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PROTECTIVE WEAR ON TB PREVENTION: KNOWLEDGE AND PRACTICES OF HEALTHCARE PERSONNEL IN GAUTENG

By

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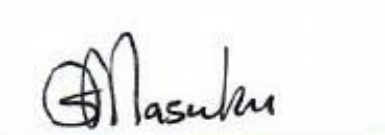
DECLARATION

I, Sikhethiwe Masuku (student number 10660519) hereby declare that this dissertation on the **"PROTECTIVE WEAR ON TB PREVENTION: KNOWLEDGE AND PRACTICES OF HEALTHCARE PERSONNEL IN GAUTENG"**, is my own work and that it has not previously been submitted for assessment to another University or for another qualification.

Signature: 

Date: January 2019

Place: Pretoria

DEDICATION

With gratitude I dedicate this study to the following people who supported me throughout the course of my life and study:

- My late grandparents who believed in education and who always emphasised that I should be better than them.
- My mother for support and encouragement.
- My uncle and his wife who ensured that I get the best education.
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ABSTRACT

Introduction: Tuberculosis (TB) remains an occupational health risk among healthcare personnel (HCP) globally, with the risk of transmission present throughout healthcare settings. The presence of undiagnosed and untreated highly infectious patients pose a great risk to the HCP who are often the forefront healthcare providers of any epidemic. Genotypic analysis of infected HCP revealed similar strains to the ones identified from the patient profile of their facilities, suggestive of nosocomial transmission.

Aim: The aim of the study was to determine healthcare personnel's knowledge and practices regarding protective wear on TB prevention in Gauteng province.

Research design and methods: A quantitative approach was used for this study. The sample was a cohort of healthcare professionals from a selected regional hospital located in Gauteng province of South Africa. Ethical approval was obtained from the University of Pretoria and the Gauteng Provincial Department of Health. Data were collected using a self-administered questionnaire which was distributed to the different categories of HCP at the selected facility. Data analysis included presentation of descriptive summary statistics, frequencies, proportions and scores with associated 95% confidence intervals by various characteristics of respondents (age, educational level, and work experience). All tests were carried at the probability of 5% to be considered significant.

Results: Knowledge of infection control policies was not significantly associated with practice. However, knowledge was significantly associated with level of education. HCP with higher levels of education demonstrated good knowledge but poor practice.

Critical knowledge gaps and poor practice were identified and should be addressed. Poor adherence to infection control measures were also revealed through the results of this study.

Conclusion and recommendations: Good knowledge of infection prevention and control policies did not result in good practice. Older HCP with lower qualifications scored higher on good practices. Knowledge and adherence to infection control policies require good infrastructure and training. The results illustrated that there was a lack of in-service training and poor infrastructure at the facility.

Key words: Health Care Personnel, Infection Prevention and Control, Tuberculosis,

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CHAPTER 1

ORIENTATION TO THE STUDY

1.1 BACKGROUND AND RATIONALE

Almost every country in the world has reported the transmission of Tuberculosis (TB) in healthcare facilities (Kompala, Shenoi and Friedland, 2013:3). Healthcare personnel (HCP) are reported to have a higher risk of acquiring TB than the general population (van der Westhuizen, Kotze, Narotam, von Delft, Willems and Dramowski, 2015b:475). The incidence of TB among HCP in low- and middle-income countries was found to be around 69 to 5780 per 100 000 population (Parmar, Sachdeva, Rade, Ghedia, Bansal, Nagaraja et al., 2015:215), and the transmission of TB to HCP is believed to occur in the work environment. Scientific evidence on the prevalence of TB among HCP has been presented both internationally and regionally (Claassens, van Schalkwyk, du Toit, Roest, Lombard, Enarson et al., 2013:3; Calligaro, Esmail, Mnguni, Mottay and Dheda, 2016). These studies focused on the origin of TB, policies on prevention, treatment and management of TB. Preventing the transmission of TB bacilli requires that TB infection prevention and control policies are established, ventilation is improved, and personal protective wear is used (Matuka, Singh, Bryce, Yassi, Kgasha, Zungu et al., 2015:193). However, irrespective of these policies and guidelines, TB still gets transmitted; HCP acquires TB while providing health care to patients with undiagnosed, untreated and potentially contagious TB (Mugomeri, Chatanga, Lefunyane, Ruhanya, Nyandoro and Chin'ombe, 2015:735).

Effective and affordable infection prevention and control guidelines have been developed (Bhebhe, Van Rooyen and Steinberg, 2014:4) to prevent airborne infections, including TB. These guidelines can be implemented for both high and low-resourced settings, but nosocomial infections continue to be reported (Bhebhe et al., 2014:5). It is impossible to ignore these challenges of nosocomial transmission incidents in health systems in the era of HCP shortage. All healthcare systems are faced with difficulties in terms of losing personnel to TB and health systems are failing to optimally implement policy guidelines (Buregyeya, Nuwaha, Verver, Criel,

Colebunders, Wanyenze et al., 2013a:3). There is inefficiency in implementation of the policies and the knowledge acquired through training (Abrar Ahmad Chughtai, Holly Seale and MacIntyre, 2013:69). In the study by Bhebhe et al. (2014:4), only 39.5% of HCP were observed using protective wear when attending to infectious TB patients. Gaps between knowledge and implementation have thus been witnessed. Training HCP was not also uniform across all facilities in South Africa; some received training and some reported that there was no annual training offered at the facilities. As a result, there is a lack of knowledge that hinders adequate implementation of TB infection prevention and control programmes.

In South Africa, workplace-acquired TB is a significant occupational health problem. TB among HCP is the third most reported occupational disease, according to the 2006 compensation fund claims. The Compensation for Occupational Injuries and Disease Act 130 of 1993 (COIDA) provides for any disability or disease caused by occupation injuries, and the Act was amended in 1997 to include TB infection as an occupational disease. Yet, a wide gap remains between the knowledge acquired and what the HCP practice when implementing infection prevention and control guidelines. The failure to adhere to policy implementation is evident in the underuse of prescribed protective wear. This has led to widespread interest in HCP safety, and many attempts have been made to reduce the gap between knowledge and practice. These have included educating and training HCP on the use of protective wear.

1.2 PROBLEM STATEMENT

TB is a public health concern among HCP with nosocomial transmission frequently occurring in hospitals (von Delft, Dramowski, Khosa, Kotze, Lederer, Mosidi et al., 2015:148). The nosocomial transmission poses a significant risk to HCP who are often at the forefront of any epidemic (von Delft et al., 2015:148). Through susceptibility profile analysis, HCP have been found to be infected with similar strains of TB identified in the outbreak of their specific hospitals (Ntambwe and Michah, 2015:3).

The TB notification rate among healthcare workers is a good indicator of the impact of TB infection control in health facilities compared to the TB notification rate in the general adult population. The reported number of TB cases per 100 000 healthcare workers was more than double the notification rate in the general adult population in 2016, regardless of policies developed globally and nationally to curb this epidemic (The World Health Organization, 2017:1155). Additionally, South Africa is identified as one of 22 countries with a significant TB burden (The World Health Organization, 2015:1051). The National Department of Health in South Africa developed various TB infection control policies with strategies to protect HCP from TB as an occupational health disease. However, despite having these policies and strategies in place, the incidence of TB among HCP in public healthcare facilities was still found to be higher than the general population (Tudor, Van der Walt, Margot, Dorman, Pan, Yenokyan et al., 2014:1077).

The healthcare system in South Africa is losing highly skilled personnel due to TB and other nosocomial infectious diseases (Buregyeya, Nuwaha, Verver, Criel, Colebunders, Wanyenze et al., 2013b:389). The most affected population with TB is the young professionals aged between 25-29 years (Matuka et al., 2015:194). Not only is there significant human resources spent on staff turnover, there is also substantial absenteeism from work due to ill-health. These add to the country's challenges in terms of human resource shortages for health.

There has been a significant gap in the implementation of occupational health and infection control guidelines for the prevention and control of TB among HCP (Tudor, Mphahlele, Van der Walt and Farley, 2013b:22). Training HCP in infection prevention and control and the use of personal protective equipment is suboptimal in healthcare facilities in South Africa (van der Westhuizen et al., 2015b:73). It is also greatly affected by the inadequate supply of correct personal protective equipment such as respirators, failures in administrative control, and negativity towards personal protective equipment portrayed by the HCP (Chughtai, Seale, Chi Dung, Maher, Nga and MacIntyre, 2015:8; Ntambwe et al., 2015:3). A compliance rate to infection control recommendations was found to be around 50%; most HCP were not using respiratory

protective equipment as indicated (Tamir, Wasie and Azage, 2016:4) within the protective policies and protocols (Brouwer, Coelho, das Dores Mosse and van Leth, 2015:44). Oversight in such practices calls for an inquiry into the utilisation of TB infection control policies to establish implementable and practical knowledge to benefit the healthcare sector in South Africa. Implementing the recommended TB infection control policies and guidelines goes beyond training, and warrants articulation of the dynamics aimed at translating these policies into practical and usable knowledge in practice.

1.3 THE SIGNIFICANCE OF THE STUDY

It is anticipated that this study will reveal gaps for further research in HCP knowledge and practice regarding infection control in the workplace. The findings of the study will contribute to:

1.3.1 Healthcare personnel

Information from this study might enhance the protection of HCP from nosocomial TB in healthcare settings. This might prevent the loss of highly skilled personnel due to TB and other nosocomial infectious diseases.

1.3.2 Healthcare practice

The knowledge gained from this study might translate existing TB prevention and control in healthcare facilities into practical knowledge. Not only must the HCP be knowledgeable on TB prevention policies but should put this knowledge into practice.

1.3.3 Policy implications

The knowledge from the study might add to existing TB prevention and control policies in terms of occupational TB. The nosocomial transmission of TB among HCP is recognised and acknowledged as an occupational disease, and it poses a serious

threat to HCP in South Africa. Regrettably, HCP are in the frontline of the TB epidemic in healthcare facilities. Awareness of the policies on TB prevention and control in healthcare facilities has not been fully utilised.

1.4 AIM OF THE STUDY

The study aimed to determine healthcare personnel's knowledge and practices regarding protective wear on TB prevention in Gauteng province.

1.5 RESEARCH OBJECTIVES

In order to achieve the research aim, the objectives were:

- to describe HCP's knowledge regarding protective wear on TB prevention in Gauteng province; and
- to describe the HCP's practices regarding protective wear on TB prevention in Gauteng province.

1.6 THE RESEARCH QUESTIONS

- What is the HCP's knowledge regarding protective wear on TB prevention in Gauteng province?
- What are the HCP's practices regarding protective wear on TB prevention in Gauteng province?

1.7 DEFINITION OF TERMS

1.7.1 Healthcare personnel (HCP)

Healthcare personnel include anyone who renders healthcare services directly to patients, such as doctors, nurses, counsellors, and physiotherapist (Aasen, 2016:16). For the purposes of this study, healthcare personnel are employees at a healthcare

facility who focus on the health and wellness of patients who seek care in different departments.

1.7.2 Healthcare facility

In general, a health facility is any location where health care is provided (Aasen, 2016:17). According to this study, a healthcare facility is a work environment for the health care personnel who provide services to patients. A work environment must be safe and present opportunity for learning to improve and develop knowledge.

1.7.3 Infection prevention and control

Infection prevention and control are specific measures and work practices that reduce the likelihood of transmitting Mycobacterium Tuberculosis (Aasen, 2016:16). For the purposes of this study, infection prevention and control refer to the structure and function of the infection control programme, including implementation and employee awareness.

1.7.4 Personal protective equipment

This refers to items specifically used to protect the healthcare personnel from exposure to body substances or droplet or airborne organisms. Personal protective equipment includes gloves, aprons, gowns, caps, masks and protective eyewear (Aasen, 2016:17). According to this study, personal protective equipment is required to prevent the spread of infection that is a possibility when healthcare personnel are exposed to occupational hazards.

1.8 DELIMITATIONS AND ASSUMPTIONS

1.8.1 Delimitations

Delimitations in a study refer to the choices a researcher makes that are under their control (Dieronitou, 2014:3). In this study, the researcher was only interested in assessing the knowledge and practices of the HCP regarding protective wear and TB prevention in Gauteng province. The researcher was unable to expand the study to the entire Gauteng province due to time and financial constraints.

1.8.2 Paradigm and assumptions

This study was underpinned by the positivism paradigm. Positivism is a philosophical theory based on objectivity with research that is directed at understanding the underlining cause of phenomena (Aliyu, Bello, Kasim and Martin, 2014:81; Polit and Beck, 2008a:1136). Positivism adheres to the view that truth and reality is free and independent of the researcher. It also requires that the research results be uniform across all researchers. The researcher intended to collect data on a cohort of HCP employed at a selected facility at a given time period. The three assumptions relevant to this study included ontology, epistemology, and methodology.

1.8.3 Ontological assumptions

An ontological assumption is a philosophy that provides for assumptions about the nature of reality. There is a real world driven by the real natural cause and ensuing effects (Polit and Beck, 2008a:1136). The reality in this study is that workplace-acquired TB is an occupational health problem and TB among HCP is the third most reported occupational disease. The current study intended to assess HCP's knowledge and practices regarding protective wear on TB prevention in Gauteng province.

1.8.4 Epistemological assumptions

Epistemology is a philosophy that provides for assumptions about knowledge. An assumption is of the view that genuine knowledge is objective and is quantifiable (Vosloo, 2014:299). In this study, the researcher collected data with a pre-designed questionnaire to assess the knowledge and practices of the HCP regarding protective wear on TB prevention in Gauteng province. The questionnaire was used to collect objective and reliable data from the respondents.

1.8.5 Methodological assumptions

Methodological assumptions focus on analysing the methods used for obtaining evidence in the study; the research methods (Aliyu et al., 2014:84). This study sought to achieve generalisation of the results since a pre-specified study design was adopted. Quantifiable statistical analyses were run to reach conclusions on HCP's knowledge and practices regarding protective wear on TB prevention in Gauteng province.

1.9 RESEARCH DESIGN AND METHODOLOGY

A quantitative methodology was used in this study. A non-experimental, descriptive survey was conducted using a self-administered structured questionnaire that the researcher distributed to the respondents. The population included all categories of HCP at a selected healthcare facility in Gauteng. Respondents were selected according to probability sampling from the categories of HCP supplied by the human resource office. Data were collected through the self-administered structured questionnaire.

Validity and reliability were ensured during the research process. Reliability was achieved by ensuring that a representation of the total population was used in the research study. The face validity and content of the questionnaire was reviewed by the researcher, supervisor, co-supervisor, and the statistician for acceptance. The

internal validity was considered by randomly selecting respondents to take part, therefore ruling out any bias that could exist between groups.

Data were collected on paper forms and entered into an electronic data capture tool: Research Electronic Data Capture (REDCap). Data were qualitatively analysed and theoretically confirmed using Strata 4.2 with the guidance of a statistician. The methodology for the study is discussed in greater depth in Chapter 3.

1.10 ETHICAL CONSIDERATIONS

The ethical principles of respect for persons, justice, beneficence and confidentiality were adhered to in this study (Wisdom and Creswell, 2013:87). Ethical considerations are plans for safeguarding the rights and welfare of participants/respondents in a study (Polit and Beck, 2013a:289).

While the HCP who participated in this study could not be classified as real patients, and as the research only involved a self-administered questionnaire, it could be accepted that there was no involvement of vulnerable respondents. Additionally, anonymity and confidentiality were respected at all times.

Ethics approval was obtained from the University of Pretoria's Faculty Postgraduate Studies Committee (approval number 133/21071) (Refer to Annexure 4). Institutional permission was also obtained from the Gauteng Department of Health. Following this permission, the researcher visited the facility to introduce herself to study respondents, and to make logistical arrangements. Participation by HCP was voluntary and written informed consent (Refer to Annexure 2) was a prerequisite for data to be gathered. No direct risk was involved. The Protection of Personal Information Act (Act 4 of 2013) was adhered to while processing respondents' personal information (da Veiga, Vorster, Pilkington and Abdullah, 2013:1156).

The informed consent form clearly stated that withdrawing from the study would not affect respondents' employment in any way. The respondents' privacy was not

infringed on and the data were only processed if informed consent was received. Data were collected directly from the respondents, hence, they were aware that their names and surnames were known to the researcher as they completed this information on the consent form. The researcher kept this information confidential. Respondents were able to opt out at any time should they have wished to do so. No personal information was used for marketing.

The researcher complied with the ethical principles while conducting the study as set out in the Declaration of Helsinki (World Medical Association, 2013:1157). The principles of autonomy, non-maleficence, beneficence and justice were maintained as described next.

1.10.1 Autonomy

Participation in the study was voluntary and no forced participation or hidden data collection took place. The researcher respected the respondents' freedom of participation. Those willing to take part did so voluntarily and the invitation to participate in this study clearly indicated that respondents could opt out at any time. The questionnaire provided high privacy levels as the respondents could complete it on their own. A written informed consent form (Refer to Annexure 2) was sent out in an envelope, attached to the questionnaire. Upon collecting completed questionnaires, data were put in sealed envelopes. This was stored securely in a safe and was only opened with the commencement of data capturing. All data were entered into a password-protected and encrypted internet-based data management system known as REDCap. Confidentiality and anonymity were applied and therefore each respondent's questionnaire was marked with a code number as an identifier, thus no name or personal details were reflected on REDCap after the collected data were captured. The researcher kept the informed consent forms in a locked cabinet.

1.10.2 Non-maleficence

Anonymity was maintained during data analysis as the respondents' names were not included during data collection or on the REDCap database. Publication of the findings will be done in a way that will not harm the respondents. No personal information will be published, as each person completed the questionnaire with a unique code and did not use their names.

1.10.3 Beneficence

Respondents were informed of the aims of the study. The results of the study will be obtainable by respondents as the dissertation will be available in the University of Pretoria library.

1.10.4 Justice

During the study, the researcher maintained the circumstances mutually agreed upon with the respondents. The researcher respected each respondent's human rights.

1.11 ORGANISATION OF THE STUDY

Chapter 1 is an introduction to highlight the reason behind the study and describe the nosocomial transmission of TB in South African healthcare facilities. The problem statement, aims and objectives are also noted in this chapter.

Chapter 2 provides information on relevant literature consulted on the knowledge and practices of the HCP regarding protective wear for TB. The policies pertaining to the protection of the HCP, both nationally and internationally, are discussed.

Chapter 3 contains the methodology of the study, including the research design, the methods, study population and sample, the measuring instrument and its validity and reliability, data collection, statistical analysis and ethical considerations.

Chapter 4 presents the results of the study, focusing on knowledge and practices of HCP in relation to TB prevention and control, as well as associations between the variables.

Chapter 5 discusses the results followed by conclusions and recommendations for training HCP. Limitations to the study are also described.

1.12 CONCLUSION

Although the nosocomial transmission of TB among HCP is recognised and acknowledged as an occupational disease, it still poses a serious threat to the HCP in South Africa. Awareness of the policies on TB prevention and control in healthcare facilities has not been fully utilised. Information from this study might enhance HCP's protection from nosocomial TB in healthcare settings. The knowledge from this study might translate the existing TB prevention and control policies in healthcare facilities into practical knowledge. The knowledge from the study could also add to the existing TB prevention and control policies against occupational TB.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

The previous chapter provided an overview of the study by presenting the background to the research problem, the aim, objectives and significance of the study. The research method, design and the scope of the study were briefly discussed. This chapter will focus on the stance of literature regarding protective wear on TB prevention and control. Additionally, the chapter will also provide both international and national policy frameworks.

Evidence reviews are in-depth examinations of research reports that provide evidence to underpin research questions, decision-making commissioning, service development or policy issues (Maredi, 2011:1257). A literature review was carried out on topics related to the knowledge and practices of HCP and available policies that seek to protect them.

The overall aim of the study was to determine healthcare personnel's knowledge and practices regarding protective wear on TB prevention at a regional hospital in Gauteng province. The increased risk of TB among HCP compared to the general adult population is a recommended indicator to measure the knowledge and practices of HCP regarding protective wear on TB prevention (Abdullah, Ismail, Mohd Nor and Abd Wahab, 2014:82). Good knowledge of and proper use and adherence to infection prevention and control guidelines can greatly reduce HCP's risk of TB transmission.

2.2 SCOPE OF THE REVIEW

The review identified scientific evidence that investigated TB infection prevention and control knowledge and practice among HCP. Furthermore, the review reported on international and national policy frameworks on TB prevention and control.

