limitation of occupational health services was notable at different levels within the healthcare system. Some of the participants extended this perceived deficiency of proper services not just to occupational health, but to the broader spectrum of public health.

Leaders have got their priorities. Unfortunately, public health is not a cry baby in the world of health, it is a clinical services that are crybabies, you need drugs to treat these, we need to operate these, theatre, you need- so err monitor, evaluating and following up preventive, prevention activities is done when children have gone to bed if you have extra time, if you are too sleepy just sleep we know we can use that kind of analogy. In my view the big policy makers the big leaders they have too much on their plate to follow most of to follow through most of their preventive activities (Researcher: mmhmm). Unless this preventing activities that are going to be probed and followed up by the international communities, the MDG's, the the what the (Researcher: WHO) these childhood, immunization, there is these statistics that you go to Geneva to present on an annual basis, those ones they followed up. - Public Health Specialist, Health Administration

Interviewees posited that public health in general lacked recognition that was afforded other

health services such as clinical services. Occupational health is one of the youngest professions in the country; this appeared to translate to a lack of recognition more pronounced compared to fields that have been in the country for a considerable time.

*“...Well the issue of occupational health and safety in this country is fairly new. Yea, only 35 years old in to the issue other than other countries-. But that should not- to say because we are only 35 years in to this issue of occupational health, **yes when you look at the whole set up in most cases, the issues of occupational health and safety total they are only seen as additional, because when you look at the planning for any organisation, occupational health and safety is only considered as any other business it's not part of the main, err business err agenda. Hmm...**”* In-depth interview, Health Administration, OHS officer

Another piece of evidence of the youthfulness of Occupational health Services in Botswana, is the legal framework which was drafted in 2012 (National Occupational health policy).

7.1.3 Worker's compensation

There was an awareness of the type of exposures and risks that healthcare workers were faced especially with the appearance and increase in more aggressive strains of TB such as MDR and XDR. There were also references to lack of monetary compensation for healthcare workers who were exposed to TB in the workplace. However, the latter actually was a clear difference in opinion between the in-depth interview participants and the focus with middle management and leaders of the view that if there is no proof that healthcare workers were exposed and

infected in the work place, then they could not be compensated. Some of the focus group participants thought they ought to be compensated as they were exposed to infectious diseases. The views of the participants are discussed further and later within this chapter under “barriers to implementation”. In-depth interviews particularly from the TB coordinators revealed that if healthcare workers were diagnosed with TB, they were furloughed, treated, and returned to work after they were considered to be non-infectious.

While most of the in-depth interview participants expressed that healthcare workers could not be compensated without proof that they were infected in the workplace, some of the TB coordinators responsible for collection and storage of data about healthcare workers infected with TB believed there was a possibility that some workers did in fact have workplace-acquired infections.

*But at the same time, we have realised that there are some of the health workers who are always being affected[sic] with TB, or infected not affected, infected with TB. **But what we have realised is that usually when people are still working in the the high-risk areas, they don't, most of them don't usually present with signs and symptoms usually they will be presenting with signs and symptoms two years or three years later after they have worked in the ward.** But we once had a case, who had those signs when they were in the, they were still working in the medical ward.* TB coordinator, Hospital A.

Even though most of the participants strongly opined that there was lack of evidence of TB infection in the work place, some seemed to break away from this school of thought to offer other possible explanations as demonstrated above. The discordance was further illustrated by the fact that Batswana* who had worked in the South African mines, and returned with a diagnosis of silicosis and TB, were compensated. However, one of the participants who asserted knowledge about Botswana Worker's compensation added that only diseases which left the worker "incapacitated" were compensated (see bold part of the verbatim quote below).

Researcher: *Is it currently by law a compensable disease for healthcare workers if they were exposed and they have the infection?*

PHS: *No, workers compensation doesn't have (Researcher: it does not cover) it does not cover tuberculosis, only in South Africa where you get tuberculosis; you get TB when you are working in the mines. (Researcher: Hmm). We know that silicosis your risk of getting tuberculosis is even higher than someone who has got HIV and the risk of TB. So they recognise that you are diagnosed with tuberculosis, any worker in the mines, then you are entitled to some compensation. Not a full compensation but a certain amount. (Researcher: Hmm)*

But our law does not say that TB is in compensable.

Researcher: *What do you think about that?*

PHS: *It needs to be, there needs to be rules for such an argument to be entertained in case in cases of healthcare workers but for me is the most important thing is healthcare workers need not get tuberculosis if good preventative measures are taken, yea, if hospitals and their ministry management take prevention and protection, prevention of disease, protection of healthcare workers*

seriously, err the guidelines of prevention of tuberculosis (**Researcher:** are there) are there, they have been followed and you would expect very few cases developing tuberculosis, that's a good thing when it comes to compensation. We don't compensate just because we compensate, you get compensated only if the illness leaves a permanent damage. **TB is largely treatable without any permanent repercussions (Researcher: but MDR) if you develop MDR err in the process you could lose or change your jobs or some part of your lungs excised or I don't know, it is the permanent incapacity that is compensated.** So TB shouldn't be a big issue in terms of compensation because by the time you are left with that unusual case who developed some lung collapse and who has to be operated and half of their lung removed but it is also a rare rare case.

Researcher: Ok, so the law as it is only compensates people who have who are really in incapacitated for loss of days of work maybe (**PHS** Yea absolutely)

PHS: Loss of days in the cost of hospital care. All that is is is part of what we call temporary incapacity and your employer actually foots that. Whereas if you have finished you six months or is it three months, whatever it takes and you are free of the TB, then you cannot qualify for compensation (**Researcher:** ok) yeah, without complications.

A copy of Botswana's Workers' Compensation Act is attached in [Appendix D](#)

7.1.4 Occupational health activities at the hospital level

Some of the existing occupational health services were introduced after occupational health officers from the environmental and occupational division of the ministry of health conducted seminars and workshops around the hospitals, then made recommendations for the hospitals to start occupational health committees (The researcher was part of the team that conducted OHS seminars for healthcare workers in 2009 prior to beginning her studies). The norm in hiring 'nurses' for instance is that the Ministry of Health determines how many nurses are needed and where and proceeds to employ them as needed. Two of the three hospitals were reported not to have an Occupational health officer or committee. Only Hospital B had an existing Occupational health committee. The chairperson of the committee was interviewed for our research project.

The participants informed the researcher that some of the main hospitals had recently appointed environmental health officers who were expected to assess environmental exposures within the hospital environment and provide control measures. The researcher planned to interview one of the environmental health officers at Hospital B, but was not able to secure a workable appointment with the environmental health officer, therefore the mandate and extent of the role of the environmental health officer remains unclear for the context and purpose of our study. The environmental health officers were educated locally in the Institutes of Health Sciences around the country, and they were diploma holders. They were relatively new in their positions and both public hospitals, A and B, were assigned these officers.

At the time of the study, some of the participating hospitals were training healthcare workers in TB infection control and management, and there were also references to plans by the hospitals in conjunction with the Ministry of Health, to screen TB among healthcare workers in the not-too-distant future. Upon exploring the perspectives of the HCWs regarding some occupational health practices, we found that some personal protective equipment for TB prevention was inconsistently available for some healthcare workers. For instance, in hospital A, the distribution of the personal protective equipment, N95s, focused primarily on the TB infections in the so-called high-risk areas, such as Medical wards and Emergency department. One of the reasons for the allocation was that the N95 was an expensive respirator and could not be distributed to areas where it was not primarily needed.

In hospital A, another issue that limited where and how N95s could be distributed was challenges with procurement and purchasing. The hospitals had to place N95 order requests to Central Medical Stores (CMS), a national supply facility which supplies public hospitals with medical equipment and drugs. The hospitals were dependent on the CMS such that if for any reason, CMS did not have N95s in their inventory then in turn the hospitals could not be provided with respirators.

There was a perception among participants that infection control personnel performed the activities that could potentially be carried out by occupational health, and as such they

expressed that there was no need for OHS. In some cases, there was a clear indication that those dealing with infection control and 'health and wellness' programs found it difficult to situated occupational health within activities and functions of the hospital.

An infection control coordinator spoke about some of the activities they conducted that could be considered to be the mandate of occupational health:

"Interviewee: hmm, no akere (like), I will say a lot, because when patients - when staff workers are pricked by a needle, (R: hmm), akere (like) that one in infection control, so we do all the tests, and they don't pay. So it's under infection control - Hepatitis B is infection control, (R: hmm), any injury like you know work related, (R: hmm), like slip and fall even though I haven't heard any. So those are infection control related even the annual x-rays infection control but mostly the only thing that happened is the needle stick. Ee (yes) because even the lab tests, plus the medication, we pay."

In-depth Interview, Infection control coordinator, Hospital C

Another example comes from the *Occupational Health Workshop Participant Journal*, one of the documents we collected. In this document, it was established that OH committees should be formed under the Workplace Wellness programme. This is perhaps why in some instances participants did not make a distinction between "wellness programme" and "occupational health" committee.

“Researcher: -and how relevant do you think the infection control and occupational health people are?

Interviewee: For wellness?

R: For preventing TB in healthcare workers.

I: Infection control, and-

R: Occupational health people.

*I: hey, they are, I *Both laugh* I I, very important, we we we, basically have to work together, you know what is currently happening? There is restructuring of Ministry of Health going, and this restructuring is bringing together the wellness programme and occupational health programme to be one body, (R: Ok) ee, it's only the process was stopped I don't know the reason behind that **but they have realised that we are, it's only the titles that separates us but we are a one, if it is a person, one person. *Both Laugh*** ee, but for for, if you talk about occupational health and infection control, issues of TB/HIV really it's all about infection control because you will talk about administrative the structures of the buildings, the environmental controls, the your ventilation the pro- personal protection tsa bo (such as) N95. It's infection control and wellness for the health worker as well, so it's – we basically have to work together...”*

In-depth interview, Wellness officer 1

The relationships among occupational health, infection control and wellness was an interesting one throughout the study. In some instances, the boundaries between these seemed blurred, in others they appeared at odds, with even positively impassioned ‘wellness’ personnel at times placing the burden of occupational exposure and control on the worker.

Wena (you) the cleaner when you come in to a consulting room to clean and you find all the doors and the windows closed (R: hmm) know that you are not supposed to go in immediately, go inside open the windows, go outside go somewhere and then come back inside after 15 minutes when the TB bacteria has gone, gone out then you start cleaning, wena nurse are you aware of what you are doing when you consulting and the fan is on top of you? it's spreading (R: spreading all the exposure) it is like – talking to them, it was a beautiful thing and we were showing them the ideal facility which is TB infection control friendly and there were like so our facilities are like this, the structures are exposing us, it's good you know the structures are exposing you, **so what are you doing about it? how do you make it friendly because you cannot remove the structures, you have to work with them the structures but how do you do it? it's something that, this is one component that made the healthcare workers to find, put himself or herself on top of the table, and say what am I doing about my health? it is really practical and I'm glad we gonna be making the the guidelines after that.** (R: hmm). In-depth interview, Wellness officer (former), Health Administration.

In other cases, there seemed to be confusion between occupational health and perhaps occupational therapy:

R: yea yes, how are – how important do you think occupational health is to - in terms of maybe TB prevention in terms of healthcare workers? Or preventing any other exposures in healthcare workers?

I: yea, no I think it's its ok, maybe it's only that people who didn't even think of occupational because infection control when you look at it, it does occupational health, everything slightly. It's doing everything. I think with that it will help, it will help. Because maybe dissemination of information, occupational (R: hmm), plus infection. **It can help, because occupational gape (also) involves you know like rehabilitation sort of, you know like counseling sort of, I think it can - it can help. So, we need to**

implement, see and then implement and see, gore (if) is it... but I think it will help because in most cases our patients sometimes they go to South Africa for this rehabilitation and occupational things-rehabilitation (R: hmm). We refer them to, there is a certain hospital in South Africa, Life HealthCare as well (R: hmm), so we refer them there. So maybe even if we have someone of that caliber then maybe it can work properly with the infection control coordinator or a specialist. In-depth interview, Infection control coordinator, Hospital C

However, this view seemed to be in stark contrast with what the same participants and the rest on the in-depth interviewees expressed, which is that there was a need for occupational health services in the country and the hospitals. Almost all participants acknowledged the need for OH. Examples of the need and appreciation for what OH could bring to the hospitals services were clear where expressed.

“You see in terms of healthcare workers, even you know, there is always a general need that at times the interest of the healthcare worker is not looked at specifically, we certainly do know that as an occupation you know there is a lot of occupational hazards for healthcare workers, and there is a tendency to look at other workers like in the mining industry and so forth but without paying much attention to healthcare workers. So yes, I generally feel that healthcare workers in this country, certainly in the various institutions are shortchanged. There isn’t enough time, there is generally yes there are but – limit their unionisation but there is this thing that limits their unionization, because their skills are limited and they are required skill and at times their needs and interests are not met. Like to give you an example like these programs like for Hepatitis B,

until recently its haphazard, there is no national program and things like that (R: hmm), so yea I think more should be done “ In-depth interview, Physician, Hospital C

Where OH committee/officers were available, there was collaboration with infection control personnel. Some health centers like hospital A, reported that they had previously had some semblance of an occupational health committee, but this had been merged with other groups to become risk management. There services/activities targeted toward healthcare workers, such as training healthcare workers in infection control, TB screenings, staff clinics. Although, this may technically fall under the specificities of OH, and in most cases they were done with aim of preventing transmission in patients, some were geared toward healthcare workers.

Even though there was no formal occupational health services in two of the three hospitals there were some controls which were put in place, and these are described in the sections below. These were likely measures which some of the healthcare workers learnt from the occupational health workshops which were conducted by the Ministry of Health, as a way of introducing Occupational health to the hospitals.

7.1.5 Administrative controls

In addition to workshops conducted to train HCWs in occupational health, posters and flyers were distributed and posted around the hospital, and some participants reported to have seen such learning material. Others described some of the activities carried out in at the wards.

*Nurse2: I worked in female medical ward since 2010, and there I have had like two cases of colleagues who had TB. They were on treatment and they finished the course. But I think at female medical ward we are at a higher risk of getting the TB. **We have measures like isolation of patients, which help to reduce the spread among patients and workers, but usually you find that it's two patients per room.** Even if the other patient is not... they are investigated...and the other one is found not to have TB, the other maybe might become negative, the other one positive. So this other patient is at a higher risk of getting TB from this other one because two patients in one room, the other one has TB and the other one doesn't have TB. Even in the general ward, the other patients, who didn't come with rule-out TB as a diagnosis for their admission, they can test positive for the AFB, when we test them, if they present with signs of TB like coughing, or anything, they can become positive for the AFB bacilli, so with that, I think we are exposed to getting the TB. That's all. Focus group 1, Nurse, Hospital B.*

For the public hospitals healthcare workers, nurses and auxiliary nurses rotated in the different parts of the hospital. For instance, a nurse could work at the emergency department for one year before being transferred to the medical units. According to the participants, this was done to reduce exposures to infectious diseases such as TB.

*TB Coordinator: Yea the infection control guidelines, formulating them, it was a very good thing, so that the healthcare workers can know what is there. (Researcher: hm) Like in our infection control guidelines, (Researcher: hmm) we really talked about the..., **we had some, we really had a concern***

about the healthcare workers (Researcher: Hmm). Like maybe say in this healthcare workers there must be rotated in the high-risk areas, every year they must be rotated in the high-risk areas. If they are in surgical wards, or in multi drug resistant ward, (Researcher: hmm) after every year they must be switched from it (Researcher: hmm). And at the same time, we say the health workers must know their HIV status, (Researcher: Hmm) so that if he is HIV+ he mustn't be allocated to those high-risk areas, especially the multi-drug resistant or even the medical ward, because our medical wards we take them as the TB wards, in hospital A because we don't have a TB ward, but unfortunately when it comes to revealing the HIV status, people don't want to reveal their HIV status. Now it becomes very very difficult for us (Researcher: hmm) really to do that.

The private hospital also followed the same process of worker-rotation:

“Researcher: have you ever had a situation where the healthcare worker was having TB that was suspected to be from the workplace?

Interviewee...But what we have actually introduced nowadays as when they do the x-rays, so what we have decided to do is that we rotate staff so that they don't stay in one unit for a long time. Maybe every year we rotate nurses, we rotate nurse-aids so that when it comes to D-ward most of them complain about back-ache because of lifting people and then medically, not that I know of. But -

R: and then what happens in that situation, when they complain about back-pain from lifting patients?

I: we do, like there is one in oncology, akere (like) there is no lifting there, we transferred one to C ward and there is one in C ward with the babies. And then there is training by physiotherapy how to lift. Its only people you know how they are, they are shown the device, how to use but at times they just want to

do their own, (R: hmm), go their own way but we do.” In-depth interview, Infection control coordinator, Hospital C

Some of the preventive activities fell between the two paradigms of occupational health and Infection control. The patient-related measures of triaging patients could help reduce exposures for both patients and HCWs. Some of the participants reported that triaging patients took place in some of the hospital units, but this was not a standard and usual practice in all the units and wards. For instance, in Hospital A, some of the hospital units had isolation cubicles, where either suspected or confirmed TB patients could be isolated. Even in some cases where isolation cubicles were available, patients with suspected TB were not necessarily isolated until they were diagnosed and confirmed, which in some cases took as long as two weeks. Hospital A had isolation cubicles within only some of the wards, and there was no exclusive TB ward. Hospital B had an independent TB ward. The story behind the absence of the TB ward as reported by some of the participants was that, there was once a ward which was dedicated for isolating patients diagnosed with TB, however, with the advent of HIV and before the government initiated the anti-retro viral program (ARV), there was a severe shortage of space to accommodate the patients who had HIV-related diseases and needed hospitalization. The former TB ward was converted to a space for such patients, and this continues to the present day. However, there was a new initiative to create a space dedicated to TB patients, and at the time of our data collection, the clinicians who were responsible for TB patients and their

patients were in the process of moving to the new facility, a portacabin (portable rooms/units), a few kilometers from Hospital A.

*“...there used to be a TB ward before and since some years back. I think, because of that it may be little cases of TB, now they found that the structure was not utilised. (Researcher: ah, ah...) But later on, now that structure was modified or err structured hmmm..part...or structured to accommodate multi drug resistant cases, and at present this structure has been is being used for multi-drug resistant TB cases. So we are admitting our multi drug resistant TB cases there. **So we have some extra there and the global fund, the global fund funded us and the structure was modified to be, to accommodate multi drug resistant TB cases...**”* In-depth interview, Hospital A, TB coordinator

Even though the hospitals did not have separate policies, guidelines and standard operating procedures for occupational health, the hospitals did have other documents that supported occupational health to some extent, even if in some cases, information collected by such documents was for use by the hospital and Ministry of Health. Routinely, all hospital workers were required to undergo entrance medical exams before resuming their clinical and general duties within the hospital. However, it was unclear how information obtained from healthcare workers' entrance medical exams was later used in the assessment of occupational exposures, if it was ever used at all. None of the participants made such a link.

Some participants reported that vaccinations for healthcare workers to prevent Hepatitis B did at one time exist, that these had ceased some years ago, but were now being reconsidered. Some of the participants felt that the policy-makers valued the opinion of external consultants compared to healthcare workers. An example was about Hepatitis vaccinations, where some participants felt were re-initiated in part because the hospitals desired to pass the then newly instituted external accreditation process.

*Interviewee: ee [yes], le bo [also/plus] wound care but bo wound care we haven't come to say this much statistics is wound care – we had this much statistics on it and this is what was done(R: hmm). The other thing is that of vaccinations, we haven't been – on that, is that every staff member should be vaccinated, but when I joined here ka [in] '07, I found that the officer who was here,[...] has long lobbied for vaccination of Hepatitis because it was once done in hospital A long back but they just disappeared like that. So before taking over the office in '07, I found that there were lots and lots of letters towards the likes of [...]which were not being acted upon. **So our people as they are, our big offices Ministry of Health as they are, you will be pursuing things, but if someone is from outside as a consultant asks them, "are you doing this, why are you not doing it?" That's when they start doing. And yet someone who has been there for ages, who was constantly asking, "what are you doing what are you doing" (R: hmm). I'm saying this when we started this thing of accreditation exercise in 2010 (R: hmm) that's when those consultants from RSA (South Africa) asked if we were vaccinating. That's when the questionnaire (R: hmm) came from Ministry asking, 'are you vaccinating your staff?' what I did, I collected all those letters and documents we wrote as the***

infection control committee with [...] and others. I took all of them, put them in a file and returned them to the ministry, and I did not fill in the questionnaire (R: hmm). I said to them, no, that is my answers for that questionnaire. Do you see how it is? That's when they developed their own, but we had already developed our own protocol of how we were going to vaccinate people. How do you prioritise this vaccination? (R: hmm). We did everything, even guidelines we created them as hospital A infection control committee (R: hmm) only to find out that then they started. By last July, the permanent secretary [ministry of health] released guidelines for Hepatitis B vaccination (R: hmm) saying people should be vaccinated. We have started that now we are in the second batch, those who had not been vaccinated, those who did not get their three shots, they started vaccinating them to cover the whole 1700 of hospital A.

In-depth interview, Infection control officer, Hospital A.

Medical exams and other check-ups for healthcare workers were not regular, and there were no consistent processes for evaluating who had medical exams and when they took place.

Different departments seemed to have different criteria, perhaps depending on the occupations of the hospital workers. For instance, it was reported that ideally, incinerator operators were to undergo medical examinations every two years and once annually for some HCWs such as those in the Intensive Care Unit.

7.1.6 Engineering controls

One of the most common engineering controls that all the hospitals implemented was natural ventilation, where the healthcare workers ensured that windows and doors to the units with patients with TB remained opened to allow an inflow of non-contaminated air from outside. In the units where ceiling fans were available, these were operated. However, natural ventilation could not be relied upon all year round as during the winter, when the temperatures dropped, the windows and doors had to be closed to protect the patients from the elements. In both hospitals A and B, participants indicated that some equipment used to prevent exposure often lacked proper and regular maintenance. For example, ceiling fans were not always functional, and there were some hospital spaces with a high number of patients and no windows, such as around the pharmacy area in Hospital A.

Yea it's kind of, it's central, we cannot even talk of windows at that place, the only source of ventilation will be the running fans, you know. Like I said it's an old design you know, and there is nothing much we can do about it, the only thing we can just do is to educate, education education, education, of patients. We also once in a while invite the TB coordinator to give lessons to patients, one hour, in fact every Wednesday like tomorrow she will be there for one hour. To start talking about tuberculosis, what it is, how to prevent it and all those things but to patients not to staff. those are some of the measures but in terms of structural designs it's pretty difficult the fans are the only things that is involved in providing ventilation. In-depth interview, Pharmacy technician IPC committee member, Hospital A

The challenges with maintenance of equipment were reported at both public hospitals.

“Another unfortunate part is that BSC is down, the one that we were using for processing our specimens. Researcher: What's BSC? Lab-tech: They call it Bio Safety Cabinet. So, it is totally down and actually some guys, inspectors from CDC, actually they have condemned it gore (because) now what it is doing, it is not aspirating the bacilli out, it actually is now bringing it inside the lab, and you see gore we have been using it for sometime rona re tsaya gore [we assumed] it's actually working, while actually it was not working, I think for bo [about] more than six months. Rona [We] the fact that it was on, we were seeing the signal that it was on, so ke raya gore [I mean] maybe when time for screening comes up, we don't know, maybe the cases are still subclinical. Focus group 2, Hospital B, laboratory technician

Most in-depth interview participants acknowledged that the hospitals in the country were constructed post-independence, and when most of these structures were built, there was no consideration for controlling infection.

“Researcher: ok, so you, I got interested in in in the lab workers again, I was wondering within the hospitals, the lab workers do sputum induction or is that done by the respiratory therapists, how's that?

Interviewee: Yea, if they are trained they can do that (R: ok), but not when – most of the time it's done by the clinicians or even the auxiliaries because it's just a simple procedure. (R: ok), so we find some open space, initially when I came in to Hospital A, they were just doing it next to paediatric [clinic] then I said “why, what are you doing?” Even some of the extractors in the TB unit they were facing the paediatric but we had to change, (R: Hmm). That's why we have moved even the MDR to Extension 12, (R: aaaahhh).” In-depth interview, TB coordinator, Health Administration

7.2 Evidence of occupational TB exposure for HCWs

There were some topics where in-depth interview participants agreed. One of these primary topics and themes is that there is no evidence that healthcare workers diagnosed with TB were exposed and infected in the workplace. This theme arose from the question to the participants which sought to understand their opinion on whether or not healthcare workers who are infected with TB should be compensated.

No,, it's difficult. It's difficult to know if they have got the TB at the workplace or they get the TB at home whatever the fact– I know they are exposed more at the workplace but they can get TB from a family member who was with them - they can get TB from friends when they are staying. It's difficult to really say they have TB from work,/where, and the other point, is that because they have not been exposed themselves, on the routine screening and that could help, to know if they were not having TB up to this time, that this is the time they are getting because we have that kind of screening, they are not doing that. They are few who are coming for screening that is difficult for us to say this is an occupational disease, slightly difficult, it can be it cannot be... In-depth interview, Health Administration, Physician

Most participants who were of the opinion that there is not enough evidence that healthcare workers were infected by TB in the workplace gave examples that exposure to TB may occur through many ways such as a family member with active TB, public transportation, at church

and other public spaces. Others remarked that since healthcare workers' HIV rates were not that different from the general population, it could be that some of the healthcare workers had TB infection which was associated with HIV infection.

However, some of the participants such as the TB coordinator at Hospital A entertained the idea that some of the workers could in fact be exposed at work. Her reasoning was that some workers, who were HIV negative, were known to have worked in high risk areas, then developed TB later.

*...err, mmmmmm, really as you know that TB is an airborne disease, it's really to say these people will be getting the infection from the patients. **But at the same time, we have realised that there are some of the health workers who are always being affected with TB, or infected not affected, infected with TB. But what we have realised is that usually when people are still working in the the high-risk areas, they don't, most of them don't usually present with signs and symptoms usually they will be presenting with signs and symptoms two years or three years later after they have worked in the ward. But we once had a case, who had those signs when they were in the, they were still working in the medical ward. But most of our cases are cases which we have, not working in the high risk areas, you find that maybe the patient will start developing some signs and symptoms, the ones who are on treatment now, the other one is working at ICU, the other one is working at surgical ward which really can say of course TB, as Hospital A does not have a TB ward, TB patients are all over, but we said***

high risk areas are medical wards, and accident and emergency and other things but sometimes the patient present the the healthcare worker present signs and symptoms, in the areas which we really think they are limited, ke raa[I mean] they are non-risky. (Researcher: ok) or they are less risky wards. (Researcher: ok) hmmm.... TB Coordinator
Hospital A

There were also healthcare workers who presented with TB and had no immediate occupational history of having worked in high-risk areas. Like the TB coordinator, most participants stood firmly by the statement that there was not enough evidence that healthcare workers were exposed to TB in their workplace. However, most also admitted that the public hospitals were “not built with infection control in mind,” but they were also likely to point out the fact that healthcare workers were also among the population who were infected with HIV/AIDS and therefore, their TB may be an opportunistic infection related to the HIV infection, and not necessarily a result of possible occupational exposure. However, one of the more sympathetic participants mentioned that he believed that when healthcare workers are found to be infected with TB, each healthcare worker should be investigated to determine where they could have been exposed. He also made reference to the high likelihood of TB exposure to healthcare workers compared to other occupations.