2.3 METHODOLOGY FOR SEARCHING SOURCES

The researcher opted for an integrative review, which is an evidence review method that provides a rigorous summary of all research evidence, including both qualitative and quantitative literature (Maredi, 2011:330; Myong, Byun, Cho, Seo, Baek, Koo et al., 2016:330). In integrative reviews, the research studies are summarised, analysed, and overall conclusions are drawn from them. Integrative reviews allow for the combination of various methods to synthesise the findings (Booth, Sutton and Papaioannou, 2016:19). The integrative review method is an approach that allows for the inclusion of diverse methodologies (i.e. experimental and non-experimental research). The researcher used the integrative review in this study to draw evidence from previous research on HCP's knowledge and practice regarding protective wear for TB prevention, and interrogated policies and guidelines protecting the HCP.

2.3.1 Search strategy

The following databases were used to search for literature on HCP's knowledge and practices regarding the protective wear for TB prevention; international and national policies on preventing TB transmission in healthcare settings were also included: The Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Google Scholar. The following keywords were used:

"tuberculosis", "healthcare", "policies", "workers" "guidelines", "personnel", "prevention", "control" (knowledge or training or education) AND occupational disease. Tuberculosis AND healthcare personnel or healthcare workers AND prevention and control AND policies AND guidelines

Additionally, international and national policies on TB prevention and control were also searched with the same keywords in the Google Scholar and CINAHL databases. Policies and guidelines to reduce nosocomial transmission and to increase the awareness of infection control policies among the HCP in all healthcare settings were identified.

2.3.2 Inclusion and exclusion criteria

This review aimed to gather available evidence on protective wear for TB prevention and control. The searched literature included:

- Research studies published in English
- Research studies published from 2013-2017
- Studies that discussed the knowledge and practices of HCP

Also, policies on infection control and TB prevention elsewhere, and in South Africa, were included. Figure 2.1 is a flowchart of the search strategy.

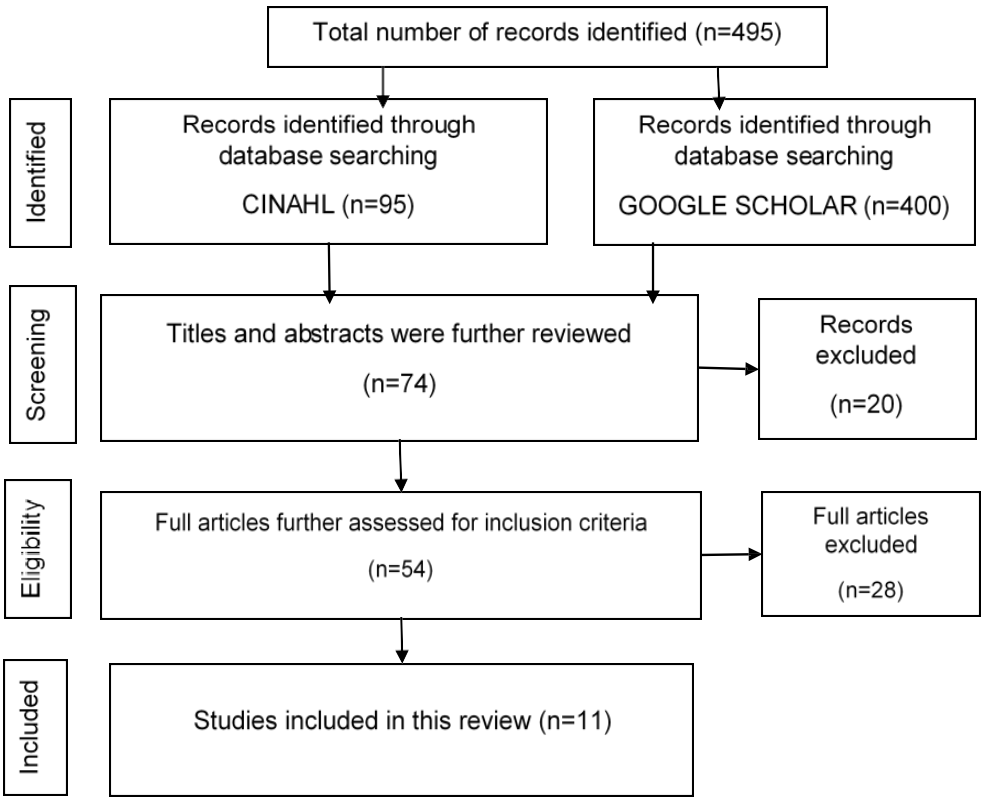

Figure 2.1: Flow diagram of the records identified through database searching

2.3.3 Search outcome

Four hundred and ninety-five (495) records were identified from the two databases. Ninety-five (95) records were identified from the CINNAL database, and 400 records were identified in the Google Scholar database. Seventy-four (74) titles and abstracts were further screened for eligibility. Twenty (20) records were excluded – these were case studies and commentary. Fifty-four (54) full articles were further screened and 28 articles were excluded as the research respondents were not HCP. Two key areas, knowledge and practice, were identified. Other literature detailing policies on TB prevention was identified among the 26 eligible articles and 11 articles were included in the review. The findings of the review included: Factors affecting knowledge of infection prevention and control, knowledge of infection prevention and control, the practice of infection prevention and control, and the available policy frameworks for prevention and control.

2.4 TB INFECTION PREVENTION AND CONTROL IN HEALTHCARE SETTINGS

2.4.1 The World Health Organisation (WHO) TB infection control measures

According to the WHO (The World Health Organization, 2009:7), countries should develop a policy on TB infection control to guide them on what to do and why. The WHO TB infection control policy promotes a combination of controls that address the prevention of TB transmission in health facilities, congregate settings, and households. The WHO prescribe managerial involvement at the national level to promote the role of the civil society in designing, implementing, and evaluating TB infection control. The policy emphasises minimising patients' time spent in a health facility. South Africa introduced a TB infection control programme in 2007 (The South African Department of Health, 2014:81). The National TB Guidelines of 2014 included measures to protect HCP at health facilities in South Africa from contracting TB at work based on infection control measures established by the WHO (The South African Department of Health,

2014:2; The World Health Organization, 2009:1008). However, despite policy directives and strategies, infection control remains suboptimal in health facilities.

The increased rate of HCP diagnosed with TB in South Africa is indicative of the occupational risk of transmission in healthcare settings. Infection control measures need to be established in all healthcare facilities.

2.4.2 Facility-level managerial and administrative control measures

The management at a healthcare facility must have political commitment, both nationally and at facility level, for a facility to implement infection control measures. Leadership duties include identifying and strengthening local coordinating bodies, and ensuring the development of a facility plan (policies and procedures) for the implementation of administrative, environmental, and personal protective control measures. Therefore, an infection control committee at each healthcare facility has to develop, monitor and manage the infection control programme (Abdullah et al., 2014:82). In addition, management is responsible for participation in research efforts and on-site surveillance of TB among healthcare staff. Advocacy, communication and social mobilisation (ACSM) is a management priority at each facility (Abdullah et al., 2014:83).

The WHO advised that administrative control measures should be implemented as a “first priority” (Abdullah et al., 2014:82). HCP should be trained on infection control strategies which include promptly identifying potentially infectious cases (triage), separating them, controlling the spread of pathogens (cough etiquette), and minimising time in healthcare settings (Dokubo, 2016:2). These strategies are:

- Triaging presumptive TB patients
- Educating patients on cough etiquette
- Minimising time spent at healthcare settings
- In-service training
- Staff health monitoring

The transmission of infectious organisms can be avoided by successfully implementing basic infection control strategies, quality management practices, and effective work practices.

2.4.2.1 Triage of presumptive TB patients

Triage of presumptive TB patients entails: identify patients with potential TB through the use of a screening questionnaire; move them to the front of the line for treatment; place them in a separate waiting area away from susceptible patients; and give them specific times for follow-up appointments.

Triaging patients with TB symptoms are of critical importance. In addition, the separation of TB patients in well-ventilated areas (planned during the design/reconstruction/use of buildings and rooms) should take place. Separation is done to protect immunosuppressed patients and HIV-infected patients. Both Multidrug-Resistant Tuberculosis (MDR-TB) and Extensively Drug-Resistant Tuberculosis (XDR-TB) patients should be isolated from TB susceptible and other patients (The South African Department of Health, 2014:1063). When health facilities are being planned, the valuable role of architects and engineers with knowledge of TB infection control is emphasised (Abdullah et al., 2014:81).

2.4.2.2 Educating patients on cough etiquette

Promoting cough etiquette among symptomatic patients is important. Patient are educated on TB with the use of posters. They are taught to use tissues when coughing, or using the elbow to cover their mouth when coughing or sneezing. Coughing patient are provided with surgical masks to minimise the number of bacteria coughed or sneezed into the airspace (Abdullah et al., 2014:81).

Education on cough hygiene (covering the mouth and nose when coughing or sneezing) should be provided to all diagnosed TB patients. Community-based approaches to managing TB should also take place, such as educating other

household members and close contacts about TB infection control (Jaramillo, Lambregts-Van Weezenbeek and Kimerling, 2016:1169). The HCP who treat TB patients should minimise their time spent with these patients if the ward/area is not adequately ventilated (Abdullah et al., 2014:82).

2.4.2.3 Minimising time in healthcare settings

Hospital stays need to be minimised to avoid nosocomial transmission of TB. This can occur through: ensuring rapid laboratory turnaround times; emphasising ambulatory treatment where possible; initiating patients on treatment in time; and referring to the community for the continuation of care. Community treatment models are useful and patients must be well informed on TB infection control in the home and community (Abdullah et al., 2014:82).

2.4.2.4 In-service staff training of healthcare personnel

There is no doubt that in-service training continues to fill the knowledge gap created by the changing society between pre-service education and the effectiveness of HCP in the work environment. In-service training and pre-service training should be implemented at each health facility. More importantly, HCP need to keep up to date with research findings pertaining to occupational exposure and patient management. In-service training should reflect the National TB Guidelines and TB infection control policies and procedures and has been required by the Department of Health since 2007 (Aasen, 2016:1019; The South African Department of Health, 2014:1063). Elements of in-service training for the HCP should focus on their need to understand the occupational risks they face, as well as their shared responsibility for reducing the risk. Training should include the early recognition of symptoms associated with TB and early diagnostic testing (without delays in the turnaround time for sputum testing and cultures). HCP should be trained on early initiation onto TB treatment, transmission of TB, infection control measures and screening for TB and HIV (Aasen, 2016:16).

Innovative materials and techniques such as group activities, drama and self-disclosure by affected staff can enhance HCP's education. This can also play a significant role in acceptance of the training programme. In this case, HCP get the opportunity to learn from each other rather than focusing on information dissemination. Drama or roleplay stimulates imagination and memory by allowing the participants to express their past experiences. In this way, they contribute to creating an interesting and meaningful environment among staff. In addition, they provide a variety of different functions of language since they reproduce real situations, so HCP are introduced to an authentic communicative context (Villafuerte, Rojas, Hormaza and Soledispa, 2018:556). Participants develop competencies for solving problems pertaining to their work environment.

2.4.2.5 Staff healthcare monitoring

Essential to HCP's TB education is the understanding that they are not immune to occupational TB and that they can become patients themselves. Staff health monitoring is part of special occupational health services that aim to reduce the risk of occupational disease in the workplace.

Systematic medical assessment of HCP who are exposed or potentially exposed to TB at a level that pose risk to their health should periodically take place. Screening as part of health monitoring can be passive or active. Passive screening relies on the concerned or symptomatic HCP seeking medical treatment for TB. Active screening is when HCP are offered the opportunity for diagnosing TB and screening for latent TB. Tuberculosis screening of HIV-infected personnel should routinely take place.

Management should encourage HCP to undergo TB testing if they experience any signs and symptoms thereof. The HCP should also be advised to go for HIV testing and counselling. HIV-infected HCP should be counselled on the importance of avoiding high-risk work settings such as working with TB patients. Deployment should take place with protection of both confidentiality and benefits within the requirements

of the law (The South African Department of Health, 2014:1063; The World Health Organization, 2009:1008).

2.5 THE POLICY FRAMEWORK ON TB PREVENTION AND CONTROL

2.5.1 International policy framework on TB prevention and control

Existing laws, policies and guidelines, as outlined in Table 2.1, provide occupational protection and services for HCP. They focus on standards that all healthcare facilities should achieve. The WHO states that TB infection control requires action at national and subnational level to provide managerial direction, and it is necessary at health facility level to implement TB infection control measures. The WHO makes uniform suggestions with respect to protecting HCP against the danger of nosocomial transmission of respiratory infections, including TB. The guidelines and recommendations on these infection control programmes are well implemented in high-income countries that are well resourced. Adopting these guidelines may prove to be a challenge in low and middle-income countries who lack capacity and finance. The policies are not suitable to adapt under the conditions that prevail in the low and middle-income countries, in terms of legislation and cost (Chughtai, Seale and MacIntyre, 2013:7). Everything possible should be done to protect and retain the HCP resource through active interventions to reduce their risk of occupational TB.

2.5.2 National policy framework on TB prevention and control

Due to the lack of a formal TB infection control policy, HCP are less likely to follow TB infection control recommendations (South Africa has a 2012 and a 2016 draft policy that has not been adopted). However, there are pieces of legislation and different policies outlined in Table 2.4 that can be adjusted and adopted by the facilities to prevent nosocomial transmission in healthcare settings. These laws and policies seek to protect employees from occupational hazards.

South Africa adopted the WHO recommendations to develop TB infection prevention and control measures (The South African Department of Health, 2014:81). These laws require employers to protect the employees against occupational hazards such as TB. However, implementation remains poor and varies from "complete" on some measures to "no implementation at all" on others. TB infection control measures and practices need to be implemented in all healthcare settings to ensure protection for both the HCP and the patients attending the healthcare facilities.

Shockingly, a study in the Vembe district in South Africa revealed that healthcare workers did not know about the accessibility to or the information contained in the TB infection control plans (Tshitangano, 2014:984; Tshitangano, Takalani , Maputle, Sonto M, Netshikweta and M, 2013:1189).

2.6 KNOWLEDGE AND PRACTICE OF HEALTHCARE PERSONNEL ON TB INFECTION PREVENTION AND CONTROL

2.6.1 Healthcare personnel knowledge on TB infection prevention and control

Considering the critical role that HCP play in the implementation of TB infection control, it is important to understand their knowledge which brings about adequate implementation of TB infection control policies. Above all there is a need to critically evaluate TB infection control training programmes. Gaps exist in terms of knowledge and behavioural change required to achieve optimal use of future infection control programmes (Kuyinu, Mohammed, Adeyeye, Odugbemi, Goodman and Odusanya, 2016:2). Although the HCP demonstrated some knowledge and reasonable practice of TB infection control, a lack of continuous training and supervision has brought about poor TB infection control practices in healthcare facilities. A review by the South African National Department of Health (SANDoH) identified HCP's irregular use of N95 respirators, even though they were available. Fit-testing was also not done (Aasen, 2016:1019). Increasing the number of HCP who are trained on TB prevention and control is a priority (South African National AIDS Council, 2014:57) and in-service training, as well as training by non-governmental organisations (NGO), assist in

achieving this goal. However, the review by the Department of Health found that not all HCP were trained on the National TB Management Guidelines (Aasen, 2016:57).

A situational analysis of public health facilities in South Africa found that a moderate proportion of HCP reported having had training on TB infection control (Engelbrecht, van Rensburg, Kigozi and van Rensburg, 2016:7). A concern was raised on fit-testing N95 respirators; better protection is provided if the respirator seals correctly, but the HCP displayed ignorance regarding fit-testing. HCP were reasonably knowledgeable about TB infection prevention and control policies and practice in an analytical study conducted in Lesotho among nurses (Mugomeri et al., 2015:736). Yet, basic knowledge around the infectiousness of TB patients and how to prevent TB transmission was inadequate. HCP were not trained on infection control procedures and were not compliant in terms of practice as expected and guided by the WHO (Buregyeya et al., 2013b:389). There is a significant need to empower HCP regarding TB infection prevention and control. Training, in isolation, will not be sufficient to obtain expected compliance by the HCP, but it will serve as a means to motivate them. The success of TB infection control is dependent on healthy, motivated and knowledgeable HCP (Gizaw, Alemu and Kibret, 2015:15). HCP who had not received some form of training on TB infection control training are more likely to acquire TB compared to HCP with training in TB infection control (Gizaw et al., 2015:14).

Effective TB infection control is essential in all healthcare facilities. However, less than 50% of health facilities in South Africa have written TB infection control guidelines/policies, according to more than half of the studies that assessed TB infection prevention and control. There was no person or committee in charge of TB infection prevention and control in the facilities. Appropriate management protocols need to be implemented to ensure that administrative, environmental and personal protective activities are functional and implemented appropriately in all healthcare facilities. Facility-specific and HCP-specific TB infection prevention and control training programmes need to be implemented on a regular basis.

2.6.2 Healthcare personnel practice on TB infection prevention and control

Poor practice towards TB infection prevention and control has been identified among the HCP. In some drug-resistant TB facilities, HCP reported collecting sputum specimens in the ward and they mentioned spending a reasonable amount time with patients presenting with cough symptoms at the facility (Boulanger, Hunt and Benatar, 2016:85). Usually, these patients are not diagnosed, and triage is not always executed due to a lack of space in facilities. A sense of urgency is required to improve adherence to guidelines for TB infection control implementation (McCarthy, Grant, Chihota, Ginindza, Mvusi, Churchyard et al., 2016:647). In a study by Boulanger et al., (2016:84), HCP reported teaching coughing patients ideal TB prevention measures such as cough etiquette and providing them with surgical masks.

HCP who attended facility-specific infection control training were likely to spend less time with coughing patients (Boulanger et al., 2016:85). Concern was raised regarding higher level HCP like doctors, who seem to be prioritised when it comes to providing personal protective equipment to staff, yet they spend less time with patients in facilities than other HCP (Adams, Ehrlich, Baatjies, van Zyl-Smit, Said-Hartley, Dawson et al., 2015:1372). Although the South African Departments of Health recommend the implementation of TB infection control measures in healthcare facilities, the measures remain poorly implemented (Aasen, 2016:16). Barriers such as inadequate knowledge of the N95 respirator, stigma and discomfort in wearing a respirator were identified as reasons for non-compliance among HCP (Siegel, Yassi, Rau, Buxton, Wouters, Engelbrecht et al., 2015:221). Adherence barriers to infection control measures need to be overcome in South African health facilities to reduce the burden of TB among HCP as HCP reported that they are afraid of contracting TB (Tudor et al., 2013b:22).

HCP mentioned various easy infection control practices such as locating cough hygiene materials, acquiring a respirator, and opening ward windows (Kanjee, Amico, Li, Mbolekwa, Moll and Friedland, 2012a:68). However, they expressed that tasks such as TB screening, triage, TB diagnosis and the associated stigma are difficult. In

Kanjee, et al.'s (2012a:69) study, moderate levels of TB infection control practices were reported by the HCP at two hospitals, with a reasonable number of HCP wearing respirators in high-risk areas.

Understanding and implementing infection prevention and control measures require adequate knowledge and skills. This occupational risk may cause panic to HCP who lack adequate knowledge surrounding the implementation of infection control measures. Therefore, exploring the knowledge and practise of HCP regarding the use of protective wear for TB is imperative.

In this study, few HCP ensured that coughing patients made use of cough hygiene and fewer HCP opened windows in patient areas and ensured that presumptive TB patients among the outpatients received priority attention. Similar findings were reported by (Mugomeri et al., 2015:736) in Lesotho where poor adherence to TB infection control guidelines was demonstrated by HCP.

A sense of urgency is needed to improve adherence to guidelines for TB infection control and the implementation of occupational TB screening programmes for HCP who are in contact with all kinds of presumptive/diagnosed TB patients (McCarthy et al., 2016:648). To successfully implement TB infection control practices, HCP need to be trained in infection control practices and support is required from all levels of the Department of Health. NGOs and other organisations working in the field of infection control can be engaged to provide training to the HCP. It is also critical that facilities develop specific infection control plans that are adaptable to their facilities (Siegel et al., 2015:222). Natural ventilation by means of opening windows is a simple basic measure to reduces transmission. Patients who are coughing can simply be separated and screened for TB to minimise transmission in facilities. These costless measures should help reduce the rapid spread of TB in the healthcare setting (Siegel et al., 2015:221).

2.7 FACTORS AFFECTING HCP KNOWLEDGE AND PRACTICE OF TB PREVENTION AND CONTROL

Reviewed studies that assessed HCP's knowledge and practices of TB prevention and control identified poor practices across all disciplines. This limitation is further compounded by the varying prevalence of TB within different regions of the country (The South African Department of Health, 2014:81). There is a significant need for improved protection of HCP, however, there has been limited and fragmented implementation of programmes to adequately protect the HCP in South Africa. An evaluation of infection control practices in all levels of care in local high burden settings is required.

Implementation of the infection prevention and control guidelines is hindered by the knowledge gap that exists. The HCP lack training on the accessibility of relevant policies and guidelines that seek to protect them against TB transmission. The contents of infection prevention and control policies and guidelines should form part of all HCP education.

As stated, the WHO prescribed measures to control and prevent TB transmission in healthcare facilities (The World Health Organization, 2009:1008). HCP can be protected from contracting TB by adhering to infection control measures, which are clearly demarcated within the National TB Guidelines (Mugomeri et al., 2015:736). However, TB infection prevention and control in healthcare facilities are presently not adequately implemented (Boulanger et al., 2016:4; Mugomeri et al., 2015:735; Brouwer et al., 2015:45). Critical knowledge gaps exist in HCP regarding the prevention and control of TB infection despite sufficient knowledge levels being reported in some studies (Victor, 2017:3). Respirators (N95) prevent the inhalation of droplet nuclei and is believed to filter up to 95% of particles exhaled into the airspace (Siegel et al., 2015:221), yet HCP seldom use personal respirators as prescribed.

Table 2.1: Summary of the articles reviewed that investigated TB infection prevention and control knowledge and practice among healthcare personnel

First Author (Year and Country)	Title of the Article	Study Setting	Findings	Comments
Shahieda (2015) (South Africa)	Incidence of occupational latent tuberculosis infection in South African healthcare workers	Prospective cohort study in seven primary and secondary level healthcare facilities in the Western Cape province; May 2009 to June 2010	Knowledge and practice of environmental measures were evaluated by gauging whether staff was aware of specific engineering, administrative and safe working practices that were practised or available in their facilities	It is imperative to understand the magnitude and the extent of the crisis that exists in the healthcare settings in order to design a programme that is easy to adapt and implement
Admasu (2013) (Addis Ababa, Ethiopia)	Infection Control Knowledge, Attitudes, and Practices among Healthcare Workers in Addis Ababa, Ethiopia	A cross-sectional evaluation of healthcare worker (HCW) knowledge, attitudes and practices about hand hygiene and tuberculosis (TB) infection control measures	Training HCWs about the importance and proper practice of hand hygiene, along with improving hand sanitiser options, may improve patient safety. Additionally, enhanced infrastructures are needed to improve TB infection control practices and allay HCW concerns about acquiring TB in the hospital	Gaps exist in terms of knowledge and behavioural change needed to achieve optimal use of future infection control programmes
Elton (2015) (Lesotho)	Adherence to tuberculosis	Analytical study of fifty-five	Assessed the level of adherence to the TB	Nurses in Lesotho were not compliant

First Author (Year and Country)	Title of the Article	Study Setting	Findings	Comments
	infection control guidelines by nurses in Lesotho	purposively sampled nurses working in TB wards and outpatient departments	infection control guidelines by nurses in TB wards and outpatient departments and the factors associated with non-adherence to the guidelines in Lesotho	with infection control guidelines
Godfrey (2016) (USA,)	A survey of tuberculosis infection control practices at the NIH/NIAID/DAIDS-supported clinical trial sites in low and middle-income countries	A survey of thirty-three NIAID-funded clinical research sites located in LMIC in the AIDS Clinical Trials Group (ACTG) and the International Maternal, Paediatric, Adolescent AIDS Clinical Trials Network (IMPAACT) net-works signalled their intention to participate in clinical trials involving TB	The study assessed infection control activities in three domains: facility-level measures, administrative control measures, and environmental measures	Continuous training and support for the HCP may promote best approach. It may also promote adherence to infection control policies
Engelbrecht (2016) (South Africa)	Factors associated with good TB infection control practices among primary healthcare	A cross-sectional self-administered survey in forty-one primary	This study sought to determine the factors associated with healthcare workers' good TB infection	Promoting knowledgeable HCP may generate effective practices regarding infection

First Author (Year and Country)	Title of the Article	Study Setting	Findings	Comments
	workers in the Free State Province, South Africa	healthcare facilities in a selected district of the Free State Province of South Africa	control practices in primary healthcare facilities in the Free State Province, South Africa	prevention and control
Zelnick (2013) (NY, USA)	Health Care Worker Perspectives on Workplace Safety, Infection Control and Drug-Resistant Tuberculosis in a High Burden HIV setting	HCWs in public hospitals in five provincial hospitals in KwaZulu-Natal South Africa	A qualitative study to contextualise epidemiological findings suggesting that HCWs' elevated risk of drug-resistant TB is related to workplace exposure to identify challenges that HCWs face implementing measures to reduce TB risk	The NDoH developed policies that can be adapted to protect the HCP and the patients from nosocomial infection. Implementation of these policies in healthcare settings is suboptimal
Kerrigan (2015) (South Africa)	High incidence of latent tuberculous infection among South African health workers: an urgent call for action	Three public sector facilities in Johannesburg	To determine the incidence and risk factors for latent tuberculous infection (LTBI) among HCWs	A sense of urgency is needed to improve adherence to guidelines for TB infection control. Implementation of occupational TB screening programmes for HCP from high TB burden countries is required
Doosti (2015) (Tehran, Iran)	Lack of optimum practice among health care workers regarding	A cross-sectional study in fifty universities of medical	Assessed the level of knowledge, attitude, and practice of HCWs in Iran	HCP are not practising infection control despite receiving some form of training. This

First Author (Year and Country)	Title of the Article	Study Setting	Findings	Comments
	tuberculosis in Iran: A knowledge, attitude, and practice study	sciences throughout Iran		increases the TB transmission risk in healthcare facilities
Girma (2015) (Ethiopia)	Assessment of knowledge and practice of health workers towards tuberculosis infection control and associated factors in public health facilities of Addis Ababa, Ethiopia: A cross-sectional study	Five hundred and ninety HCWs in a selected healthcare facility in Addis Ababa	The study assessed the knowledge and practice of health professionals towards TB infection control and its associated factors in health facilities of Addis Ababa, Ethiopia	Training and work experience determine knowledge of infection prevention and control among healthcare personnel
Farley (2012) (USA)	A national infection control evaluation of drug-resistant tuberculosis hospitals in South Africa	A cross-sectional descriptive all multidrug-resistant (MDR-TB) and extensively drug-resistant TB (XDR-TB) facilities in South Africa	The study conducted an operational evaluation of infection control in drug-resistant TB settings at a national level	The study identified poor infection control practices across all disciplines
Kanjee (2012) (USA)	Tuberculosis infection control in a high drug-resistance setting in rural South Africa: Information, motivation, and behavioural skills	Rural South African hospitals	The study assessed HCW TB infection control information, motivation, and behavioural skills (IMB) and implementation in two resource-limited rural	Training HCP on TB infection control may influence their behaviour regarding the implementation of TB infection control measures

First Author (Year and Country)	Title of the Article	Study Setting	Findings	Comments
			South African hospitals with prevalent drug-resistant TB	

Table 2.2: International policy framework on TB prevention and control

Country	Framework	Title	Excerpt on TB Prevention and Control
The World Health Organisation	Guideline	ILO/WHO Guidelines on Health Services and HIH/AIDA (2005) http://www.who.int/hiv/pub/prev_ care/ilowhoguidelines.pdf.	Provide health and safety for persons at work. The purpose of these guidelines is to promote the sound management of HIV/AIDS in health services, and prevent occupational exposure
The World Health Organisation	Guideline	Joint WHO/ILO guidelines on post-exposure prophylaxis (PEP) to prevention of infection (2007) http://apps.who.int/iris/handle/10665/43838.	Provide health and safety for persons at work and the prevention of transmission
The World Health Organisation	Policy/Guidelines	WHO Policy on TB Infection Control in Healthcare Facilities, Congregate Settings and Household (2009) http://whqlibdoc.who.int/publications /2009/9789241598323_eng.pdf.	Aimed at minimising the risk of TB transmission within populations
The World Health Organisation	Policy/Guidelines	Joint WHO/ILO Policy Guidelines on improving Health Worker Access to Prevention, Treatment and Care Services for HIV/TB (2010) http://whqlibdoc.who.int/publications	These guidelines were designed to focus on reinforcing and accelerating the implementation of

Country	Framework	Title	Excerpt on TB Prevention and Control
		/2010/9789241500692_eng.pdf	best health practices for health workers living with HIV or TB, or those at risk of being exposed to HIV or TB in the workplace
The World Health Organisation	Policy/Guidelines	WHO Tuberculosis Laboratory Biosafety Manual,2012 http://www.who.int/tb/publications/ 2012/tb_biosafety/en/.	This manual describes the minimum biosafety measures that should be implemented at the different levels of TB testing laboratories to reduce the risk of a laboratory-acquired infection
The World Health Organisation	Guidelines	WHO Systemic Screening for Active Tuberculosis, Principles and recommendations (2013) http://www.who.int/tb/tbscreening/en/.	Early detection of TB is essential to further improve health outcomes for people with TB, and to reduce TB transmission more effectively
The World Health Organisation	Guidelines	Guide on the monitoring of TB Disease among Health Care Workers. SAID, TB Care I and II (2013) www.tbcare1.org/publications/toolbox/ .../HCW_TB_Incidence	This policy proposed a combination of recommended measures aimed at minimising the risk of TB transmission both in the general

Country	Framework	Title	Excerpt on TB Prevention and Control
			population and among HCWs

Table 2.3: National policy framework on TB prevention and control

Country	Framework	Title	Except on TB Prevention and Control
South Africa	National Legislation	Occupational Health and Safety Act, (No 85 of 1993) https://www.acts.co.za/occupational-health-and-safety-act-1993/index.html	Provide health and safety for persons at work
		Regulations for Hazardous Biological Substances, 2001 https://www.saioh.co.za/page/Legislation	Provision of information and training to employees on potential risks of HBA and risk reduction
		The Labour Relations Act (No 66 of 1996) http://www.labour.gov.za/DOL /legislation/acts/labour-relations/ labour-relations-act	Prevents discrimination and unfair dismissal of workers afflicted with occupational disease or injury
		Code of Good Practice: Key Aspects of HIV/AIDS and employment, 2000 http://www.labour.gov.za/DOL/ legislation/codes-of-good-practise	Establishment of a workplace HIV policy and programme
	National Policy/Guidelines	SA National TB Management Guidelines 2014 https://www.health-e.org.za/2014/06 /10/guidelines-national...	Protection of HCP, early diagnosis, VCT, IPT, ART and redeployment to low risk areas. Regular

Country	Framework	Title	Except on TB Prevention and Control
			medical surveillance of HCP
		South African National Tuberculosis Infection Control Guideline (Draft),2007 www.inpracticeafrica.com/Resources /Guidelines/Tuberculosis-and...	Increase awareness of TB in HCP and staff. Increase access to voluntary HIV testing and counselling. Provision of personal protective equipment
		National Infection Prevention and Control Guidelines for TB, MDR-TB and XDR-TB (2015) http://www.ip-connect.org/ndoh-national-infection-prevention-and-control-guidelines-for-tb	Controls (Administrative, Environmental and Personal protective equipment). Surveillance of HCP and management of HIV-infected HCP

2.8 CONTEXTUALISATION OF THE LITERATURE

The barrier most generally referred to was the unavailability of space to actualise triage of presumptive TB patients, both at out and in-patient settings. Although the HCP realised that presumptive TB patients ought to be separated, it was unrealistic based on the unavailability of space in many facilities.

There is extensive room for improvement in all aspects of TB infection prevention and control in most of the healthcare facilities surveyed in the studies reviewed. TB infection prevention and control training programmes are effective in improving the knowledge, attitude and practice of HCP. Improved management of TB infection control policies and practice is urgently required in facilities across the country.

There are legislative and policy provisions to address workplace-acquired TB in HCP. However, South African healthcare facilities do not have satisfactory or suitable TB infection control measures to ensure their employees are protected from nosocomial infections. Most HCP seem to adopt a fatalistic approach to their work with regards to preventing the transmission and acquisition of TB to other patients and themselves. A tailored approach for TB prevention and control is thus urgently needed in South Africa.

2.9 CONCLUSION

To protect HCP from contracting TB at health facilities, the South African government incorporated infection control measures developed by the WHO into the National TB Guidelines. However, full adherence to facility and administrative level measures, environmental controls and personal protective equipment controls were not achieved in any of the health facilities where studies were conducted.

Various knowledge, attitude and practice (KAP) surveys provide insight into the knowledge HCP have about TB, TB infection control measures, and the attitudes of HCP towards TB and TB infection control. These surveys revealed that practices regarding adherence to infection control measures were not always a reflection of HCP's knowledge, but that other factors such as stigma also play a role.

Stigma could prevent HCP from protective activities such as wearing N95 respirators and getting tested for TB when they recognise TB symptoms in themselves (Kanjee, Amico, Li, Mbolekwa, Moll and Friedland, 2012c:70). Adherence barriers to infection control measures in South African health facilities need to be overcome to reduce the burden of TB among HCP (Tudor, Van der Walt, Hill and Farley, 2013a:144).

In the next chapter, the research design and methods are presented.

CHAPTER 3

RESEARCH DESIGN AND METHODS

3.1 INTRODUCTION

The previous chapter presented an integrative review of literature that was consulted on HCP's knowledge and practices regarding protective wear on TB prevention and control. Additionally, the chapter discussed the policies pertaining to protecting HCP both nationally and internationally.

This chapter presents the research methods used during this study. The chapter covers aspects such as the study design, methods of data collection, management, validation, and analysis. Additionally, the statistical methods used for analysis, including data coding and the analysis plan, are discussed. The primary aim of this study was to determine HCP's knowledge and practices regarding protective wear on TB prevention in a selected regional hospital in Gauteng province. The objectives of the study were to:

- describe HCP's knowledge regarding protective wear on TB prevention in Gauteng province; and
- describe the HCP's practices regarding protective wear on TB prevention in Gauteng province.

3.2 RESEARCH DESIGN AND METHODS

A non-experimental, descriptive survey was conducted to collect data from HCP employed at a regional hospital in Gauteng, with at least two years' experience. The study used a self-administered questionnaire (Refer to Anexure1) at a single research setting from December 2017 to March 2018. Descriptive studies provide an accurate portrayal of research subjects' characteristics by way of (1) discovering new meaning, (2) describing what exists, (3) determining the frequency with which something occurs,

and (4) categorising information (Burns and Grove, 2014). The study focused on the knowledge and practices of HCP regarding protective wear on TB prevention.

3.3 STUDY POPULATION

A study or target population is the entire aggregation of cases the researcher is interested in and wants to draw a conclusion about upon completion of the research study (Korn and Graubard, 2011:1170; Polit and Beck, 2008a:1136). The study population was all the HCP employed at a regional hospital situated in Gauteng province. The hospital employs 578 HCP.

The inclusion criteria for participation in the study were:

- HCP current employment at the selected healthcare facility.
- HCP with at least two years working experience in the healthcare facility.

3.4 SAMPLING

Sampling is the process of selecting a portion of the population to represent the entire population and from whom inferences about the population can be made. A sample is a subset of the population (Polit and Beck, 2013b:234). Probability systematic sampling was used to select the respondents from the population. This ensured that each respondent chosen had an equal, independent chance of being selected (Polit and Beck, 2013b; Ingham-Broomfield, 2014:37). Systematic sampling is the selection of every *k*th individual from a group (Polit and Beck, 2013b:235). Systematic sampling of the respondents was as follows: every thirty-fifth in a hundred individuals was selected randomly from the various categories of HCP.

In this study, the researcher used systemic random sampling, which is a type of probability sampling. The number of respondents selected is weighted according to the size of that category, selected akin to the proportion of the number in the category in relation to the total population (Haegele and Hodge, 2015:1139; Polit and Beck,

2013a:331). In the selected facility, each category of staff (doctors, all categories of nurses, pharmacist, physiotherapists and radiologist) were proportionately represented. A statistician's services were employed to determine the sampling method and to calculate the sample. The total number of respondents who were systematically, randomly selected per healthcare category is summarised in Table 3.1.

Table 3.1: The number of respondents systemically sampled per category

Category	Population	Sample
Registered Professional Nurses	231	40
Enrolled Nurses	109	19
Enrolled Nurse Assistants	111	19
Doctors	100	17
Radiographers	9	2
Pharmacists	6	1
Pharmacists Assistants	8	1
Physiotherapists	4	1
Total	**578**	**100**

3.5 RESEARCH INSTRUMENT

A self-administered structured questionnaire was used as the research instrument. The questionnaire was developed with the assistance of a qualified statistician, based on literature detailed in section 3.5.1. The questions were adjusted after the pilot study was completed. According to (Burns et al., 2014:1173), a questionnaire is a printed self-report form designed to elicit information that can be obtained through the written responses of the subjects. The use of a questionnaire rather than face-to-face interviews saved the researcher cost and time. Analysing a questionnaire is also much easier, and questionnaires reduce bias as the researcher's own opinions do not influence the respondent to answer questions in a certain manner. Questionnaires are also less intrusive than telephone or face-to-face surveys. When a respondent receives a questionnaire, they are free to complete the questionnaire, regardless of constraints. Refer to Annexure 1 for the questionnaire used in this study.

3.5.1 Development of the questionnaire

In the development of the questionnaire, the information needed for the study was identified (Burns et al., 2014:427). All necessary questions to gather important information for the study were included. The questionnaire was brief, including only those questions that were absolutely necessary, keeping in mind that no information that is key to the study should be lacking (da Veiga et al., 2013). The outline of the instrument content was then designed. An in-depth literature study was conducted to match questionnaires that corresponded to the outline of questions or items in the instrument (Burns et al., 2014:427).

The following basic steps to formulate the individual questions were applied: 1) sentences were brief and clear; 2) the response options did not reflect any bias; 3) each question contained only one thought; and 4) it was relevant to the study (De Vos, 2012b:85). The terminology used in the questions was carefully selected to avoid confusion (Bryman, 2012:7). During the construction of each question, no assumptions were made (Bryman, 2012:7). All draft questions had a lead-in part and a response set. The lead-in part of the questions was evaluated individually to exclude problems such as vague meaning of language and leading questions. All the questions had a response category and clear instructions were given to the respondent on how to respond (Burns et al., 2014:399). The order of the questions could influence responses to the questions, but each question was evaluated according to semantics and feelings brought forward while answering the questions (Burns et al., 2014:427).

Both open-ended and closed-ended questions were used in the questionnaire. The open-ended questions allowed the respondents to answer the questions in their own words. The types of closed-ended questions used were dichotomous questions (Yes/No), multiple choice questions, (statements that best suit the respondents' views), rank order questions (list of items to choose from), and rating questions (respondents could choose from a scale) (Polit and Beck, 2013b:64).

3.5.2 Selection used to guide data collection

The questions were grouped according to specific sections and research objectives (Burns et al., 2014). The sections are outlined as follows:

- **Section A:** Gathered the demographic data.
- **Section B:** Gathered information regarding the HCP's knowledge regarding TB infection prevention and control.
- **Section C:** Gathered information regarding the HCP's practice regarding TB infection prevention and control and the use of protective wear for TB prevention.

The questionnaire consisted of nine pages, containing more than 95% text and checkbox questions. The study presented answers in the following formats:

Demographics data: Checkboxes and text
Knowledge: Checkboxes (Yes/No/Not Sure) and text
Practices: Checkboxes (Yes/No/Not Sure) and text

3.6 PILOT STUDY

A pilot study is a mini-study conducted by the researcher before the actual investigation takes place. The aim of the pilot study is to test the research method and the instrument (Brink and Van der Walt, 2012:20). The researcher selected ten respondents to complete the questionnaire in a selected provincial hospital (not the one selected for the main study). The respondents from the pilot study reported that the average time taken to complete the questionnaire was 20 minutes. The results of these respondents also did not form part of the analysis.

The pilot study was conducted to ensure that the research procedures were in place for adequate data collection in the research project and that all questions were clearly understood (Denscombe, 2014:1144). After the pilot study was conducted, the

following changes were made to the questionnaire based on the recommendations from the pilot study respondents:

- The number of dependents variable changed from categorising the dependents to listing the number of dependents that the respondent has. Number of dependents would be categorised during analysis.
- The number of years' working experience variable changed from categorising the number of years to listing the number of years that the respondent had worked at the facility. Number of years would be categorised during analysis.
- The number of years included the current job location and the previous job location. Number of years would categorised during analysis
- Added "Not Sure" to "Yes/No" so respondents could state if they were unsure of an answer.
- Questions 33 and 34 asked for 4 suggestions, yet space was only provided for 3 answers; a fourth line was thus added.