If a healthcare worker has tuberculosis and wanted to be compensated because he's got tuberculosis and is convinced that TB has a reason out of the contacts, close contact with patients or cough, ummm that case will have to be looked at on an a case

by case balance of probabilities it shouldn't be a case of who has proved beyond reasonable doubt that this case is for the clinic and not from the girlfriend we have to look at each case on its own merit, we also know that once you get HIV your risk of developing TB is increased). So if you ask me in my view the compensation for healthcare worker who's got TB should be treated with the most sympathetic eye and the compensation of err err err lets say a till, a supermarket till worker who develops tuberculosis, TB is not a typical err occupational disease but it can be, it can be argued.

Public Health Specialist A, Health Administration

The above participant also mentioned that compensation for TB infection and disease were a highly contestable issue between the government and healthcare workers, there was a particular occupation where there was acceptance that their TB exposure and disease was far clearer and as such they were partially compensated. These were miners:

*No, workers compensation doesn't have (Researcher: it does not cover) it does not cover tuberculosis, only in South Africa where you get tuberculosis; you get TB when you are working in the mines. We know that silicosis your risk of getting tuberculosis is even higher than someone who has got HIV and the risk of TB. **So they recognise that you are diagnosed with tuberculosis, any worker in the mines, then you are entitled to some compensation. Not a full compensation but a certain amount. But our law does not say that TB is in compensable.*** Public Health Specialist A, Health Administration

Some participants indicated that one of the difficulties with TB tests particularly for healthcare workers, was that most tested positive for Purified Protein Derivative (PPD) due to exposure to bacilli, which was a high possibility given the nature of their work. This meant that those who

tested positive for PPD had latent TB, or that it was possible that they had received the Bacillus Calmette-Guerin (BCG) vaccine at some point. This complicated the healthcare worker TB screenings which were on-going in some of our research sites during data collection. Those conducting the screenings were more interested in providing clinical intervention for only healthcare workers with active TB disease.

The view that there was no evidence that healthcare workers were infected with TB in the workplace seemed to be an agreement among participants from public hospitals. This question was less relevant for participants from the private hospital because the nature of their profit-making institution means most Batswana could not afford to pay hospitalization and medication fees, therefore they did not admit a lot of patients with TB, and no healthcare workers were diagnosed with TB. Hospital C, which is a private hospital, remarked that they had fewer TB patients, therefore they faced less pressure as far as investigating the number of healthcare workers who could have potentially contracted TB in the workplace was concerned.

The TB coordinators who were responsible for collecting the data on TB among healthcare workers found it challenging to evaluate these numbers, because it is not mandatory to report the TB status to the hospital or TB coordinator. Although nationally, it was mandatory to report the number of TB patients, within the hospitals, healthcare workers infected with TB were encouraged but not mandated to inform the hospital TB coordinators about the condition. Participants indicated that most healthcare workers would elect to seek TB treatment from a

health station that was not in proximity to where they worked, possibly due to lack of confidentiality in their own health facility or due to fears of being stigmatized and ostracized.

During our data collection, hospital A had a healthcare worker who was going through the process of TB diagnosis and the TB coordinator had initiated the process of contact tracing in the healthcare worker's department.

*"...Yea you know at present, we are working hand in hand with infection control office, (Researcher: hmm) so we have talked to the management about this, after our training with the CDC Atlanta people for infection control, and then we are our health workers are being screened hmm, they are being screened for TB, there is a doctor and one of the nurses who is dealing with the doctor to screen. (Researcher: hmm) **as you know, as I have been telling you that, there is one of the health workers who is now on TB treatment, we asked that can we please do an x-ray and then we collected sputum we found that there is 3 pluses so then, the co-workers are being screened for for TB. But...**"* In-depth interview, Hospital A, TB coordinator

The Ministry of Health via the Botswana national TB program has a registry, which is a database for all patients diagnosed with TB and provided with treatment via the national healthcare system. We requested access to this database, but were notified that this would be a fruitless exercise, as the registry did not differentiate registrants by occupation. This means that we

would not have been able to identify from the registry who was a healthcare worker and who was not. However, the TB coordinators had the data of the healthcare workers who chose to report their status to the TB coordinator and to receive treatment through them (it is highly likely that these figures under-estimate the number of healthcare workers with TB, as it is not compulsory for workers to report their TB status to the TB coordinator). We present some of them in the table below as obtained from the Hospital A TB coordinator. As we did not obtain any other numbers, and these are too few to conduct any statistical tests, we included the table here to demonstrate the number of healthcare workers who had TB, out of approximately 1700 workers. We however cannot be definitive about these as it is unclear whether they were exposed to TB in the workplace or in the community. Additionally, the TB coordinator from whom we collected these figures, had the following to say:

TB Coordinator: *Yea, yea, I do have the statistics, (sounds...mumbles...inaudible, door closing/shelves opening, pages flipping) yea I do have the statistics (hmm) but I cannot really tell that this is the real correct statistics (Researcher: ok) because what happens is that some of the healthcare workers (Researcher: Hmm) they do hide. They go as you know, you are not forced to take treatment (Researcher: Hmm), so they decide to take treatment wherever they want to take treatment. (Researcher: Ahhh). And you find that sometimes when they have been on lows, sometimes they decide to take the treatment elsewhere (Researcher: hmm) and then I cannot really capture the figures. So the figures which I have are those who really are identified in here, they are taking treatment here. Or even if they are not taking, or maybe I hear that 'so and so was on TB treatment' and then start to write.* In-depth interview, TB coordinator, Hospital A

Table 7 Number of HCWs with TB disease, reported to TB coordinator at Hospital A.

	2010	2011	2012
Drug-susceptible TB	(2) 2-Auxillary nurses	(8) – 4-Medical Doctors, 1-Nurse 3- Auxillary Nurses	(4) 3- Nurses 1- Auxillary
MDR- TB	(4) † 3- Auxillary Nurses 1- Registered Nurse		
Extra-pulmonary TB	(1) Job title, not identified	(2) 2 Auxillary Nurses *1 death	

*1 death: Was working in the laboratory at the time of death, history of having worked in medical wards

† Some have history of working in medical wards (HRA)

Unspecified number, HIV+

For the healthcare workers who were infected with TB and chose to receive healthcare services through the TB coordinator, they could be admitted and placed in isolation depending on availability of space within the hospital wards. The treatment they received was not any different from all the other patients. Their progress was followed by the TB coordinator, and

they often followed the sequence; (a) provided with TB treatment; (b) a furlough which consisted of 6 weeks off daily duties or until non-infectious stage; (c) contact tracing which included following up with the family; (d) follow up on return-to-work. It is unclear what the TB the process of “follow up with the family” entailed, however, after the healthcare worker was ascertained to be non-infectious they could return to work, however, there was no monetary compensation for lost work time.

7.3 Infection control

This category includes the activities and processes that participants discussed which were carried out to minimize the spread of infection among patients. It includes any mentions of activities and process involving: passive/active surveillance or basic collecting of data that pertains to TB patients; the diagnosis and treatment of patients with TB; infection control measures such as triaging and isolation of patients; use of personal protective equipment; infection control plans devised at the unit, hospital, and ministry levels; informal and formal evaluating and monitoring processes for ensuring pre-planned infection prevention and control (IPC) activities are completed; and TB infection control guidelines.

7.3.1 Awareness & acknowledgement of importance of IPC

Infection control was an important theme in this study because it is central to the control of TB among patients and healthcare workers. Therefore, we sought to understand the level of

awareness of this topic for both in-depth interview participants as well as during the focus groups. We found that there was a general acknowledgement and agreement of the importance of infection prevention and control at all levels and both within private and public hospitals. In comparison to occupational health which is a relatively young field and profession in Botswana, the introduction of infection control was more recent, having been introduced in the country within the past decade.

However, examples of the level of leadership buy-in and support for IPC were discussed by participants in particular; the TB coordinators, wellness officers and the infection control officers.

“Interviewee: ee (yes), they are I will check for you the the because there was some communication that was circulated (Researcher: Hmm) just listing the proposed structure of the Ministry of Health, (R: Hmm).

*Interviewee: hey, the the the only challenge that I see is the one that is beyond all of us, (R:Hmm) because I I could refer to the old hospitals and say is the structural ones (R: Hmm) that the way they were built they do not have the infection control in mind (R: Hmm) even the new hospitals we have like Scottish Livingstone, Serowe, (R: Hmm) **the way they are built infection control was not put in mind but the- fortunately I was talking to [...] the TB Programme head the other day and he told me that he has met... proposed that when there are some plans for the new hospitals that are to be built, (R: Hmm) they should be part of the the the people who sit to discuss the plans so that they could put in the infection control measures. I don't whether it was Dr [...] or Dr***

[...] because I talk with them more about this TB/HIV infection control (R: Hmm). Fortunately for the up- upcoming ones the infection control measures will be in (R: Hmm) place because when we (R: Hmm) go out and train the health workers because we train all of them, from the grou- grounds men to the cleaners, the the health, the nurses, all of them of the pharmacists they were like, we hear you guys (R: Hmm) and you know how much we are exposed to this TB (R: Hmm) but the problem is that the settings that we work in, wa bona (you see), (R: Hmm) so it gets really difficult for us but we always look at their, before we train we go around their facility to look at possible measures that can be done, like say having the- although they don't help/have[not sure] the the the fans, tse (that) (R: Hmm) di dikologang jaana (go round/circulate) just at least to aid in taking out the some air, and open the little windows that we have (R: Hmm) at our facilities (R: Hmm) jee, but we try, and the N95's were there but the pharmacists would order them for people who are in TB wards.

There was mention of the national infection control policy whose formulation was being discussed by stakeholders at the time of our data collection. At the national level, the Ministry of Health, under the auspices of the Botswana National TB program, formulated *TB infection control guidelines* which were to be followed by healthcare workers in the hospitals and clinics to minimize the spread of TB infection in Botswana. The content of the guidelines is discussed at length under the guideline evaluation section. The public hospitals had been assigned infection control officers and the two public hospitals in our study both had IPC committees, which in turn assigned IPC focal persons in every hospital unit.

At the time of the study, the government of Botswana employed a system of operations called Performance Based Reward System (PBRs), in which at the beginning of every financial year, it was mandatory for every healthcare worker to submit to their supervisor the job-related activities they planned to achieve within that financial year. In-depth interview participants informed us that infection control was important enough to the national healthcare system that HCWs were urged to include IPC objectives in their PBRs. Within the PBRs, evaluation was done annually and those who had achieved set objectives were offered incentives and prizes.

7.3.2 Some infection prevention control measures are implemented.

Some of the participants were enthusiastic and had the impression that some IPC measures were being implemented, despite the challenges that were faced by IPC. They informed the researcher that weather in Botswana is relatively stable for the majority of the year and therefore regardless of the lack of expensive mechanical ventilation, healthcare workers could open windows and doors to allow natural airflow and ventilation into the patient wards. In some wards, TB patients were triaged and isolated accordingly to minimize spread of infection. Even though personal protective equipment, N95 in particular, was not always readily available, some of the participants reported that it was accepted and used by some healthcare workers.

“...Actually in radiology, we are too much closer to the exposure with these TB cases, because we really touch the patient and we have to do those x-rays and there is instruction to normally give,

like "take a deep breathing"; and "hold it", those are the things we think, but what we have put as a measure, each and every patient who comes for chest x-ray for confirmation if it's a TB case, we normally prefer to have a lab test results and a Mantoux test if possible, so those are the first things we ask...(inaudible) this patient is a TB suspect, can you bring this so that we can confirm there is positive or whatever, so that we can put more measure on the person who is in the room. On top of that we have those masks, er..N95 which everybody got, every time, actually, we normally use it more than three or four times, but normally we order them, every time they are there, so that anybody who comes to collect the patient, he must put those things and normally patients who are coming for chest x-ray, suspected TB, we had a like er..like if the patients are admitted or they are from the clinic, they normally send us a message or they call us, "please we are bringing a patient" so that we can even not only to prevent the staff, even the other people who are next to the bench there, we normally tell then..."

Focus group 2, Hospital B, Radiographer

From the private hospital, some of the auxiliary nurses outlined some of the procedures they follow:

Yes, in this hospital, there are procedures that are being followed. Like when a TB patient arrives, they are isolated, they are placed in a room by themselves. The masks are placed there, gloves and gowns, and a sign is placed on the door, to show people the level of protection they need when they get into this room. The patient is also taught that they should not go outside, to prevent what, so that they just stay in the room, because the bacteria is still highly infectious for them to go outside. Now, there are masks that are used,

N95, we use them when we get into the patient's room. Then we throw away everything that we donned. We are supposed to use disposable gloves, and disposable masks, then throw them away. There's another procedure, even when you get in the room, if you are a worker, coming to do whatever you are coming to do, you must come with a well-equipped trolley, to prevent going out of the room frequently, fetching this and that. When you get into the room, you do what you are supposed to do, you complete it once, then leave. Even the waste, the mask has to stay in the room. When you leave you throw them away into the red plastic bag. Everything you use you put in the red plastic, unless it is domestic waste, like food, or regular garbage from home. The red plastic is located by the door, make sure you throw waste in there and leave it there.

Focus group 1, Auxillary 7, Hospital C

Some participants who were in leadership of hospital units mentioned that within their units, they allocated IPC-related tasks and gave responsibility to different individuals. They also used checklists to evaluate if IPC measures were being carried out

7.3.3 Hospital physical structures not conducive to IPC (Infection control engineering controls)

Despite the leadership and healthcare worker buy-in of IPC, one of the most common themes among in-depth interview participants, was that hospital architectural structures were not conducive for IPC. Some participants added that this was not a phenomenon restricted to hospitals constructed just post Botswana's 1966 sovereign independence. Even hospitals which

had been recently constructed were faced with structures which were not accommodative of infection control measures and practices.

For instance, hospital B, which officially opened in 2008, still faced infection control and other issues. The hospital was constructed to be self-contained where all the departments were under one roof, and in this attempt, there were areas where there was potential for reduced natural ventilation, an important consideration as there was no mechanical ventilation. At the time of the study, one of the participants informed the researcher that one of the wards in hospital B, the psychiatric ward, had been closed. This ward was constructed such that it was separated from the rest of the departments by glass walls. Its landscaping included stones, and unfortunately some of the patients vandalized the glass, rendering the department non-functional and putting the safety of other patients and healthcare workers at risk. This example is used to create context for participant comments about how the construction of this relatively new hospital was “not conducive” to some measures.

Even at the ministerial level there was recognition that it was a challenge to put infection control measures into place because the buildings did not have the structural capacity to allow this.

“Researcher:...what do you think are the challenges of the healthcare workers in implementing the guidelines?”

Interviewee: there are many challenges, and the managerial part of it is the support from management, (R: hmm). Some of the facilities, they are claiming not to get support from the management and whenever the management gives support things go well, (R: hmm). The other thing

*was the lack of knowledge about infection control, (R: hmm) I. This is why the training is more needed on it. Which has orientation and education on that, the community also does not get information; they need also to be informed that it must come from healthcare workers going down. The other part is err I cannot say workload, (R: hmm) – workload leaving open windows to do that is not a problem, **the other part is environmental measures which is the structures, our structures in Botswana they are not really infection-control-friendly, designed (R: hmm) there is really a problem. If you can see all our IDCC there is a problem, they are worse, and then we have tried to do something but there is a problem of that.*** In-depth interview, Physician, Ministry of Health

As far as infection control was concerned, in areas where participants indicated that there were limitations of putting in practice IPC measures, TB patients could not be isolated, for instance, because there was limited space for performing this measure.

There were no dedicated TB isolation facilities in 2 of the 3 hospitals. According to the 2011 National TB treatment guidelines, TB isolation facilities had been eliminated at the advent of HIV to increase hospital admission capacity for the influx and high incidence of HIV patients. Interestingly, even though TB facilities were swapped for HIV units, TB seemed to be one of the common opportunistic infections among those with HIV/AIDS, but it is unclear how IPC was handled in these units. Some of the participants chimed in that there were discussions of merging HIV and TB programs and to reassign infection control from focusing on TB to all transmissible infectious diseases.

...and from the recent workshops what I have heard is that now the ministry is moving away from this idea of looking at TB alone, looking at HIV alone, so when they are talking of infection control, they are talking of infection control on a broad scope, where now under infection control, you should talk of infection control in general, but what I have heard of late is that they are trying to integrate the HIV and TB programs, so that it becomes one because what has been happening is that you find HIV people will call their workshop, they will also talk of infection control there. TB people will also call their workshop they will also talk of their infection control but the latest strategy I am hearing is that the ministry now is integrating the two programs, so that now even when you talk of infection control it is in general... In-depth interview, Hospital B, Laboratory technician

In cases where the architectural structures were not conducive for IPC, the hospitals often attempted improvisation by providing equipment which could offer prevention and control of infection. However, even in such cases, participants from both in-depth interviews and focus groups lamented that some of the equipment was poorly maintained and evaluated. For example, the biosafety class 2 medical laboratory for hospital B, at some point had a non-functioning biosafety cabinet. The laboratory staff were not aware of this incident and proceeded to use this cabinet for almost half a year.

In some cases, in an attempt to control infection, in some buildings, patients were urged to wait outside the building, where there was ample natural ventilation, however, this became a challenge during winter and rainy seasons.

7.3.4 Infection Prevention and Control Measures identified as inadequate.

Architectural structures non-conducive for IPC and poorly maintained hospital equipment were not the only inadequacies identified by participants. Some participants mentioned that despite the guidelines stipulating timelines for patient diagnoses, TB patient diagnoses were not timely and communicating with relevant personnel in the chain of command for diagnosis was not always easy. For the most part, patients and the general public remained uneducated about TB exposure and transmission. Some focus group participants such as hospital orderlies expressed their opinion that even if some measures were place, these could not abate the magnitude of the TB problem.

Yes ma'am. Now I encourage the people at the Ministry [of health], and those people when they help one another like this, they should also come and see how congested it is in the medicals. And they should also think about building wards where they can isolate those patients. It is so congested; it is so congested such that the disease will not go anywhere even if the windows and doors are opened. Yes. Focus group 1, Hospital orderly, Hospital A

Another inadequacy of the IPC system discussed by some infection control nurses was that infection control officers were not trained adequately in IPC. The Officers received only a 2-

week induction specific to TB IPC before they assumed the administrative duties of being an infection control officer.

Some of the hospital cleaners added that there were new programs and processes which could potentially affect hospital IPC education and adaptation. One such program was the then pilot governmental outsourcing of cleaning services. Participants from the focus groups, especially from hospital A who were part of this program, reported receiving no infection control training and in some cases their company had not provided personal protective equipment in the form of N95. Therefore, when they started duties within the wards, there was potential for exposure to TB without knowledge of how to protect themselves.

You will find that we who are not government workers, who are from outsourced companies, we are protected by the leaders in the health departments. But, you will find that that protection doesn't work because we sometimes don't have masks, nor gloves, which means we don't get that protection. We can be contract the disease any time. But if you say something like that to the office, you are told, if you don't want work, leave. Those are the challenges that we are faced with.

Focus group 1, Cleaner1, Hospital A

Another cleaner added that even though the outsourced cleaning company did not have many resources, the ward where they were assigned provided some protective equipment.

As for us, you will find that over there where we work, they try by all means to have us protected, because they can give us their masks, gloves and they remind us all the time what to do to protect ourselves, to wear masks and gloves. So, as a matter of fact, on our company's side, they may be

the things to protect ourselves with, but it's not the same as where we are. It seems where we are [? the ward they are currently working] they care that we are sure that we protect ourselves..

Focus group 1, Cleaner1, Hospital A.

Comments from participants about the company were inconsistent. Some mentioned that the out-sourced cleaning company did not provide them with PPE, others said it was there but not adequate, while others said they were provided with PPE much later.

Our masks, the company gave them to us, it means that in the beginning they didn't understand that we need such things. We used these for a long time, the ones that are said to be to light for protection. The good ones came much later. Researcher: Oh so they did come? Cleaner2: Yes, but in the meantime, we had been working with patients in the closable cubicles, the ones in which the TB suspects are housed. We would get in to clean. And we didn't know that you couldn't get closer to the patient. We would get very close to the patient to help them.. Focus group 1,

Cleaner, Hospital A

It appears the outsourced-cleaning company also provided some infection control measures, even though there seemed to be inadequate information given to the participants on why some procedures were completed.

*Our company, I am not sure others, they asked us to go and do a medical exam, such that we give them the results. But what I don't know is after you do that, the doctors are the ones what they write, we don't know what they are checking. **But when we asked about the issue, they said they are doing it so that if I have TB, tomorrow I will not say I got it here, the disease that I bring, they must know before, so tomorrow I will not say I got it from [Hospital A].** So when I come*

here, they will know this one was said to be fit, if I am not fit, they will know that this she had it where she came from. Researcher: Oh so they have been done? Cleaner 5: I don't know about others, I did them. Even now in [Hospital A], there are some injections that we were given, but I don't know what the injections do, because it's their writing, they know what they inject us for. Researcher: And you didn't ask why they were injecting you? Cleaner 5: No, they said they are protecting us, and I didn't ask this and this, but they said they were protecting us.

Focus group 1, Cleaner5, Hospital A

7.4 Guidelines and Policies

The following are the inclusion criteria used to code the category “Guidelines and Policies”

- (a) A written system or one verbally agreed upon that is used to direct the healthcare workers on the actions they are supposed to take.
- (b) What system was decided upon (national guidelines or hospital guidelines). The decision-making process regarding used to guide activities (e.g. consensus or any other method).
- (c) Actualisation of what is written in order to achieve a goal initially agreed upon, e.g. screening healthcare workers for TB.
- (d) Who ensures that activities are carried out as planned or written down – leadership.
- (e) Communication between stakeholders who formulated or have interest in the guidelines, regarding activities that are implemented.
- (f) The level/magnitude to which what is written is translated to activities.

(g) Obstacles that prevent healthcare workers from implementing guidelines.

Using the above criteria, the main concepts that were derived from the synthesis of data from the in-depth interviews and focus groups were the following:

- Origin of guidelines
- Formulation of guidelines
- Availability of guidelines
- Implementation of guidelines
- Factors influencing implementation
- Changes brought about by guidelines

7.4.1 Origin of guidelines

Guidelines for preventing TB exposure in patients and healthcare workers were reported to be available, and most if not all of them had been benchmarked on external and international guidelines especially from WHO and some health organizations from the United States of America. Some in-depth interview participants who took part in the formulation of policies expressed that WHO guidelines were followed during the creation of local ones, and that there was an attempt to ensure that the created guidelines were reflective of the local resources and socio-economic context. After the guidelines were formulated they were handed over to the benchmark organization, or its representatives, for review and commentary. According to the

participants, the process of handing over proposed guidelines to the external organizations for review was to bring in a view of an entity not involved in the process of formulation, and possibly an objective and editorial element to the process.

The participants expressed that it was imperative for the social, economic and healthcare system context of the country (Botswana) to be taken into consideration during benchmarking and formulation of local guidelines. One example given was that prior to 2010, WHO recommended using culture for TB diagnosis, but because of shortages of medical laboratory technology and personnel, cultures had a long turnaround time. There was an agreement to conduct diagnostic assessments using sputum. The World Health Organization changed their guidelines for this assessment from culture to sputum based on this practicality. A recent study has demonstrated that in 2011 Botswana adopted the WHO guidelines to use the ‘fully automated molecular test’ that can detect *Mycobacterium tuberculosis* and resistance to the drug Rifampicin (RIF) at once, the Xpert MTB/RIF, a test developed on the GeneXpert platform (Agizew et al., 2017). According to Agizew and colleagues, the Xpert MTB/RIF was first piloted in August 2012, and at that time we were in the data collection stage of our research. It is possible that because the pilot-status of the test, the ministry of health had not yet released the test to all health facilities as none of our participants mentioned the Xpert MTB/RIF test. Even though in-depth interviews participants such as TB coordinators and physician mentioned using culture for TB diagnosis, the TB guidelines by the Botswana National TB Program did have a section

stating the anticipation of the GeneXpert molecular tests (Figure 11), which affirms that the 2012 pilot.

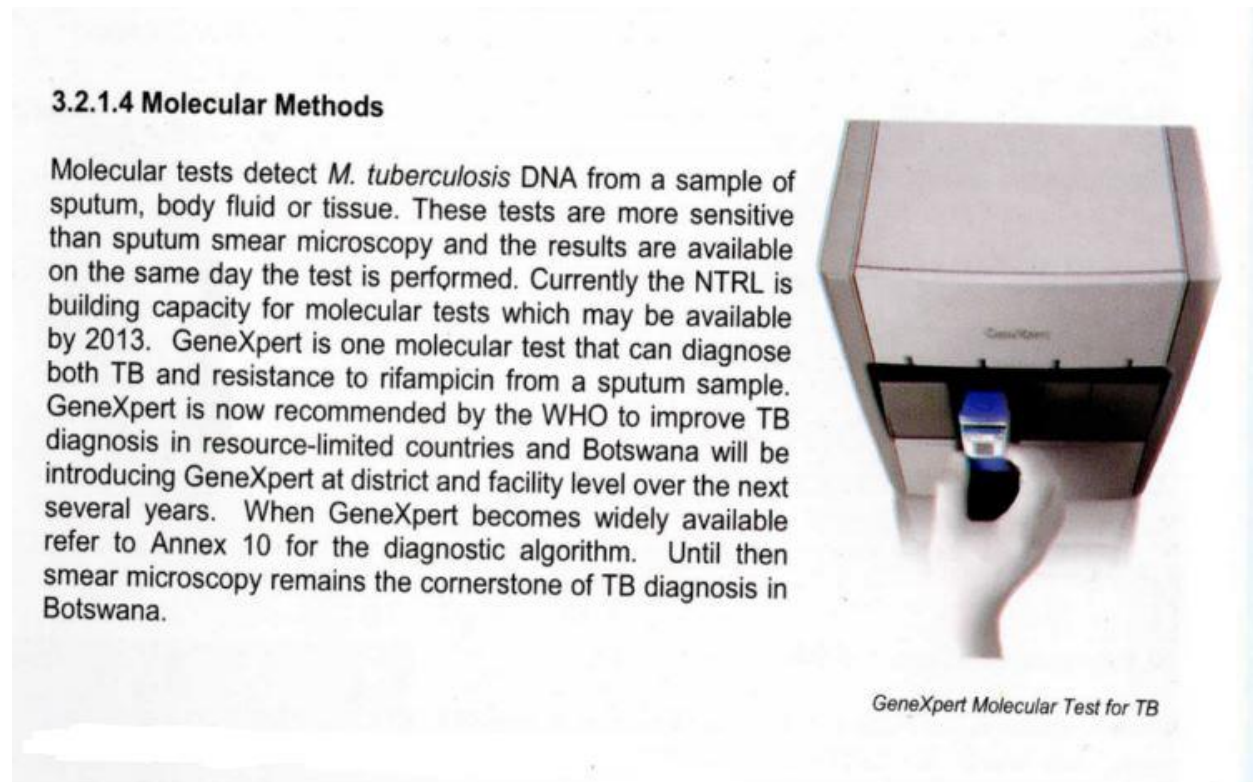


Figure 11 Expected implementation of GeneXpert from Botswana TB Manual 2011 edition

Guidelines were formulated through consensus, and most of the in-depth interviewees had taken part in formulating one or more guidelines, either TB or other guidelines utilized within the healthcare system. Consensus in this context means that different stakeholders agreed to what could be included in the guidelines. In-depth interview participants were either in middle management and still provided clinical care to patients, like the physician at Hospital A, or were previously involved in clinical care, but then given roles that were somewhat peripheral to

clinical care. For instance, the infection control officer at Hospital B, was previously a nursing officer, but when the hospital decided to begin their infection control unit, she and another nursing officer were requested to occupy that office. Others, such as participants situated at the health administration, were purely focused on policy formulation, implementation and evaluation. The in-depth interview participants had the perception that other HCWs, including those who provide direct care to TB patients, had also taken part in formulation of guidelines. It was expressed that the involvement of healthcare workers who provide daily care for TB patients, was crucial as *“they can own them”*.