3.7 DATA COLLECTION

"Data collection is the process of selecting subjects and gathering data from these subjects" (Burns et al., 2014:1173). The structured questionnaire was used and distributed to the respondents in sealed envelopes. The questionnaire was accompanied by a cover letter explaining the title, the purpose of the study, the rights of the respondents during the study, the risks and benefits of the study, as well as the researcher's and the institution's contact details. The respondents were requested to return the completed questionnaire in a sealed envelope to the head of the department who, in turn, would lock them in a safe cabinet. The researcher collected the completed questionnaires on a weekly basis (Burns et al., 2014:1173).

The respondents were asked to return the completed questionnaire within two weeks after receiving it. Follow-up requests were forwarded to the individuals to ensure the timely return of the completed questionnaires (da Veiga et al., 2013:4). The

questionnaire was divided into three sections as previously discussed and took twenty minutes to complete.

3.7.1 Quality control

Quality control is a process that guarantees a level of quality in a research study (Polit and Beck, 2013a:166). The respondents were expected to complete the questionnaire independently without influence from colleagues. Quality control is discussed in terms of validity and reliability.

3.7.1.1 Validity and reliability

- **Validity**

"The validity of an instrument is a determination of the extent to which the instrument actually reflects the abstract constructs being examined" (burns and Grove, 2013:399). In assessing the validity of the questionnaire, the content and face validity aspects are important. Internal and external validity was assessed.

"Content validity is concerned with adequacy of coverage of the content area being measured" (Polit and Beck, 2013a:168). The questionnaire was checked by the researcher, supervisor, co-supervisor and the statistician for accuracy. Any ambiguous questions were reviewed and corrected.

Face validity gives the appearance of measuring the research objectives. Each question used in the instrument was evaluated to determine if the instrument is measuring what it is supposed to measure, keeping the research objectives in mind. The internal validity was considered by randomly selecting respondents to take part in the study, therefore ruling out any bias that might exist between groups (Polit and Beck, 2013a:168).

"External validity is the degree to which the results can be generalised to settings other than the ones studied" (Polit and Beck, 2013a:168). The results obtained from this

study will be utilised in the healthcare setting to promote the prevention of nosocomial TB and to translate knowledge into practice.

- **Reliability**

"The reliability of a measure denotes the consistency of measures obtained in the use of a particular instrument and is an indication of the extent of random error in the measurement method" (Burns et al., 2014:1173). In this study, reliability was achieved by ensuring that the results were consistent and that an accurate representation of the population under study was referred to. The measurements will be of such a nature that it remains the same and is stable over time (Golafshani, 2013:137). The same instrument was used throughout to ensure reliability.

3.8 DATA ANALYSIS

The total number of completed questionnaires received was 102. The response rate was thus 54%. The total number of completed questionnaires received per category of HCP is summarised in Table 3.2.

Table 3.2: Total number of completed and received per category of healthcare personnel

Category	Population size	Number of questionnaires distributed	Total number of questionnaires received	Total number of questionnaires not completed
Registered Professional Nurses	231	76	63	13
Enrolled Nurses	109	35	11	24
Enrolled Nurse Assistants	111	37	15	22
Doctors	100	33	4	29
Radiographers	9	3	3	0

Category	Population size	Number of questionnaires distributed	Total number of questionnaires received	Total number of questionnaires not completed
Pharmacists	6	2	2	0
Pharmacists Assistants	8	2	2	0
Physiotherapists	4	2	2	0
Total	**578**	**190**	**102**	**88**

Only study numbers were entered into the database and no personal identifiers were entered. Both closed-ended question responses and open-ended question responses were coded. Completed questionnaires were collected and the data were captured into the REDCap database. Captured data were exported into Stata and sent to a statistician for analysis. Data cleaning took place whereby data were checked and errors rectified. Descriptive statistics were used to describe responses to a variable. Descriptive statistics for quantitative data included the mean (a measure of central tendency/ centre of the data set) and the standard deviation (description of the dispersion of a set of data) (Rovai, Baker and Ponton, 2013:9).

Data management is the organisation of data, from its entry to the research cycle through to the dissemination and archiving of valuable results (Wisdom et al., 2013:1135).

The following graphic presentations were used to illustrate the data collected: histograms, pie-charts and bar graphs. Graphic presentations are advantageous since they are visually effective and they simplify the task of interpreting the data (De Vos, 2012a:5).

3.8.1 Statistical methods

Data analysis refers to the manipulation of numeric data through a statistical procedure for the purpose of describing the phenomena (Wisdom et al., 2013:1135). In this study, data were analysed using Stata 14.2 with the guidance of a statistician. Data analysis included the presentation of descriptive summary statistics, frequencies, proportions and scores with associated 95% confidence intervals by various characteristics of respondents (age, educational level and work experience). All tests were carried at the probability of 5% to be considered significant.

Descriptive statistics were also used to describe and combine the data collected that would simplify the task of interpreting and communicating the numerical information (Polit and Beck 2013a:166).

3.8.2 Study procedures

The researcher planned the activities that would need to be done within time limits to complete the study within the given timeframe. The study procedures are illustrated in figure 3.1.

The Kruskal-Wallis analysis of variance was used to determine if a difference existed in the distribution of values in this population. The Kruskal-Wallis equality of populations rank test was used to determine whether the distribution of the populations was different from each other. The sum of different rankings was compared to see the degree to which the sum differs from what would be expected.

For categorical data, frequencies and percentages were determined. The Chi-square test was applied to categorical data to determine the significance of associations between groups within the population. Associations were deemed statistically significant at alpha equal to ≤0.05.

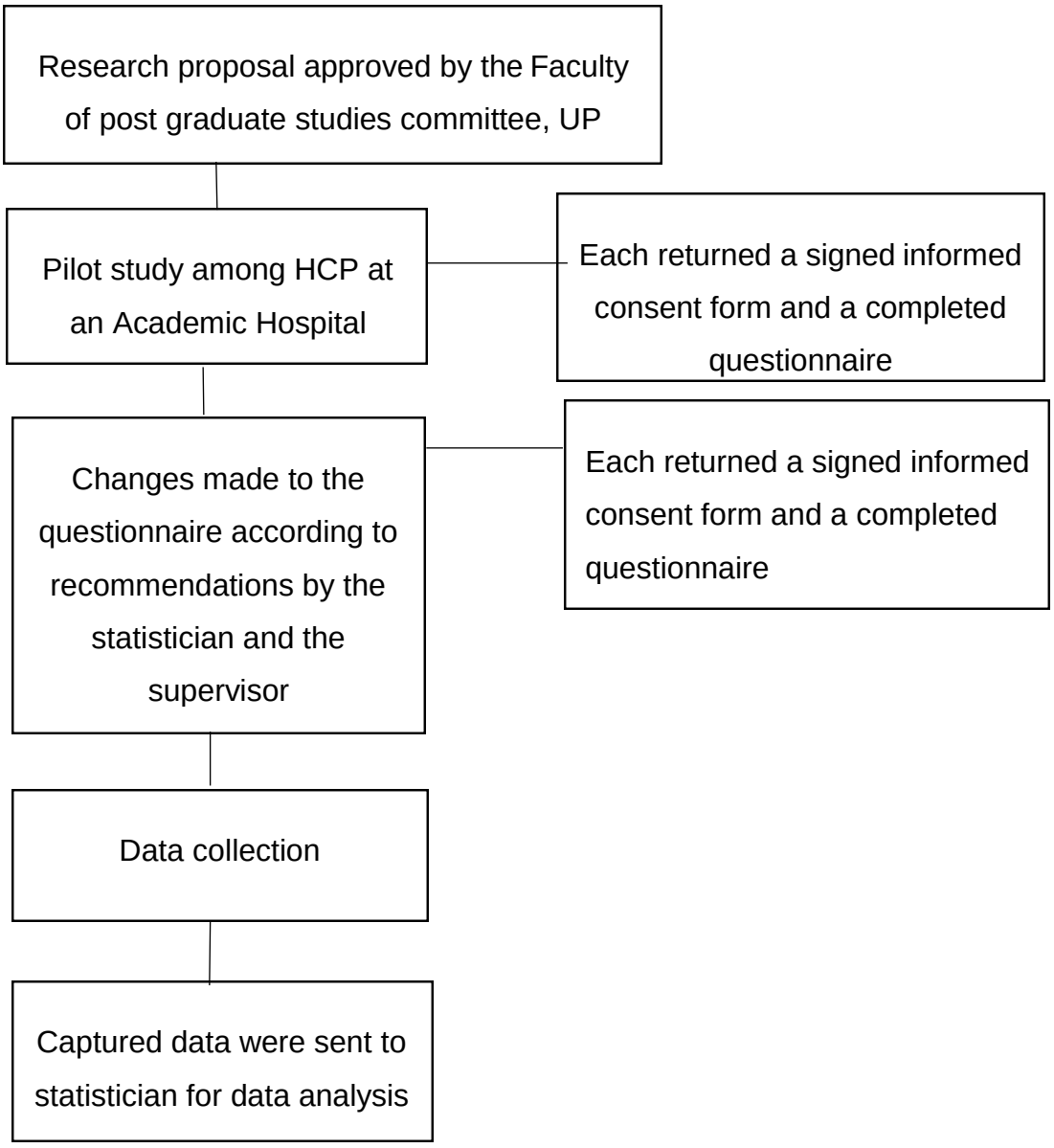

Figure 3.1: Outline of study procedures

3.9 CONCLUSION

This chapter presented the research design and methods employed to conduct the study. A quantitative, descriptive, cross-sectional research design was applied. The data collection instrument was a self-administered questionnaire. The aim of the study was to collect data to determine HCP's knowledge and practices regarding protective wear on TB prevention in Gauteng province. For each of the variables, namely

knowledge and practices, dimensions were formed, and data analysis was done within these dimensions. Throughout the research study, the researcher considered and maintained ethical principles. Data analysis was done with assistance from a qualified statistician at the South African Medical Research Council (SAMRC). A comprehensive description of the results is presented in the next chapter.

CHAPTER 4

PRESENTATION OF RESULTS AND DISCUSSION

4.1 INTRODUCTION

The previous chapter discussed the research design and methods in detail, while this chapter presents the results as per the data obtained from the questionnaires. Descriptive statistics were used to provide information about the respondents with reference to their demographic characteristics and responses to the questionnaire. The objectives of the study were to

- determine the HCP's knowledge regarding the protective wear on TB prevention in Gauteng.
- determine the HCP's practices regarding the protective wear on TB prevention in Gauteng.

4.2 DATA COLLECTION METHODS

A total of 190 copies of the questionnaire were distributed to HCP at the selected healthcare facility in Gauteng. However, only 102 (54%) copies were returned. All 102 questionnaires were captured into the REDCap database. Data cleaning was performed before sending the database to the statistician who analysed the data on Stata 14.2 software. However, with a Cronbach alpha coefficience of 0.7935 the reliability of the questionnaire is very strong. Significant findings are indicated in bold font ($p<0.05$).

4.2.1 The research instrument

The questionnaire consisted of the following sections:

Section A – Demographic data: The demographic profile of the respondents was explored through the development of thirteen items.

Section B – Knowledge of TB infection control policies: In this section with nine items, respondents were expected to indicate if the questions related to their work environment. They had to choose only one option for a statement by marking with a (√) in the appropriate box. Item 18 had an added open-ended question to assess if the HCP have knowledge of the infection control programme. They were expected to name the three parts of the infection control programme.

Section C – Practice of TB infection control: Twelve items were created to evaluate the HCP's practice regarding the infection control guidelines. Respondents indicated whether the statement was a true reflection of their practice. They were also expected to mark with a (√) in the space provided if it was "true" or "false", and they had to specify the proportion of the time from "never" to "most of the time". Finally, there were two open-ended questions designed to:

- give suggestions to improve knowledge and practice
- identify hindrances that affect knowledge and practice

4.3 SECTION A: DEMOGRAPHIC DATA

4.3.1 Gender of the respondents

It was observed that the majority (77.2%, n=78) of respondents were female, while 22.8% (n=23) were male respondents. One respondent did not disclose gender. Although the percentage of male HCP is minimal, the general public's perception of health care should be that of a highly skilled and well-educated workforce in which stereotyping should not take place (Kluczyńska, 2017:1366). However, attending skills development training in order to keep up to date with current trends in infection control might pose a challenge to the profession due to family responsibilities.

4.3.2 Age of the respondents

The minimum respondent age was 26 and the oldest was 61. Mean age was 42 [sd - 8.480] and the median was 42. The majority of the respondents were all categories of nurses. The data received correlates well with the age distribution of registered nurses in South Africa according to the South African Nursing Council. Their statistics indicate that 27% of registered nurses/midwives are aged between 40-49, and 29% of the registered nurses/midwives are between the ages of 50 and 59 (South African Nursing Council, 2013a:4). The statistics also show that there are more female nurses than male nurses (South African Nursing Council, 2013b:2).

The data received regarding the age distribution of the HCP who participated in this study, are summarised and categorised in groups of less than or equal to 35 years, 36 to 45 years, and over 46 years as shown in Figure 4.1.

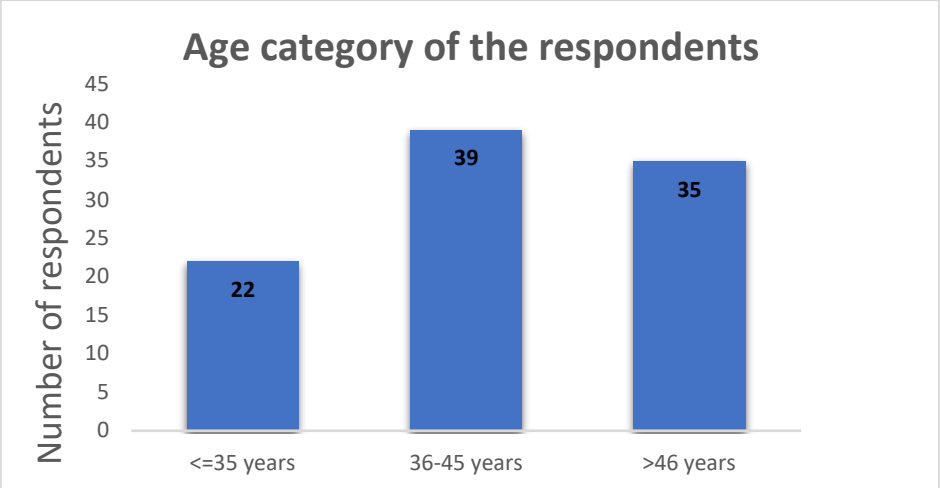

Figure 4.1: Bar chart showing age distribution of the respondents

Figure 4.1 shows that out of 102 respondents, the majority were between 36 and 45 years of age. At least 22.2% (n=22) were 35 years and younger, 40.6% (n=39) were between 36-45 years, and 36.5% (n=35) were over the age of 46.

4.3.3 Marital status of the respondents

The respondents in the study were asked to indicate their marital status which is summarised in Figure 4.2.

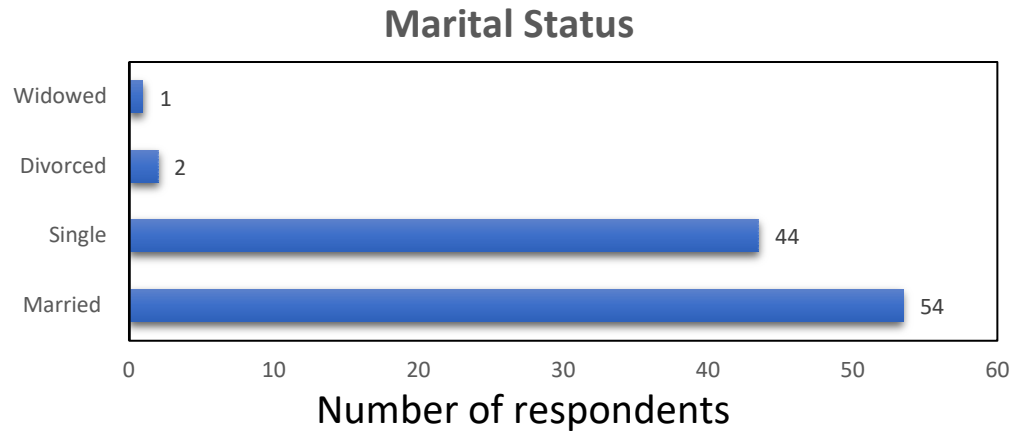

Figure 4.2: Bar chart showing marital status of the respondents

Figure 4.2 shows the respondents who reported their marital status. The majority (53.5%, n=54) of respondents were married, 43.5% (n-44) were single, and only 2 respondents were divorced and 1 was widowed. One respondent did not indicate their marital status. One would believe that satisfied employees are productive at work and are likely to pay attention to work requirements and adhere to the provided guidelines. Demographic characteristics such as the marital status of the personnel play a role in job satisfaction. Some studies that investigated the influence of marital status on job performance found that married employees have less stress at work compared to their single counterparts (Olatunji and Mokuolu, 2014). It is therefore imperative to consider employees' marital status when designing plans to improve satisfaction in the work environment that would, in turn, encourage adherence to infection control guidelines.

4.3.4 Number of dependents

The respondents were asked to indicate their number of dependents, regardless of the ages of the dependents. Eighty-five (85) respondents reported having dependents: 72.9% (n-62) had less than 3 dependents and 27.1% (n-23) had more 4 dependents.

Eighty-five (85) respondents out of the 102 respondents offered their number of dependents as ranging from 1 to 6, and 17 respondents had no dependents.

The HCP's job is mentally, emotionally and physically draining. Research has shown that both work stress and work-family conflict predict burnout. Burnout negatively influences personal protective equipment compliance and adherence to work safety practices (Smith, Hughes, DeJoy and Dyal, 2018:387).

4.3.5 Mode of transportation

All the respondents reported the mode of transportation they used. More than half (58.8%, n-60) used their own transport to work, while 41.2% (n-42) used public transport. Employees who get sufficient physical activity perform better at work in terms of quality and quantity of work. The HCP who use public transport are likely to be more energetic than the ones who use their own transport, since public transport involves some form of walking to and from where one gets the transport.

4.3.6 Professional qualification

The respondents were asked to indicate their professional qualifications to determine the proportion of each category of HCP who participated in the study. Most of the respondents were registered nurses. The data are summarised in Figure 4.3.

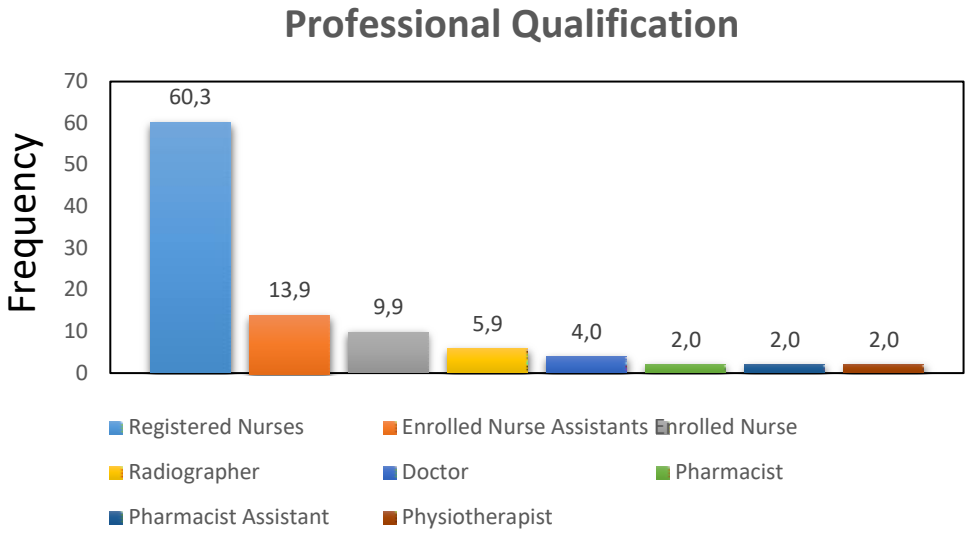

Figure 4.3: Bar chart showing professional qualification reported by the respondents

Figure 4.3 shows that a higher number of the nursing staff responded to the study compared to the rest of the HCP. Registered nurses formed the majority of the respondents at 60.3% (n-61). There were 13.9% (n-14) enrolled nurse assistants, 9.9% (n-10) enrolled nurses, 4% (n-4) doctors, 5.9% (n-6) radiographers, 4% (n-4) pharmacists, and 2% (n-2) physiotherapists.