Their involvement I think it was very good so that they can own them.
(Researcher: Hmm) So that they can really know what is there because some of them, the things were really, were really impossible like, I can give you an example, when we were formulating we thought of maybe, errmmm, yea we thought of maybe like rotating these people we thought of maybe rotating them after 2 years, but they said ‘no, no, no, 2 years is too much’ (Researcher: Hmm) ‘why can’t you make it one year?’ In-depth interview, Hospital A, TB coordinator

This was a sentiment not shared by some of the focus group participants.

*I think the people in the ground should be included in making these policies to a certain extent, because if these are implemented from a higher level they will be expecting you know, so much productivity, but give me the tools to produce are not there, at the end of the day you are stuck because you have to use the little that you have, for example there is so much shortage of staff, but you are expected to perform to 100%, which is really hard, you will find sometimes you are really pressed down, but you do with the little that you have. **So, I feel also that if the policy-makers would involve the people in the ground, not that they are not involved I don't know, but I have never been involved myself that's why I am talking like this, if maybe people in the ground like we are here, challenges are asked from us and they take it from there, because in fact it starts from the top to the bottom, we expect this and this, but the tools of achieving that goal there are little none, so it is a very big challenge.***

Focus group 2, Hospital A, Medical Laboratory technologist

Another medical laboratory technologist from a different focus group and hospital expressed the same sentiments.

I think my sister has said it all. The problem is lack of consultation, because in our country we like benchmarking. We go outside, in Africa, outside Africa and we find some countries that even economically they are weaker than Botswana, but

*they are doing very well in TB, and then we don't really find out, go into details to find out [why] in such an African state that may not have so much resources like Botswana, how come they are doing better than us, so maybe they just look at the document, that is already there and they adopt that document and bring it to Botswana, but you may find that those people may have gone into the communities and did a very good consultation, **so as she has said (1) they don't consult, they just impose documents on people, (2.) they don't take into account staff issues, because in other countries, you will find that, at least very few that I have visited personally in Africa, you will find that when they appoint an infection control nurse, she is doing infection control, she is coming at night, she is not coming on shift, you understand? but you will find that here there is multi-tasking thing. When you complain, you are labeled that you are refusing instruction.***

Focus group 2, Hospital B, Medical Laboratory Technologist

7.4.2 Formulation of guidelines

The formulation of guidelines took place at both the ministerial and hospital levels. At the national level, the Ministry of Health, specifically the Botswana National TB program, hosted the formulation of the TB treatment as well as the TB infection control guidelines. Those involved in formulation of the guidelines represented different institutions within the health fraternity and participated in the process on a voluntary basis. All the participants who had

taken part in guideline formulation mentioned that it was a process that required many people from different fields working together over a stretch of time, which could be laborious and presented many opportunities for differing opinions. The guidelines were benchmarked on guidelines formulated and promulgated by international health organizations such as the World Health Organization. There was an underlying assumption that WHO guidelines were evidence-based and therefore the guidelines being formulated at the Ministerial level would inherit the same scientific rigour.

At the hospital level, some healthcare workers engaged in the process of drafting Infection control and/or occupational health plans in order to guide implementation at the hospital level. In some of these cases, those who participated in this exercise had no overarching national-level document to base theirs on, and simultaneously, some did not possess relevant or sufficient knowledge to be able to produce implementable documents. For instance, when Hospital C wanted to draft a policy on “violence in the workplace”, they were not able to acquire any national-level policy on this subject matter.

We are struggling because even with this whole accreditation process I think that health and safety is the one that is scoring the lowest (R: hmmm) compared to all of them because I think currently we are sitting at about, we are sitting at I think its 58 when everybody else is way above 60 way above 70 (R: yea), yea you know I think we just- because there is fear of us- there is a lot of work to be done and and – less or not really I wouldn't say there is support as such from you know

*either Ministry of Health and the Occupational Health Division, Ministry of Labour, the Occupational Health Division(R: hmmm) err **just to mention I think, a couple of months back because I know – we tried to get information from them with respect to violence in the workplace and that any guidelines and whatever that it is. You find that there is nothing (R: hmmm). You know, Ministry of Labour is saying no It's Ministry of Health, Ministry of Health is saying oh no that is what- they were saying they will check with the Mental Health Board and I am like I'm not talking about mental health, we are talking about mental health patients either abusing or VIOLENTLY, whatever others whether in the staff, it's like violence in the workplace in general whether is staff, patients and staff- staff to staff or client to whatever way and you find that there is nothing.** - OHS personnel, Hospital C*

In addition to not having access to high-level policy documents to formulate hospital-level guidelines, some committees may not have adequate capacity of relevant knowledge to be able to conduct necessary research and to compile cohesive guidelines.

*yea, I mean it's- when we started, accreditation, when we started it was mainly on voluntary basis. We started I think we were about 10 members in the committee at that point. Around ten or so(R: hmmm), **then slowly but surely people start pulling out when they start realising how much work it is and***

some of those who were in the committee they were not very very literate because you know when you are establishing a committee and putting documents in place(R: hmmm), you need to read a lot and do a bit of research and that stuff, and consider the fact that pretty much all the documents we've put in place are – there is nothing at national level, like disaster management, from the occupational division anyway(R: hmmm). - OHS committee chairperson, Hospital C

7.4.3 Availability of guidelines

From primarily the focus groups, it was found out that both public and private hospitals follow the guidelines developed by the Botswana National Tuberculosis Program, and this was the case for both TB treatment guidelines and Infection control guidelines.

Researcher: ok, do you have any written specific guidelines that guide how you manage TB patients?

Interviewee: we follow the national guidelines, they are there, we follow exactly the same. We fill in exactly the same form, we follow exactly the same programme so I'm sure you will have it. So the Botswana National Programme does exactly what we do (R: Ok) we don't divert from that. Physician, Hospital C.

At the national level the Ministry of Health expected the healthcare workers to refer to these guidelines in treating and managing TB disease. However, at the hospital level, the different

units dealing with the day-to-day management of TB patients referred to these guidelines but in addition some, such as the 'infection control Unit' at hospital C, formulated their own infection control plans and standard operating procedures for which they sought approval from hospital leadership then distributed to the rest of the hospital.

R: Are you ever in touch with the occupational health at the Ministry of Health? R: Ok, So I realise from this that you have obviously worked with some, with some guidelines in developing TB and infection control guidelines, have you worked with the TB ones?

I: In the TB ward?

R: No TB guidelines,

*I: Err, specifically the TB plan we are creating, (R: Hmm) and then other than that we have airborne precautions and then Isolation, I think. The airborne and isolation we have two SOPs (R: Hmm) they are specifically dealing with TB (R: Hmm) but TB falls under them. The airborne precaution as an SOP, this is what we have to do (R: Hmm), and then we have the other one for isolation of patients with infectious diseases (R: and you were involved in that?) Yes, we are the ones who created them. **We created them and distributed them to the staff to see (R: Hmm), they comment, we come together and do one SOP, and the management authorised it that it can be used.***

In-depth interview, Infection control nurse, Hospital B.

In order to render the guidelines more accessible, the most pertinent prevention information was translated into printed educational material such as posters and made available

throughout hospitals, in places where patients and healthcare workers could easily access them. As a way to continue teaching and raising awareness among patients and healthcare workers, the infection control and TB program coordinators held seminars and workshops in the hospitals.

There was certainty that the government, through policy-makers and aid of healthcare workers, had formulated guidelines for prevention of exposure to TB and its subsequent treatment. Most if not all of the in-depth interview participants had taken part in formulation of either occupational health or infection control guidelines. However, in the focus group discussions it was revealed that some of the healthcare workers engaged in direct clinical work were not aware of or did not access these guidelines. The guidelines were available, but the healthcare workers had not accessed them until they were invited to participate in workshops.

*Well I recently attended a TB workshop. So the guidelines and the manuals and all those books were shown to us. **So, they asked us, do you have these in your units?" So they were very surprised to see that we didn't have them, we have never seen them, they were surprised at that. But they know that they have given to each unit and in turn that we don't have them, we have never seen them. So we suggested that during these workshops, they must make sure that everybody has these guidelines, these manuals, each participant gets to have a copy, so maybe that's how we can share information with others, because these workshops they are the ones that we attend so that we can share***

information with others. So the guidelines are there, the problem like the lab-personnel has said, distribution of these copies, that's the problem. Thank you.

Nurse, Hospital B, Focus group 2

7.4.4 Implementation of guidelines

There seemed to be a common thread that ran through the in-depth interviews and the focus groups. The participants viewed themselves as ‘implementers’ across all levels, and if there were offices charged with the responsibility of implementing policies or guidelines they were not necessarily distinguished as such. Both in-depth interviewees and focus group participants labeled the activities such as triaging patients, and donning PPE as ‘implementation’. For example:

Researcher: what do you think are the challenges of healthcare workers concerning, err TB prevention, what do you think they face? The challenges, that they are facing in their daily work to prevent TB in their daily work, to prevent TB?

Interviewee: The challenges that I see, they do have the knowledge the problem is to implement it, sometimes they will be mentioning things like, no I just forgot to put on the N95 and yet I was going to that TB patient, (R: hmm) wa bona, yes they have knowledge but they have to impart it by doing the right of which they are not doing (R: hmm).

.- In-depth interview, TB coordinator, Hospital A

Therefore, in this section “implementation” is used in the manner the participants used it.

However, “implementation” in a broad sense and how it is used in the policy arena is explored a bit further in the discussion under “Barriers to implementation” (section 6.5).

As previously mentioned most in-depth interview participants were aware that guidelines were available. Some of the participants acknowledged that in order to implement the guidelines effectively, the participants must not only have access to the guidelines, but also be trained to implement them. There was, however, discordance on the extent of training of healthcare workers for guideline implementation.

*“...so I think it's a good... we do have good guidelines, the problem is most I don't think most people have really been trained, they don't know much about TB infection control, but now since around February [2012], we had TB infection control umm workshop. **So since then, most people are being trained, almost every week, including this week, so since then, we have sort of 'cause we had sort of infection control plan but there was no TB infection control plan. It was just a draft, so only now it's when we are really developing it. So, since then, as part of the infection control plan umm...strategies, is to to to train more and more people, so every week, since I think they started around April, since then more and more people and being trained in infection control.***

***Otherwise most people didn't know about it.** But i think with more training I think more people would know about it. And also with more people being aware of how umm, at risk they are they will get more interested in knowing about TB...”*

In-depth interview, Hospital A, Physician

Even among those who agreed that healthcare workers had been trained to implement guidelines, they seemed to be cognizant of where there were limitations for implementation. For example, there was reference by some participants to the fact that in some hospital units there were patients with TB, and there was knowledge that these patients could potentially be infectious, and yet patients were not properly triaged and isolated in order to reduce the level of exposure to other patients and healthcare workers. Some of the participants remarked that this was due to the fact that healthcare workers were not trained in TB exposure and prevention and therefore lacked awareness and knowledge of the strategies they could implement to reduce TB exposures. In the same line, the participants expressed that some of the healthcare workers were not aware the potential for exposure to TB and what this could ultimately mean to their health and work.

Yea, yea, they've been trained. We are targeting the high risk areas (Researcher: ok) because the the nurses will train first for infection control (Researcher: ok) and even for TB case management that's under stable about that when we are doing our training we are giving the high risk areas and high pro.. nnetlane¹, the first priority so, we are training them as I'm saying, when it comes to implementation but I can say that now, as I have said, now we see that there is a progress as I'm saying that some sub committees some, there are some sub

¹ Word used if you cannot remember the actual name of a thing or person

*committees in the wards for infection control, at least now I think we have a way forward. Just so we see them, we have arranged that we meet them every first week of the month, so that they can give us feedback, what they are doing in the wards, and like now we are having this vision, we will be doing an assessment to see how they are doing. Our aim is just to keep checking them doing the ... assessing them just to make them to know that they have to now and then think about infection control when they are in the wards. **Because when you look at the health workers in general, whether you are a doctor or a ... they don't take TB as a serious issue.***

In-depth Interview, Hospital A, TB coordinator

In contrast to the above, some in-depth interview participants expressed with conviction that healthcare workers had knowledge of occupational exposure to TB and ways to prevent and control infection. Those who voiced this believed that healthcare workers just did not want to implement guidelines, and that it was not because they had a low healthcare worker to patient ratio, but that they failed to carry out and conduct their duties as healthcare workers.

I think we are just too relaxed, we have developed this err, not necessarily what should I call it, I don't care attitude, you know things are ok so far, that attitude. Or I cannot be infected, that attitude is someone. Even when HIV started, you know me, I cannot get HIV, yet they were indulging in unprotected sexual activity but they were still saying

*that. You know issues of denial, sometimes it's just that complacency people are not willing to work and they want to be paid, and they can go for strike for that, (R: Hmm), but if you to their clinics you find things in bad shape, bad, even bad shape serious. **So some things are very pathetic, they just do routine things, patient I mean consultation, taking drugs, but actual things that can really affect their lives, even in the consulting room, you know, you are not opening windows- who is going to open them? Should we develop a policy? How do we (R: for opening windows? laughs*) you know, now nurses and doctors please open windows otherwise you are going to be surcharged. (Both laugh*) So those things, people, you know we are, we don't work hard, I think we are so dependent on the government on everything that they will bring this, they will bring that tomorrow.***

TB coordinator, Health Administration

7.4.5 Factors influencing implementation

The researcher sought to understand some of the factors that influenced why the guidelines and/or programs were implemented. There were various reasons for these including that the health administration had requested one of the regional accreditation bodies, Council for Health Service Accreditation of Southern Africa, (COHSASA), (Cohsasa, 2018), to evaluate operational and service provision level of the hospitals. This country-wide project was kick-started in the main tertiary and district hospitals, and both of the public hospitals which took part in this study were going through the process of evaluation at the time of data collection.

External international health organizations such as WHO took part in the formulation of infection control and occupational health guidelines. The presence of the accreditation programs seemed to influence how some programs were implemented as some participants felt that in some cases implementation happened because HCWs were expected to do so by management, in order to meet the evaluation criteria. In some instances, where programs had already started, the introduction of the evaluation process sped up or enhanced the way the programs functioned. The occupational health and safety (OHS) committee at Hospital B was initiated in 2009, but it lacked direction, and shortly after that COHSASA started the evaluation process, the latter stated some of the criteria they needed in order for the OHS program to pass the evaluation. These criteria assisted in providing the OHS program with how to get started.

R: when did the committee start?

*I: 2009 around August I think it was. Erm when it started that's when the first workshop with the Ministry of Health (R: hmmm), with the Department of Occupational health and Safety in the Ministry. That's when it started. Yes, that's when it started, August 2009 and it's been in existence since, **yea I think for us it has been a bit of an advantage because shortly after we started that's when this whole accreditation for the hospital thing came in because we didn't have the – like a guideline of how we are going to be running the committee and all that. The committee and a whole lot of things like what we need to get in place to ensure that the committee is actually running and delivering at the end of the day (R: hmmm). Erm but when the accreditation process started they***

brought in the service element guideline, I don't know I think that's what it's called (R: hmmm), so it's more like guiding us on what we need to put in place, to say we have a fully-fledged functional committee. So we are actually using those guidelines (R: hmmm) to prepare or to get the committee to excel or a better level, you know.

In-depth interview, Hospital B, OHS committee chairperson

The objective of the evaluation by COHSASA was to assess the level of functionality of the different departments and advise on areas for improvement. COHSASA could advise on identified areas for improvement and give recommendations at the hospital level, but changes had to be approved at the upper policy-decision making levels such as the District Management Health Team and the Health Administration.

7.4.6 Changes brought about by guidelines

Most of the participants described the challenges they faced, and those they perceived were faced by the healthcare workers who were interacting with patients more regularly. The challenges encountered by the implementers are discussed at length under a separate and independent category as there seemed to be challenges in all areas ranging from buildings that “were not constructed with infection control in mind” and attitudes by healthcare workers as well as leadership that was perceived to be inadequate. However, participants reported that it

was not all doom and gloom, as there were aspects of the TB prevention and treatment process that had improved since the beginning of the guideline implementation by the government.

The participants who worked intimately with laboratories that handled TB specimens indicated that the government had introduced better and faster diagnostic methods. Physicians were now using the more reliable and precise smear sputum diagnostic methods, instead of relying on less precise chest X-rays. Patients who were admitted, diagnosed and treated for TB and subsequently considered to be non-infectious and stable, were discharged from the hospital to eliminate the risk of re-exposure from other patients and healthcare workers.

At the time of the data collection for our study there was at least one TB study in process, which was recently published (Surie et al., 2017). The study was hosted by Hospital A and conducted in partnership with a US university. The participants acknowledged that such studies were aimed at improving the control of TB in the healthcare system in the country.

According to the TB coordinators and infection control officers, infection control was relatively a young profession in the country, but strides were taken to increase the number of professionals educated in infection control, as well as occupational health. Some of the participants informed the researcher that at the time, relevant stakeholders were drafting a national policy for Infection prevention and control.

There was agreement among in-depth interview participants, physicians, nurses and infection control officers, both from public and private hospitals, that there was need for occupational health services for healthcare workers as they were in such a unique position of providing services and being considered essential services which meant that they waived their right to strike. Other participants demonstrated confusion about the importance of occupational health services, especially in light of the services provided by infection control. The synthesized discussions of participants regarding Occupational health services are discussed below

7.5 Barriers to implementation

Under this category we identified environmental, human, and institutional factors that render it difficult or impossible to implement measures that could potentially minimize or prevent exposure to TB among patients and healthcare workers. We separated these “barriers to implementation” into five different themes; (1) Guideline-related factors, (2) Patient-related factors, (3) Health-care worker related factors, (4) Institutional (Ward, hospital, Ministry, National) and (5) Environmental.

7.5.1 Guideline-related factors

All the in-depth interview participants expressed that there was availability of well-drafted guidelines and on the other hand agreed that implementation and evaluation were not always

done as outlined in the guidelines. Some of the participants believed that lack of training was one of the primary reasons healthcare workers were not implementing guidelines.

Even though some in-depth interview participants expressed that guidelines were well-crafted, there were examples of HCWs with no background knowledge of the topic participating in drafting the documents.

...and some of those who were in the committee they were not very literate because you know when you are establishing a committee and putting documents in place (R: hmmm), you need to read a lot and do a bit of research and that stuff, and consider the fact that pretty much all the documents we've put in place are – there is nothing at national level, like disaster management, from the occupational division anyway (R: hmmm)...

In-depth interview, Hospital B, OHS committee chairperson

One of main issues with guidelines, was that no one could say with certainty that guidelines were implemented at the level of the front-line healthcare worker. Implementation was not easy to evaluate, perhaps due to the fact that the guidelines did not provide ways in which implementation could be measured. In some instances, guidelines did not provide adequate guidance on steps to be taken. For instance, beyond the TB guidelines, in Hospital B, boiler and incinerator workers worked in spaces where considerable and evident fumes were produced.

The OHS committee identified the need for respirators, but there were no guidelines for these, and OHS personnel MoH or MLHA could not provide guidance on where to acquire respirators. All the guideline documents that were collected for our study were developed in collaboration with international agencies such as the WHO, CDC and others. The idea that guidelines were formulated with external experts and as such might not be easy to implement in Botswana continued to be strongly expressed by focus group participants.

...What I have realised is that the policy-makers they like to, like they are saying, they adopt things from the books made by the Americans or the what-what, like they will say, we will have 2% mortality rate due to TB, but they will never take into account whether that we don't have those ventilated like you said pressure what what, we have never had those pressure things, they are just American things written in the books, and the next person who is going to review the policy is going to write the same thing, is not going to review what has been failing us. Instead of checking that we wrote this policy in 2008 and we said this and this and we failed, so why...

Focus group 2, Hospital B, Nurse

There was concordance among the professional cadres (nurses, laboratory technicians) and the industrial class (cleaners, drivers) that guidelines were not readily accessible, content-wise as well as physically to HCWs. One example of this was related by the TB coordinator at Hospital B.

She pointed out that her office normally distributed copies of TB treatment algorithms to different wards, but upon her return to the same wards, no one would confirm that they ever saw or used the printed algorithms.

7.5.2 Patient-related factors

Some of the participants believed that one of the reasons why implementing guidelines was challenging was because patients lack knowledge about TB. In both private and public hospitals, participants gave examples of patients who even after being diagnosed with active TB, would continue to wander around the hospital and declined being confined to isolation areas.

7.5.3 Healthcare worker related factors

Among the participants especially who were no longer carrying out clinical work such as bedside nursing, there was a perception that guidelines are not being implemented because HCWs simply do not do their job as they ought. As an infection control officer at Hospital C captured it; *“It is human nature not to want to follow procedure”* This was an outlook shared by a couple of participants who believed that healthcare workers could implement the guidelines if they truly wanted, but they chose not. There was as well the idea that TB and “IPC not taken seriously,” because TB was considered an old disease while IPC was not a top priority for HCWs but an afterthought. One of the in-depth interview participants demonstrated the overall relationship between public health prevention, in particular TB prevention, with the following metaphor:

*Leaders have got their priorities unfortunately public health is not a cry baby in the world of health, it is a clinical services that are cry babies, you need drugs to treat these, we need to operate these, theatre, you need- so err monitor, evaluating and following up preventive, **prevention activities is done when children have gone to bed if you have extra time, if you are too sleepy just sleep we know we can use that kind of analogy.** in my view the big policy makers the big leaders they have too much on their plate to follow most of to follow through most of their preventive activities. Unless this preventing activities that are going to be probed and followed up by the international communities, the MDG's, the the what the the (Researcher: WHO) these childhood, immunisation, there is these statistics that you go to Geneva to present on an annual basis, those ones they followed up.. Health Specialist A, Health Administration*

When we asked the in-depth interview participants what they thought regarding the challenges facing those who implement guidelines, some remarked that the mentality of the healthcare workers was that they were already exposed to TB and had a sense of giving up. Some had worked for a long time prior to being required to wear “these things” so did not find the need to protect themselves nor did they understand why they had to take these steps now.

It was reported that it was common for HCWs to not complete OHS and infection control incident report forms. However, some participants especially at hospital A, believed that such perceptions might be changing because more HCWs were infected with TB.

*I think we might have gone through the wards and you see, really how the wards are and as you know there is really some other administrative issues. Usually people don't take them seriously, when you come to infection control, we are really training people in doing everything there is less implementation. **But now these days I think now people now are starting to sense more when they see that most of the health workers, are being infected with the disease. Ee, but now they start to come up and other things, they having some other administrative things by having the subcommittee, infection control committees in their wards they're having some things, what do you call... The checklist in the wards, who is responsible for this, who is responsible for for this. But I think in the long run, when com... when time comes, people now, I think there will be limited things because now it seems as if nurses are aware of this. Because what they were focusing on, they were focusing on the PPE, the PPE, protective what.*** In-depth interview, TB coordinator, Hospital A.

Some interviewees believed that healthcare workers had IPC knowledge, and that it was the implementation they lacked. However, there was variability regarding this perception, some believed that the guidelines were not being implemented because healthcare workers lacked the appropriate knowledge about TB exposure and not guideline content.

Healthcare workers were also said to be reticent when it came to participating in IPC programs. It was reported that most HCWs failed to show up for HIV/TB screening organised by the hospitals. A recurring theme among the in-depth interviewees was that HCWs were not showing up, for TB and HIV screening programs for example, because they had a fear of being stigmatised. Nurses and TB coordinators opined that HCWs would prefer to seek healthcare at

different town and private doctors for a higher fee, rather than where they worked. Some indicated that HCWs probably do this because they feared that their health information would be communicated to their colleagues without their permission. However, the concept of refusal to screen for TB due to HIV infection because of potential stigma was not spoken about among the focus group participants.

*“...But when we teach them, we even need to support these people because when they are sick these means they are not supporting them even when they are sick. **They don’t know or even the patients they keep the sickness to themselves. Stigma also is a problem.***

R: how? How is that?

I: aa, stigma, TB stigma, its serious, they don’t want to disclose to their – some of them they don’t want even to disclose to their workplaces they say they will start shunning me. Some will say people will start saying I have HIV(R: Hmm). So the TB/HIV thing- when you say somebody has TB. I came across one patient one time, I was in Block 9(R: Hmm), so this patient because even when I’m in a facility when I go there I see patients I give them DOT I talk to them(R: Hmm). I wouldn’t be like relying on the nurses- I want to have that relationship with the patient also to know how the TB patients, how they are feeling how they are doing so I’ll be giving them DOT – talking to them. So then I met this lady I was asking her ‘ did you do HIV test?’ no. she is working, does your boss know you have TB? No. she is a maid. [door opens]...” TB Coordinator, District

From the focus groups, some the daily-rate workers expressed the lack of care or concern by the leadership and mentioned that there were systems that are not in place such as trainings and resources.

“...Now these people, this thing called government is hard because even if you go the top most, you will find that in the midst there are people who are lazy, some just deliberately make it difficult for you, some in there are sloths, some have laziness, some do not care about other people. Sometimes when you are a leader, say if you are the minister of health, you must know that, you are the one who feels deeper pain if your department is said to be run poorly. but out of the ones you work with say about 20 of them, perhaps from you up to 11, they are dishonest, and they just want to be paid, and they make your job difficult. The challenge is they are not the same, there are some who are compassionate and care for people, and there are those who do not care. Right now like we are saying we are not trained in the hospital, we are not trained. the vehicles are not enough, for one to say a vehicle must be for such and such patients, for a person not to contract disease from another person, there are some who when you speak to them, they may hear you, even though they are far above us, some just do not care about those things. The sad thing is that people work together and they make the government, yet they are not the same...” Focus group 2, Hospital B male hospital driver

A demonstration of distrust of the government continued. A member of the professional's focus group shared a concern that the government would not assist if they contracted TB in the workplace.

*What I can say is we have talked about the prevention and what-what among the health care workers. **The thing is if I a health care worker acquired TB during in the workplace, what is it that the government is doing to help me, and what is it that in case if I can die or something happens to me, what is it that they will be doing my family because I had a friend who died due to hospital acquired infection and nothing has been done, and even up to today, nothing. So you are trying to educate us, help help, but the government is not helping us, I don't know if I can say the government or who is not helping us, we are helping people to get better, we are preventing infection, we are curing them.** What is it that the government is doing to protect us besides preventing, because preventing is what WE are doing and what is it that the government is doing to help us?* Focus group 1, Nurse 1, hospital 2

From another focus group, the health professionals felt that the policy-makers could improve the way the policies are formulated and implemented.