4.3.7 Highest level of qualification

The respondents in this study were requested to indicate their highest level of qualification to determine whether academic development took place among HCP who participated in the study. Most of the respondents held a diploma qualification. The data are summarised in Figure 4.4.

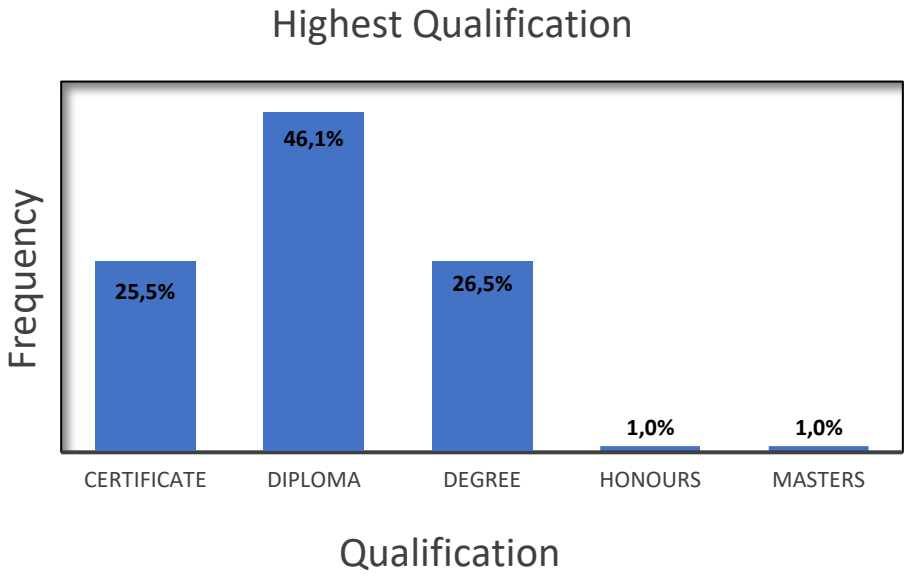

Figure 4.4: Bar chart showing highest qualification of the respondents in this sample

Figure 4.4 shows information presented by respondents who reported on their post-matric qualifications. The highest qualification was a Masters degree, which only one respondent reported to have. One respondent graduated with an Honours degree, while the rest of the staff reported to have a diploma qualification. Of the respondents, 46.1% (n-47) had a diploma qualification, 26% (n-27) had a degree qualification, and 25.5% (n-26) had a certificate.

It is thus evident from the data that the majority of respondents had a diploma qualification. A main concern was the low response rate of a Masters degree in nursing which was indicated as the highest qualification. This was identified as an educational need that has to be developed in future professional development programmes. In order to increase the educational level of the HCP, part-time course work can be developed by tertiary institutions to help them balance the demands between school, work and home. Financial support can also greatly encourage the HCP to take up programmes to improve their skills (Couper, Ray, Blaauw, Ng'wena, Muchiri, Oyungu et al., 2018:553).

4.3.8 Years of experience

This question addressed respondents' years of experience. Respondents were asked to indicate how many years they had been practising as HCP.

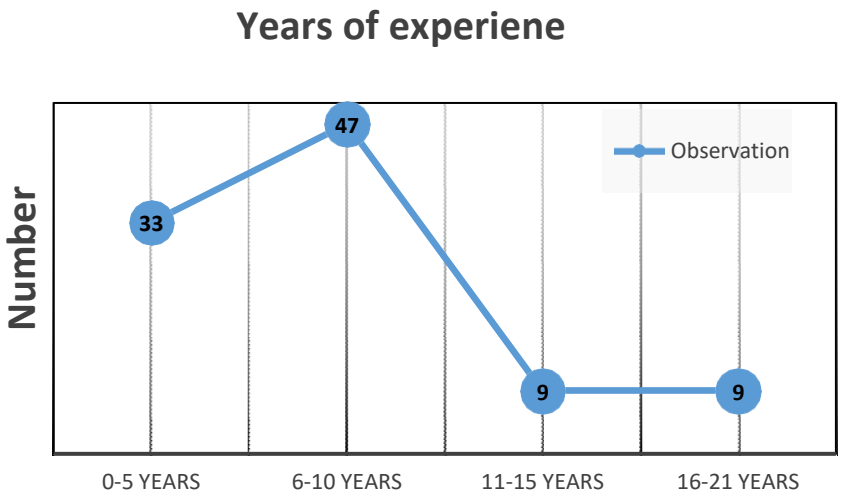

Figure 4.5: A plot chart showing distribution of working experience of the respondents

Figure 4.5 shows the distribution of respondents' work experience in this study. The number of years worked in the facility ranged from 2 to 21 years, with the majority of the respondents (48.0%, n-47) reporting to have between 6 and 10 years' work experience. A number of respondents who reported to have changed departments were within the facility and some did not indicate the change of job location.

4.3.9 Current job location

Respondents in this study were asked to indicate how many years they had been working in their current department. The majority of the respondents (56%, n-57) were working in the wards. The respondents who reported working in Casualty were 17% (n-17), Outpatient 16% (n-16), Radiology 6% (n-6), Pharmacy 4% (n-4), and 1% (n-1) were working in the Physiotherapy department. Job location is one of the risk factors of TB infection. A study that investigated the risk factors for TB infection among healthcare workers in KwaZulu-Natal, South Africa, identified time spent with TB

patients as an independent risk factor for TB. The HCP in that study spent significant time in the wards (Tudor, Van der Walt, Margot, Dorman, Pan, Yenokyan et al., 2016).

Similarly, in this study, the majority of the HCP were working in the wards, which is regarded as a risk factor for TB transmission. The fact that the majority of the respondents were working in the wards could be an important factor in developing programmes to strengthen infection control; more importantly, to enforce good practices for infection control.

4.3.10 Previous job location

Respondents in this study were asked to indicate how many years they had worked in other sections/departments prior to working in the current department. The majority of respondents (68%, n-44) reported that they worked in the wards prior to their current job location. The job location in the facility determines the level of risk of TB transmission. Although research has not established specific areas of healthcare facilities where HCP are more likely to be exposed to TB, the implementation and maintenance of infection control measures and practices remain important in the protection of HCP working in healthcare settings (Tudor et al., 2016:262).

4.3.11 Years at previous job location

Respondents in this study were also requested to indicate the number of years they were in their previous job location. The respondents who worked in a previous location for 1 to 5 years prior to their current job location totalled 34% (n-33). The respondents who worked in a previous location for 6 to 10 years were at 48% (n-47), 11 to 15 years were at 9% (n-9), and 16 to 21 years were at 9% (n-9).

Patients remain in the wards for longer periods, which poses a greater risk to the HCP who are in contact with these patients. This suggests that there is an increased risk of disease spread in in-patient settings compared to outpatient settings. Therefore, HCP who spend more years in one location may be at a greater risk than those who

frequently change their job location. It could be an important factor for managers to rotate staff more frequently to reduce the risk of TB transmission (von Delft et al., 2015:148). Staying in the same job location is a disadvantage for HCP as they tend to relax and assume they are protected.

4.3.12 Training on TB infection prevention and TB management

The respondents were asked to indicate if they received training on TB infection prevention and TB management. Results are summarised in Table 4.1.

Table 4.1: Training on TB infection prevention and management

Training on TB Management	Proportion	Std. Err.	[95% Conf. Interval]	
No	0.76	0.04	0.67	0.84
Yes	0.24	0.04	0.16	0.33

Table 4.1 indicates the inadequate training on TB infection prevention and management, with 76.5% (n=78) of the sample reporting that they did not receive any training. Only 24% (CI 0.16-0.33) received training on TB infection prevention and management.

4.3.13 How often do you do TB infection control and TB management training

The respondents in this study were requested to indicate how often the facility offered training on TB infection prevention, control and management. These results are summarised in Figure 4.6.

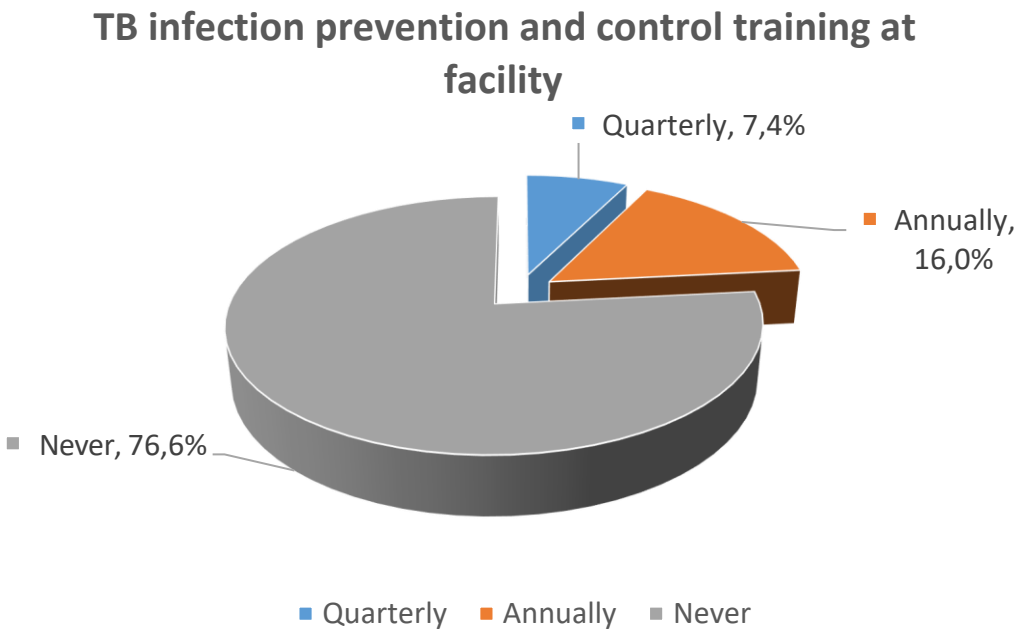

Figure 4.6: Pie chart of the respondents who reported on training on TB infection prevention and control at the facility

Figure 4.6 shows that the majority of the respondents (76.6%, n-76) reported that training is never offered at the facility. However, 7.4% (n-7) stated that the training is done quarterly, and 16.0% (n-15) reported that training takes place annually. Each facility is expected to have good work practice regarding TB infection control, yet respondents gave conflicting answers regarding the infection control and TB management training at the facility. Looking at a few respondents who reported that they knew about the TB infection control training at the facility, it is clear that selected HCP attend training. All HCP, regardless of the section they are deployed in, are exposed to the risk of nosocomial infection. It is thus imperative for all HCP, not only those in the TB clinic, to be trained on TB infection control policies and guidelines as all areas in the facility present some risk (Tudor et al., 2013a:144).

4.4 SECTION B: KNOWLEDGE OF TB INFECTION CONTROL POLICIES AMONG HEALTHCARE PERSONNEL

This section addressed the knowledge of TB infection control policies. Questions 14-22 emphasise the HCP's knowledge of infection control policies. The responses of the respondents are summarised in Table 4.2.

Table 4.2: Questions on knowledge of TB infection control policies

Q/ No	Question	Correct		Incorrect		Not sure	
		n	%	n	%	n	%
14	Every facility should establish an Infection Control Committee	91	89.2	1	1.0	10	9.8
15	What is the main reason a HCP develops TB disease?						
	— Spending more time with TB clients in the clinic	64	74.4	16	18.6	6	7.0
	— Not wearing a respirator when attending to the TB clients	75	84.3	11	12.3	3	3.4
	— Wearing a mask when attending to the TB clients	37	43.5	36	**42.4**	12	14.1
16	Which of these measures that protect the Healthcare Personnel from TB infection is done at your workplace?						
	— Training of the healthcare personnel to identify early TB infection	25	24.5	77	**75.5**	-	-
	— Medical surveillance program	89	87.2	13	12.8	-	-
17	How can a HCP reduce the chances of getting TB in Hospital or outpatient clinic?						
	— Offer masks to coughing patients and other symptomatic persons upon entry to the facility	93	93.0	3	3.0	4	4.0

Q/ No	Question	Correct		Incorrect		Not sure	
		n	%	n	%	n	%
	— Wear appropriate personal protective equipment	92	97.9	2	2.1	0	
	— Open window/door to keep a ventilated working space	95	97.9	2	2.1	0	
	— Isolate patients with suspected TB from other patients	85	89.5	2	2.1	8	8.4
18	What are the parts of infection control program designed to reduce TB transmission in the healthcare settings	25	21.5	77	**78.5**	-	-
19	Tick the most important environmental control measures to reduce TB transmission in the healthcare setting	65	63.7	37	36.3	-	-
20	Tick the most important administrative control measures to reduce TB transmission in the healthcare setting	42	41.2	60	**58.8**	-	-
21	Do you believe that UV lights can minimise TB transmission at the facility?	40	42.6	11	11.7	43	**45.7**
22	TB bacteria that is exhaled into the airspace can remain viable for about 30 minutes	36	42.9	10	11.9	38	**45.2**

Key: Q/No=Question Number

Table 4.2 indicate respondents' knowledge and understanding of TB infection control. The section consisted of 9 questions with answers that required the respondents to tick the right answer, respond "Yes/No/Not sure", and offer written responses. The knowledge of the HCP in the sample was good with the majority (89.2%) correctly answering the question of establishing an infection control committee at the facility.

When infected with TB, patients receiving care at the facilities cough and release bacteria as droplets into the airspace. TB bacteria can be inhaled; HCP working with and spending time around infected patients can thus get infected (Barrera, Livchits

and Nardell, 2015:381). Respondents in this sample knew that spending more time with TB patients expose them to greater risk of contracting TB. Coughing patients should be provided with masks to protect the HCP and other patients. The majority (84.3%, n=75) of the respondents knew that they should wear a respirator when attending to TB patients. However, some of the respondents (42.4%, n=36) seemed not to know that there is a difference between a respirator and a mask, and some were not sure (14.1%, n=12). Thus, a knowledge gap exists, especially in terms of the right protective wear for the HCP and the patients to prevent the spread of the TB bacteria. Knowledge deficit was also demonstrated in a clinical observation and simulation study among the HCP (Kang, O'donnell, Colaianne, Bircher, Ren and Smith, 2017).

Regarding the reduction of HCP getting TB in the healthcare setting, the majority of respondents answered correctly. Training HCP to identify TB is key in preventing the spread of TB. However, the majority of the respondents (75.5%, n-77) reported that training was not offered at the facility. Again, medical surveillance in this context provides a medical assessment of the HCP potentially exposed to the risk of TB pathogens (McDiarmid, Polovich, Power, Connor and Weissman, 2013:4), as well as taking action to reduce the risk to the HCP. It was noted that 87.2% (n-89) of respondents reported that medical surveillance was available at the facility. Less than 10% of the respondents were either unsure of the correct answer or did not know the correct answer.

Offering a face mask to coughing patients reduce the spread of the bacteria as the face mask can capture large wet particles near the patient’s mouth and nose. This prevents the bacteria from being released into the air space at the facility (Ethington, Newsome, Waugh and Lee, 2018:482). Of the respondents in this sample, 93% (n-93) knew that coughing patients should be offered a mask to reduce the spread of TB bacteria. However, 4% (n-4) were not sure if it is the right thing to do, and 2.1% (n-2) did not know at all.

The HCP need to wear appropriate personal protective wear when attending to TB patients to reduce their risk of transmission. The majority of the respondents (97.9%,

n-95) knew that appropriate protective wear should be worn to reduce the risk of transmission. It was also noted that 97.9% (n-95) knew that an open window/door policy establishes good ventilation in the working space.

Persons who have or are suspected of having infectious TB disease should be separated or placed in an area away from other patients, preferably in an airborne infection isolation room. Of the respondents in this sample, 89.5% (n-85) knew that it is correct to separate patient presumed to have TB, and only 8.4% (n-4) were not sure. Two respondents did not know that presumptive TB patients should be separated from other patients.

Of this sample, 78.5% (n-77) did not state the parts of the infection control programme which are administrative, environmental, and personal protective wear. However, they described elements of the programmes that include the open window policy and educating the patients on cough etiquette. There is a lack of training among HCP regarding infection control policies that safeguard them. Respondents also demonstrated a lack of understanding regarding the infection control programme.

Respondents in this sample failed to identify the correct environmental and administrative infection control measures. Examples of administrative and environmental control was given in the subsequent question, but they could not identify these measures. Of the respondents, 36.3% (n-37) failed to select the most important measures of environmental control when answering the question. The question on the most important administrative measure was correctly answered by only 42 respondents out of the 102. Thus, a knowledge gap exists among the HCP regarding infection control measures that need to be implemented in healthcare settings.

Ultraviolet lights (UV lights) can reduce the spread of TB in hospital wards and waiting rooms. UV lights kill TB bacteria by damaging their DNA so they cannot infect people, grow or divide (Fernstrom and Goldblatt, 2013) . Most of the respondents (45.7%, n=43) were not sure how UV lights assist in the reduction of TB infection in their workplace. Some of the respondents (11.7%, n-11) did not know what UV lights are.

Some respondents indicated that they had an idea of how UV lights work. They specified that they were unsure of its effectiveness as they had not seen any studies proving the effectiveness of UV lights. They also raised issues around the maintenance of the UV lights.

When a person with TB coughs, tubercle bacilli are transported in fine droplets from the infection in the lungs into the air. The droplets are extremely small and remain in the air for a long time if they are not exposed to sunlight or propelled out of the space by fans (Murphy, 2017:32). In this sample, the majority (45.2%, n=38) of the respondents were not sure if the TB bacteria could survive in the airspace for approximately 30 minutes, and 11.9% (n-10) did not know at all. Only 36% (n-36) acknowledged that TB bacteria expelled in the air can survive for approximately 30 minutes.

4.5 SECTION C: PRACTICE OF TB INFECTION CONTROL POLICIES AMONG HEALTHCARE PERSONNEL

Questions 23-32 put more emphasis on HCP's practices regarding infection prevention and control. The respondents' answers to these questions are summarised in Table 4.3.

Table 4.3: Questions on practice of TB infection control policies.

Q/N	Question	Never	10% of the time	25%of the time	50% of the time	75% of the time	Total
23	What proportion of your shift/day do you collect sputum in the ward?	50 (53.2%)	12 (12.8%)	8 (8.5%)	3 (3.2%)	21 (22.3%)	94
24	What proportion of your shift/day is spent in a	27 (28.4%)	15 (15.8%)	9 (9.5%)	3 (3.2%)	41 (43.1%)	95

Q/N	Question	Never	10% of the time	25%of the time	50% of the time	75% of the time	Total
	room/ward with coughing patients?						
25	What proportion of your day/shift caring for TB patients do you wear a respirator?	32 (33.7%)	7 (7.4%)	4 (4.2%)	7 (7.4%)	45 (47.3%)	95
26	What percentage of your time do you teach patients respiratory etiquette/cough hygiene	30 (31.6%)	7 (7.4%)	1 (1%)	1 (1%)	56 (59%)	95

Q/N	Statement	True		False		Not Sure		Total
		n	%	n	%	n	%	
27	Most nurses and doctors have already been infected with TB, so prevention measures are not necessary.	19	20.9	64	70.3	8	8.8	91
28	My infection control practice has greatly improved since learning TB infection and prevention.	60	63.2	13	13.6	22	23.2	95
29	I am very worried about being infected with TB.	78	83.8	14	15.1	1	1.1	93
30	I sometimes do not wear a respirator even when I know I should.	50	54.4	41	44.6	1	1.0	92
31	Our hospital has a strong infection control policy.	46	48.4	30	31.6	19	20.0	95
32	I close the windows at night because cold air will make the patients sicker.	40	44.9	35	39.4	14	15.7	89

Table 4.3 indicates the responses of the respondents in terms of their practice of TB infection control policies. In Section C of the questionnaire, practice was assessed to

evaluate the respondents' practices regarding the TB infection control guidelines available in the facility. The section consisted of 10 questions with answers that required the respondents to tick the right answer, as well as offer written responses and recommendations.

Regarding the question on collecting sputum in the ward, more than half of the respondents (53%, n-50) never collected sputum in the ward. However, there were some respondents who reported that they had collected sputum in the ward at some point. A few respondents (28.4%, n-27) reported that they never spent time with coughing patients during their working hours. The majority of the respondents (46%, n-44) spent time with coughing patients for some time during their working hours. Only 33.7% (n-32) of the respondents reported that they wore a respirator while attending to TB patients, while the rest did not use a respirator. Teaching patients cough etiquette/cough hygiene was practised by most of the respondents, with only 31.6% (n-30) who did not teach patients cough etiquette.