"...So I was thinking, if the government wanted to benchmark from who did better, they could have looked at those countries, which, we have reduced TB to zero, I can't say zero, but its somewhere which is better than zero, so at least just

*because there is that restriction whereby patient must when you are diagnosed with TB somewhere they transport you to that hospital so you can be there. So I was hoping that they could benchmark from those countries that are doing better, rather than keeping on writing policies and reviewing and writing them again. Now, why did we fail this because we don't have the facilities that we said we would have, instead she will just write what the other person wrote. You see, and its not working for us, so like I said can you please go there and ask them, that "let's use what we have". You cannot say you are going to have 2% mortality rate and you expect people to work miracles with no oxygen or no nothing, and you keep on asking things from other departments. Things don't work like that..."*Focus group 1, hospital B, radiographer

7.5.4 Institutional/Systemic (Ward, hospital, Ministry, National)

There were some instances of discordance between comments from in-depth interview participants at the national policy-formulation level and healthcare workers at the hospital level. For instance, a TB coordinator at the health administration described:

Hmm, I wish you could also visit the NTRL (National TB Reference Lab), it's a very wonderful, really lab workers are exposed because they manipulate specimens[sic] and as they manipulate they may be errors of course. But you know as lab people you are you are taught really how to deal with specimen so that you are not directly exposing yourself to the to the aerosols, to minimise manipulation of the sputum, but those who are dealing with cultures we have bio-safety cabinets but when you deal with cultures, there is no way that we can just work in an open space, so we work directly under the bio-safety cabinets. The bio-safety cabinets as you manipulate the specimen it has extractors, it extracts and takes, all the air around that, and outside yes, and then it brings in fresher air, fresh air, you know in the in the air, where you are working with the specimen. (R: Hmm, do you have pressure), yes they give you pressure in them, every day you have a bio-septic net has to be checked to see how, whether it is functional (R: ok), or working very well (R: ok). In-depth interview, Health Administration, TB coordinator

At the hospital level, a laboratory technician who performed diagnostic activities on a daily basis, had a different experience.

Another unfortunate part is that BSC is down, the one that we were using for processing our specimens. Researcher: What's BSC? Lab-tech: They call it Bio Safety Cabinet. So it is totally down and actually some guys, inspectors from CDC, actually they have condemned it gore[because] now what it is doing, it is not aspirating the bacilli out, it actually is now bringing it inside the lab, and you see gore we have been using it for sometime rona re tsaya gore [we assumed] it's actually working, while actually it was not working, I think for bo[about] more than six months. Rona [We] the fact that it was on, we were seeing the signal that it was on, so ke raya gore [I mean] maybe when time for screening comes up, we don't know, maybe the cases are still subclinical. Focus group 2, Hospital B, laboratory technician

This example could be identified as an example of differences between the perception of those at the leadership level and those at the implementation level. At the leadership level, the TB coordinator describes how the biosafety cabinet functions well, while at the implementation level the laboratory technician decried persistent malfunctions of a biosafety cabinet.

The healthcare system has limited resources that have to be split among competing programs. One of the limited resources was human resources. The shortage of healthcare workers was spoken about by some participants, such as the infection control officer at Hospital B, who related a real story where you sometimes find two nurses in a night shift, taking care of 76 patients. Some of the participants were of the opinion that *“everything is dumped on nurses.”*

One of the other resources that were scarce was personal protective equipment, namely the respirator N95. In the two public hospitals from which we collected data, PPE was only distributed to areas labelled “high-risk”, such as emergency department and medical wards where there was a high concentration of TB patients and others who had myriad infectious diseases. The focus group participants told graphic stories about their encounters with PPE, this was told related so vehemently that we coined a specific concept from what they expressed, the concept of “*Armouring* (armoring)”

7.5.5 **Armouring**

For the findings of our study, “*armouring*” is a conceptualization that derives from the focus groups. Their perception was that the professional healthcare workers, i.e. nurses, enter the ward or cubicle wearing Personal Protective Equipment, including N95 respirator, gloves and gown, to render care to a patient. In that same space and time, the cleaner, who also assists in the care of the patient, does not have the PPE similar to the one donned by the nurse, and is also not aware of the potentially infectious disease that the patient may have.

The focus group participants used the same term, “*go ipapana*” *, a term which is commonly used in the context of military to mean that the soldiers are prepared and geared for war, or they have the military armour or gear (Otlogetswe Thapelo, 2012).

In the focus group that this term was mentioned, the participants reported that in such a situation, the nurses or whoever will be “armoured” to work with the patient, fail to inform the cleaners that the patient in question potentially has an infectious disease and that any healthcare worker who provides care must be diligent in protecting themselves against the infectiousness of the patient.

*“I work as a cleaner. What I know is that TB is one of the diseases that are prevalent in Botswana, and it is one of the infectious diseases, that if you have a patient with TB, you have to have protective equipment. I am not sure how much you wanted me to say, but I know that much. Even if we have protective equipment, in some ways we don't think it's adequate. Sometimes as someone already mentioned, TB patients are everywhere, the person who already spoke, spoke the truth. It isn't that the TB ward is the only place you will find TB patients. You meet them everywhere even where patients are registered, at the payment office, everywhere where you are, you meet them. But sometimes we get the short end of the stick, **it is possible that sometimes, anywhere you are, a patient comes from wherever, and when they arrive as such with the patient, they come wearing respirators, but when they arrive like that, they will not advise you to wear a respirator as well. They come "armoured" knowing that we are bringing a patient, knowing what is needed. If they find you on duty, they will not tell you what is necessary for you to protect yourself, they are at that point just focusing on the assistance they need from you, without telling you what you need to do.** Afterwards is*

*Ipápánà/•ldr• go ema sentle o ipaakantse ka sebetša.

Ipapana •verb• To stand properly/firmly, armed with a weapon.

when you may think to yourself that they might be a problem here. Those are the things that happen to us and we don't think this is right. When you think of an incident after it has already happened, if it's a disease as it were, as we know TB is an infectious disease transmitted through air, we find this to be not right. If when they came with a TB patient where you are as a worker, they let you know that we have a patient, so that you can find ways to protect yourself, not just seeing people protecting themselves without you knowing what is going on. I am done.” – Cleaner, hospital B

Another participant shared the same sentiment.

*Participant 4 (female). Thank you. I am a lady who cleans here in the hospital. My children have already spoken what I wanted to say. Actually, my child, if it's possible, we would to ask our leaders in the hospital, the ones we work with, the nurses in the wards, like my colleague has already said, patients are everywhere. Even if they have their ward (TB ward), they initially come from our wards, even if they end up in the TB ward, they begin from our wards. But we are basically saying the same thing; when there are patient like this, our leaders don't tell us. **They just bring them, armour themselves like they do, like we usually see them armoured, and we just get in with a mop and a broom, work, work, work, with no knowledge. Some days later, that's when you will ask yourself why these people do this - it must mean there is something, when we have been long getting in because we know nothing, we cannot read nor write. So, please if it is possible my child, tell them that they should inform us on time; when such a patient comes in, they should inform us to protect ourselves. They shouldn't just think for themselves, they should think of us as well. It is that risky for us. Our leaders don't***

tell us on time such that we live in such risky situations. We are not protected. Thank you, my child. Focus group 1, Participant 4(female) Cleaner, Hospital B.

Hospital orderlies from another hospital, also talked about not being informed about a patient's condition.

In addition, if the patient is in high dependency, if it's in the morning, we bathe them, we change them or whatever else, but we are not told about the patient's situation, whether it's this or that way, we just get in to bathe and change their sheets. We are never at all told about the situation. Or if it's a patient who is not able to feed themselves, we feed them, and when you feed a patient, you are not going to feed them from a distance as if you are breaking a piece of wood. Yes ma'am. Focus group 1, Hospital Orderly, Hospital A

The participants from the private hospital made no reference or insinuations regarding “armouring,” but they did express some of the concerns they had.

Auxillary 9: Yes ma'am, about TB, what I understand is that if it's a patient who is coming from another hospital with the knowledge that they have TB, they are isolated, you find that that situation is much better, because there will be gloves and masks placed there. Personal protective equipment is placed there. Now, the biggest challenge, where I think we are at great risk, is when the patient comes and they are undiagnosed. You will find that we bathe that patient, we get into the room not knowing that they may have TB. Then later, after we have gone into the room many times, then you will that the results have come and they show

that the person has TB, after we have gone in there many times. Now, this is one, this is where I understand that sometimes we are not protected because by that time you may have been exposed to many things. So, at this time we cannot say we are 100% protected. We may be going around carrying the disease, because we don't know. That's all.. Focus group 1, Auxiliary nurse, Hospital C.

The general lack of resources also meant that there were no separate funds to train HCWs in TB exposure prevention. Although infection control was accepted and promoted from the national to the hospital unit level, there were instances where there was not adequate management buy-in, especially if activities originated from the healthcare worker level. Ward level IPC Plans or OHS activities such as purchasing of respirators for boiler and incinerator workers had to be authorized by hospital leadership. Some participants believed that if they had created plans, but the resources could not be provided by the hospital/District Health Management Teams/MoH, it meant such plans were useless and had failed even before implementation.

There was no national level routine evaluation to determine how many HCWs had TB and there was little targeted activity towards determining effectiveness of guidelines. Most in-depth interview participants, especially those at the health administration level, were aware of the lack of monitoring and evaluation at different levels and systems of the TB control system. There was an intention to improve, but funding was needed to carry out monitoring and evaluation activities. According to some of the participants, there were constant changes in the

national health system and these systemic changes rendered it difficult to keep track of outcomes. For instance, the District Health Management Teams (DHMT) was a relatively new program and experienced teething problems which created difficulty in the TB prevention and control cog-wheel.

7.5.6 Environmental factors

As previously indicated, many structures within the hospitals were not built with a capacity for infection control. There was an implication from our data collection that there was limited consultation between architects and users. Therefore, there were some environmental and structural challenges that rendered implementing guidelines difficult. For instance, the guidelines may instruct hospitals or units to have designated “coughing spots”, but if there are no such spaces with hospitals, implementers would compromise and find alternative solutions which may not favour the prevention of TB. An example of this was related by one of the focus group participants, who mentioned that because they did not have designated coughing spots, they allowed patients to use bathrooms as coughing spots, and these bathrooms could then be used by other patients without first being disinfected.

...From the lab, maybe the highlight of the problem that we are having with these patients ke gore [is that] when they produce sputum, now that other patients have the bathrooms there, so they want to go in there as well, when we tell them that you have to go outside, by the parking lot there, I know it's a case they once brought to the hospital superintendent,

***gore(that)** “no these people they think they are good, this facility was built for us, now they are discriminating against us, why should we go and cough in the parking lot when other patients are going to the bathroom”, so despite the explanation, you know gape (that in addition) the problem, maybe from our facility... – Focus group 1, Laboratory technician, hospital B*

7.6 Observations beyond categories

7.6.1 Distinct differences between interview and focus groups

As the categories and themes gained more clarity there seemed to be clear differences between the perspectives of in-depth interview participants and those of focus groups. Even though the interview scripts were open and could be modified as needed, the in-depth interview and focus group participants were asked relatively similar questions. For instance, both were asked about the challenges facing healthcare workers as they implemented TB guidelines used in the prevention of healthcare worker TB. The responses from these two groups were predominantly different. This difference was not only limited to this response with focus group participants mostly expressing limited control over the activities they could undertake. The category “Barriers to implementation” primarily demonstrates this as even the concept of “*armouring*” seems to enunciate the differences and level of control over infection control situations between the cleaners/daily rate workers (focus group 2) and other occupational groups such as members of the professional cadres (focus group 1).

7.6.2 Differences in implementation between the public hospitals and private

Another difference that was brought out by categories and themes is that of public versus private hospital. The private hospital seemed to have comparatively better executed measures and the focus group members (auxiliary nurses and orderlies) appeared to have better knowledge and demonstration of concepts of infection control compared to the counterparts in the hospital. Some explanation of this could be that the private hospital being a for-profit organization is better resourced compared to the public, both in terms of medical equipment, personnel and funding. This would mean that there are few patients to every health professional which could potentially allow the workers to have more time to engage in infection control trainings. However, this is speculation and further studies such as surveys comparing the infection control and occupational health activities between private and public hospitals could further elucidate this finding.

Chapter 7 explicitly describes in detail the four major categories and subsequent themes under each of the categories. The next chapter focuses on the salient findings and explores them in view of the current literature.

Chapter 8: Discussion – In-depth interviews and focus groups

In this chapter we primarily described the concepts that emerged from synthesising data that came from the in-depth interviews and focus groups. In this chapter, we go beyond description, and interpret our findings in light of existing literature. It is also to contextualise these findings in light of the current socio-economic and political dynamics in Botswana. We will discuss the limitations of our study, as well as exploring ideas for future research and some recommendations based on Botswana context and what is currently known in the literature. The philosophical underpinnings of our study are those of the field of Occupational Hygiene, while the qualitative methodological framework we adhered to was Interpretive Description (Thorne, 2016), and the coding mechanics and building of concepts was from Miles, Huberman and Saldana (2014).

The objectives of our study were to gain insight into the perspectives of healthcare workers in select Botswana hospitals, towards occupational health and infection control measures implemented to prevent or control TB among healthcare workers. In order to understand this, we conducted 21 one-on-one in-depth interviews with healthcare workers at the clinical level as well as management and policy-levels. A total of five focus groups were conducted at the 3 research sites. In order to preserve homogeneity (Knodel, 1993) and therefore encourage interaction among the participants, we conducted 2 separate focus groups at 2 of the research sites and only one at the 3rd research site due to research timeline constraints.

The first focus group comprised frontline healthcare workers and other hospital workers such as hospital car drivers, cleaners and auxiliary nurses. The participants of the second focus group were professional healthcare workers such as nurses, radiographers and laboratory technicians.

Thorne (2016) suggests distilling the broad spectrum of the findings to the most important thematic messages which will potentially be useful and relevant to the audience they will be addressing, in our case these are healthcare workers, policy-makers and administrators. Therefore, the discussion covers all the four themes from a broad perspective rather than enunciating each idea from the categories. Thorne (2016) suggests using the following questions as a guide in deciphering the key messages to include in the discussion part of the interpretive description study:

- What are the main messages here for the practice field?
- What is it that I know now, having done this study that I did not know before?
- Or, perhaps that I did not know in quite the same way? “

The main findings are summarised in the table 8 below.

Category	Theme	Example
Occupational Health Services	<ol style="list-style-type: none"> Occupational health services in the hospitals Evidence of Occupational TB among health care workers 	<ol style="list-style-type: none"> Field of OH started in Botswana in 1973 through Factories act Limited OH services in private and public hospitals Workers compensation – without proof of TB exposure, there is no compensation Some administrative controls implemented: triaging patients, staff rotations. No OH policies, but some documents available Natural ventilation, limited mechanical ventilation and limited maintenance <ol style="list-style-type: none"> Agreement among in-depth interviews that there is no evidence that HCW are exposed and infected by TB at work <ul style="list-style-type: none"> Some participants (TB coordinator), HIV negative HCW worked in high-risk area, then developed TB
Infection control	<ol style="list-style-type: none"> Awareness and acknowledgement of importance of IPC Hospital physical structures not conducive for IPC IPC measures inadequate 	<ol style="list-style-type: none"> IPC acknowledged as important both private and public hospitals <ul style="list-style-type: none"> Some IPC measure implemented No isolation facilities in 2/3 hospitals Communicating with relevant personnel for timely patient diagnosis challenging <ul style="list-style-type: none"> IPC officers not adequately trained
Guidelines and policies	<ol style="list-style-type: none"> Origin of guidelines Formulation of guidelines Availability of guidelines Implementation of guidelines Factors influencing guidelines Changes brought about by guidelines 	<ol style="list-style-type: none"> Guidelines benchmarked on international guidelines At hospital level, HCWs drafted OH/IPC plans, sometimes, no overarching policies Hospitals followed governmental guidelines. Guidelines not accessed by all HCWs implemented guidelines but not trained to implement. External stakeholders influenced implementation Improvement in diagnostic methods
Barriers to implementation	<ol style="list-style-type: none"> Guideline-related barriers Patient-related barriers Healthcare worker-related barriers Institutional/Systemic <ol style="list-style-type: none"> Armouring Environmental factors 	<ol style="list-style-type: none"> Well-crafted guidelines, but implementation & evaluation are lacking. <ul style="list-style-type: none"> No training to implement guidelines Patients lack knowledge about TB HCW attitudes barrier to implementation. <ul style="list-style-type: none"> HCW resigned to TB exposure, apathy to IPC programs Scarcity of equipment, PPE <ul style="list-style-type: none"> Armouring -Disparity in controls Structural deficits, eg. No designated coughing spots

Table 8: Summary of findings

8.1 Occupational Health Services

The category occupational health services had 2 themes under it. These were “Occupational health services in hospitals” and “evidence of occupational TB among healthcare workers.”

8.1.1 Occupational Health Services in the hospitals - Limited OH

We set out to explore the perspectives of healthcare workers on TB occupational exposures.

The underlying assumption behind our research question was that there were existing occupational health language and structures that healthcare workers would understand and have a reference point of what we asked. Indeed, there seemed to be an understanding and awareness of what occupational TB exposure and control might entail, however this understanding was in some instances conflated and confused with the role of infection prevention and control. An example of this lack of distinction between the role and occupational health and IPC was demonstrated by participants indicating their wondering about the necessity of OHS when IPC was already carrying out some of the tasks that prevent TB exposures among HCWs.

The limited recognition of the role of OHS in the occupational TB control is not surprising given that occupational health is a relatively young field in Botswana in particular, the continent of Africa as a whole, and other low-income regions of the world. In their article titled *Global Occupational health: current challenges and the need for urgent action* Lucchini and London

(2014) observe that in what they term 'industrializing' countries, there are occupational health and safety laws and enforcement activities, however these fall short as the majority of workers in these countries work under safety conditions that are subpar to the standards that the World Health Organization recommends. In Bangladesh environmental and occupational health researchers concluded that the reason why cleaners and waste workers within healthcare establishments were rarely provided with PPE was because of lack of resources but mostly they pointed to lack of enforcement of regulations by the government (Patwary, O'Hare, & Sarker, 2011).

According to Lucchini and London (2014) Less than 10% of workers in low-income countries have access to sufficient occupational health services. One of the reasons that OHS and systems are not as strong as they ought to be is that economists regard OHS as the last step in their economy-building models; that OHS ought to be considered after and when the economy is strong enough to take on 'additional expenses'. In developing countries OHS is likely not implemented due to many economic development-related issues as well as many other health conditions competing for attention of the health ministries (Owie HO, 2016).

Botswana, as a middle-income country is no exception to the observation of lack of OHS services and systems, and poorly enforced policies. In our study, we found that at the hospital level, there were no OHS officers or units or committee save for one hospital. Hospital B had an occupational health committee whose chairperson we interviewed. The health administration had an Environmental and Occupational health (OEH) department which in theory provided

guidance on EOH matters to the hospitals. Instead of Occupational health committees or even offices, we were informed that the Health leadership has recommended for hospitals to commence risk assessment committees which were supposed to cover OHS issues within the hospitals. Prevention work including OHS was peripheral and a not central matter for with the mandate to make decisions. It was but an *'add on'*, *"something to do when the children are asleep"* as one of the policy-makers used a metaphor to describe the relationship he witnessed between public health and acute care. It appears this metaphor can be borrowed and applied to OHS within the hospital environments. This disparity between OHS and more attention-grabbing clinical conditions and services, can place a burden on healthcare workers, because in situations where there are no OHS provisions at the policy and hospital leadership level, the responsibility to protect the self falls squarely on the shoulders of a HCW, and if the healthcare worker has not been trained in appropriate measures this could mean an increased risk of exposure (Patwary et al., 2011; Verkuil & Middelkoop, 2016).

In Botswana, outside of the hospital environment, OHS as rendered by the then Ministry of Labour and Home Affairs, but its focus was limited to factories with the exception of some factory-like units within the hospital environment. They also dealt with employees who had grievances against their employers, and they would undertake a workplace inspection and assessment if they received a tip about occupational hazards, but this was an exception and not the rule.

8.1.2 Evidence of occupational TB exposure for HCWs

Some of the TB coordinators we interviewed reported that there were healthcare workers who upon examination were diagnosed with TB. When we enquired if such HCWs should be compensated because of their infection and loss of days at work, most of our in-depth interview participants, forthrightly indicated that it this could not be done because it was impossible to determine whether such HCWs were exposed to TB at their workplaces or in the community. A participant well-versed in the Workers' compensation Act, informed us that only "total incapacity" was compensated.

However, the Botswana's Workers' compensation describes different types of incapacity including "partial incapacity"

"insurer" means any person carrying on insurance business within the meaning of that expression as defined in the Insurance Industry Act;

"Medical Board" means the Medical Board appointed under section 6;

"partial incapacity" means incapacity of a temporary nature caused by injury or occupational disease contracted, which reduces the earning capacity of a worker in any employment in which he was engaged at the time of the accident;

"permanent partial incapacity" means incapacity of a permanent nature caused by injury or occupational disease contracted, which reduces the earning capacity of a worker in every employment which he was capable of undertaking at that time:

Provided that every injury specified in the First Schedule, except such injury or combination of injuries in respect of which the percentage or aggregate percentage of the loss of earning capacity as specified in that Schedule against such injury or injuries amounts to 100 per cent or more, shall be deemed to result in permanent partial incapacity;

"scheduled disease" means any disease specified in the Second Schedule;

"total incapacity" means such incapacity whether of a temporary or permanent nature, caused by injury or occupational disease contracted, as incapacitates a worker for any employment which he was capable of undertaking at the time of the accident:

Provided that permanent total incapacity shall be deemed to result from an injury or from any combination of injuries specified in the First Schedule where the percentage or aggregate

Figure 12 Excerpt Botswana Worker's compensation Act, Part 1, Section 2: Interpretation (Annexed in Appendix D).

Unlike most participants who indicated that healthcare workers could not be compensated because there was no evidence that TB was contracted at work, the Public health specialist offered that HCW TB cases could be investigated on an individual basis.

He further added that according to Botswana's Compensation Act, TB was not compensable, however, upon closer look, the Botswana Workers' compensation Act, under the "Second Schedule: Occupational Diseases (Section 27), does have a section that could allow HCWs who contract TB at the workplace (if this could be established), to be compensated at the discretion of the Commissioner of the Workers Compensation's appointed medical Board.

Infectious or parasitic diseases contracted in an occupation where there is a particular risk of contamination.	(a) Health or laboratory work. (b) Veterinary works, animal. (c) Work handling animal carcasses, parts or such carcasses, or merchandise
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Figure 13 Excerpt from Botswana Worker's Compensation, Section Schedule, Occupational Diseases
(Copy attached in Appendix D)

In this case, TB an infectious disease, would fall under (a)Health or laboratory work.

Among focus groups participants, HCWs voiced a preference for some form of pre-injury remuneration, such as 'risk allowance' which would recognize that they were exposed to diseases such as TB. Their perspective was that with TB patients in particular, it was not easy to protect oneself as there are a lot of dynamics that have to go into protecting oneself against TB as a hospital worker. An example of this is what gave birth to the concept of "Armouring," a concept from the "*Barriers to implementation*" but also pertinent to this theme and debate of evidence or lack thereof of exposure. Armouring is the concept that professional healthcare

workers, i.e. nurses, would enter the ward or cubicle wearing PPE; N95 respirator, gloves and gown to provide care to a patient. Within the same cubicle would be a cleaner, who also assists in the care of the patient, *sans* PPE similar to the one donned by the nurse, and additionally may not aware of the potentially infectious disease that the patient may have.

Contrary to the perspective of the focus groups participants, there was agreement among in-depth interview participants that if the HCWs are to '*have a case with the government*' in order to be compensated if they are infected with TB, they have to prove that they were not exposed to TB in the community. With no studies or any statistical or epidemiologic evidence of TB exposures among HCWs the participants were keen to make these rather strong observations. There was a study conducted to determine if TB clusters observed around the capital of Botswana, Gaborone, had any nosocomial origins (Surie et al., 2017). However, this study on community TB clusters was only published in 2017, which meant that there was no evidence whatsoever for the interviewees to speak that authoritatively concerning this matter at the time of the data collection of our study. It could be that the participants received this information from the same source, but it was not disclosed, or the researcher was not able to probe further to get to this information.

Botswana has a high incidence of TB in the general population due to high incidence of HIV, similar to its neighboring countries, particularly South Africa which has one of the highest HIV TB incidences in the world including among healthcare workers. There are several HCW TB

studies that have been conducted in South Africa that could have advised health leadership in Botswana as far as TB exposures in HCW are concerned (Naidoo & Jinabhai, 2006; von Delft et al., 2015). Of course, there are varying socio-economic and political contexts between Botswana and South Africa, but in the absence of data in Botswana, these could have been a starting point to consider when it comes HCW TB exposure, infection and disease compared to the general population.

International Labour Organization(ILO) C161 - Occupational Health Services Convention, 1985 (No. 161), Part II (Functions), Article 5 States:

“Without prejudice to the responsibility of each employer for the health and safety of the workers in his employment, and with due regard to the necessity for the workers to participate in matters of occupational health and safety, occupational health services shall have such of the following functions as are adequate and appropriate to the occupational risks of the undertaking:”

It goes on to list the specific tasks to be undertaken by each member, but the two that particularly relate to our study are:

- (a) Identification and assessment of the risks from health hazards in the workplace
- (k) Participation in analysis of occupational accidents and occupational diseases.

(161. convention concerning occupational health services, 19851991)

We are unclear whether Botswana has ratified this convention, but in the absence of an OHS system and a relevant occupational assessment which ought to be provided by the employer, as the ILO recommends, the responsibility to prove that the healthcare worker has had an occupational exposure, the burden to 'prove' infection appears to fall on the healthcare worker, Verkuil & Middelkoop, (2016) observed.

Another observation is that this potentially points to the gap that could be filled by OHS in the health system, particularly occupational hygienists, whom upon finding that there were healthcare workers infected with TB, could conduct risk analysis to determine if said healthcare workers were exposed to TB within the hospital environment. There is a growing number of published studies that discuss occupational TB from the IPC lens with no input from OHS (Bhebhe, Van Rooyen, & Steinberg, 2014; Rothe et al., 2013; von Delft et al., 2015) The lack of discussion of occupational TB from the perspective of OHS seems to be the elephant in the room, except in this case, no one actually seems to see the elephant. Occupational TB studies which mention OHS are far and few between (Zelnick et al., 2013).

8.2 Infection control

Under this category we discuss all the three themes that emerged from the results.

8.2.1 Acknowledgement and awareness of importance of IPC

General infection control is an even more recent newcomer to Botswana as far as health preventative fields are concerned. It is even more recent than its cousin occupational health, yet infection control within our research sites seemed to have been more embraced than OHS.

There was an agreement both at the public and private hospital and in-depth interview and focus group levels that IPC was important. Perhaps the acknowledgement and embracing of IPC was evidenced by the fact that the two public hospitals in our study were assigned infection control personnel who worked closely with TB coordinators. At the time of our study the private hospital had just employed a senior nurse who was in charge of infection control and we had a chance to interview her.

This growing recognition of the importance of IPC is not limited to Botswana, it is evident in the number of increasing publications even in Sub-Saharan Africa region particularly in the Southern African region, with South Africa being the epicenter of research studies focused on TB infection control (Gandhi et al., 2013; Naidoo, Taylor, & Jinabhai, 2007; Pillay & Sturm, 2007). An increasing incidence and prevalence of TB in the general population have been recorded in the post-apartheid South Africa, with spikes of TB seen in the 2006 MDR and XDR nosocomial TB outbreak which resulted in high mortality rates among patients as well as healthcare workers (Naidoo & Jinabhai, 2006).

Two decades ago Harries et. al., (1997) summarized what they deemed *“Practical and affordable measures for the protection of healthcare workers from TB in low-income countries”*.

This review provided measures the authors suggested were needed in order to protect healthcare workers, and these were;

- (a) Prompt diagnosis and treatment of infectious patients
- (b) Adherence to criteria for suspected TB
- (c) Investigate TB suspects as outpatients
- (d) Decrease delays in sputum collection & delivery
- (e) Improve safety of laboratory workers
- (f) Isolate infectious TB patients
- (g) Use short-course chemotherapy
- (h) Wards with TB patients to have high levels light and UV lights and exhaust fans where possible
- (j) Patient cough training (respiratory etiquette), as well as
- (l) Screening HCWs for TB infection and disease (Harries, Maher, & Nunn, 1997).