There is a widely held false belief that healthcare workers are somehow immune to TB disease (TB-proof) (von Delft et al., 2015:147). The question on whether it is true or false that HCP are already infected and need no protection was answered by 91 respondents. Of those respondents, 20.9% (n-19) agreed that HCP do not need protection, while 8.8% (n-8) were not sure. Out of the 95 respondents who responded on the question related to good practice after training, 63.2% (n-60) indicated that it was true. The others (13.6%, n-13) said it was not true, while 23.2% (n-22) were not sure.

Almost all the respondents (83.8%, n-78) reported that they were worried about getting infected with TB. However, more than half (54.4%, n-50) of the respondents did not wear respirators even though they knew they were supposed to. Similar findings to this study have been observed in another study conducted in South African primary healthcare facilities, where researchers identified poor compliance with the levels of infection control prioritised by the WHO. Malotle, Spiegel, Yassi et al., (2017:263) also

found that despite the availability of protective wear, HCP infrequently used appropriate respiratory protection in South African settings.

A few respondents (48.4%, n-46) knew and reported that their healthcare facility had a strong infection control policy and 20% (n-19) were not sure if such a policy existed. A total of 31.6% (n-30) indicated that the facility did not have an infection control policy in place. Close to 50% of the HCP reported that they close windows at night because of the cold weather, while a few (39.4%, n-35) did not close the windows. It can therefore be noted that practice is not always associated with knowledge. Although respondents knew that an open window/door policy reduces risk of transmission as indicated in Section B, they do not always open windows. HCP also lack compliance regarding the use of protective wear (Beam, Hotchkiss, Gibbs, Hewlett, Iwen, Nuss et al., 2018:579).

The respondents in this sample were requested to give suggestions that would assist to improve their knowledge and practice towards infection prevention and control. Their suggestions and opinions are presented in the content analysis that follows.

4.6 SECTION C CONTINUED: MY OWN SUMMARY OF RESPONSES

Under this section, summary of responses was conducted on questions 33 and 34. Content analysis was used in a quantitative manner to describe and to classify these open-ended responses. Summary analysis was done to break down information from the respondents' responses on the open-ended questions and formed into themes. The summary analysis was carried out on the statements presented in Table 4.4.

Table 4.4: Open-ended questions

	Statement	Requirement
33	Give 4 suggestions that you consider will assist in improving Knowledge and Practice of the Healthcare Personnel:	Provided own suggestion

	Statement	Requirement
34	List 4 hindrances that affect Knowledge and Practice of effective infection control by the Healthcare Personnel:	Provided own suggestion

Question 33: Open-ended question on factors considered to assist in improving Knowledge and Practice of the Healthcare Personnel

Respondents were requested to write down the factors that they considered would improve their knowledge and practices. Responses given by the respondents to question 33 are listed and summarised in Table 4.5.

Table 4.5: Factors considered to assist in improving knowledge and practice of the healthcare personnel

No	Item	Frequency	%
1	In-service training	18	46.4
2	Availability of a strong infection policy	5	13.5
3	Availability and easy access to protective wear	4	10.8
4	Regular support from the district health office	3	8.1
5	Staff health monitoring	2	6.1
6	Regular meetings with the TB coordinator	2	6.1
7	Formation of a TB Committee	2	6.1
8	Isolation of TB patients	1	2.9
	Total	**37**	**100**

The responses were summarised into eight themes. As observed from Table 4.5, 46.4% (n=18) of the respondents see in-service training as a tool that can enhance their knowledge and improve their practice. The availability of a strong infection control programme had 13.5% (n-5) responses. At least 10.8% (n-4) perceived regular support from the district health office as necessary. A few (6.1%, n-2) respondents believed that staff health monitoring is key, while 6.1% (n-2) believed regular meetings with the TB coordinator could improve their knowledge and practice. However, 6.1%

(n-2) believed that the formation of a TB committee could help, and only 2.9% (n-1) believed isolating TB patients is important. HCP experience significant barriers in implementing infection control practices. They can become more competent in implementing infection control programmes if these barriers are addressed. Training insufficiencies can have a widespread negative impact on HCP's knowledge and practice (Havens, Gittell and Vasey, 2018:132).

Question 34: Open-ended question on the factors that hinder knowledge and practice of effective infection control by the healthcare personnel

The respondents listed several items relating to hindrances that affect their knowledge and practices of effective infection prevention and control. The responses are summarised in Table 4.6.

Table 4.6: Factors that hinder the knowledge and practice of the healthcare personnel

No	Item	Frequency	%
1	Delays in disease detection	11	39.3
2	Lack of knowledge	9	32.1
3	Staff shortage resulting in less priority given to training programs	3	10.7
4	Poor infrastructure	3	10.7
5	Non-adherence to policy by the health staff	1	3.6
6	Lack of effective infection control	1	3.6
	Total	**28**	**100**

Table 4.6 addresses the factors that hinder HCP's knowledge and practices of effective infection prevention and control. On looking at these factors, the researcher summarised the responses into six themes. As observed from Table 4.6, the majority of respondents (39.3%, n-11) blamed delays in disease detection. Some (32.1%, n-9) see a lack of knowledge as a major hindrance. Ten per cent (n-3) see staff shortage, which results in lower priority being given to training programmes, as an issue, and 10.7% (n-3) believed poor infrastructure is a hindrance. Three per cent (n-1) felt the

non-adherence to policy by the healthcare staff was the problem, while 3.6% (n-1) blamed a lack of infection control. A study in Montenegro showed that the median length of patient and health system delay was 30 and 27 days. Similar to the reasons stated by the respondents in this study, delays from diagnosis to treatment are a challenge for TB patients as they remain infectious and can easily spread the bacteria (Blumberg, 2018:361).

4.7 ASSESSING THE ASSOCIATION BETWEEN DIFFERENT CATEGORIES AND KNOWLEDGE

Table 4.7: Summary table of chi-square comparison of scores of knowledge based on demographic characteristics

Demographic Characteristics	Rank X^2	P-value	Remark
Gender	1.058	0.30	No significant difference
Age Category	8.859	**0.01**	**Significant difference**
Number of dependents	0.189	0.66	No significant difference
Marital Status	1.614	0.66	No significant difference
Professional Qualification	13.014	**0.05**	**Significant difference**
Highest level of education	17.798	**0.00**	**Significant difference**
Years of experience	3.346	**0.50**	No significant difference

Table 4.7 shows that there was no statistical difference in knowledge between male respondents and female respondents. A significant difference in knowledge exist in the age category of the respondents. Younger respondents were likely to be more knowledgeable compared to older respondents, perhaps because younger HCP are more concerned about professional development than older HCP. The older HCP are probably more concerned about preparing for retirement than professional development. However, in some studies, challenges such as lack of time and money were identified as barriers to knowledge (Sabio, 2019:12). There was no association between the number of the dependents each respondent had and their knowledge of TB infection control policies. There was also no significance in marital status. A significant relationship was shown between the respondents' level of education and

knowledge (p-value **0.00**); knowledge was associated with a higher level of qualification.

4.7.1 Comparison of knowledge based on marital status and number of dependents

The data from this study suggest that knowledge was not influenced by the marital status of the respondents, since no significant difference in marital status was observed (p-value 0.66). Having dependents did not influence the knowledge of the respondents in this sample, as no significant difference exists in the number of dependents each respondent had (p-value 0.66). This study adds to the current literature by highlighting gaps in training. Lack of knowledge expose the HCP to occupational risks, and is a great need to develop programmes and strategies to overcome these challenges faced by HCP (Wang, He, Geng, Song, Wang, Liu et al., 2018:26).

4.7.2 Comparison of knowledge based on professional qualification

A difference existed in relation to knowledge and professional qualification of the respondents (p-value **0.05**). A professional qualification was associated with good knowledge and the level of qualification was associated with good knowledge of infection prevention and control (p-value **0.00**). Adequate knowledge was demonstrated by the professional qualification of the HCP as well as the highest qualification. There is a clear indication that the change in knowledge was directly linked to the level of education in this sample. However, years of experience had no statistical significance (p-value 0.50). Focusing on the educational needs of the HCP as identified in this study, would improve the knowledge and skills needed to practice and adhere to infection control policies. Again, frequent in-service training can significantly improve the HCP's knowledge (van der Westhuizen, Kotze, Narotam, von Delft, Willems and Dramowski, 2015a:5).

Table 4.8: Summary of mean knowledge based on gender of respondents

Gender	Mean	Sd	Min	Max	p50
Male	75.2	15.0	40.0	90.0	80.0
Female	70.5	13.6	40.0	100.0	70.0
Total	**71.6**	**14.0**	**40.0**	**100.0**	**70.0**

4.7.3 Mean knowledge by gender

Table 4.8 shows mean knowledge of the respondents based on their gender. There was no difference in score for the two groups measured. The scores for the male respondents were (mean-75.2, sd-15.0, min-40.0, max-90.0, median-80.0). The scores for the female respondents were (mean-70.5, sd-13.6, min-40.0, max-100.0, median-70.0). There was a difference exhibited between these two groups; they demonstrated equal chances of knowledge even though there were fewer male respondents than female respondents.

Comparison of knowledge was measured among the HCP using the Kruskal-Wallis test. The Kruskal-Wallis test is used for one independent variable with two or more levels, and an ordinal dependent variable. In other words, it is the non-parametric version of ANOVA and a generalised form of the Mann-Whitney test method since it permits two or more groups. It is a non-parametric multiple range test of differences in central tendency (median) that essentially provides a one-way analysis of variance for three or more independent samples based on ranked data (Granato, de Araújo Calado and Jarvis, 2014) .

4.8 ASSESSING THE ASSOCIATION BETWEEN DIFFERENT CATEGORIES AND PRACTICE

Table 4.9: Summary table of Chi-square comparison of scores of practices based on demographic characteristics

Demographic Characteristics	Rank X^2	P-value	Remark
Gender	1.058	0.30	No significant difference
Age Category	8.859	**0.01**	**Significant difference**
Number of dependents	0.189	0.66	No significant difference
Marital Status	1.614	0.66	No significant difference
Professional Qualification	1.461	0.48	No significant difference
Highest level of education	2.950	0.57	No significant difference
Years of experience	2.950	0.39	No significant difference

Table 4.9 presents a comparison of practice scores of the respondents based on the demographic characteristics of the HCP. Practice of infection and prevention was measured in terms of score percentage. A high score was reached by the respondent who answered more than 50% of the items correctly in Section B of the questionnaire, which measured the level of practice.

4.8.1 Practice and gender

There was no statistical significance between the high level of practice and the gender of the respondents. Being male or female was not associated with good practice (p-value 0,29), although their rank scores differ. There was no evidence to suggest a difference between the gender of the respondents and their level of practice; however, significant statistical differences were found in mean practice scores in relation to the gender of the respondents in a study by Imad Fashafsheh. That study assessed the knowledge and practices of nursing staff towards infection control measures in governmental hospitals found in the North West bank districts of Palestine (Fashafsheh, Ayed, Eqtait and Harazneh, 2015:88).

4.8.2 Practice and age

Practice was compared to the age of the participants. There is significant evidence suggesting that a difference exists between the age category of the respondents and practice (p-value **0.01**). Good practice in this sample was greatly associated with age. This is comparable with a study by (Desta, Ayenew, Sitotaw, Tegegne, Dires and Getie, 2018:465), and could be due to the fact that as age advances, year of service increases which, in turn, improves practice through time.

4.8.3 Practice by marital status and number of dependents

This score shows that being married was not at all associated with good practice. The number of dependents that the respondent has was also not associated with good practice. No evidence exists that suggest a significance between HCP's practice and their marital status (p-value 0.65). There is also no association between practice and the number of dependents for the respondents (p-value 0.66).

4.8.4 Practice professional qualification and the highest qualification

Regarding practice and professional qualification, no association was found between good practice and professional qualification. There is thus no evidence suggesting that professional qualifications yield good practice (p-value-0.36). The highest qualification also did not show any statistical significance. Good practice was not associated with the highest qualification (p-value-0.33). This result is in conflict with a study conducted in Northwest Ethiopia (Desta et al., 2018:465), and the difference might be due to sampling size, study participant difference and misreporting or self-reporting.

4.8.5 Practice and years of experience

Ideally, work experience provides an important opportunity for personal growth. Organisational support with regard to HCP's skills development plays a pivotal role. Having more years of working experience in an environment is associated with good

practice. However, in this sample having long working experience did not suggest any evidence of good practice (p-value-0.39). Working experience was not associated with good practice; yet, the duration of work experience was significantly associated with knowledge in a study conducted in Egypt (Hakim, Mohsen and Bakr, 2014:8).

4.9 COMPARISON BETWEEN KNOWLEDGE AND PRACTICE AMONG HEALTHCARE PERSONNEL

Table 4.10: Summary of mean knowledge and practice based on age

Variable		Observation	Mean	Std. Err.	[95% Conf. Interval]	
Knowledge of infection prevention and control		102	70.69	1.47	68.25	73.13
Practice of infection prevention and control		102	48.73	2.01	45.38	52.07
Knowledge	<=35 years	22	68.18	3.06	62.92	73.45
	35-46 years	39	71.54	2.59	67.18	75.90
	>46 years	35	72.57	2.26	68.75	76.39
	Age not recorded	6	63.33	6.67	49.90	76.77
Practice	<=35 years	22	44.09	4.04	37.14	51.04
	35-46 years	39	45.90	3.22	40.47	51.32
	>46 years	35	57.43	3.26	51.91	62.95
	Age not recorded	6	33.33	6.67	19.90	46.77

Table 4.10 shows a summary of comparison of mean knowledge and practice of the respondents based on the age category. Knowledge and practice were measured, and a comparison was made between all the age categories of HCP. There is no association between the scores of knowledge and practice. However, knowledge

scores were good among HCP in healthcare settings (Engelbrecht et al., 2016:221). Therefore, it is necessary to implement an in-service training programme in infection prevention and control among HCP in facilities in order to improve their knowledge and practices of infection prevention and control. Health institutes are recommended to consider the link between theoretical and practical aspects in planning and developing the curriculum and programmes in healthcare education in general, and HCP's education in particular.

Mean knowledge was above 50% for all the age categories of the respondents. Mean practice increased with age in this sample. There is a difference between those in the age group below 35 years and those over the age of 46 years. The age below 35 years had the lowest mean practice of 44.1% (CI 37.4-51.04). Respondents in the age group between 35 and 46 had a mean of 45.9% (CI 51.91-62.95). The highest mean practice was observed in the age group of respondents over the age of 46 years (57.43% CI 51.91-62.95).

The evidence shows that significant differences exist between the different age groups. Respondents older than 46 years showed higher levels of practice compared to the younger respondents. However, the knowledge score of the older respondents is lower compared to the younger respondents. The mean knowledge for the sample was 70.7% (CI 68.2-73.1), while the mean practice was 48.7% (CI 45.4-52.1). This evidence could be an indicator to develop programmes tailor-made for the HCP, targeting the senior workers in terms of professional development. The result of this study indicates the urgent need to implement an in-service training course in order to improve the HCP's knowledge on infection prevention and control measures.

4.9.1 Knowledge and practice based on gender and age category

Figure 4.7 shows the comparison of mean scores of the respondents based on the gender and age category.

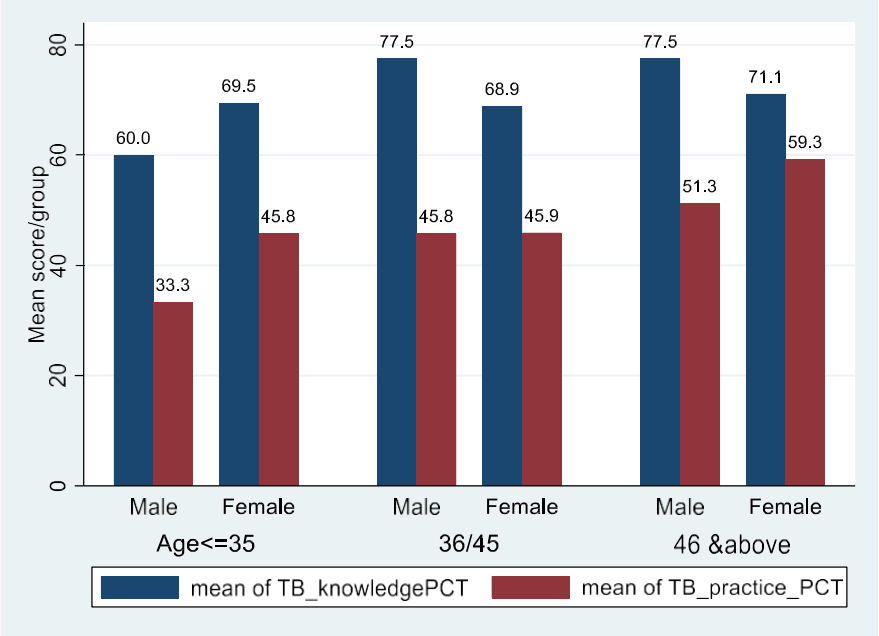

Figure 4.7: Bar chart showing comparison of knowledge and practice based on gender and age category

4.9.2 Comparison of mean knowledge and practice by gender and age category

Measurement of mean knowledge and practice demonstrated no difference in the practice between the male respondents and the female respondents. Both male and female respondents over the age of 46 years demonstrated a higher level of practice compared to their younger counterparts. The younger category of <=35 years scored less than 50% (33.3% and 45.8%), while the older category of >=46 years scored above 50% (51.3% and 59.3%). Looking at the findings in this study, emphasis should be directed to monitoring HCP's practice of infection control measures (Engelbrecht et al., 2016:634).

4.9.3 Comparison of knowledge and practice by marital status and number of dependents

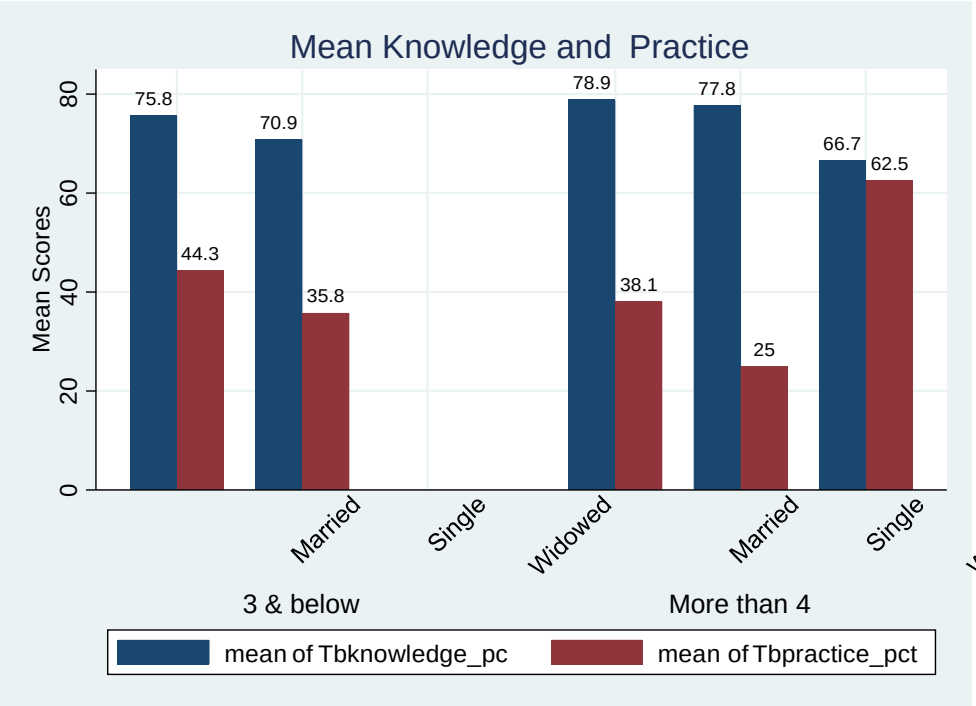

Figure 4.8: Bar chart showing mean knowledge and mean practice based on marital status and number of dependents

Figure 4.8 indicates that there was no difference in knowledge scores between the group of married respondents who had 3 or less dependents, and those with more than 4 dependents (78.8% and 78.9%). Respondents who were single with 3 or fewer dependents had a similar score to the single respondents with more than 4 dependents. However, the respondents who were widowed with more than 4 dependents demonstrated knowledge of 66.7%. The widowed respondents with more than 4 dependents also demonstrated higher levels of practice, at 62.5% compare to the rest of the respondents.