While the awareness of importance of infection control measures have been increasing in the last decade, the implementation and effectiveness not been extensively studied in LMICs. In our study, based on what participants expressed, some of these measures were not being implemented at the time of our data collection. For instance, (c) some TB patients were still being hospitalised without screening (l) and in some cases TB diagnosis was not established until after two weeks (f) and during those two weeks the patients suspected of TB were not being isolated. Infectious TB patients (f) were not always triaged.

The Botswana National TB Program oversees all TB infection programs including the TB infection control manual whose first edition was released in 2009 (more on this in the next chapter). At the time of our study, some of the participants informed us that there were talks of drafting a national IPC policy. Both Hospital A and B had IPC committees which met regularly and they assigned each unit an IPC focal person who was supposed to be a unit leader in matters of IPC and reported any IPC issues back to the committee as necessary. Programs for IPC may be in place but how effective these are at reducing TB infection remains difficult to measure, in fact upon our enquiry on the monitoring and evaluation of programs, a few in-depth interview participants acknowledged that this was an area that was lacking. This is in agreement with the observations by some occupational and environmental health researchers who concluded that most preventative programs in the low and middle-income countries fail due to lack of enforcement of regulations and evaluation of effectiveness (Lucchini & London, 2014; Owie HO, 2016; Patwary et al., 2011).

8.2.2 Some IPC measures are implemented

WHO published *Guidelines for the prevention of tuberculosis in resource-limited settings* (World Health Organization, 1999). The Botswana guideline includes content from the WHO because in there were representatives from WHO in the guideline development group. The WHO guideline lists measures that can be implemented in low-resource settings such as Botswana. From both our focus groups and in-depth interviews, we gathered that there were some infection control

measures that were being implemented by the healthcare workers. Under administrative measures, the healthcare workers informed us that sometimes they triaged TB patients and ensured that they were provided medical assistance speedily in order to reduce the time in which they could expose other patients.

Botswana has dry and hot seasons as well as a cold season. Healthcare workers reported that during hot seasons they opened the windows towards where there were TB patients, in order to dilute the air within the wards and reduce the concentration of TB droplet nuclei, and thereby observing some of the environmental controls suggested by the TB guidelines and WHO (1999). According to participants, Personal protective equipment, in the form of N95 was provided to healthcare workers, and workers opened windows when possible. The participants demonstrated that they understood these concepts even though these measures were not always carried out as recommended. Participants stated that there was still room for improvement.

Mehtar (2008) claims that the reason why guidelines exist in low and middle-income countries is because the guidelines are mostly copied as they are from high-income countries. Mehtar (2008) further states that the reason why there are very few aspects of such guidelines being implemented is that the governments and facilities responsible for the implementation lack the funds and the capacity to do so.

8.2.3 Hospital physical structures not conducive to IPC

(IPC – engineering controls)

Among all the themes, categories and concepts, one of the most dominant ones which was concordant across the majority of in-depth participants, was that of hospital structures that were not built to enhance IPC. This was consistent even for hospitals which were built over the past 10 years, and it was also consistent at a macro level; the way the whole hospital is built, and micro level; how the cubicles were constructed within the wards.

Hospitals whose physical structures demonstrate IPC as an afterthought are not unique to Botswana and not even specific to TB prevention and control. Nosocomial infection throughout Africa appear to have “limited investment in facilities” as a risk factor (Rothe, Schlaich, & Thompson, 2013). Rothe and colleagues (2013), explore the connection between different risk factors that influence healthcare-associated infections in Sub-Saharan Africa, and they separate these into: Healthcare-associated infections care infrastructure; susceptible patient population; and limited investigation into achievable/affordable interventions. Even though Rothe et al., (2013) separate these for the sake of identifying and possibly narrowing down the factors, some, if not all of them can be said to be interconnected. For instance, in a hospital environment there can be architectural structures that are not favorable for IPC, due to “limited investment in facilities” and the latter can be due to “competing priorities” in the “national healthcare infrastructure”

The Sub-Saharan Africa region seems to have been made increasingly aware of the inadequacy of health systems and infrastructures by the Ebola outbreak whose epi-center was Guinea, Sierra Leone and Liberia, where mortalities included healthcare workers (Center for Disease Control and Prevention, 2016). Bringing it down to the Southern part of the continent and in the countries surrounding Botswana, even South Africa, where technology and science seems to be more advanced than in most African countries, has to grapple with the issue of architecture which does not favor IPC (von Delft et al., 2015).

8.2.4 Infection prevention and control measures identified as inadequate

Participants reported that even though some IPC measures were implemented, this was not enough. Provision of a holistic infection control program is complex and multi-faceted, and when exploring the specifics of IPC, we found out that not only was the funding for these activities not adequate, but that it is possible that the IPC officers themselves did not receive adequate training to equip them to assess and provide relevant IPC intervention.

It appears IPC officers all of whom were nurses prior to their then current roles, were informed of their new roles during the time when the hospitals were seeking to be accredited by the South African-based accreditation body, COHSASA. They were excused from the nursing duties to focus specifically on IPC.

The inadequacy of infection control is not a concept limited to studied health facilities, let alone Botswana hospitals only. With the formalized profession and field of IPC being a recent addition to the hospital environment within Sub-Saharan African countries, the lack of capacity to

implement infection control measures as indicated in the policies and SOPs is a common occurrence (Buregyeya et al., 2013; Ogbonnaya, Chukwu, Uwakwe, Oyibo, & Ndukwe, 2011). Malangu and Mngomezulu (2015) evaluated TB infection control measures implemented in the neighbouring South African province of Kwazulu Natal and found out that institutional manager who were responsible for ensuring the implementation of administrative control measures did not comply with 9 out of 10 measures. Overall, they found out that the facilities they surveyed complied with less than 50% of TB infection control measures (Malangu & Mngomezulu, 2015).

8.3 Guidelines and policies

8.3.1 Origin, formulation and availability of guidelines

In the ideal evidence-based practice process, scientific research is meant to inform policy and in turn, policy feeds the guidelines that health practitioners are supposed to use in their everyday practice. Ultimately then, health outcomes are supposed reflect the rigour of guidelines and policy from which they derive. From evaluating the guidelines that had been collected, it was evident that the guideline developers compiled the guidelines from different sources including WHO guidelines. Some of the In-depth interview participants differed from the focus group participants in what they said about the guideline formulation process. The former believed that healthcare workers were represented during guideline-formulation so the healthcare workers *“can own them”* as one TB coordinator expressed, while some of the focus group participants mentioned that they had never taken part in any guideline development. However,

that some the focus group participants had not been involved in guideline formulation does not necessarily nullify representation of HCWs during guideline formulation.

As Nathavitharana et al. (2017) discuss in their research on how healthcare workers can be agents of change in occupational TB, health organizations such as WHO formulate guidelines for settings with limited resources, but it appears the reality on the ground is that resources are limited even beyond their estimation. It has been reported that only 10% of workers in LMIC have access to OHS and that some countries have not even ratified some of the Conventions that are relevant to occupational exposure control (LaDou, 2003; Lucchini & London, 2014). This was echoed by some of the participants who felt that varied guidelines were available, but that it was the implementation and translation of the guidelines to practice that was not adequate.

8.3.2 Barriers to implementation

Implementation as referred to by many of the participants, meant that some IPC/OH activities were conducted at the hospital and ward level which is different from the way it is meant in the iterative process of policy-writing, implementation, monitoring and evaluation. However, some of the participants at the ministerial level affirmed having done some implementation activities

Even though the above participant mentioned the implementation activities they conducted, it appeared this process was inconsistent and was not in any systematic manner such that one could readily know the specific processes or activities that were carried out during

implementation and who was supposed to conduct them.

Perhaps the manner in which implementation was inconsistent as far as who was supposed to do what, can be seen in some of the guidelines. For instance, the “National TB Programme” manual had the following statement under its aim:

With such a general reference which includes all workers, it then speaks to why every healthcare worker sees themselves as “implementers.” The same applied to the ‘TB infection control manual;’

If the guidelines were this generic, then it suffices to mention that it would not be easy to specifically point out who the implementers were.

From synthesizing data, we found 5 different levels and dimensions which appeared to render difficult the implementation of measures. For all the 5 factors which influenced implementation, at the center or some level close, there seemed to be a communication disconnect between stakeholders. This is likely due to the fact that there was no distinct office or person who was tasked with the process of implementation. When guidelines were available, HCWs were not trained on how to translate them to daily practice and no one could say with certainty whether guidelines were truly being implemented by end users. Some of those at the management level felt that HCWs were not taking adequate and deliberate steps to implement available guidelines.

An example of the fracture between different levels of healthcare workers, including healthcare workers and policy-makers is the concept original to this study, the concept of '*Armouring*.'

How healthcare worker relationships and behaviours influence how IPC measures are implemented have been discussed directly and indirectly in various studies (DeJoy, 1996; Kanjee et al., 2012; Moore, Gamage, Bryce, Copes, & Yassi, 2005; Verkuil & Middelkoop, 2016; Yassi et al., 2007). '*Armouring*' which was reported by focus group members regarding their IPC relationship with their managers and supervisors, the nurses, could be symbolic of how IPC communication between different cadres and professionals aid or interferes with IPC measures. A study on perspectives of HCWs, from South Africa, pointed out that one of the factors that hindered implementation of IPC measures was that HCWs had little trust in IPC, as often there was lack of congruency between policy and practice (Zelnick et al., 2013).

The objectives of our study were to explore the perspectives of policy-makers and hospital leaders towards infection control and occupational health policies and guidelines. We learnt from hospital leaders, infection control personnel and policy makers that occupational health and infection control services were limited within the public and private hospitals we studied. This group was also of the opinion that healthcare workers could not be compensated for TB exposure and disease because there was no evidence that workers were exposed in the workplace. However, some such a TB coordinator added that some HIV negative workers had developed TB disease after working in high risk areas. Another, a policy maker expressed that

matters of TB disease and compensation could be assessed case by case instead of a somewhat dismissal, 'there is no evidence of occupational TB exposure.'

Finally, we sought to understand the perspectives and attitudes of healthcare workers who have direct contact with TB patients, toward the process of implementing guidelines used in preventing exposure to occupational TB. From focus groups with nurses, laboratory technicians and radiographer and with cleaners and drivers, we gathered that there were factors that influenced implementation of guidelines and control measures such as stakeholders external to the hospital; lack of training on implementation and lack of communication between healthcare workers and hospital leaders.

From the findings and discussion, our research questions have been answered. From this dissertation, there is now a better understanding of the perspectives of hospital leaders, policy-makers and infection control personnel regarding occupational TB exposure, formulation and implementation of occupational and infection control measures.

In chapter 7 recommendation in light of the findings. Limitations and proposed future studies are also discussed.

Chapter 9: Evaluation of guidelines

Research Question 3.

What is the content of the infection control and occupational health policies and guidelines used to control TB in healthcare workers as determined by the Appraisal of Guidelines for Research & Evaluation (AGREE) instrument?

9.1 Literature review on guidelines

The creation of guidelines and their use to guide medical treatment and dedicated infection control practices has helped to reduce TB exposures and infection among healthcare workers mostly in high income countries (Wenger et al., 1995) However, Lower-Middle Income countries are disproportionately affected by the global burden of TB, due to lack of resources for clinical treatment and the capacity to actualize TB infection control guidelines (Granich et al., 1999); the high incidence of Human Immunodeficiency Virus (HIV)/TB comorbidity has also contributed to the weakening of health systems which in turn has led to increasing incidence of TB (Reid et al., 2012)

Since the resurgence of tuberculosis disease in the late 1980s and early 1990s, in addition to the clinical treatment and intervention to reduce the pathological effects of TB disease, there has been an increasing number of infection prevention and control guidelines that have been developed to minimize TB exposure and infection in patients and healthcare workers (Jensen et

al, 1994; WHO 1999; WHO 2009). The seminal HCW-TB prevention activities include guidelines created by the United States Center for Disease Control (CDC) titled *Guidelines for preventing transmission of tuberculosis, 1990*, and *Guidelines for Preventing the Transmission of Mycobacterium tuberculosis in healthcare Facilities, 1994*.

(Jensen et al., 2005; Maloney et al., 1995; World Health Organization (WHO), 1999; World Health Organization (WHO), 2009) Since then, policies and guidelines continue to be formulated for prevention of exposure to TB in healthcare workers.

Where pre- and post-guideline TB transmission rates and disease were studied, there was some evidence that the introduction of guidelines and their implementation, improved TB management and clinical practices, resulted in reduced exposures, infection and disease rates (Maloney et al., 1995). Studies conducted after the implementation of guidelines indicate that TB case rates in patients and healthcare workers were reduced. In a retrospective study by Maloney et al. (1995), tuberculin skin tests were used to compare rates of TB sero-conversion before and during implementation of recommended guidelines. Healthcare workers who worked in wards such as “medical” and “HIV” which housed patients with TB, were 3.5 times as likely to sero-convert compared to those who worked in other wards. Over 16% of the healthcare workers had a positive tuberculin test before implementation of guidelines compared to only 5.1% during the implementation period (Maloney et al., 1995). Yet questions remain about the specific aspects of guidelines which led and can lead to reduced exposures and fewer TB cases among healthcare workers (Alonso-Coello et al., 2010).

Kanyerere and Salaniponi (2003) conducted a Malawian-based study to determine incidence of TB in healthcare workers and to determine if the guidelines recommended by the National TB program were being properly implemented. The TB case notification rate in healthcare workers was 5780/100 000 during the time of the study compared to 240/100 000 in the general population. The authors concluded that National TB program guidelines were poorly implemented giving an example of sputum smear guidelines that were not being followed.

Most of the studies that evaluate guideline implementation in association with TB exposure and infection rates pay little attention to the content and quality of guidelines (Kanyerere & Salaniponi, 2003). The conclusion that guidelines are poorly implemented without exploring the content and quality of guidelines decontextualizes the implementation of guidelines and does not adequately explore how specific aspects of the guidelines may present a challenge to the healthcare workers who are to implement them (Alonso-Coello et al., 2010). In addition, there have been a few studies which have unequivocally pointed out those TB guidelines are not easily translated to implementation and that more research should be undertaken in this area (Gallardo et al., 2010)

One HCW TB incidence study by Naidoo et al., (2006) noted that at the time of their study, South Africa did not have guidelines for controlling nosocomial TB despite WHO recommended guidelines. Some South African provinces have since developed guidelines to prevent TB in

healthcare workers, but even recent studies point out the failure of TB control in South Africa, citing 'passive case finding' instead of 'active case finding' which is recommended by guidelines. (Luhailima et al., 2008; Wood et al., 2011) Passive case finding is the low-hanging-fruit in the paradigm of assessment of TB in that healthcare systems investigate patients who are showing symptoms of TB and are already in health facilities. Active case finding involves screening patients, using Tuberculin skin testing (TST) techniques and conducting regular TB surveillance. The WHO's strategy for TB control, Direct Observed Therapy Short course (another guideline) is also said to be insufficient in high HIV/AIDS burden like South Africa (Wood et al., 2011).

The question of the content, quality of guidelines and translation to implementation, has not been extensively studied likely because it brings in the question of criteria to be used in determining the quality of guidelines, the instrument or tool to use and how and why that instrument would be selected. Due to the importance of guidelines and their quality (and ease or difficulty of implementation) in improving health outcomes, studies have been conducted to determine which evaluation or appraisal instruments would be best to use in critiquing the guidelines (Alonso-Coello et al., 2010; Graham, Calder, Hébert, Carter, & Tetroe, 2000).

Vlayen et al. (2005), reviewed 24 appraisal tools which were mostly developed in high income countries. The specific evaluation items within the tools included; reliability, validity, clinical applicability and flexibility, clarity, dissemination, and implementation among others. In the Vlayen et al. (2005) study and the others that were reviewed, the appraisal tool developed by

Cluzeau and colleagues (Brouwers et al., 2010) proved to have the most rigour compared to other instruments. In the Graham et al. (2000) study, the Cluzeau instrument was the only one which had been subjected to validation and had good reliability. The Cluzeau and colleagues' tool formed the basis of what is now the Appraisal of Guidelines for Research and Evaluation, also known as the AGREE instrument. It is for these validity and reliability merits that we chose to use the AGREE instrument to evaluate the quality of guidelines used in healthcare worker TB infection prevention and control in Botswana.

Healthcare worker TB studies from Sub Saharan Africa recommend a thorough implementation of the infection prevention strategies in order to reduce TB case rates and possibly reverse the adverse effects of occupational TB (Nathavitharana et al., 2017; Rothe et al., 2013). Other recent studies add a dimension of the need for stronger occupational health systems to prevent TB exposure in healthcare workers (Osaretin Owie & Apanga, 2016). Sub-Saharan Africa, as indicated by studies from South Africa, Uganda, Congo, and Malawi have high HIV and TB incidence rates. Despite these high regional HIV/TB statistics, there are countries within the continent where there are few published studies in TB HCWs. Botswana is a case in point; where epidemiology studies report a HIV incidence of over 30% in the adult population and a TB incidence rate of 694 per 100 000 in the general population (Creek et al., 2000; World Health Organization, 2009).

The Botswana National TB Program (BNTP) and public hospitals (all centrally managed by Botswana Ministry of Health) have developed policies and guidelines for prevention of TB exposures in the general population, however, effectiveness of their implementation on prevention of occupational TB infection have not been evaluated or published.

Our aim was to evaluate guidelines used in the prevention of exposure to HCWs⁰⁰ using the AGREE II tool. Initial reading of the guidelines indicated they were created without the aid of the AGREE tool, therefore there was need to modify the use of the tool for evaluation.

9.2 Methods – Guideline collection

Preventative techniques ranging from infection control to occupational exposure control have been demonstrated to reduce TB among healthcare workers (Maloney et al., 1995). In the United States in particular, infection control and occupational health guidelines were formulated and healthcare workers implemented these guidelines, and decrease in TB incidence in healthcare workers were reported. Although international organizations such as the World Health Organization have assisted in developing guidelines contextualized for LMICs, the effectiveness of these guidelines have not been evaluated. The third research question for our study sought to evaluate the content of infection control and occupational health guidelines that healthcare workers in Botswana implement in order to reduce TB exposures.

All guidelines were collected from in-depth interview participants with the exception of one, the TB infection control training manual which was collected during the TB infection control training workshop. One of the in-depth interview participants – the TB coordinator from Hospital A - informed and extended an invitation to the researcher to attend one of the workshops she co-facilitated, and this is where the training manual was obtained. The following documents/instruments were collected:

1. Botswana National TB program TB treatment guidelines
2. TB infection control guidelines
3. TB infection control training manual
4. Occupational health and safety workshop training manual
5. National Occupational Health and Safety policy (the policy was in a draft form at the time of collection)

The first two were evaluated using the Appraisal of Guidelines for Research & Evaluation (AGREE) instrument tool. The National Occupational Health and Safety Policy was not selected for the evaluation as it was in draft form and not promulgated during the time of data collection. The two training manuals were not evaluated as they are not guidelines.

9.3 Analysis - Guideline Evaluation using AGREE tool with modifications

The Appraisal of Guidelines for Research & Evaluation (AGREE) tool has 6 domains and 23 items which are used in assessing a guideline (Brouwers et al., 2010). The domains and their items are outlined in Table 9 and 10.

Instead of applying each domain and item and having one to four reviewers each score, as is usual when the AGREE tool is used, we used the tool to explore the content and describe of the guidelines using the domains, but we loosely scored the domains and did not compute the final outcomes. Therefore, the scoring and interpretation are omitted from our findings and discussion. We did this because the guidelines were missing many aspects expected according to the AGREE tool, possibly because when the guidelines were created a tool such as AGREE was not used, possibly because the those formulating the guidelines were not aware of its existence. Instead of reporting what would have been low scores, we explored the guidelines in a way which could demonstrate to the guideline-creators where the guidelines could be strengthened if they were to use an instrument like the AGREE tool to create their guidelines.

9.4 Findings from the AGREE tool

We sought to understand the perspectives of healthcare workers about occupational health and infection control within the context of prevention of occupational TB. An evaluation of the content of the guidelines would contribute a dimension that would illuminate why and how activities towards prevention of occupational TB were carried out or not. In this section, the outcome of the evaluation is discussed under respective items and the latter are written in *italics* for clarity. The summaries of evaluation for the two manuals that were reviewed can be found in Tables 9 and 10 respectively.

AGREE Domain/Item(s)	TB programme manual assessment
1. Scope and purpose <ul style="list-style-type: none"> Overall objectives Health question specifically described Population described 	<ul style="list-style-type: none"> Aim stated in the preface section. Health question and target population described. Page 6 of manual states: "To give clear and practical guidance to health workers in the provision of high-quality TB care..."
2. Stakeholder involvement <ul style="list-style-type: none"> Inclusion of relevant groups Views of target population sought Target users clearly defined 	<ul style="list-style-type: none"> Organizations represented are clearly stated, however, professional expertise of individuals NOT stated. Unclear whether views of target population have been sought, manual does not state that.
3. Rigour of development <ul style="list-style-type: none"> Systematic methods for evidence Criteria for evidence described Strengths/limitations described Methods for formulation described Explicit link, recommendations & evidence Guideline reviewed by experts Procedure for updates provided Development group includes relevant professional groups 	<ul style="list-style-type: none"> Unclear how literature review was conducted, how, when by whom. TB epidemiology mentioned but no source. No critique of literature review mentioned No specific recommendations nor methods in formulating them General benefits of guideline mentioned but could be more explicit. No record of expert reviews, one person mentioned as reviewer, but expertise not mentioned. Need to update manual is provided, how or when not mentioned
4. Clarity of presentation <ul style="list-style-type: none"> Recommendations are specific Different options for management of condition Key recommendations identifiable 	<ul style="list-style-type: none"> Guideline does not explicitly state recommendations Options for management drug-sensitive, drug-resistant Tb, pulmonary and extra pulmonary TB are discussed, however, these refer to the general population. Key recommendation not provided, but key take-home messages provided
5. Applicability <ul style="list-style-type: none"> Facilitators & barriers described Guideline provides for putting recommendations into practice Potential resource implications considered Monitoring/auditing criteria presented 	<ul style="list-style-type: none"> Facilitators and barriers not discussed Forms for gathering TB patient information provided Cost analysis nor resource implications provided Guideline provides: "framework for monitoring and evaluation", however, this could be more detailed.
6. Editorial independence <ul style="list-style-type: none"> Views of funding body not influenced guideline content Competing interests recorded and addressed 	<ul style="list-style-type: none"> The guideline does not indicate the position of BNTP regarding the guideline and contents. Competing interests not mentioned.
7. Overall assessment	<p>This guideline is a good starting point, however it could be enhanced as follows:</p> <ul style="list-style-type: none"> The language and writing could be more explicit, further details could be included There is a section on infection control, but there is no mention of occupational health

Table 9: Summary of AGREE evaluation of National TB programme manual

9.4.1 National TB Programme Manual

The National TB Programme Manual (NTPM) collected for evaluation is the seventh (7th) edition of the TB treatment guidelines.

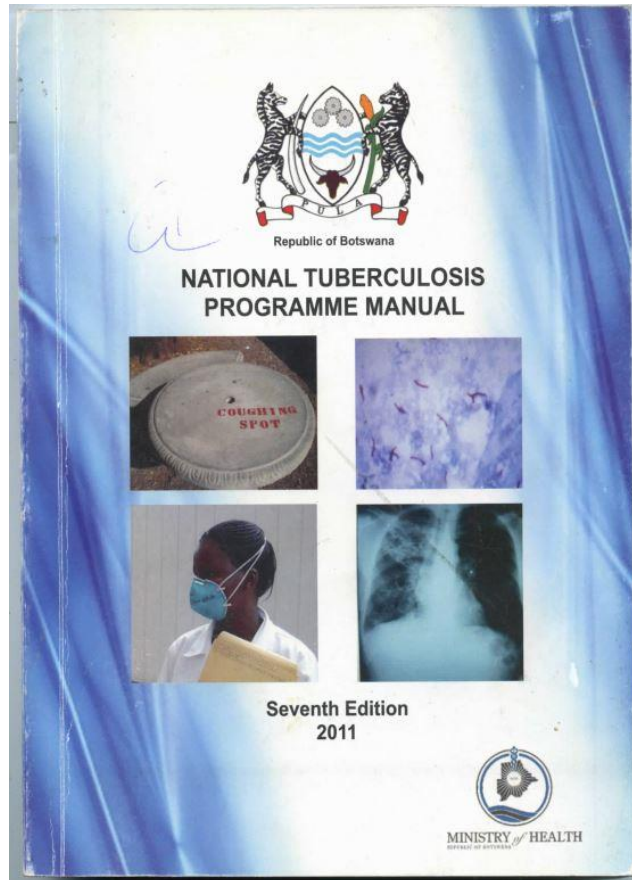


Figure 14: National TB program manual cover

9.4.1.1 Scope and purpose

Under the primary domain of scope there are 3 items, which seek to explore if the objective of the guideline is specifically described; (1) *The overall objective(s) of the guideline is (are) specifically described*. The aim of the NTPM was clearly stated in the “preface” section. Items 2 and 3 respectively, explore if (2) *The health question covered by the guideline is specifically described* and (3) *The population to whom the guideline is meant to apply is specifically described*. The health question and the target of the guidelines are both stated on page 6: “The aim of this manual is the same as that of the previous edition: to give clear and practical guidance to health workers in the provision of effective, high-quality TB care and treatment at every level of the Botswana healthcare system.”

9.4.2 Stakeholder Involvement

The ‘stakeholder involvement’ domain contains 3 items; (4) *The guideline development group includes individuals from all relevant groups*. The organizations represented in formulating the guideline are well stated. The individuals who also took part in creating the guideline are clearly written, however, their professional expertise has not been listed, nor how much they contributed to the guideline formulation. Under the preparation of document there is a list of individuals acknowledged for contributions to the document, however, the type of contribution is not indicated. A group of individuals is listed as having been the writing group, but no indication of the guideline sections they wrote. In the final manuscript review, one person is

acknowledged as having edited the final manuscript, and another for assisting with photography.