Being a widow and having more than 4 dependents was thus not an impediment to good knowledge and good practice. However, an assumption would be that being widowed and having a responsibility of dependents would affect one's practice. There is a positive correlation between job stress and work-family conflict in dual-earner

families. Increases in work-family conflicts increase job stress in individuals and could have a significant impact on work interface.

In a study conducted by Samios (Samios, 2018:1088), widowed HCP showed more stress and burnout symptoms in their work than their married counterparts. The widowed HCP lacked the intimate and support relationship of marriage (Samios, 2018). It can therefore be concluded that marital status, as a single factor, does not influence good knowledge practice, but the psychosocial impact of family life and marriage have an influence on good knowledge and practice.

4.9.4 Knowledge and practice by gender and professional qualification

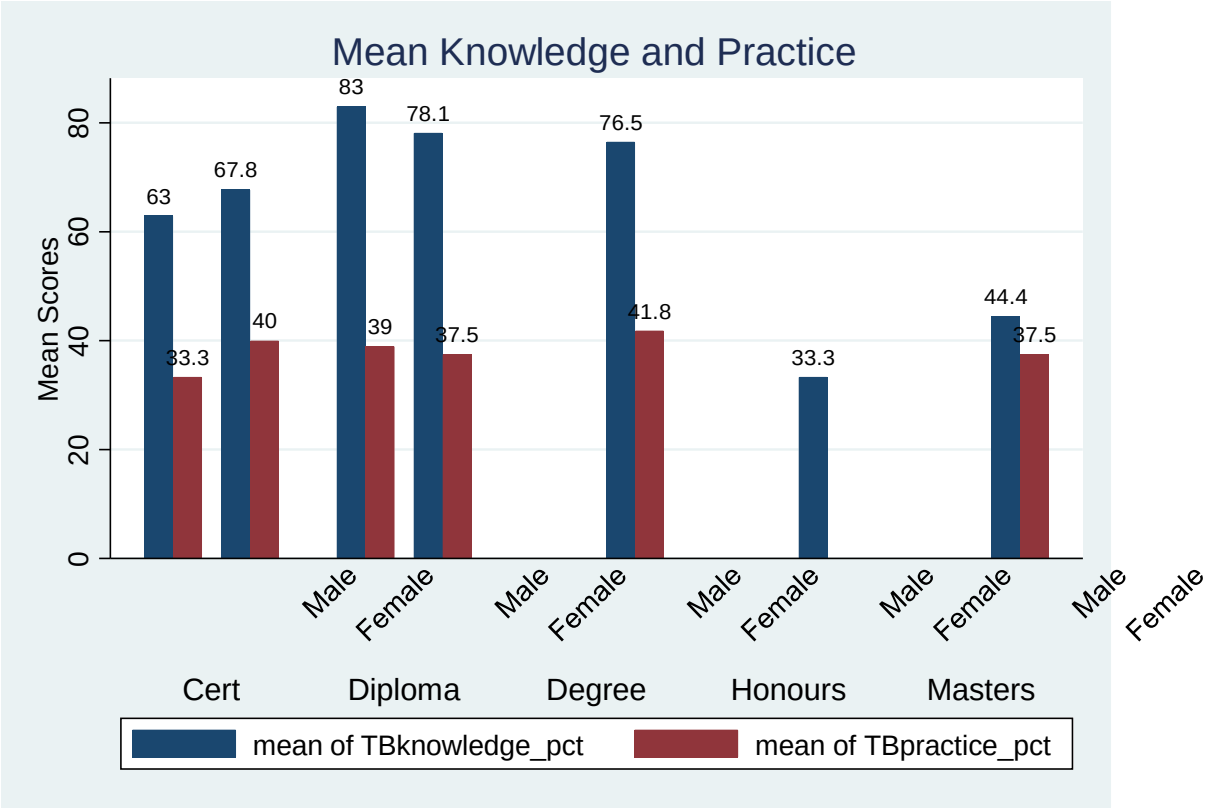

Figure 4.9: Bar chart showing comparison of knowledge and practice based on highest level of qualification

Figure 4.9 shows the mean knowledge and practice scores for male and female respondents based on their highest qualification. Mean knowledge for both female and

male respondents was generally good. However, mean practice scores for both male and female respondents were lower than 50% in all levels of qualification. Higher levels of qualification were not associated with good practice. In a study by (Adegboye, Zakari, Ahmed and Olufemi, 2018:72), adherence to the prevention of nosocomial infection was poor despite the good knowledge demonstrated by the HCP. It can therefore be concluded that good knowledge does not influence good practice.

4.9.5 Knowledge and practice by years of experience

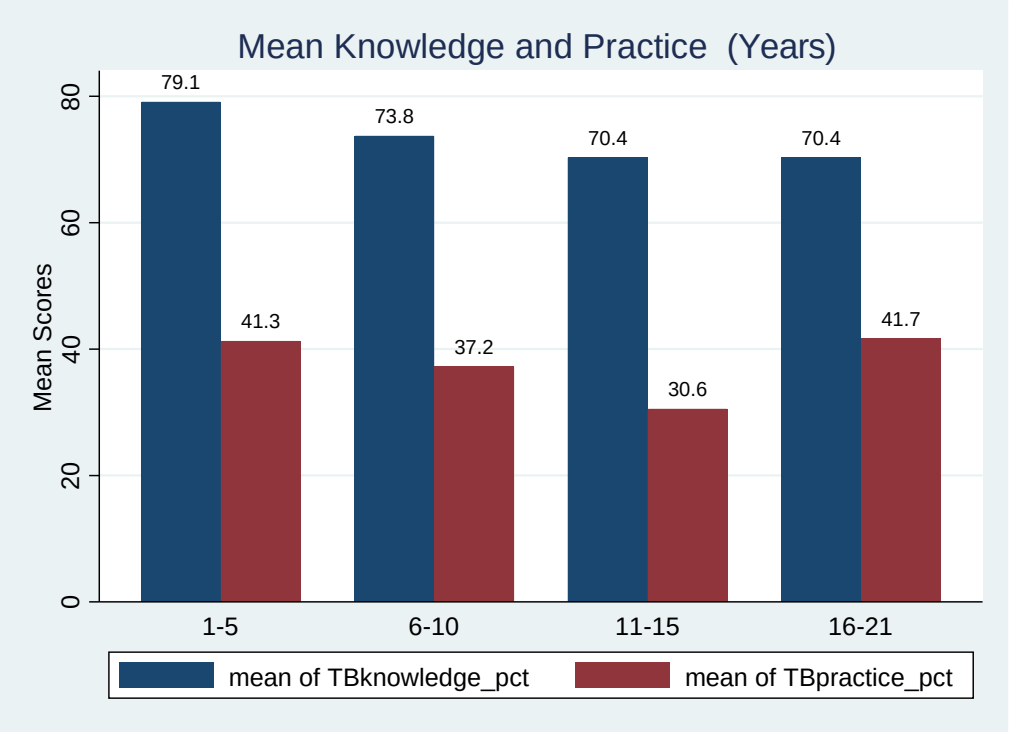

Figure 4.10: Comparison of knowledge and practice by years of experience

There was a significant relationship between mean knowledge and practice and the years of experience. Analysis revealed that years of experience was not associated with good knowledge. Higher level of knowledge was observed in the group of HCP with <=5 years' experience, compared to the ones who had worked for 16-21years. The mean practice was low in all the groups and none had a score =>50%. It was evident that HCP with lower experience were more knowledgeable compared to their counterparts with more years of experience. This could be identified as an educational need that has to be addressed in professional and skills development programmes. It

is therefore recommended that the institution should have regular educational programmes on infection control for all HCP. The same recommendations were suggested by (Adegboye et al., 2018:73).

4.9.6 Knowledge and practice based on age category and highest level of qualification

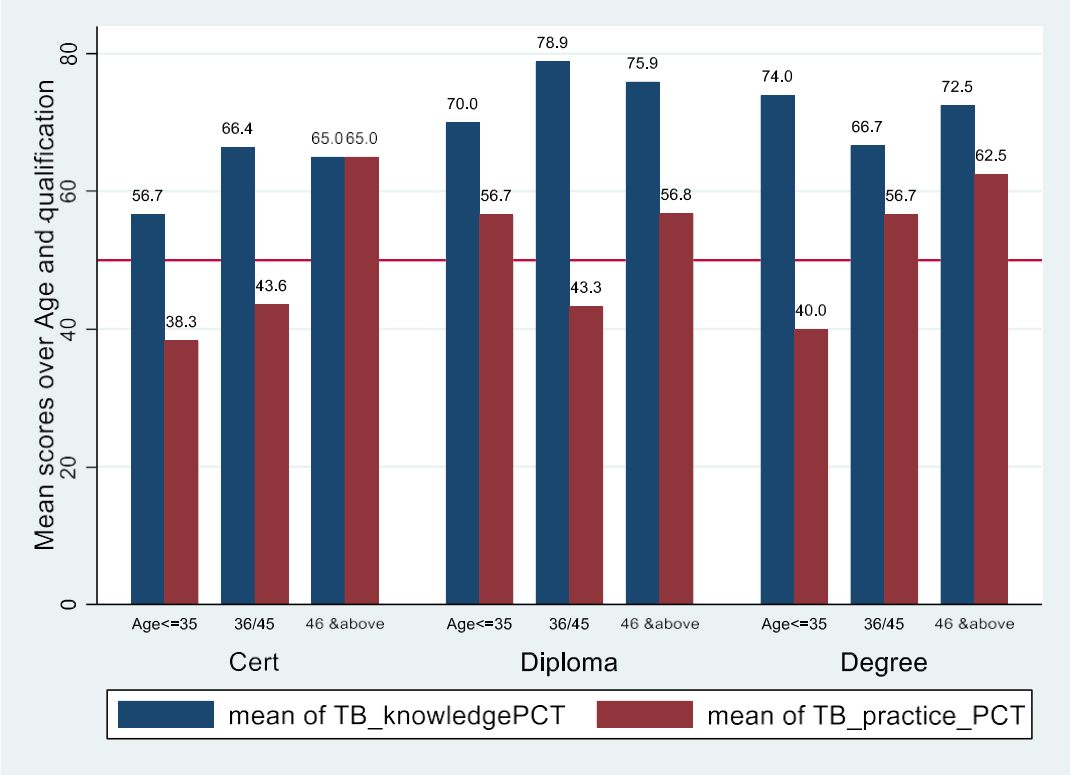

Figure 4.11: Mean knowledge and mean practice between age and professional qualification

Figure 4.11 presents the knowledge and practice scores by age group and degree demonstrating the groups that scored above 50%.

It was observed that only respondents who were 46 and older in the certificate group scored above 50% on practice. In the diploma group, those in the 36-45 age group scored less than 50% while those who are younger than 35 years with a degree scored less than 50%.

Generally, there is no evidence to demonstrate that there is any association between knowledge and practice. There is evidence to show that knowledge of practice increases with age. Respondents in the age category older than 46 years demonstrated higher levels of practice compared to the lower age categories. It is noted in this sample that the respondents in the age category older than 46 years were constant in practice, scoring above 50%.

There should be a regular system to monitor infection control practices as well as disseminating information which will serve as a guide to HCP (Loveday, Wilson, Pratt, Golsorkhi, Tingle, Bak et al., 2014:70).

4.10 CONCLUSION

The objectives were highlighted to guide in the result analysis. A brief description of the data collection method showed that more than 50% of the questionnaires distributed were returned. A highlight on the instrument revealed that the objectives of the study were captured in the instrument.

In this chapter, a summary of the results that emerged from the conducted study among 102 HCP in Gauteng, South Africa, was described. Data analysis provided for descriptive and inferential statistics to describe each variable and the dimensions that constitute the variable. The knowledge and practices of HCP regarding TB infection prevention and control at the workplace were described, and focus was placed on findings of statistically significant value.

Results revealed that HCP generally displayed good knowledge about TB infection prevention and control. However, practice was not good in general. Certain knowledge gaps that form part of infection control measures were identified, such as not knowing that UV lights kill bacteria and that the infection control measures are required to protect them at their workplace. HCP's practice towards TB and infection control measures were less favourable although they felt adherence to infection control measures were important and they wanted to be trained on TB infection control.

However, a minority of HCP indicated that they would seldom wear a respirator. A large proportion of HCP were worried about getting TB, yet poor adherence to infection control measures were identified.

In the following chapter, a discussion of the results as well as the limitations of the study, its conclusion and recommendations, are addressed.

CHAPTER 5

REVIEW OF FINDINGS, RECOMMENDATIONS, IMPLICATIONS, LIMITATIONS AND CONCLUSION

5.1 INTRODUCTION

Despite successes such as a general decline in TB rates, a marked geographic variation in TB case rates persists, rendering the HCP in different areas, including South Africa, at risks (World Health Organization, 2014:11). Since HCP are still at an increased risk of TB transmission (Churchyard, Kim, Shah, Rustomjee, Gandhi, Mathema et al., 2017:29), ongoing infection control measures need to be adhered to. These infection control measures can prevent HCP from contracting TB.

Findings regarding the data collection instrument as well as findings according to the variables are discussed in this chapter. For each of the variables, knowledge and practice comparisons were made according to respondents' regularity of exposure to TB patients, current work setting, the duration of employment in the current work setting, attendance of TB infection control training, and adherence to infection control measures. The data collection instrument's reliability efficiency was 0.7935. Cronbach's alpha determines the internal consistency or average correlation of items in a survey instrument to gauge its reliability (Granato et al., 2014). A good or excellent strength of association is a Cronbach's α coefficient ≥0.60.

Results and their interpretations were presented in the previous chapter. In this chapter the conclusions, recommendations, implications and limitations of the study are discussed based on the research findings in Chapter 4. The conclusions and recommendations are presented chronologically according to the specific sections and research objectives of the research instrument used.

The aim of the study was to determine HCP's knowledge and practices regarding protective wear on TB prevention in Gauteng province. The research objectives were:

- to describe HCP's knowledge regarding protective wear on TB prevention in Gauteng province; and
- to describe HCP's practices regarding the protective wear on TB prevention in Gauteng province.

5.2 DATA COLLECTION INSTRUMENT

The study followed a quantitative approach to collect data. Data were collected by means of a self-administered questionnaire, as described in Chapter 3. The researcher chose this method for data collection based on scientific evidence as returns were immediate, and costs were low. The respondents had privacy and it provided time for them to think before they answered (Polit and Beck, 2008b:290).

5.2.1 Section A: Demographic information of the respondents

The majority of the respondents were female (77%) (See Section 4.3). Respondents in the age group of 35 years and younger formed the largest group. The younger group of respondents demonstrated good knowledge of TB prevention and had higher qualifications compared to the older group.

The majority (53.5%) of respondents were married, and 43.5% were single. Almost all the respondents had dependents; 72.9% had 3 or less, while 27.1% had more than 4 dependents. Of the respondents, 58.8% used their own transport to work while 41.2% used public transport. The nursing category formed the majority of the respondents (60.3%,13.9% and 9.9%), with registered nurses as the majority of respondents. Of the sample, 46.1% had a diploma qualification. Their years of experience ranged from 2-21 years, and the majority of the respondents (48.0%) had between 6-10 years' experience. The larger proportion of the HCP (76%) did not attend any TB infection prevention control training. According to HCP's responses, TB infection prevention control training was never offered at the facility.

Each facility should appoint one person to serve as the infection control officer. Larger facilities may also have a committee. The officer is responsible for overseeing the infection control committee and developing a written infection control plan, monitoring its implementation, and providing effective training for healthcare workers and other staff.

5.2.2 Section B: Knowledge of healthcare personnel regarding TB infection control policies

HCP's knowledge pertaining to the infection prevention and control guidelines was generally good as they scored more than 75% for seven of the ten questions (See Table 4.2). Educating and training HCP about TB prevention in the workplace was emphasised. Policies can be developed, but without educating the users, who are the HCP, implementation is unlikely. HCP in this sample displayed better knowledge regarding the infection prevention and control guidelines compared to HCP involved in other South African studies. In a study involving drug-resistant TB conducted by (Farley, Tudor, Mphahlele, Franz, Perrin, Dorman et al., 2012:82), only 66% of HCP could identify infection control measures that were designed to prevent TB transmission in health facilities.

Despite a larger proportion of the sample displaying good knowledge across most questions, HCP demonstrated knowledge gaps regarding the TB bacteria that can remain viable in the airspace waiting area. The elements of education should include the prevention and pathogenesis of TB. It is imperative for the HCP to be trained on and to understand TB transmission as transmission is invisible. As this measure of infection control is important in the protection of both HCP and patients, more emphasis is needed on improving awareness of the transmission of TB in healthcare settings, as well as its prevention.

Knowledge about signs and symptoms of TB is necessary in order for HCP to implement administrative control measures such as separating presumptive TB patients from the general waiting area (The World Health Organization, 2009:7). A risk

of TB transmission occurs when symptomatic TB patients and infectious TB patients are not timeously identified and separated from the general waiting areas. This may directly impact on HCP as they may be at risk of contracting TB from infectious patients in the waiting areas when giving educational talks to patients.

The majority of the HCP demonstrated a knowledge gap regarding the function of N95 respirators and a mask. This was shown by a significant number of HCP who were not sure if they should wear a mask when attending TB patients. The N95 respirator can filter minute particles, rendering protection against the TB bacilli. However, a mask only acts as a barrier to reduce the distance that exhaled air can travel. It does not offer protection for inhaled particles. However, in another sub-Saharan country, HCP demonstrated poorer knowledge regarding N95 respirators (Temesgen and Demissie, 2014). Training HCP on the function of N95 respirators could promote its use and potentially decrease the TB transmission risk among HCP.

Most HCP in this study displayed good knowledge, although some critical areas of poorer knowledge were also identified, similar to other national and international studies (Bhebhe et al., 2014:6; Irani, Shahraki, Ghaderi and Nasehi, 2015:8). Narrowing the critical knowledge gaps could benefit the HCP by increasing their awareness of infection control measures that could protect them from contracting TB.

5.2.3 Section C: Practice of healthcare personnel regarding TB infection control policies

HCP's good practice was measured regarding the TB infection control guidelines available in the facility in Section B of the questionnaire. The section consisted of 10 questions with answers that required the respondents to tick the right answer and offer written responses and recommendations.

According to the guidelines for infection prevention and control, sputum collection should be done in well-ventilated areas. In this study, 22% of the respondents reported that they collected sputum in the ward (See Table 4.3).

Most of the respondents (72%) reported spending time with coughing patients most of the time during their working hours. However, less than 50% reported using respirators while attending to TB patients. Respirators were not used despite the HCP being concerned about contracting TB. The practice of correct infection prevention and control guidelines was thus suboptimal.

The respondents in this sample agreed that it is not true that HCP are immune to TB infection, although 8.8% were not sure (See Table 4.3). Almost all the respondents agreed that training improves practice (63.2%). The other 13.6% (n-13) did not agree and 23.2% (n-22) were not sure.

Less than 50% of the HCP knew and reported that their healthcare facility had a strong infection control policy and 20% were not sure if the policy existed. Of the respondents, 31.6% (n-30) indicated that the facility did not have an infection control policy in place. Close to 50% of the HCP reported that they close windows at night because of the cold weather, while a few did not close the windows (39.4%, n-35). The HCP were requested to offer suggestions on improving their knowledge and practice towards infection prevention and control. These suggestions were summarised in Table 4.4. Hindrances that affect the HCP's knowledge and practice of effective infection control were provided by the respondents. These options are summarised in Table 4.5.

5.3 ASSOCIATION BETWEEN VARIABLES

5.3.1 Associations between knowledge and practice

Associations between the HCP's knowledge and practice was determined. In this study, knowledge was not significantly associated with practice. However, good knowledge was significantly associated with the level of education. HCP with higher levels of qualification demonstrated good knowledge, but poor practice. Good practice increased with age, since older HCP demonstrated better practice compared to the younger HCP.

Practice towards TB infection control measures was less favourable although they knew that adherence to infection control measures was needed. Emphasis on training regarding the implementation of the infection prevention and control guidelines cannot be overlooked. However, a minority of HCP indicated that they do not always wear N95 respirators. A large proportion of HCP were worried about getting TB, although there was poor adherence to infection control measures.