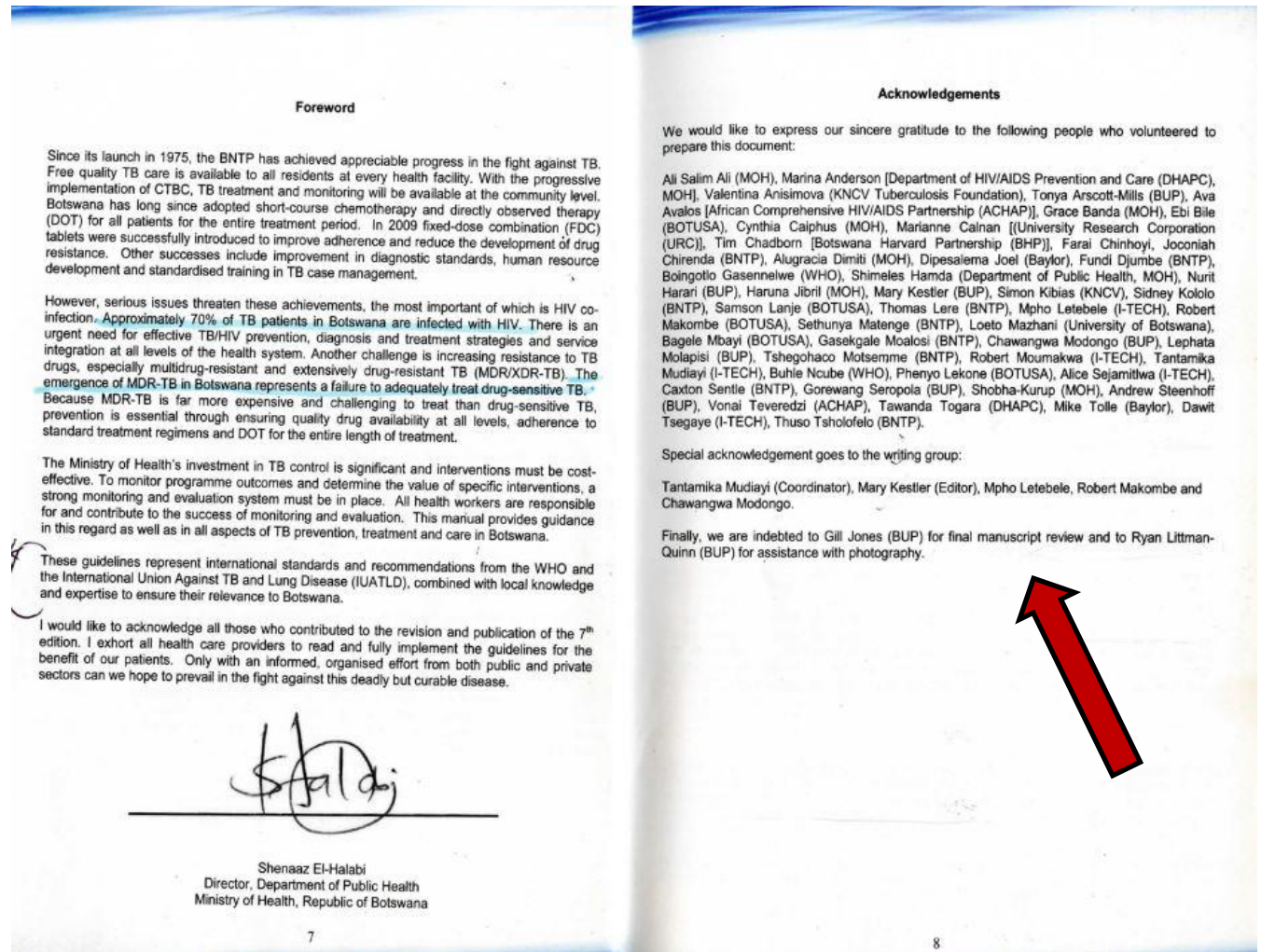


Figure 15: Contributors to the TB manual

The second item under this domain is (5) *The views and preferences of the target population (patients, public) have been sought*. The views and preferences of the healthcare workers were **NOT** sought because there is no where on the document where it is stated otherwise. For the third and final item, (6) *The target users of the guideline are clearly defined*. Healthcare workers

are clearly stated as target users of the guideline, but there is no differentiation among types of healthcare workers.

9.4.3 Rigour of development

Rigour of development is covered by items 7 – 14. Item seven seeks to investigate if (7) *systematic methods were used to search for evidence*. The guideline does not clearly state how the search for literature was conducted, where, or by whom. There is reference to TB epidemiology and other evident researched information, but there is no mention of the source for this information. There is no provision of references that were used to formulate the guidelines. Perhaps this was provided in the earlier editions but the current edition does not state this clearly.

This was followed by item (8) *The criteria for selecting the evidence are clearly described*. As described in the previous item, there is no reference to literature and inclusion or exclusion criteria are not stated. Item 9 sought to understand if *'The strength and limitations of the body of evidence are clearly described.'* The manual makes no reference to the literature or its critique. Item (10) *The methods for formulating the recommendation are clearly described* was also missing; there were no specific recommendations or methods used in formulating them. Item (11) sought to explore *'The health benefits, side effects, and risks and have been considered in formulating the recommendations'*. As mentioned in item 10, there were no specific recommendations described, but the general benefits of developing a guideline for control and treatment of TB were discussed, though they could have been more explicit and

detailed. Treatment of TB, MDR-TB and XDR-TB are discussed, however side effects and risks are not discussed. The natural and logical progression from items 11 and previous ones is to enquire if (12) *there is an explicit link between the recommendations and the supporting evidence*. What the guideline has stated is what is currently known about TB, treatment and control in the literature. However, there is no explicit reference to the literature and there are no linkages to the recommendations to the supporting evidence. Items 13 and 14 investigated how the guideline was reviewed. On item (13) *The guideline has been externally reviewed by experts prior to its publication*, there were no recorded expert reviews. Instead, the guideline was reviewed by one person- G.J of Botswana U-PENN partnership – and G.J.'s expertise is not explicitly stated. A google search of G.J. Botswana U-PENN partnership shows G.J. as the individuals who comprise the "Administration of the Botswana-Penn Partnership". The last item under 'Rigour of development' enquired if (14) *a procedure for updating the guideline is provided*. There is reference to why there was a need to update the current guideline. "The revision of the 2007 6th edition of the guidelines was one of the recommendations from the 2009 evaluation of the BNTP [Botswana National Tuberculosis Programme]. It was also necessary to update treatment regimens with new information from the BNTP 2006-2008 Annual Report and the 4th edition of the WHO Treatment of Tuberculosis Guidelines." Beyond the above statement, there is no reference to how or when the current manual will be updated.

9.4.4 Clarity of Presentation

The 'clarity of presentation' domain assesses if key information within the guideline was presented in a clear and identifiable manner. This domain had 3 items. Item (15) enquired if *The recommendations are specific and unambiguous*. The guideline does not refer to recommendations. Item 16's criterion was (16) *the different options for management of the condition or health issue are clearly presented*. Drug-sensitive, drug-resistant TBs, and pulmonary and extra pulmonary TB are all discussed. Management of these is provided in the indexed section of the guideline. However, these are about the general population and do not necessarily reference healthcare worker exposures. The final item enquires whether (17) *key recommendations are easily identifiable*. These are not provided, and a summary of key take-home messages could have been provided.

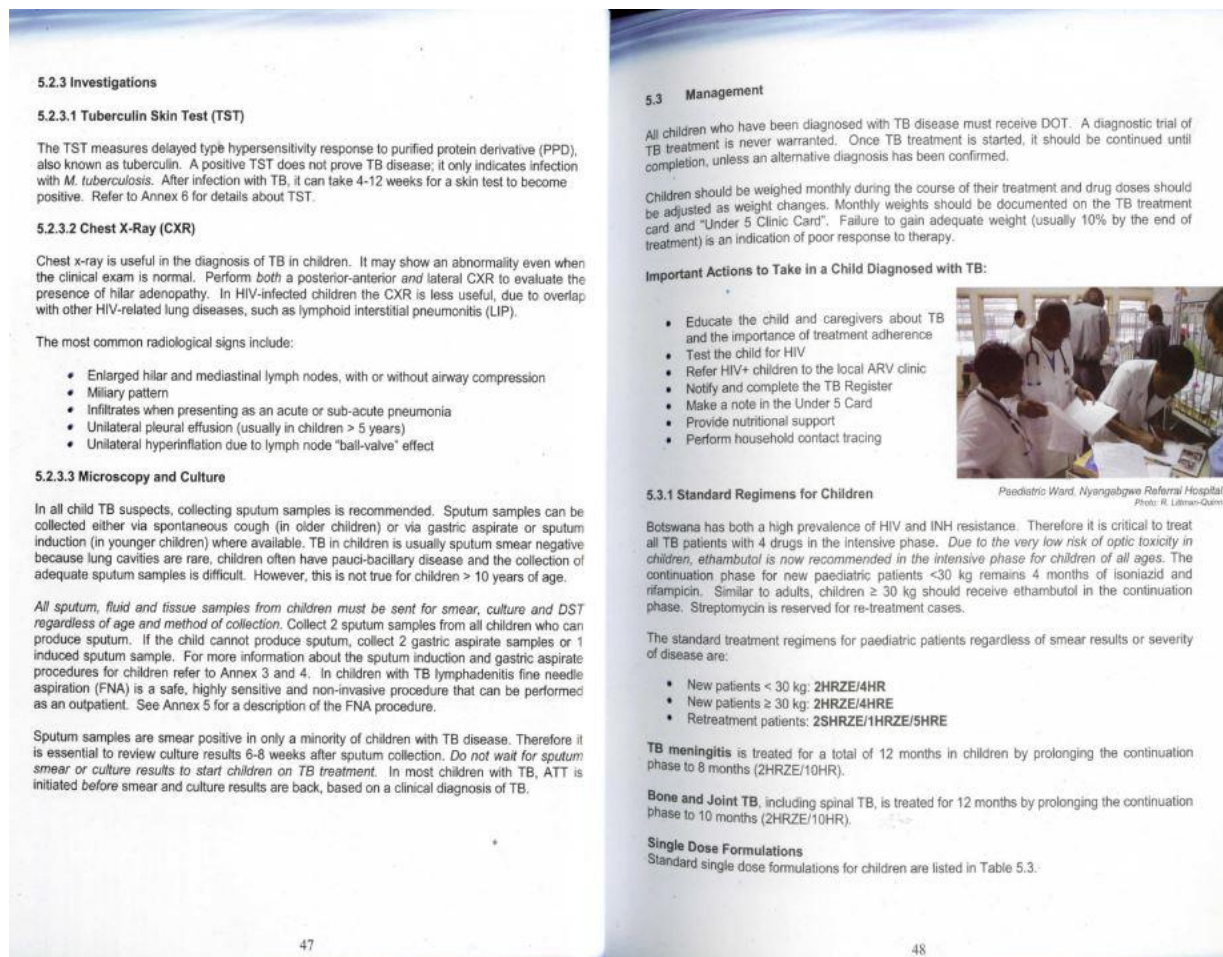


Figure 16: Investigating a TB case

9.4.5 **Applicability**

The domain 'applicability' comprises 4 items which investigate the ease with which the guideline is transferable to implementation. Item (18) *The guideline describes facilitators and barriers to its application*, and these were not discussed. Items (19) seeks to explore if *The guideline provides advice and/or tools and how the recommendations can be put into practice*. There are some forms provided on how healthcare workers could gather information from TB patients. Part of applicability is asking if *the potential resource implications of applying the recommendations have been considered (Item 20)*. There is no cost-analysis or any reference to resource implications provided by the guideline. The final item under 'applicability' is (21) *the guideline presents monitoring and/or auditing criteria*. The guideline provides a "framework for Monitoring and Evaluation" in Table 10 could have been expanded upon.

9.4.6 **Editorial Independence**

The domain 'editorial independence' had 2 items; (22) *the views of the funding body have not influenced the content of the guideline*, and (23) *competing interests of guideline development group members have been recorded and addressed*. The guideline had no statement which indicated the position of BNTP on the guideline and its contents. There was no record of having addressed competing interests.

9.4.7 **Overall Assessment**

Title: National Tuberculosis Programme Manual, 7th Edition, 2011

The overall assessment section of the AGREE tool Guideline recommended for use is 'Yes' but with modifications.

The guideline is a good starting point, but it could be enhanced greatly in several areas:

- a) the writing of the guideline could be made clearer and more explicit. There is significant detail that the formulators did not include. For instance, omitting literature search and review and how that integrates with the guideline. B) the authors of the guideline could have clearly stated who the HCWs referred to were and the roles they play in the management of TB. There is a section on Task Distribution which explains the role that is to be played by different professionals - this could have been mentioned up front. C) how an average healthcare worker, for example, a nurse or an allied healthcare worker, could use this guideline on a daily basis should have been stated. There is reference to healthcare workers and how they can manage TB patients, but there is no reference to what happens when the HCWs themselves become patients. C) there is a section on TB infection control, but there is no reference to Occupational health.

9.4.8 Tuberculosis Infection control guidelines

The second guideline that was evaluated using the AGREE tool was the national Tuberculosis Infection control guidelines (NTIC). The summary of how the six domains of the were evaluated is in Table 10.

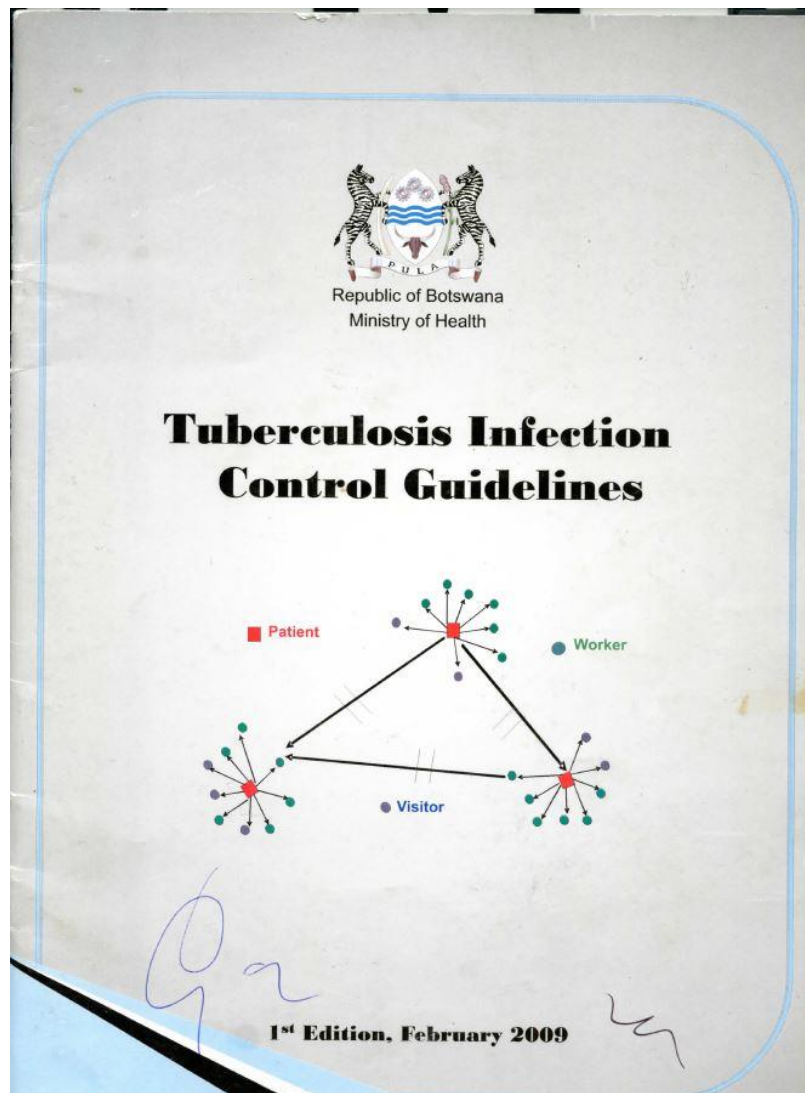


Figure 17: Tuberculosis infection control guidelines cover

AGREE Domain/Item(s)	Tuberculosis infection control guidelines
8. Scope and purpose <ul style="list-style-type: none"> Overall objectives Health question specifically described Population described 	<ul style="list-style-type: none"> The overall objective is described; “to help healthcare workers minimize the risk of transmission of Tuberculosis in all facilities” Health objective: help HCWs minimize transmission of MTB The guideline is for HCWs but can be followed by any member of the population with TB.
9. Stakeholder involvement <ul style="list-style-type: none"> Inclusion of relevant groups Views of target population sought Target users clearly defined 	<ul style="list-style-type: none"> Organizations represented stated clearly, as well as individuals, however, the individuals’ expertise is not stated. It has not been stated whether the views of HCWs were sought. Target users described under foreword section.
10. Rigour of development <ul style="list-style-type: none"> Systematic methods for evidence Criteria for evidence described Strengths/limitations described Methods for formulation described Explicit link, recommendations & evidence Guideline reviewed by experts Procedure for updates provided Development group includes relevant professional groups 	<ul style="list-style-type: none"> Bibliography is presented on the last page of the guideline, including BNTP manual of 2007 and 5 WHO reports Well-known literature included in the manual but not explicitly referenced No evidence of external expert reviews There is no information about future updates
11. Clarity of presentation <ul style="list-style-type: none"> Recommendations are specific Different options for management of condition Key recommendations identifiable 	<ul style="list-style-type: none"> Step-by-step instructions provided, but not necessarily labeled recommendations Key messages are highlighted within each chapter
12. Applicability <ul style="list-style-type: none"> Facilitators & barriers described Guideline provides for putting recommendations into practice Potential resource implications considered Monitoring/auditing criteria presented 	<ul style="list-style-type: none"> Facilitators and barriers are not described No cost analysis has been described Guideline provides a “monitoring and evaluation of TB IC programme”
13. Editorial independence <ul style="list-style-type: none"> Views of funding body not influenced guideline content Competing interests recorded and addressed 	<ul style="list-style-type: none"> Nothing has been stated on editorial independence.
14. Overall assessment	The guideline is recommended with some modifications: <ul style="list-style-type: none"> The guideline is for different target populations, it could be divided into those sections for clarity Expertise who took part in the compilation of the manual could be clearly stated.

Table 10: Summary of AGREE evaluation for TB infection control manual

9.4.9 Scope and Purpose

9.4.9.1 The overall objective of the guideline

The overall objective of the guideline is specifically described. "The goal of this document is to help healthcare workers minimise the risk of transmission of tuberculosis (TB) in all facilities.

The main objective of this first NTIC guidelines document is to minimise the patient to patient and patient to HCW transmission of TB in healthcare facilities and other settings with a high-prevalence of HIV such as prisons."

9.4.9.2 The health question

The health question covered by the guideline is specifically described. The health objective is to help healthcare workers minimise the risk of transmission of *Mycobacterium tuberculosis* in all facilities. The title of the guideline also states clearly what the guideline is going to tackle.

9.4.9.3 The population

The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described. This was not necessarily the case. The guideline is meant for healthcare workers, but the guideline is meant to be followed if any member of the population has TB. The guideline is generic (figure 18).

FOREWORD

It is my pleasure to introduce the first National Tuberculosis Infection Control (NTIC) Guidelines in Botswana. The goal of this document is to help health care workers minimise the risk of transmission of tuberculosis (TB) in all facilities. Health care provision in Botswana is based on the primary health care concept where there is integration of services. Patients infected with the human immunodeficiency virus (HIV) and health care workers (HCW) are particularly vulnerable to developing TB disease if they come into contact with *Mycobacterium tuberculosis* (M.TB). The main objective of this first NTIC guidelines document is to minimise the patient to patient and patient to HCW transmission of TB in health care facilities and other settings with a high-prevalence of HIV such as prisons.

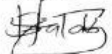
This NTIC guidelines document is for policy makers, HCW, administrators, and stakeholders in the public, private and non-governmental organizations involved in the care and treatment of people living with TB and HIV/AIDS. The intent of this document is to give the reader an understanding of the following issues in the context of TB and HIV care settings:

- TB transmission in health facilities providing services to HIV-infected individuals.
- Infection control (IC) procedures to reduce the risk of TB transmission in HIV/AIDS care settings.
- Protection of HCW through voluntary HIV counselling and testing (VCT), screening for TB disease and increased awareness of TB in all health care settings
- Importance of IC in other congregate settings including prisons, jails, detention areas and other facilities where large numbers of HIV-infected individuals gather.
- Infection control issues surrounding multi-drug resistant TB (MDR-TB) and extensively-drug resistant TB (XDR-TB).

Botswana, like other countries, is concerned with the escalating number of TB cases including MDR and XDR-TB. In 2006, 8941 new and relapse cases were reported, and over 100 MDR-TB and 3 XDR-TB cases were reported in 2007. The majority of these cases were adults aged between 15 and 49 years, the same age group most affected by HIV.

It is therefore important that we use these NTIC Guidelines at all times during the delivery of health care services to STOP TB transmission in Botswana.

I thank you



Shenaaz El-Halabi
Director, Department of Public Health
Ministry of Health

Figure 18: Target population for the infection control manual

9.4.10 Stakeholder Involvement

9.4.10.1 Professional groups represented

The guideline development group includes individuals from different professional groups. The organisations represented in the technical working group that formulated the guidelines were clearly stated. The individuals representing the organisations were stated, however, the professions of the individuals were not given. Therefore, it is difficult to evaluate whether all relevant stakeholders were represented. From reading the guideline and interaction with policy-formulators in the in-depth interview section of our research, the author personally knows some of the individuals in the working group. Infection control and lab technology safety is represented. However, this being a guideline about healthcare workers and TB as an occupational exposure, there was no representation from Occupational health- so in that regard, not all stakeholders were represented.

9.4.10.2 Views of the target population

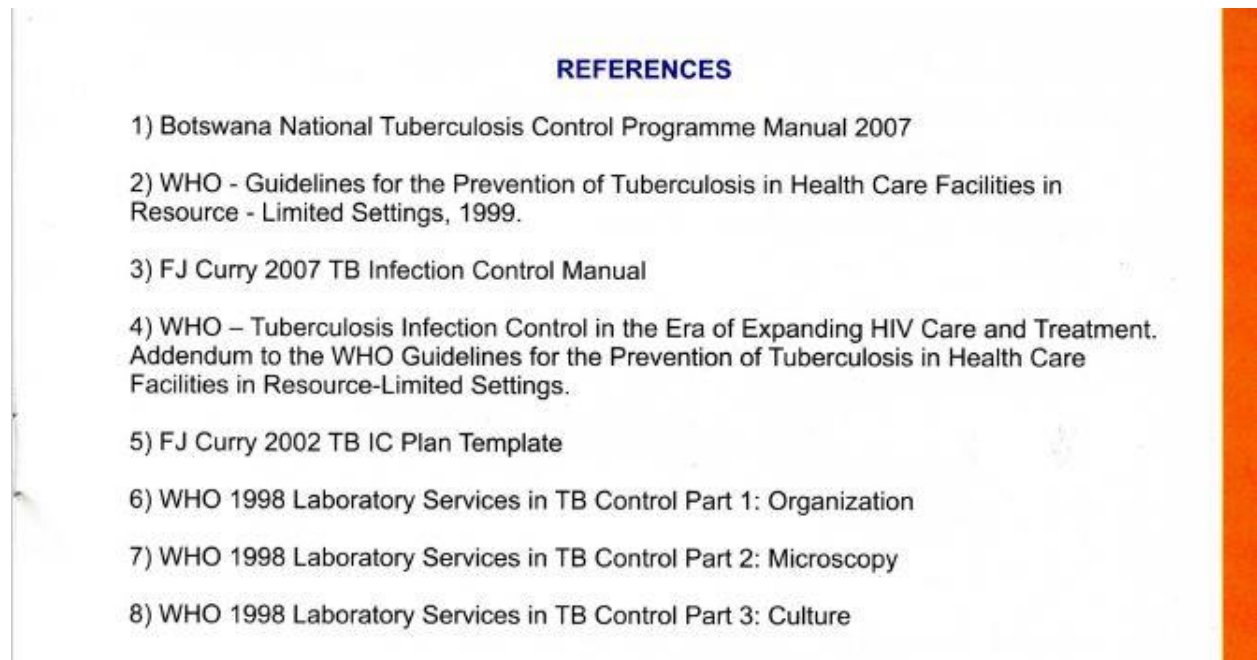
The views and preferences of the target population (patients, public, etc.) were sought as follows: There were no views sought from patients about their experiences with TB in health facilities. Some of the representatives in the working group were clinicians or had clinical experience, but there is no apparent evidence that views of healthcare workers were sought and represented in the guideline.

9.4.10.3 Target users

The target users of the guideline was stated as healthcare workers. The target users were described under the "foreword" section of the guideline and not featured under the contents page. This could have been placed under a well-labeled section and indexed under 'contents' to access it easily.

9.4.11 Rigour of Development

References were provided on the last page of the guideline. However, no literature search strategy was named, nor keywords used or databases searched. The references include Botswana National Tuberculosis Control Programme Manual of 2007, five World Health Organization Reports and two by a journal articles by Curry F.J (Figure 19). The criteria for selecting the evidence were not described.



REFERENCES

- 1) Botswana National Tuberculosis Control Programme Manual 2007
- 2) WHO - Guidelines for the Prevention of Tuberculosis in Health Care Facilities in Resource - Limited Settings, 1999.
- 3) FJ Curry 2007 TB Infection Control Manual
- 4) WHO – Tuberculosis Infection Control in the Era of Expanding HIV Care and Treatment. Addendum to the WHO Guidelines for the Prevention of Tuberculosis in Health Care Facilities in Resource-Limited Settings.
- 5) FJ Curry 2002 TB IC Plan Template
- 6) WHO 1998 Laboratory Services in TB Control Part 1: Organization
- 7) WHO 1998 Laboratory Services in TB Control Part 2: Microscopy
- 8) WHO 1998 Laboratory Services in TB Control Part 3: Culture

Figure 19: Bibliography for IPC manual

9.4.11.1 The strengths and limitations of the body of evidence

Strengths and limitations were not described. There is an evident reference to a body of knowledge, for instance the section on? "Epidemiology of TB in Botswana" shows that some research was conducted elsewhere, but the strengths and limitations of such research were not discussed.

9.4.11.2 The methods for formulating the recommendations

The guideline does not have clearly described recommendations, however, there are instructions provided for healthcare workers to implement. Some instructions are detailed enough to understand, others are not. For example, under the section titled "Personal Respiratory Protection", facilities that use respirators are informed to have a "Respiratory Protection Program". The plan for said program is outlined and includes items such as "Selection of the respirator" and "who should use the respirator."

9.4.11.3 The health benefits, side effects, and risks

The health benefits of lowering TB transmission among patients and healthcare workers were alluded to. Risks of not lowering exposure to TB are also touched upon, but in general there is no clear connection made between the recommendations/instructions and the health benefits/side effects and risks. All these could have been outlined and more clearly labelled and stated.

9.4.11.4 Link between recommendations and supporting evidence.

Instructions are based on WHO guidelines; perhaps there is an assumption that WHO's reports are well-researched (Figure 20). In general, the infection control strategies provided are not much different from those in the literature and are well-known in the infection control field. However, the guideline itself does not necessarily make that link obvious.

Figure 6: Recommended Sitting Arrangement for Natural Ventilation in TB IC



Source: World Health Organization

Assuming HCW are TB free.

Figure 7: Alternative Sitting Arrangement for Natural Ventilation in TB IC



Source: World Health Organization

Figure 8: Sitting Arrangement NOT Recommended for Natural Ventilation in TB IC



Source: World Health Organization

Figure 20: Reference to WHO literature in IPC manual

9.4.11.5 External review by experts

There is no evidence that the guideline was externally reviewed by experts prior to its publication though there were some representatives from well-known international health organizations such as WHO, on the working group. There is also no information regarding the future updates of the guideline.

9.4.12 **Clarity of Presentation**

9.4.12.1 The specificity of recommendations

The guideline gives instructions in some cases, step-by-step of what to do, but there are no clearly-stated recommendations. For instance, there are some descriptions of how to isolate and manage different types of TB patients within the healthcare facilities.

9.4.12.2 Key recommendations

Within each chapter, 'key messages' are highlighted (Figure 21). For example, under Chapter 3: special areas and infection control, one of the key messages given is: "All staff members working in this department, designated family members should have access to respirators."