5.4 RECOMMENDATIONS

5.4.1 Recommendations regarding training of healthcare personnel

- In-service TB infection control training for all HCP needs to be an ongoing activity and should be documented.
- The HCP's employers and managers need to take responsibility and accountability for the welfare of their employees. Specifically, they should ensure that all HCP are familiar with infection prevention and control guidelines.
- The elements of training should emphasise awareness of the risks that HCP are exposed to.
- HCP should be aware of the shared responsibility of TB prevention that is between the employees and the employer.
- Innovative means of sharing information should be used, such as self-disclosure by affected staff.
- HCP with a personal diagnosis of TB should share their experiences.

5.4.2 Recommendations regarding infection control practices

- Renewed commitment by managers at health facilities is needed to periodically train HCP on TB infection control as recommended by the WHO and the Department of Health.
- A culture of adherence to infection control measures should be created through managers leading by example and adhering to infection control measures, and also

motivating their staff to adhere to infection control measures. Managers should be informed of their critical role in actively supporting adherence and communicating its importance to the HCP team on a regular basis. Managers should have a stance of prioritisation of TB infection control measures to help ensure that policies translate into practice.

- Findings of this study should be disseminated to managers at healthcare facilities to increase their awareness of knowledge and practices of TB infection prevention and control policies. These reports to policymakers and national authorities should ultimately translate into better designs for improved policies for HCP regarding nosocomial transmission. Commitment by the policymakers is crucial.
- Poor infection control practices exist among HCP in South Africa (Ntambwe et al., 2015; Engelbrecht and Van Rensburg, 2013; Claassens et al., 2013; Tshitangano, 2014; Zelnick, Gibbs, Loveday, Padayatchi and O'donnell, 2013; Kanjee, Amico, Li, Mbolekwa, Moll and Friedland, 2012b). It is imperative for healthcare facility managers to insist on and advocate for the implementation of policies.

5.4.3 Recommendations regarding research needs

This study identified the need to review available guidelines to create a simple policy that would be accessible and understood by the HCP.

- Assessment of the impact of pre- and post-training programmes on the implementation of TB infection control policy is required. Evaluation should be direct observations of HCP's adherence to infection control measures in the workplace, rather than self-reporting.
- Future studies should investigate the availability of resources at all health facilities in South Africa. Studies should also look into strategies or interventions that can enhance the effectiveness of the infection prevention and control policies.
- It is recommended that a similar study be conducted in other provinces of South Africa to gain a more comprehensive picture of the knowledge and practices of HCP.

- There is a need to investigate the non-adherence to personal protective equipment such as not wearing the N95 respirator when attending to patients in general.
- The role of the infection control officer should be explored to determine the form of training and skills that they have, and to determine the time allocated to infection control duties.

5.5 LIMITATIONS OF THE STUDY

This study assessed the knowledge and practices of all categories of HCP in infection prevention and control at one regional hospital, which may limit the generalisation of the findings to other regional hospitals in South Africa. Different results could have been realised if the study was conducted in all facilities in Gauteng. Additional questions could have been included in the survey to provide added valuable information. However, the questionnaire would take too long to complete.

Additional questions, such as the availability of the N95 respirators, could have provided insight into the correct measures being taken. The question could also confirm whether the N95 respirator was “fit-tested”.

The study relied on self-reporting of practices, which may have resulted in findings that do not reflect actual behaviour. Despite its limitations, the results of this study hold several implications for HCP working in South Africa.

5.6 CONTRIBUTION TO BODY OF KNOWLEDGE

The study highlighted the extreme importance of regularly conducting surveys to determine overall weaknesses in the implementation of infection control measures in healthcare settings. Results could be used to improve infection control practices in the field of healthcare. Obtained data can also be used to compare the standard of infection control in South Africa to the rest of the world. The importance of the results can be used as a monitoring indicator.

5.7 FINAL CONCLUSION

This study aimed to determine the knowledge and practices of HCP regarding TB protective wear in healthcare settings. The discussions were guided by the objectives of the study. A quantitative, non-experimental, descriptive survey was conducted to collect data from HCP with at least two years' experience.

The researcher set out to determine the HCP's knowledge and practice regarding protective wear in the workplace. The outcomes as described in this chapter indicated that, in general, good knowledge and poor practice towards TB infection control existed among the majority of respondents. Critical knowledge gaps and poor practice were, however, identified and should be addressed. Poor adherence to infection control measures was also revealed through the results of this study.

Healthcare facilities should provide TB infection control training as per WHO recommendations. Healthcare facilities should also provide the necessary resources for the implementation of infection control measures. However, the responsibility of adhering to infection control measures also rests on each individual HCP, and training on TB and infection control may positively influence their practices. Further research, validation of a KAP tool and regular KAP studies to monitor trends, even at undergraduate levels, may be valuable to create more awareness about the risks of TB transmission and the importance of adhering to guidelines since South Africa has a high burden of TB disease.

The value of regular and refresher training for the HCP on TB and infection control measures cannot be overstated as it may contribute to improved adherence. Ultimately, adherence to infection control measures may improve the wellbeing of HCP by decreasing their anxiety about, and risk of, contracting TB in the workplace.

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ANNEXURE 1: QUESTIONNAIRE

UNIVERSITEIT VAN PRETORIA
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Faculty of Health Sciences

QUESTIONAIRE

TITLE: PROTECTIVE WEAR ON TB PREVENTION: KNOWLEDGE AND PRACTICES OF HEALTH CARE PERSONNEL IN GAUTENG PROVINCE

Respondent Number ☐☐☐

Section A: Demographic data

1.	**Q1_Sex**	**Sex**	**1 Male** ☐	**2 Female** ☐
2.	**Q2_Age**	**How old are you?**	**____Years**	
3.	**Q3_Marital_Status**	**Marital Status**	**1. Married** ☐ **2. Single** ☐ **3. Divorced** ☐	**4. Widowed** ☐ **5. Separated** ☐ **6. cohabiting** ☐

4.	Q4_Number_Dependents	Number of dependents	☐
4.1	Q4.1 Ages _Dependents	List the ages of your dependents	☐ ☐
5.	Q5_Transport	How do you get to work?	Public transport ☐ Own transport ☐
6.	Q6_P_Qualification	Professional Qualification	1. Registered Nurse ☐ 2. Enrolled Nurse ☐ 3. Enrolled Nurse Assistant ☐ 4. Doctor ☐ 5. Radiographer ☐ 6. Pharmacist ☐ 7. Pharmacist Assistant ☐ 8. Physiotherapist ☐
7.	Q7_H_level_Education	Highest level of Education	1. Certificate ☐ 2. Diploma ☐ 3. Degree ☐ 4. Honours ☐ 5. Masters ☐ 6. PHD ☐
8.	Q8_Yrs_Work	How long have you been working in this facility	_____Years _____Months

9.	**Q9_Curr_Joblocat**	**Current Job location**	**1. OPD** ☐ **2. Wards** ☐ **3. Laboratory** ☐ **4. Pharmacy** ☐ **5. Radiology** ☐ **6. Physiotherapy** ☐ **7. N/A** ☐
10.	**Q10_Prev_Joblocat**	**Previous Job location**	**1. OPD** ☐ **2. Wards** ☐ **3. Laboratory** ☐ **4. Pharmacy** ☐ **5. Radiology** ☐ **6. Physiotherapy** ☐
11	**Q11_Yrs_PrevJoblocat**	**Number of years at previous Job location**	☐ **Years**
12.	**Q12_Training_TBMx**	**Have you done training on TB Management**	**1. Yes** ☐ **2. No** ☐
12.1	**Q12.1_Training_Duration**	**If yes, duration of Training:**	**_____Days** **_____ Weeks** **_____Months**

_____ Years

13	Q13_Lth_TBMx_Training	How often do you do TB infection control and TB management training?	Quarterly	☐
			Annually	☐
			Never	☐

Section B Knowledge of TB Infection Control Policies

(This section tests your knowledge and understanding about the TB Infection Control)

14.	Q14_Facility_TBICC	Every facility should establish an Infection Control Committee *(Ü one box)*	1. Yes	☐
			2. No	☐
			3. Not sure	☐

15.	Q15_HCP_TB Reason	What is the main reason a HCP develops TB disease *(Please Üthe appropriate box(s))*		
15.1		Spending more time with TB clients in the clinic Yes	1. Yes	☐
			2. No	☐
			3. Not Sure	☐
15.2		Not wearing a respirator when attending to the TB clients	1. Yes	☐
			2. No	☐
			3. Not Sure	☐
15.3		Wearing a mask when attending to the TB clients	1. Yes	☐

2. No ☐

3. Not Sure ☐

16. Q16_TB_ProtectMeasures — Which of these measures that protect Health Care Personnel from TB infection is done at your workplace? *(PleaseÜthe appropriate box(s))*

☐ 1.Training of the health care personnel to identify early TB infection

☐ 2. Medical surveillance program

17. Q17_TBI_Reduce — How can a HCP reduce chances of getting TB in Hospital or outpatient clinic *(PleaseÜthe appropriate box(s))?*

17.1	Offer masks to coughing patients and other symptomatic persons upon entry to the facility	1. Yes 2. No 3. Not Sure	☐ ☐ ☐
17.2	Wear appropriate personal protective equipment	1. Yes 2. No 3. Not Sure	☐ ☐ ☐
17.3	Open window/door to keep a ventilated working space	1. Yes 2. No 3. Not Sure	☐ ☐ ☐
17.4	Isolate patients with suspected TB from other patients	1. Yes 2. No 3. Not Sure	☐ ☐ ☐

18. Q18_TBIC_Parts — What are the parts of infection control program designed to prevent TB transmission in the health care facility?

1._____

2._____

3._____

19. Q19_TBIC_Environmental Tick the most important environmental control measure to reduce TB transmission in the health care setting.

☐ 1. Assigning someone the responsibility and authority for TB infection control in the health-care setting.

☐ 2. Conducting a TB infection control risk assessment of the setting.

☐ 3. Using natural ventilation (e.g., open doors, windows).

☐ 4. Using mechanical ventilation equipment to circulate and move air in a building.

20. Q20_TBIC_Administration Tick the most important administrative control measures to reduce TB transmission in the health care setting.

☐ 1. Assigning someone the responsibility and authority for TB infection control in the health-care setting.

☐ 2. Conducting a TB infection control risk assessment of the setting.

☐ 3. Using natural ventilation (e.g., open doors, windows).

☐ 4. Using mechanical ventilation equipment to circulate and move air in a building.

21	Q21_TBI_UVreduce	Do you believe that UV lights can minimise TB transmission at the facility? Provide reason for your answer: _____ _____	1. Yes 2. No 3. Not Sure	☐ ☐ ☐
22	Q22_TBBacteria	TB bacteria that is exhaled into the airspace can remain viable for about 30 minutes.	1. True 2. False 3. Not Sure	☐ ☐ ☐

Section C: TB Infection Control Practices

(This section evaluates the HCP practices regarding the Infection Control guidelines)

23.	Q23_Sputumcollect_Ward	What proportion of your shift/day do you collect sputum in the ward	1=never 2=almost always 3=10% of the time 4=25% of the time 5=50% of the time 6=75% of the time	☐ ☐ ☐ ☐ ☐ ☐
24.	Q24_Time_Coughpt	What proportion of your shift/day is spent in a room/ward with coughing patients	1=never 2=almost always 3=10% of the time 4=25% of the time	☐ ☐ ☐ ☐

			5=50% of the time	☐
			6=75% of the time	☐
25.	Q25_TBcare_Respirator	What proportion of your day/shift caring for TB patients do you wear a respirator?	1=never 2=almost always 3=10% of the time 4=25% of the time 5=50% of the time 6=75% of the time	☐ ☐ ☐ ☐ ☐ ☐
26.	Q26_TeachPt_CoughEtiquette	What percentage of your time do you teach patients respiratory etiquette/cough hygiene?	1=never 2=almost always 3=10% of the time 4=25% of the time 5=50% of the time 6=75% of the time	☐ ☐ ☐ ☐ ☐ ☐
27.	Q27_TBIP_Necessary.	Most nurses and doctors have already been infected with TB, so prevention measures are not necessary.	1. True 2. False 3. Not Sure	☐ ☐ ☐
28.	Q28_TBIClearning_Improvement	My infection control practice has greatly improved since learning TB infection and prevention.	1. True 2. False 3. Not Sure	☐ ☐ ☐

29.	**Q29_TBI_Worry.**	**I am very worried about being infected with TB.**	**1. True** **2. False** **3. Not Sure**	☐ ☐ ☐
30.	**Q30_WearTBRespirator_Sometimes**	**I sometimes do not wear a respirator even when I know I should.**	**1. True** **2. False** **3. Not Sure**	☐ ☐ ☐
31.	**Q31_TBICP_Available**	**Our hospital has strong infection control policy.**	**1. True** **2. False** **3. Not Sure**	☐ ☐ ☐
32.	**Q32_Closewindows_whencold**	**I close the windows at night because cold air will make the patients sicker.**	**1. True** **2. False** **3. Not Sure**	☐ ☐ ☐

33. Q33_Answer Give 4 suggestions that you consider will assist in improving Knowledge and Practice of the Health Care Personnel:

1._____

2._____

3._____

4 _____

34. Q34_Answer. List 4 hindrances that affect Knowledge and Practice of effective infection control by the Health Care Personnel:

1._____

2._____

3._____

4._____

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ANNEXURE 2: CONSENT FORM

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Faculty of Health Sciences

- Informed consent form –

TITLE: PROTECTIVE WEAR ON TB PREVENTION: KNOWLEDGE AND PRACTICES OF HEALTHCARE PERSONNEL IN GAUTENG.

INTRODUCTION

Good day, my name is **Sikhethiwe Masuku** and I am a student with the University of Pretoria. Tuberculosis is one of the nosocomial infections that affect many health care personnel in the work environment. We want to know what employees understand about Tuberculosis prevention and control policies that safeguard their welfare. We also want to know your thoughts regarding the implementation of these prevention and control policies at your work environment.

PROCEDURES

We are asking facility personnel to answer questions about what they know about TB prevention and control. We will also ask you about your opinion about TB prevention and control policies available at your work environment. If you agree to participate, we will give you a form with questions relating to your knowledge, practice and your opinion regarding the TB prevention and control policies. It takes you about 20 minutes to complete the form. The answers and information you give us will not be shared with anyone at this facility, including your supervisors, and are for the study only. After you have completed the questionnaire, we

will use this information to evaluate the knowledge and the practices on TB infection prevention and control at this facility.

RISKS AND BENEFITS

There are no health risks to joining the study, or any direct benefits to you either. The benefit of joining the study is that you will help us better understand how to improve practice and adherence to policies that safeguard your welfare. We have spoken with the facility managers and supervisors, and they know that you are being asked to participate in this study and they have allowed you to take the time to participate. They will not see the answers you give us.

VOLUNTARY PARTICIPATION

You do not have to agree to be in this study. If you do not want to join the study, it will not affect your job at this facility. And, if you do participate, your job will not be affected by your time or your answers.

If you have any questions about your rights as a research participant, or if you think you have not been treated fairly, you may contact the following people:

For questions about this study or a research- contact:

Sikhethiwe Masuku
Tel: 012 339 8654

ETHICAL APPROVAL

This study protocol has been submitted to the University of Pretoria Ethics Committee and written approval has been granted by that committee. The study has been structured in accordance with the Declaration of Helsinki (last updated: October 2013) which deals with the recommendations guiding doctors in biomedical research involving human participants. A copy may be obtained from me should you wish to review it.

If you want any information regarding your rights as a research participant, or have complaints regarding this research study, you may contact:

Enquiries The Research Ethics Office: Tel: 012 356 3084 or 012 356 3085

This independent committee is established to help protect the rights of research respondents and gave written approval for the study protocol.

STATEMENT OF CONSENT AND SIGNATURES

I have read this form or had it read to me. I was able to discuss the information with study staff. I understand that my decision whether or not to take part in the study is voluntary. I understand that if I decide to join the study I may withdraw at any time.

If you have read this consent form (or had it explained to you), all your questions have been answered, and you agree to take part in this study, please sign your name below.

Respondent (Print Name & Surname	Responded Signature	Date Time	
Study Staff conducting consent discussion (Print Name & Surname)	Responded Signature	Date Time	

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ANNEXURE 3: APPROVAL LETTER FROM FACULTY POSTGRADUATE STUDIES COMMITTEE, UNIVERSITY OF PRETORIA

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Faculty of Health Sciences

22 March 2017

Faculty Ethics Committee
Faculty of Health Sciences
University of Pretoria

To whom it may concern,

Evaluation of protocol for the following student:
Student S Masuku (MCur) 10660519
ASSESSMENT OF KNOWLEDGE AND PRACTICES OF HEALTH CARE PERSONNEL REGARDING THE PROTECTIVE WEAR USE ON TB PREVENTION IN GAUTENG PROVINCE

This letter serves to confirm that the abovementioned protocol was resubmitted and approved following the School Postgraduate meeting of 15 March 2017 and referred to the School Academic Advisory Committee and Faculty Ethics Committee for final discussion.

Sincerely yours,

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ANNEXURE 4: ETHICS APPROVAL LETTER FROM THE ETHICS COMMITTEE, UNIVERSITY OF PRETORIA

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Faculty of Health Sciences Research Ethics Committee

28/06/2018

Sikhethiwe Masuku
Department of Nursing Science
University of Pretoria

Dear Sikhethiwe Masuku

RE.: 133/2017 ~ Letter dated 14 May 2018

133/2017 Masuku	
Study Title	PROTECTIVE WEAR ON TB PREVENTION: KNOWLEDGE AND PRACTICES OF HEALTHCARE PERSONNEL IN GAUTENG.
Principal Investigator	Sikhethiwe Masuku Tel: 062 089 5701 Email: sikhethiwe.masuku@mrc.ac.za Dept: Nursing Science

We hereby acknowledge receipt of the following document:

- Extension until end of 30 December 2019

which has been approved at 27 June 2018 meeting.

With regards

Dr R Sommers; MBChB; MMed (Int); MPharMed; PhD
Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria

012 356 3085 **fhsethics.up.ac.za** http://www.up.ac.za/healthethics
Private Bag X323, Arcadia, 0007 - Tswelopele Building, Level 4-59, Gezina, Pretoria

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ANNEXURE 5: LETTER OF APPROVAL FOR GAUTENG PROVINCE

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

Enquiries: Dr. Lufuno Razwiedani
Tel: +27 12 451 9036
E-mail: lufuno.razwiedani@gauteng.gov.za

TSHWANE RESEARCH COMMITTEE: CLEARANCE CERTIFICATE

MEETING: 03/2017
PROJECT NUMBER: 78/2017
NHRD REFERENCE NUMBER: GP_2017RP45_573

TOPIC: PROTECTIVE WEAR ON TB PREVENTION: KNOWLEDGE AND PRACTICES OF HEALTHCARE PERSONNEL IN GAUTENG.

Name of the Researcher:	Sikhethiwe Masuku
Name of the Supervisor:	Prof M D Peu and Dr RS Mogale
Facility:	Steve Biko Academic Hospital and Mamelodi Tertiary Hospital
Name of the Department:	South African Medical Research Council

NB: THIS OFFICE REQUEST A FULL REPORT ON THE OUTCOME OF THE RESEARCH DONE AND

NOTE THAT RESUBMISSION OF THE PROTOCOL BY RESEARCHER(S) IS REQUIRED IF THERE IS DEPARTURE FROM THE PROTOCOL PROCEDURES AS APPROVED BY THE COMMITTEE.

DECISION OF THE COMMITTEE: APPROVED

.....
Dr. Lufuno Razwiedani
Chairperson: Tshwane Research Committee
Date: 04/10/2017

.....
Mr. M. Makhudu
Acting Chief Director: Tshwane District Health
Date: 4/10/2017

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ANNEXURE 6: EDITING CERTIFICATE

Between the lines editing

Leatitia Romero
Professional Copy-Editor, Translator and Proofreader
(BA HONS)

Cell: 083 236 4536
leatitiaromero@gmail.com
www.betweenthelinesediting.co.za

14 January 2019

To whom it may concern:

I hereby confirm that I have edited the thesis of SIKHETHIWE MASUKU, entitled: "PROTECTIVE WEAR ON TB PREVENTION: KNOWLEDGE AND PRACTICES OF HEALTHCARE PERSONNEL IN GAUTENG". Any amendments introduced by the author or supervisor hereafter, is not covered by this confirmation. The author ultimately decided whether to accept or decline any recommendations made by the editor, and it remains the author's responsibility at all times to confirm the accuracy and originality of the completed work.

Leatitia Romero
(Electronically sent – no signature)

Affiliations

PEG: Professional Editors Group
English Academy of South Africa
SATI: South African Translators' Institute
SfEP: Society for Editors and Proofreaders