2.2.1 Administrative Control Measures That MUST Be Implemented At All Times

Key messages:

- TB infection control plan
- Screening
- Education
- Triage
- Prompt diagnosis and treatment

2.2.2 Tuberculosis IC Plan

Administrative controls start with the development of an IC plan (ICP). This plan MUST be at all levels of health care delivery with a minimum of the following:

- A description of the high-risk areas within the facility
- Specific IC measures in specific areas
- Activities to implement IC measures
- The roles and responsibilities of all HCW at specific health care levels
- The TB and HIV/AIDS epidemiological profile of the setting, including information about TB and HIV among HCW
- The local prevalence of DR-TB
- **Frequency of screening HCW for TB disease**
- Training for HCW on IC measures. At a minimum training must cover:
 - Pathogenesis and transmission of TB
 - Groups at highest risk of TB disease, especially immunosuppressed HCW
 - Difference between LTBI and TB disease
 - Signs and Symptoms of TB disease
 - MDR-TB
 - Specific IC measures
 - Where to get a copy of the ICP
- Timeline, budget and other resources required to implement the plan

The development of the TB ICP implies that important activities MUST take place before it is developed and implemented. These activities include:

- Identification of high-risk areas
- Assessment of HCW training needs
- Assessment of HIV prevalence in the patient population

Prevalence of TB/HIV in HCWs

2.2.3 Essential Components of the ICP:

- Assigning responsibility and authority
- Conduct TB risk assessment
- Conduct TB IC setting assessment
- Develop a comprehensive written ICP and policies for implementing it
- Implement the ICP
- Educate HCW and patients
- Evaluate annually
- **Revise ICP as needed**

Figure 21: IPC manual key messages

9.4.13 Applicability

The guideline does not describe facilitators and barriers to its application. However, the guideline gives instructions and in some cases gives steps of what to do.

For example, Chapter 3 discusses laboratory safety; one of the sub-topics under this section is 3:10 'Sputum Collection and Handling'. This outlines some steps to be taken to avoid or minimise TB transmission during sputum collection.

9.4.13.1 Potential resource implications

No cost analysis or potential expenditure of resources were discussed. However, "availability of TB IC Resources" was mentioned under Chapter 4 - Monitoring and Evaluation of TB IC programme.

9.4.13.2 Monitoring or auditing criteria

The guideline provides a chapter (4) on "Monitoring and Evaluation of TB IC Programme." It delineates the activities to be monitored such Monitoring '-Presence of a focal TB IC person' '- Number of HCW trained on infection control,' 'Implementation of IPC' 'Annual Evaluation.'

9.4.14 Editorial Independence

It is unclear whether the views of the funding body (government programme, BTNP) influenced the content of the guideline, as such a disclaimer was not stated in the guideline. The guideline also does not disclose any competing interest of the group members who wrote the guideline.

9.4.15 Overall quality of the guideline

This guideline is recommended for use with some modifications. Given that this was the first edition of this manual, and it was borne out of the need to lower TB transmissions between patients and patients, and patients and healthcare workers, this was a good effort on the part of the formulators. Since this is clearly a needed guideline, the evaluator would recommend that it continue to be used but with some modifications.

1. Scope and Purpose: These could be clearly stated and written in a section by themselves where it would have been easy for anyone picking up the guideline and open to the section under which they are written and well-labelled. The rationale for developing these could also be stated and for whom they were made.

2. Stakeholder Involvement: The individuals who took part in the writing of the guideline were clearly stated, but their professional fields were not, therefore it is not easy to know their expertise and professional affiliation and how their contribution strengthened the guideline. This could be clearly stated and with clear statement of how each individual contributed to the guideline in their professional capacity.

3. Rigour of development: There was some evidence that the guideline writing group used some scientific literature as they referred to some epidemiological data. They also included on the last page of the guidelines, the references they used, such as the WHO reports. Some of the

details that could have been included are: 1. Keywords that were used to search for the literature. 2. Databases from which they searched for journal articles 3. How the literature was searched. 4. The strengths and weaknesses of the literature.

4. Clarity of Presentation: The contents section of the guideline describes the sections in the guideline. Some sections are described in more detail than others. There are some sections of the guideline which could have been separated into independent sections and named to show their content. For example, the purpose and target populations of the guideline were included under "Foreword" instead of an independent section.

5. Applicability: The guideline gives instructions on what healthcare workers can and must do when handling or encountering TB patients. However, the guideline does not address the resources that the healthcare workers have at their disposal in order to implement the guidelines. The guideline provides a monitoring and evaluation section and suggests activities that can be done in order to ensure that TB infection control programs are planned for and implemented.

6. Editorial Independence: The guideline was not reviewed by experts in relevant professional or clinical fields for accuracy and appropriateness.

9.5 Discussion

The AGREE tool II is meant to be an encompassing evaluation tool which can be used for general public health guidelines and not just clinical ones. Yet, for the guidelines we evaluated, the tool was rather stringent as a significant amount of what the criteria required simply did not exist in the guidelines and in some instances the questions and criteria the AGREE tool sought were not relevant or not fitting for the evaluated guidelines. The AGREE tool probed about recommendations, health benefits, side effects and risks, concepts which are fitting for a more clinical guideline and not necessarily one similar to the guidelines we evaluated. This could mean one of the two things; the first being that the guidelines did not have adequate content, which could mean that the guidelines have potential for improvement as far as evaluation with the AGREE tool is concerned. Another possibility was that the tool was not the most appropriate and relevant to evaluate the selected guidelines. However, prior to the guideline evaluation we looked at another potential evaluation tool; the Global Rating Scale (GRS) (Brouwers et al., 2012). The GRS comprised the following four elements; (1) 'Rate the guideline developments' (2) 'Rate the guideline presentation' (3) 'Rate the guideline recommendations' and (4) 'Rate the completeness of reporting, independent of the development methods' (Brouwers et al., 2012). We ultimately selected the AGREE II tool as it was reported to be a more rigorous tool compared to many other guideline evaluation tools (Brouwers et al., 2012; Cates et al., 2001; Graham, Calder, Hébert, Carter, & Tetroe, 2000) Therefore even though the GRS could have been adequate as far as evaluation of our collected guidelines was concerned, the AGREE II was a better tool as it elucidated some of the areas within the guidelines which

could be elaborated upon and in some cases invited the formulators of the guidelines to pay specific attention to what was missing from the guidelines(Brouwers et al., 2012).

For instance, the National TB Programme Manual did not state how and what literature was conducted in order to develop the guidelines. There was reference to some global TB epidemiology, and other bits of literature, but the source of this information was not provided. The specific questions in the AGREE II tool were able to highlight these short-comings, something GRS would likely not have brought forth as the guidance it provides in this area is to consider if “the evidentiary base was developed systematically” and if the “recommendations were consistent with the literature...”(Brouwers et al., 2012).

9.5.1 The effectiveness of guideline evaluation

It could be argued that the National TB Programme Manual was written to be translated further by end-point users into standard operating procedures for ease-of-use, which would be why perhaps its format does not readily lend itself to an easy read. It is a document with over 100 pages which does not lend itself to being “readable” to the average healthcare worker in a busy institution

The seemingly limited connection between the AGREE tool and the evaluated guidelines raises some questions such as: if these guidelines which were partially benchmarked on some well-known health organizations such as WHO whose guidelines are presumably research/evidence-

based, can they be translated into daily health practices and can they deliver the outcomes intended by WHO and/or countries like Botswana? Some of the participants expressed their viewpoints regarding externally-imported ideas, guidelines and texts.

“What I have realised is that the policy-makers they like to, like they are saying, they adopt things from the books made by the Americans or the what-what, like they will say, we will have 2% mortality rate due to TB, but they will never take into account whether that we don't have those ventilated..like you said pressure what what, we have never had those pressure things, they are just American things written in the books, and the next person who is going to review the policy is going to write the same thing, is not going to review what has been failing us. Instead of checking that we wrote this policy in 2008 and we said this and this and we failed, so why now why did we fail this because we don't have the facilities that we said we would have, instead she will just write what the other person wrote. You see, and its not working for us, so like I said can you please go there and ask them, that "let's use what we have". You cannot say you are going to have 2% mortality rate and you expect people to work miracles with no oxygen or no nothing, and you keep on asking things from other departments. Things don't work like that.” – Nurse 1, hospital B.

The participant above raises pertinent questions, one of them being ‘how effective are guidelines adopted from high-income countries for use in low and middle-income countries’. Global health organizations such as WHO often assist by developing guidelines specifically for LMIC/resource-limited countries, but the question of effectiveness still remains, and this

relationship between adopted guidelines and their effectiveness remains relatively unstudied. Even locally curated guidelines have been shown to be poorly implemented, studies such as the one conducted in Malawi demonstrate this (Kanyerere & Salaniponi, 2003).

Guidelines meant for LMIC may be well-translated to fit local contexts but guidelines in isolation do not necessarily lead to better outcomes, even studies conducted in high-income countries demonstrate this. One study on what determined healthcare worker compliance with infection control procedures concluded that it goes hand-in-hand with organizational characteristics and environmental factors (Yassi et al., 2007).

One of the glaring omissions that is highlighted by the AGREE tool is that for both evaluated guidelines, there is no evidence that the formulators sought the input of the end-users whether at the beginning or after the guidelines were completed and distributed. This is somewhat reflected in what some of the participants expressed.

I think my sister has said it all. The problem is lack of consultation, because in our country we like benchmarking. We go outside, in Africa, outside Africa and we find some countries that even economically they are weaker than Botswana, but they are doing very well in TB, and then we don't really find out, go into details to find out[why] in such an African state that may not have so much resources like Botswana, how come they are doing better than us, so maybe they just look at the document, that is already there and they adopt that document and bring it to Botswana, but you may

find that those people may have gone into the communities and did a very good consultation, so as she has said (1) they don't consult, they just impose documents on people, (2.) they don't take into account staff issues, because in other countries, you will find that, at least very few that I have visited personally in Africa, you will find that when they appoint an infection control nurse, she is doing infection control, she is coming at night, she is not coming on shift, you understand? but you will find that here there is multi-tasking thing. When you complain, you are labeled that you are refusing instruction. Focus group 2, Hospital B, Medical Laboratory Technologist

The above quotes demonstrate a link between the gaps identified by the AGREE tool, and what was mentioned by the focus participants. Other connections include what some participants mentioned about guidelines being adopted from international organizations. This could to some extent be a demonstration of 'trustworthiness' for the current research's findings since triangulated methods (focus groups and collected documents) point to a similar outcome. Based on this and with the assumption that the reviewed guidelines are referred to when the researcher and participants mention guidelines, the next chapters on limitations and recommendations include information from this chapter.

Chapter 10: Strengths, limitations, recommendations and future studies

10.1 Strengths of the study

At the beginning of our study, there were no published studies from Botswana which shed light on perspectives of healthcare workers as far as exposure to TB is concerned. There were strengths about this study that positions it to be a foundation for future studies and to be translated into practice.

10.1.1 Originality

There are different studies on TB that have been conducted in Botswana (Creek et al., 2000; Emerson et al., 2016; Surie et al., 2017; Talbot et al., 2003), however, none of them explored TB occupational exposures from a qualitative framework specifically interpretive description. No other study has distinctly explored perspectives of healthcare workers from the occupational hygiene lens and infection control.

10.1.2 Study population

The study population in this research was heterogeneous in the sense that we interviewed policy-makers and hospital leaders, health professionals such as nurses, laboratory technicians, radiographers, pharmacy technicians, infection control personnel and TB coordinators, auxiliary nurses as well as daily-rate workers such as cleaners and drivers. Some qualitative studies do not include a diversity of healthcare workers in this sense. For instance, Emerson and

colleagues' study just mentions that they interviewed healthcare workers without elucidating any further on the different occupational titles of their participants.

10.1.3 Study sites

One of the marks of strength in qualitative research in general is triangulation as it leads to representative credibility (Thorne, 2016). Triangulation refers to using different sources of information. In our study we interviewed participants from both public (district and tertiary hospital) the highest national authority in matters of health- the ministry of health, different health system with varying functionalities.

10.1.4 Researcher

One of the multi-faceted aspects of 'trustworthiness' as described by Thorne (2016) is 'representative credibility.' This happens when the researcher has the ability to recognize her own biases and to distinguish between those and actual external truths. The researcher was born and raised in Botswana and understands the Tswana culture which helped in building rapport with participants, as well as conducting some of the focus groups in the local language. This helped particularly with aspects of Setswana and figures of speech that are not necessarily translatable to English. Another layer of understanding the researcher brought is having worked in Botswana's healthcare system and understanding the apprehension participants may have about Western researchers, which (Brada, 2011) discusses in "Not here." That the researcher

was born in Botswana but studied in the West ensured that that duality worked to the advantage of the study.

10.2 Limitations of the study

At the beginning of this study there were few studies conducted in Botswana in the general area of our stud. Because there were few studies, it meant there was a lot of uncertainty about an appropriate starting point and context. Below, we discuss the limitations of our study, namely field of study, study sites, nature of disease and target population.

10.2.1 Methodological limitations

10.2.1.1 Interpretive description

Interpretive description was the most appropriate framework to use for our study as it claims to readily avail itself to outcomes that can applied in a health setting. However, that the framework is relatively new and likely still getting solidified it was not always easy to understand and follow it. However, the same can be said of any qualitative methodology as they tend to be iterative and non-linear particularly in the derivation of codes and themes.

10.2.1.2 In-depth interviews and focus groups

We used a semi-structured interviewing style, which meant the author could deviate slightly from the interview script as the need arose. However, this could have also led to varying responses from participants which could mean that some responses which could have formed

themes failed to reach that level because they were not corroborated by any other participants. This could have applied for both interviews and focus groups. However, our research questions were answered which likely means any substantive themes were captured.

10.2.1.3 Possible recruitment bias

We used a combination of purposive sampling to recruit participants for this study. This meant that the people we recruited were specifically recruited in order for us to determine the research questions we set prior to commencing the study. Although this suited the study, it means that it is possible that we may have left out participants who could provide information that may have been important to our study despite being beyond the scope of our research questions. This error could have possibly led to recruitment error, however, questions arising from the current study provided a foundation for future studies.

10.2.2 Researcher limitations

The researcher is a novice qualitative researcher which means it is possible to have overlooked important aspects of qualitative research that an experienced researcher would not have.

However, this was not likely as the researcher attended qualitative health research conferences to learn about the field. The author also met the founder of interpretive description and sat in an interpretive description workshop facilitated by Thorne.

10.2.3 Field of study limitations

TB disease is often studied from many different perspectives. Our current study focused on TB in healthcare workers primarily from an occupational hygiene lens. This means that our primary task was to find out about the “anticipation, recognition, evaluation and control” of TB among healthcare workers. Ultimately then, the findings from our study may not be applicable to other frameworks of other study disciplines.

10.2.4 Study sites limitations

Botswana has 3 tertiary/referral hospitals; 7 district, 16 primary, 2 mission and 2 private hospitals, and an unknown number of clinics (Government of Botswana, 2011). Of these, we limited study to 1 tertiary hospital, 1 district hospital, and 1 private hospital. All the hospitals studied were situated in Gaborone (capital city) and a town approximately 30 kilometres from Gaborone (Molepolole). In other words, we studied TB in healthcare workers in the urban areas of Botswana whose demography, health facilities and resources are entirely different from the rural areas.

We conducted 21 depth interviews and 5 focus groups and evaluated two guidelines and these were conducted in 2 public hospitals and one private. Our findings may not necessarily be readily generalizable to all the different types of the hospitals available in Botswana because each hospital likely has unique characteristics different from the facilities we studied. However, in qualitative research, the primary aim is not necessarily generalizability of the findings, but

that the selected research population is appropriate for the research questions the study seeks to address. Given that there are 3 tertiary hospitals and 1 was in our study, our findings may be applicable to the other 2 as hospitals in the same level tend to possess similar characteristics in terms of hospital beds and healthcare worker demographics. The public hospitals are under the jurisdiction of the Ministry of Health and therefore there could be some commonalities that render possible some generalizability. However, such comparisons and application must be done with caution.

10.2.5 Nature of disease limitation

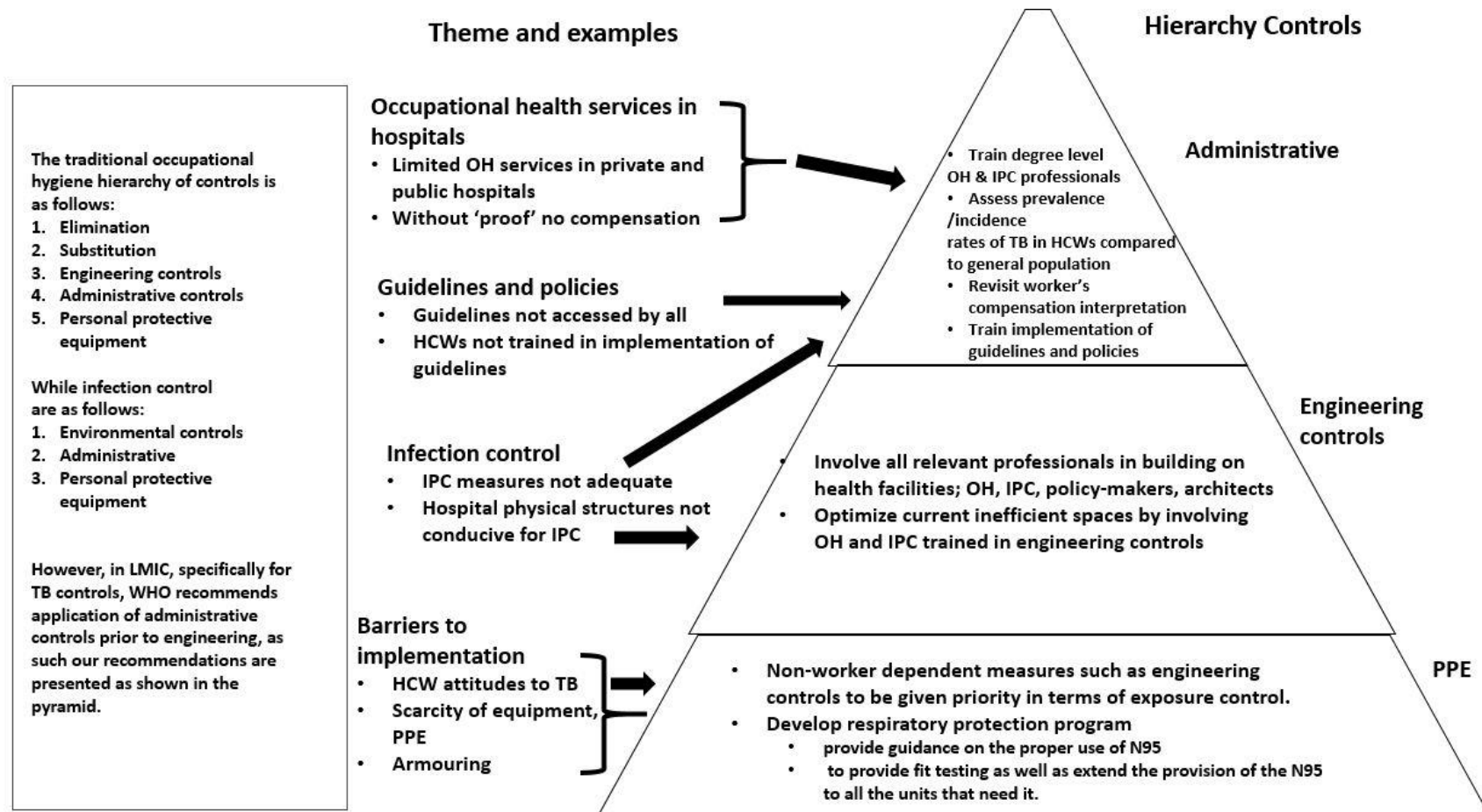
We conducted a qualitative study that focused on the perception of TB prevention and control among healthcare workers. Our study was limited and focused on TB, and even though some concepts discussed in our study may be similar to other infectious diseases which are transmittable via the airborne route, findings from our study may not necessarily be extrapolated to other conditions.

10.2.6 Study target population limitations

We sought to understand the perspectives of healthcare workers who have direct contact with TB patients, TB program leaders and policy-makers. These were included in our study, and as such our findings can only reflect perspectives of healthcare workers on TB exposure and prevention within the hospital environment

10.3 Recommendations

Figure 22: Summary of recommendations



Our research is rooted within the occupational hygiene paradigm, and the recommendations are framed and prioritized per the occupational hygiene hierarchy of controls. The recommendations are summarized in Figure 22. There are recommendations targeted at the Ministry level as well as for the hospital level. Although the recommendations are provided from the OH paradigm, it is with understanding that OH solutions can only be implemented within the context of multi-disciplinary and systems approach, and that collaboration and input from other health professionals is and will be necessary. The hierarchy of controls is as follows: 1) Elimination; 2) Substitution; 3) Engineering controls 4) Administrative; and 5) Personal protective equipment.

10.3.1 Elimination/Minimization

The traditional occupational hygiene hierarchy of controls has ‘elimination’ or substitution of the contaminant as the first level of exposure control. Substitution is not possible, and it is not feasible to think about elimination a nebulous biological contaminant such as TB in a hospital setting, for this level of control we will use “minimization” instead of “elimination”.

This recommendation to eliminate TB among healthcare workers and the general population in Botswana may seem far-fetched, but the country both at the ministry and hospital level could contextually adopt the strategy set forth by the “STOP TB Partnership” which aims to prevent 45 million people from being infected with TB; to provide effective treatment for 29 million people and save 10 million lives by 2020 (United Nations Office for Project Services, 2018)

Elimination or minimization will largely depend policies and political will. There since policies are technically legal tools, they are henceforth included under 'Administrative controls.'

10.3.2 Administrative Controls

10.3.2.1 Policies and guidelines.

Administrative controls involve changing the way that worker performs their job tasks to reduce exposure. For this recommendation, we assume that healthcare workers are guided by written policies and standard operating procedures as far as preventing their exposure to TB.

10.3.2.1.1 Policy to train degree-level occupational health and infection control personnel

Part of the long-term plan will involve training of occupational health personnel at both the policy-making level as well at those who can be engaged at the hospital level. From our interviews we gathered that the Ministry of Health had recently employed Environmental Health officers (EHO) at the hospital level. Although most EHOs are also trained in the fundamentals of occupational hygiene and Health in general, the Ministry of Health would also benefit greatly from training specifically OH officers including those with skills for evaluation and control of hazards within the hospital environment.

We also surmised that infection control officers were not adequately trained. Therefore, it would be prudent to develop a comprehensive infection control training program with continuing education follow up that lasts longer than the two-week session offered to the IPC

officers in our study. One of the training institutions, either the University of Botswana or the Institute of Health Sciences, could introduce a 2-semester infection control training program which offers certification at the end of the program. This would ensure that IPC officers are well-equipped to assess IPC situations within the hospital environment beyond TB prevention.

The training of occupational hygiene/health specialists would reverse the problem identified under findings as “Limited or no occupational health Services in the hospitals.” The local university, University of Botswana currently offers a basic degree in Environmental Health. The department could also offer a course with a strong occupational hygiene component if funding could be secured from either the government or international funding bodies. Addressing these would likely improve the conditions for health care workers and as a result reduce high-turn over rates. However, the challenge would be to sustain such programs.

The training of OH and IPC personnel would enable the government and stakeholders to fortify the existing structures that provide OH at the policy-making level and would introduce OH in hospitals. Once the OH personnel are introduced at the hospital-level the following could be conducted.

10.3.2.1.2 Assess the rates of TB in HCWs compared to the general population.

An OH personnel in conjunction with the infection control personnel and a hospital epidemiologist could carry out a risk analysis which would start with the determination of the

incidence rate of healthcare workers infected with TB. There are various studies of this nature conducted and published by researchers from South Africa and globally (Jones, 2017; O'Donnell et al., 2010b; Tudor et al., 2016) . The OH and team could contextualize such methodologies and sampling strategies to determine the incidence of TB among healthcare workers as well some of the factors that place healthcare workers at a high risk of TB exposure. Risk factors would provide the OH and team with more concrete and specific information on how to tailor exposure prevention measures. This would provide the policy-makers and hospitals leaders with more certain evidence on the parameters of 'if, how, what and when' healthcare workers are exposed to TB in the hospital environment.

10.3.2.1.3 Surveillance of TB in healthcare workers

When OH personnel have been trained, employed and began risk assessments to determine TB rates among healthcare workers, regular surveillance programs can then be set up to determine the rates of latent and active TB among healthcare workers. This would be carried out in conjunction with the Ministry of Health's Botswana National TB program. The OH would work together with the occupational physician where they would carry out TB tests among healthcare workers at regular intervals and appropriate intervention would be provided. One of the guidelines we collected during data collection shows that BNTP collects TB information from all TB patients. However, the forms do not have a patient's occupational history, and if the BNTP form could collect this information, it could be used as part of the surveillance program.

10.3.2.1.4 Simplified, and accessible guidelines and standard operating procedures

From the focus groups and in-depth interviews, there were themes that made it clear some hospital leaders had not reviewed existing guidelines and there were some healthcare workers who claimed not to have access to the guidelines, standard operating procedures or infection control plans. Therefore, considering the above, we recommend that relevant guiding instruments, such as Standard Operating Procedures (SOPs) be simplified and made readily available to all healthcare workers.

Upon reviewing the collected guidelines, we found out some of the guidelines were not organized in a clear manner. The guidelines should be simply written and they also ought to be based on a traceable research-based tool, where if evaluated it would be easier to determine where and how the guidelines were created.

Long term, effectiveness of guidelines ought to be evaluated. In addition to guidelines being written in a simple and clear manner, the effectiveness of existing guideline ought to be evaluated using objective measures. This would inform policy-makers and healthcare workers if creating such guidelines and implementing them is worth their personnel and fiscal efforts. Specific guidelines and measures such as infection control programs should also be evaluated in order to establish their effectiveness.

10.3.2.1.5 Worker's compensation Act – revisit interpretation of

One of the contentious issues that arose from our findings was that of Workers' compensation. It was one of the central arguments of the category "No evidence of TB exposure." In-depth

interview participants insisted that as long as healthcare workers cannot ‘prove’ that they contracted TB and infected in the workplace, they could not essentially convince the government that they ought to be paid for having a nosocomial TB. The difficulty with this claim was and is that first, the burden to determine a workplace exposure is left upon the shoulders of the healthcare worker—that

*“... no, unless there is proven proof evidence [sic] that people are, that people who are who have TB - get it in the hospital. Then the healthcare workers have a case to fight the government, to get an incentive but other than that, it’s not gonna be possible but I think it would make a huge difference(R:hmm), because you get a lot of health workers who don’t want to manage TB they just think like, yea TB maybe but *MDR, †XDR no no no! They don’t want anything to to do with it...”. - Physician, Hospital A*

One of the reasons why participants talked about ‘no evidence of exposure’ could be due to the interpretation of the current Worker’s Compensation Act.

The second issue with this statement was that in the absence of professionals trained to assess occupational exposure – occupational hygienists - healthcare workers would not be able to ‘prove’ that their infection arose from the workplace even if that had been the case. Therefore, with the introduction of trained OH personnel into the health and hospital system, the question

of whether healthcare workers ought to or not be compensated- and the interpretation of the Worker's compensation act regarding this could be revisited. The OH team would avail this information after conducting thorough risk assessments. This would be considered in the presence of a multi-disciplinary team.

10.3.2.1.6 Education/Training

The final aspect under administrative controls would be educating workers on all the above-mentioned recommendations to direct healthcare workers on how these could be implemented effectively. One of the strategies for minimizing barriers to implementation would be to provide training on how healthcare workers at all levels could communicate effectively to reduce incidents such as the one painted by the concept of *armouring*.

10.3.3 Engineering controls

The depth of the controls implemented at this level would also partially depend on the availability of the relevant personnel including the occupational hygiene/health specialists. Engineering controls would address the problem identified under themes and labelled, "*hospital structures not conducive for IPC.*" These controls would also involve policy-makers at the Ministry level and implementation at the hospital and ward levels.

At the ministry level, in consideration of available finances, during the conception and construction of hospitals, architects must collaborate with relevant stakeholders including occupational hygienists, infection control specialists to build physical structures that allow for

control of infection. Occupational health and infection control personnel knowledgeable in the engineering controls required for TB and other infectious diseases, such as local exhaust ventilation which can be automated to permit negative pressure and removal of contaminated air from the patients' rooms. At the hospital level, there would be OH personnel who would assess the proper functioning of the installed engineering controls. To optimize the spaces as they exist, involve OH and IPC professionals trained in engineering controls to advice on proper ventilation.

10.3.4 Personal Protective Equipment

We identified through the in-depth interviews that the hospitals acquired personal protective equipment against TB, namely, N95, but the N95 respirator is only provided in parts of the hospital deemed 'high risk areas' where there is a high number of TB patients under the care of healthcare workers. This could point to the probability that PPE, which in OH is placed in the last rung of the hierarchy of controls, is given far more precedence than it ought. Adding to this concern is that healthcare workers gave examples of numerous occasions where an undiagnosed patient may be under the care of healthcare workers for a considerable amount of time, only to be later diagnosed as having TB. Such incidences concerned healthcare workers as far as their exposure to TB was concerned and we offer the following recommendations:

- More non-worker dependent measures such as engineering controls to be given priority in terms of exposure control.

- Respiratory protection program to be developed, to provide guidance on the proper use of N95; to provide fit testing as well as extend the provision of the N95 to all the units that need it.

The above recommendations provide a starting point for solutions to some of the most important themes that emerged from our findings. However, these ought to be considered within the context which our study was conducted, and in the following section such limitations are discussed.

10.3.5 Proposed future Studies

The current study provides insights on infection control and occupational health measures for TB within 3 hospitals in Botswana.

We identified some fundamental gaps that could be addressed by the relevant authorities. The findings show that there are limited “Occupational Health Services” within the hospitals. There are no active Occupational health personnel within the hospitals to carry out surveillance and assess TB rates among healthcare workers. Due to limited temporal and financial resources our study was limited to urban areas and relatively large hospitals.

10.3.5.1 OH and IPC measures in rural areas.

Future studies could extend from the current work by exploring the perspectives of healthcare workers at small health posts and clinics and as well as assessing infection control and occupational health measures in rural Botswana. The demographics, health facilities and resources in rural Botswana differ from those in the urban areas and studying OH and IPC measures and perspectives of healthcare workers in those areas would assist in finding gaps that exist in those areas.

10.3.5.2 Content of existing Occupational health and IPC

It would also be beneficial to evaluate the few existing Occupational health programs to better understand what these programs comprise and their outcomes. Only one institution had an

Occupational health and Safety committee which met once a month, and our study did not explore the activities of the committee in any formal manner. Therefore, it would be advantageous to seek out the OHS concepts and activities covered by the committee and evaluate them. Infection control officers reported that they were not trained in IPC except for a 2-week induction course. Future studies could evaluate what the 2-week induction course entails, as well as the roles and functions of the IPC as stipulated by the hospitals.

10.3.5.3 Rates of TB among healthcare workers

The rates of TB among healthcare workers remain unknown; therefore, future studies would do well by beginning to explore this area to understand the specific magnitude of the TB exposure and infection among healthcare workers.

10.3.5.4 Workers' compensation among healthcare workers with TB

As stated above worker's compensation was of the contentious findings from our study, as some program leaders seemed to place on the healthcare workers the burden of "proving" that their TB disease emanated from occupational exposures. A study on workers' compensation for HCW TB disease would be possible if there are rates of TB among healthcare workers. These could then be studied alongside how compensation is carried out for other professionals even outside the hospital or even outside Botswana.

10.3.5.5 The policy-making process

This study concerned itself with policy as far as it applies to healthcare worker TB. Healthcare workers applied the word 'policy' liberally and often misapplied it when in essence they referred to standard operating procedures. Future studies could explore the OH and IPC policy-making process in Botswana as well as the actors and how policy is translated to everyday OH and IPC activities.

10.4 Conclusion

We set out to: (1) explore perceptions, perspectives and attitudes of policy makers and healthcare workers towards formulating and implementing infection prevention measures that control occupational TB; (2) evaluate the existing infection control and occupational health measures used to prevent occupational TB. Our purposeful sample included three hospitals (2 public and 1 private) in Botswana. Some of the focus groups were conducted in Setswana but were transcribed verbatim and translated to English by the researcher. We used the software Nvivo 10 to store and manage data qualitative methodology interpretive description to analyse data.

There were 4 major themes that emerged from our data. Even though these themes were aligned with the primary keywords from the research questions, they emerged inductively from the data and the categories emanated from the words of the participants. The primary themes were: (1) Occupational Health Services, (2) Infection prevention and control, (3) barriers to implementation and (4) guidelines and policies. Each of the themes has various categories related to them: under Occupational Health Services, there were two categories; (a) 'No Occupational health services within the hospitals' and (b) 'No evidence of occupational TB'. These two categories were interlinked in that the hospitals did not have occupational health personnel save for the district hospital which had a partially functioning occupational health committee. Since there were no OH personnel within the hospitals it then sufficed that in-depth interview participants, mostly in middle-management and some leading IPC programs, other policy-makers, naturally expressed that there was no evidence that healthcare workers

who happened to have TB disease could not unequivocally claim that their disease was nosocomial in nature because they could not provide evidence to support such claims. Surprisingly, even though some of the participants insisted that healthcare workers could not claim TB exposure and infection occurred in the workplace, all participants agreed that OHS was an important and required service.

The infection prevention theme was less dramatic with most of the in-depth interview participants agreeing that Botswana hospitals were not built with '*infection control in mind*'. There was also agreement across the in-depth interviews that IPC measures were not uniformly implemented across the wards and that even though some measures were being implemented there was still great room for improvement.

Healthcare workers within both focus groups for professionals and for 'daily rate' workers could readily identify some of the barriers they were faced with as far as implementing occupational health and infection control measures was concerned. One of the hindering factors appeared to be communication between hospital leadership and the healthcare workers. An example of this was the concept original to the study which we termed *armouring*. The term was used by the participants to refer to a situation which depicted lack of communication between a professional healthcare worker such as a nurse and an industrial worker such as a cleaner. The industrial workers described how the nurse would be donned from head to toe with protective

equipment as if geared or '*armoured*' for war, while the cleaner would be PPE-less but providing care for the same patient.

The final theme exploring guidelines demonstrated lack of rigour in creating guidelines used in prevention of TB both in healthcare workers and general population. The guidelines were inconsistent in terms of their content to a point where we had to modify the clinically stringent AGREE tool in order to evaluate them. The guidelines omitted important aspects on how the guidelines were created such as the literature review and if the guidelines were reviewed by any scientific team or whether they had been given to the end-user to test for practicality prior to distribution.

Our study had limitations that situated it within the context which we conducted the research. However, these limitations were minimized in various aspects by the strategies we put in place in order to reduce bias and to ensure that our recommendations were relevant to the research questions, aligned with the rationale, the interpretive methodology as well as the field of occupational hygiene.

The findings suggest that the government of Botswana has not invested greatly in Occupational health within the hospital environment, and it is probable that there were valid reasons preventing this venture. However, if the country seeks to eliminate TB within the general population and among healthcare workers, as this is the global trend and a public health necessity, it is going to be expedient to train qualified occupational hygienists or occupational

health officers. These professionals will conduct risk assessments which will inform the relevant authorities the rates of TB among healthcare workers. Trained OH personnel are equipped to provide appropriate occupational preventative and control measures to protect healthcare workers, and to refer to those already infected to medical professionals for correct clinical interventions. A key concept which will be developed by OH personnel will be to determine whether healthcare workers have an excess incidence of TB and whether the disease is acquired in the hospital. This essential data may lead to a re-evaluation of whether TB is a compensable disease for healthcare workers.

These recommendations are based on our findings and provide a platform from which to discuss occupational TB exposure in Botswana. This study contributes to a body knowledge that will enable the health system in Botswana to dialogue regarding evidence-based practice in healthcare worker TB exposure and prevention. We offer these recommendations in light of the many factors that influence the health and economy of Botswana.

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Appendices

Appendix A In-depth interview question script

1. What is the role of your department in preventing/ controlling occupational exposures in healthcare workers?
 - a. Does your department have a role specifically focusing on prevention and control of occupational TB in healthcare workers?
2. Is there any relationship between the TB guidelines formulated by your institution and those developed by the National TB program; WHO?
3. Was your department involved in formulating these guidelines?
 - a. What was your role in the development of these guidelines?
 - b. Who were other stakeholders?
 - c. Were other healthcare workers involved in developing these guidelines?
4. What activities does your department carry out to ensure that the developed guidelines are implemented as intended?
5. What are your thoughts regarding TB exposure in healthcare workers?

Policy/guideline formulation and implementation for policy-makers within the hospital

1. Could you tell me a little bit about your role here at the hospital?
2. What is the process of admitting, treating and managing TB patients in your institution?

Is there a written policy or guidelines for this process?

3. Is there a TB coordinating body/program in your institution?
 - a. What is the mandate of the program?
 - b. What are the specific activities conducted by the program?
 - i. What activities are being carried out to promote TB awareness and prevention in your institution?
 - ii. How is the program managed?
 - iii. What are the educational qualifications of the TB coordinator?
 - c. How much of the financial and human resources of the program is dedicated to occupational TB exposures?

Infection prevention and control

1. Have you been involved in formulating guidelines for TB prevention in a hospital?
 - a. When were the guidelines formulated?
2. Does your institute have infection control and prevention measures for preventing TB transmission such as:
 - a. Patient isolation facilities?
 - b. Natural ventilation or mechanical ventilation system? What type does it have?
Negative pressure with at least 12 air changes per hour?
 - c. Personal protective equipment for HCWs? Such as N95 respirators? What type?
3. How are the messages about prevention of TB in healthcare workers relayed to healthcare workers in different departments in the hospital?

4. Is there surveillance of TB in healthcare workers in your facility?
 - a. Is there a continuous monitoring of TB infection control measures in your institution?

Occupational health – Healthcare worker exposure control

1. Are there healthcare workers involved in formulating measures that prevent exposure to TB? How are they involved?
2. How are workers trained to prevent TB exposure/transmission?
 - a. How often?
3. What intervention is provided for healthcare workers who have TB?
4. Is there research being conducted to improve TB prevention in healthcare workers?
5. Were you or your institution representative involved in the formulation of TB policies and guidelines?
 - a. What are the long-term goals of your hospital in terms of TB occupational exposures
6. How much resources are dedicated to preventing TB exposures in healthcare workers?
 - a. What percentage of the budget is dedicated to preventing TB exposures in healthcare workers?
 - b. Who makes decisions regarding resources from prevention and control of TB towards healthcare workers

- c. How many infection control personnel are dedicated to management of infection control in healthcare workers?
 - i. How much time do they dedicate to healthcare workers?
- d. How many occupational health practitioners are there to manage occupational TB?

Appendix B Focus group interview script

1. Can we discuss amongst ourselves what we know about TB infection, disease?
2. What has been your experience of TB prevention and control activities aimed at healthcare workers in your facility?
3. What are your thoughts towards the way patients with TB are diagnosed/treated/care for compared to patients with other infectious disease, for example hepatitis B?
4. What do you think could be done to prevent or reduce TB exposures among healthcare workers? And how?
5. What are your thoughts toward the current infection prevention control and occupational health policies/guidelines/programs in your health facility? Are you assisting in reducing TB exposures in healthcare workers?
 - a. Do you find them easy to implement?
 - b. If no? In what ways do you think these could be rendered easier to implement?
6. Are you aware of ways/measures of how you could prevent yourself from being exposed to Tb in your workplace?
 - a. What are your thoughts about steps needed to prevent oneself and others (patients and other healthcare workers) from TB exposure?
7. Are you aware of where to seek assistance in case of exposure to TB?

Appendix C Botswana Factories Act (Chapter 44:01)

CHAPTER 44:01 FACTORIES ARRANGEMENT OF SECTIONS	
SECTION	
PART I <i>Preliminary and Application of Act</i>	
1.	Short title and Minister's power of exemption
2.	General application of Act
3.	Application to factories belonging to the Government
4.	Power to exempt in case of public emergency
PART II <i>Interpretation</i>	
5.	Interpretation of expression "factory"
6.	General interpretation
PART III <i>Registration of Factories</i>	
7.	Register of factories
8.	Registration of existing factories
9.	Registration of new factories
10.	Plans of new factories
11.	Appointment of Factories Appeal Board
12.	Appeal to Board from decision of chief inspector
PART IV <i>Health - General Provisions</i>	
13.	Cleanliness
14.	Overcrowding
15.	Ventilation
16.	Lighting
17.	Drainage of floors
18.	Sanitary conveniences
19.	Enforcement of provisions of section 18 by local authorities
20.	Duty of inspector as to sanitary defects remediable by local authority
PART V <i>Safety - General Provisions</i>	
21.	Prime movers
22.	Transmission machinery
23.	Other machinery
24.	Provisions as to unfenced machinery
25.	Construction and maintenance of fencing
26.	Construction and disposal of new machinery
27.	Vessels containing dangerous liquids
28.	Self-acting machines
29.	Training and supervision of inexperienced workers
30.	Hoists and lifts
31.	Chains, ropes and lifting tackle
32.	Cranes and other lifting machines
33.	Register of chains, ropes and lifting tackle and lifting machines
34.	Safe means of access and safe place of employment
35.	Precautions in places where dangerous fumes are liable to be present
36.	Precautions in respect of explosive or inflammable dust, gas, vapour or substance

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Figure 23: Cover page, Botswana Factories Act (Click on cover page to access complete document).

Appendix D Botswana Worker's Compensation Act (Chapter 47:03)

	<i>Medical Aid</i>
28.	Medical expenses
29.	Decisions of Commissioner in regard to medical aid
30.	Fees for medical aid to be prescribed
	PART IX
	<i>Compulsory Insurance</i>
31.	Employer to insure against liability under this Act
32.	Certificate of insurance
33.	Certain conditions in policy to be ineffective
34.	Duty to surrender certificate of insurance on cancellation of policy
35.	Duty of insurer to satisfy determination against employer
36.	Penalty for false statement and wilful avoidance of policy
37.	Employers against whom claims are made to give information as to insurance
	PART X
	<i>Alternative Remedies</i>
38.	Agreement as to compensation
39.	Procedure in fatal cases
40.	Remedies against both employer and stranger
41.	Proceeding independently of this Act
42.	Where employer not liable in damages
43.	Principals and contractors
44.	Provisions in case of bankruptcy of employer
45.	Contracting out
	PART XI
	<i>Miscellaneous</i>
46.	Power of Minister to submit questions of law
47.	Appeals to the High Court
48.	Limitation of power of employer to end or decrease periodical payments
49.	Payment of compensation by instalment
50.	Application to the Commissioner
51.	Enforcement of determinations
52.	Compensation not to be assigned, charged or attached
53.	Regulations
54.	Offences
55.	Other laws
56.	Savings
57.	Transitional provisions
	First Schedule - Schedule of Percentage Incapacities
	Second Schedule - Occupational Diseases

Act 23, 1998.

An Act to provide for compensation of workers for injuries suffered or occupational diseases contracted in the course of their employment or for death resulting from such injuries or diseases and for matters incidental and connected to the foregoing.

[Date of Commencement: 28th November, 2001]

PART I *Preliminary (ss 1-3)*

1. Short title

Copyright Government of Botswana

Figure 24: Cover page, Botswana Worker's compensation act (click on cover page to access complete document).

Appendix E National Tuberculosis Programme Manual

The scanned copy of the manual was too large such that it rendered the whole thesis copy too large to send over email. As a result, scanned copies of the section of the manual have been attached throughout Chapter 9: Evaluation of Guidelines.

Appendix F Tuberculosis Infection Control Guidelines

The scanned copy of the *Tuberculosis Programme Manual* I was too large such that it rendered the whole thesis copy too large to send over email. As a result, scanned copies of the section of the manual have been attached throughout Chapter 9: Evaluation of Guidelines.

Appendix G Examples of coding

Examples of coding: guidelines and policy instruments

As an example, data which fit the following criteria would be labeled with the code “guidelines and policies”.

1. Written rules or those verbally agreed upon, that are in place and used to direct the healthcare workers on the actions they are to take in their daily practice.
2. Activities conducted to bring stakeholders together to draft guidelines.
3. Method of decision-making followed in creating the rules. (consensus etc.)

In the *excerpt below, the infection control officer describes how her institution and unit received a letter from the government which invited them to participate in the creation of an infection control policy which would take place in the future. This text fulfilled criterion 2; ‘activities conducted to bring stakeholders together to draft guidelines’ Therefore it was coded, ‘guidelines and policies’ (where “I” refers to the interviewee and “R” to the researcher).

R: ok, (I: hmm, hmm) alright so you mentioned a little bit about the ministry of health and – so is there a collaboration between infection control here and maybe other committees whether external or internal.

I: hm-hm, I will say with infection control at the government(R: coughs) we went to a meeting last week, when was that? I was invited to a meeting; I think its last month(R: hmm). The first time- they want to make a policy ya infection control(R: hmm). So we were invited. It was a one day meeting (R: ok) so maybe from there we will but – before that (inaudible). I am not sure, maybe[...]will know, I don’t know (R: hmm). But the first time I met with the government

and it was in September, they invited us they wrote us a letter to make policy ya (R: infection control) infection control. Or maybe I don't know whether it's the first thing that, (R: hmm), I'm not sure-

R: ee (yes),

I: hmmm, but we had a meeting in September maybe the other meeting will be next year because it's almost the end of the year.

R: yea,

I: yea, because they said before that they went around the country, (R: hmm), looking at the infection, precautions, everything, (R: hmm), and then they could see that there is a problem, there are two doctors who are assigned to do that. So they called a meeting and we went, all the hospitals, from Gantsi to Tsabong- from Gantsi to Maun, there were there at-(R: hmm), gatwe kae (what's the name again), Grand Palm, is it Grand Palm? Hmm, so we had a meeting, otherwise.

In-depth Interview, Infection control officer, Hospital C

Guidelines and policies – formulation

The code, 'guidelines and policies - formulation' was partially derived from the keywords the researcher used in the question, in order to bring forth the perspectives of the participants regarding formulating guidelines. The excerpt below qualified to be coded as "guidelines and policies – formulation" because the participant referred to the second criteria of activities conducted by stakeholders in preparation for the meetings where different professionals congregated in order to compile policy instruments.

"R: And what did you think about the whole process of formulating guidelines? What was your impression?"

I: ok, so, it's a long process, It takes forever.

R: How many days was it?

I: I had attended maybe i think 3-4 meetings, so there would be meeting like the ones that I had attended for a longer time were the ones that were dealing with reviewing the MDR-TB side. The MDR-TB section and the treatment guidelines. So the way we did it to have a meeting, obviously, you would have read through the old manual first and you would see like which things you think can be changed in this manual and is there anything new that we can... we can add on. So, most of the things that were changed at the time, was the fact that we already do have the MDR-TB guidelines, so they shouldn't be a lot of them be them on the guidelines for drug sensitive TB and to try as much as possible to make things simpler, like previously though also had had things like ok, somebody is resistant to this drug or this drug, but to simplify it you just say "drug resistant TB, refer to the nearest MDR-TB site", and also the new ones, included the new methods of detecting TB, and just to include that and how people should respond to it, like if they have a test, they know that they should refer to the MDR-TB site. it was mostly just trying to simplify and not to put much information in because we already have the treatment guidelines for MDR. So the one for the drug sensitive was just to simplify it. Re: ok" In-depth interview

Participant, Physician at Hospital A

Guidelines and policies – implementation

1. The rules adhered to (national or local level rules)
2. Actualization/implementation of what is written in order to achieve a goal agreed upon, e.g. screening healthcare workers for TB
3. Who ensures that activities are carried out as planned or written down – leadership
4. The level/magnitude to which what is written is translated to activities

5. Obstacles that hinder activities to be carried out

The excerpt below is an example of a piece of data that was coded, “guidelines and policies – implementation.” The participant referred to an example of an existing agreement where a physiotherapist would train healthcare workers on the techniques of safe-lifting. This an example of criterion 2; ‘actualization/implementation of what is written in order to achieve a goal agreed upon’. The participant added that even though a physiotherapist was instructing healthcare workers on safe-lifting techniques, the healthcare workers did not always follow this instruction. When asked why this was the case, the participant remarked that human beings do not always follow instructions. This response qualified the text to be coded ‘guidelines and policies – implementation’ as it fulfilled criterion 5, ‘obstacles that hinder activities to be carried out.’

“R: And then what happens in that situation, when they complain about back-pain from lifting patients?

*I: we do, like there is one in oncology, akere (?like) there is no lifting there, we transferred one to C ward and there is one in C ward with the babies. **And then there is training by physiotherapy how to lift. Its only people you know how they are, they are shown the device, how to use but at times they just want to do their own, (R: hmm), go their own way but we do.***

R: why do you think they just go on and do whatever they want even though they are shown?

I: aa, akere you know human beings, but we do tell them when you sweep when you lift, you kneel down you go up but it’s about the – and attitudes tsa bone hela((their) referring to their attitudes) but they do know about technique ya(of) lifting.” - Infection control officer at Hospital C

The code “Occupational health and safety (OHS) – control measures” had the following criteria:

1. Elimination or substitution of contaminant
2. Engineering controls (natural ventilation, mechanical ventilation: local exhaust ventilation (LEV); laminar flow hoods)
3. Administrative measures; isolation of patients, open windows, rotation of workers, ?OHS committee
4. Personal protective equipment; N95, surgical masks, gloves, gowns
5. Reference to use of the above terms by healthcare workers
6. An un-prompted use of words "occupational health" or any of the above

With the above criteria, any chunk of data that made reference to any of the mentioned criteria was coded, OHS- control measures. For example, the text in the excerpt below was coded “OHS- control measures’ because the participant refers to personal protective equipment by specifically mentioning ‘N95’, ‘gown’ and an engineering control ‘ventilation’. Those descriptors provided the paragraph a chance to be coded OHS- control measures.

*“I: well, I think what we are doing here, kwano[here] in our hospital we are really trying to prevent our staff from contracting because we have all the PPE’s for that, we use N95 masks for all those who will be entering the room, we will be having some isolation precautions that we will be observing, you don’t just go in there. **You go with a N95, the gown....**(R : ok) and all the PPE as necessary and we restrict movements so that err at least le ene molwetsi wa teng a reste gape[at least the patient can also rest](R: hmm) even when we go in **there we make sure that there is enough ventilation**(R: hmmm) hmmm. (R: ok)” -Hospital Matron, Hospital C*

As coding got more developed and nuanced, the initial sub-codes, 'child and grandchild nodes' in the language of NVivo, were merged as it became logical for them to be placed under higher and more abstract categories. Some of the earlier codes were used as themes and these described elements within a category.

Appendix H Examples of constant comparative analysis

Hospital Matron, Hospital C

*"And *MRSA also we have only had 1 case but when we did the patient was admitted from another hospital, so it was from another it was not from ours. (Researcher: Hmmm) Because what we do with every patient who comes from another hospital (Researcher: Hmmm) we... screen them for MRSA (Researcher: ok) if they have got a catheters, if they got wounds, (Researcher: Hmmm) we take swabs, (Researcher: ok) before we can admit them, so we should know whether that thing developed here (Researcher: ok or the patient came with it (Researcher: are they kept in isolation during that time?). Yes. Yes we isolate them, every patient who comes from another hospital especially if there is a query TB, we isolate them. (Researcher: ok) Ee mma. We isolate all of them.. and then what is it again?.... (Hospital Matron laughs*)"*

Hospital Matron, Hospital C

"Hospital Matron: to...?the system ya teng(of)? Like I'm saying...most of the things re rely mo go ene goromente wa rona [we rely on the government], useless at times...and asking for thing. It takes ever so long for things to be done. So ...like err rona kwano[here] for infections prevention purposes as a hospital, we have just decided that like I told you, we isolate patients, we do this and that, we collect the statistics, (Researcher: hmmm) like every Monday (Researcher: hmm) I will go through the wards (Researcher: hmm) just to check if there are any infections that need to be...communicable diseases, that needs to be reported to the ministry. (Researcher: hmmm) so every day we check if there is anything alarming, like there was one point when we had patients with malaria. And it was awkward because those patients were coming from Sikwane. (Researcher: hmmm.) so when I called them, there were two of them, bana ba motho[siblings]. Then I called them ke ba raa kere[I said to them] there is a problem here, it looks like there is malaria ee tswang ko[from] Sikwane. They said aa no. Then I said can you please come and see what I am talking about. So I went and interviewed the mother. When I interviewed and told them that there are 3 more patient there who were presenting exactly like her children in

Sikwane and one of them had already died. Then I called the team and said bo doctor Libsi...can you please come. They all came from there as a team and visited the area. And indeed there was malaria in Sikwane. So unfortunately even those ones they died. Ene ele bale [they were] disabled...but they were really looked after. So they all died.

The above two excerpts are from the same interview which was conducted with the hospital matron of hospital C. The parts in bold font both describe a process of assessing whether patients have any infectious diseases with the aim of reducing exposures. Both excerpts were coded 'infection control', and for comparative analysis we sought to understand what made them similar and what made them different and whether anything appeared contradictory. What made the analysed sections similar or varied contributed to the next level of conceptualisation, namely, themes or categories. For in-between interviews analysis, ideally a fair analysis would mean comparatively exploring variations when two participants were responding to the same question. Due to the nature of the semi-structured interviews, this meant that questions were sometimes modified or even entirely different from the original script depending on the discourse that the participant engaged in. In such cases, sections of interviews were compared and analyses based on the same code. For example, to analyse the variations between the TB coordinator from the health administration centre and the TB coordinator from Hospital A, excerpts coded 'occupational health' were compared, as demonstrated below.

Coordinator: We we started a wellness programme long, long time ago with UPENN, the things that are, we are saying people should be tested for TB (R: ok), for HIV (R: Hmm), so that in the event that they are, they are HIV positive they cannot work in the cultures. But as you know people even health workers they don't want to, you know we had a wonderful unit there, we trained a lot of people (R: Hmm), we have guidelines, but for for health workers its- we even had a small clinic where health-workers can just go there to be tested and to reveal their tests

to management (R: Hmm). *That's what I am telling the lab but there is no one forth coming, with their status so that they don't, they can, they are not you know deployed in you know risk areas. Yes but they don't (R: Hmm). They don't tell us then you find they are deployed everywhere, not only in terms of needle pricks and other things and compensation so that we know the history gore wena[that you] you came in [...]you came in to to the lab and these are the records you were HIV-, you know your your chest was ok, there were no symptoms of active tuberculosis. And the intention was to do this, you know bi-annual, twice a year, but there is a wellness unit here. They only facilitate that I know that is trying moving forward is [...] Primary Hospital. They are, we even identified some of the people who were having active TB.*

TB coordinator – Hospital A

TB Coordinator: Yea, yea, I do have the statistics, (sounds...mumbles..inaudible, door closing/shelves opening, pages flipping) yea I do have the statistics (hmm) but I cannot really tell that this is the real correct statistics (Researcher: ok) because what happens is that some of the healthcare workers (Researcher: Hmm) they do hide. They go as you know, you are not forced to take treatment (Researcher: Hmm), so they decide to take treatment wherever they want to take treatment. (Researcher: Ahhh). And you find that sometimes when they have been on lows, sometimes they decide to take the treatment elsewhere (Researcher: hmm) and then I cannot really capture the figures. So the figures which I have are those who really are identified in here, they are taking treatment here. Or even if they are not taking, or maybe I hear that 'so and so was on TB treatment' and then start to write.

In both interviews the participants reference healthcare worker exposure to infectious diseases, HIV and TB. The primary similarity is they both refer to healthcare workers not utilising services that are provided by their institutions.