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**EVALUATION OF N95 RESPIRATOR MASK COMPLIANCE IN A SELECTED
HOSPITAL IN KWAZULU-NATAL.**

**A RESEARCH STUDY SUBMITTED IN PARTIAL FULFILMENT OF THE
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UNIVERSITY OF KWAZULU-NATAL

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MANAGEMENT**

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DECLARATION

I, Zandile Benedictor Mbele, declare that this research report work is my own work. It is submitted for the degree of Master of Nursing at the University of KwaZulu-Natal. This study has not been submitted previously for any degree or examination at this or any other University.

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DEDICATION

I dedicate this dissertation to my late mother Baliwe Angeline Mbele who supported me until the end and who passed away on 8th of August 2015

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I thank the respondents who participated in this study for their time taken to participate, and my supervisor, Doctor Jane Kerr for her support and guidance.

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ABSTRACT

Introduction

Airborne infection control strategies to prevent *Mycobacterium tuberculosis* (*M. tuberculosis*) transmission have long been a neglected component of tuberculosis (TB) control programmes. The challenges facing health care workers (HCWs) are that of occupational acquired TB and human immunodeficiency virus (HIV). The emerging infectious diseases such as blood borne viruses and HIV in recent years have created new challenges for all HCWs including students who may be interacting with infected patients and clients during their clinical exposure. Microbes transmitted by airborne droplets or contact routes often generate anxieties and fears of being infected among HCWs and students particularly when placed in units having high risk patients/clients.

Objectives of the study

The study objectives were threefold: To evaluate the level of N95 respirator mask compliance among HCWs in the selected hospital; to determine the perceived barriers to compliance regarding the use of the N95 respirator masks by the HCWs of the selected hospital. To evaluate compliance with infection prevention and control policy, and administration and environmental control strategies related to N95 respirator masks in the selected hospital.

Method

A quantitative, non-experimental and descriptive design was used to conduct the study. A sample of 280 HCWs working in the selected institution met the inclusion criteria for this study. 98.5 % (n=276) were nurses and 1.5% (n =4) were doctors. A structured questionnaire was used to collect data and the SPSS version 22 was used for data analysis.

Results

Compliance with the use of N95 respirator mask was measured and evaluated as low in the study. N = 208 (74.6%) respondents reported that they do not wear the N95 respirator mask as a habitual inclination. N = 204 (72.9%) respondents reported that there was no respiratory protection programme in the institution. N = 270 (92.6%) respondents reported they were not medically evaluated before being permitted to wear the N95 respirator mask and N = 270

(96.4%) respondents reported that they were not fit tested. Barriers to the use of the N95 respirator masks included the unavailability of the N95 masks in the facility, high environmental temperatures, unavailability of respiratory protection policies, and that the N95 mask is uncomfortable and hinders communication. Administrative and environmental measures to control TB are not available

Recommendations

It is recommended that compliance with the respiratory protection programme in the health care facilities of the province of KwaZulu-Natal as a whole be further researched in future, that N95 masks be made available, and that a respiratory protection policy is made available to the HWCs.

Key words: Compliance, HCWs, N95 respirator masks, respiratory programme, fit test, medical evaluation, and TB prevention and control.

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LIST OF ACRONYMS

AFB	Acid Fast Bacillus
CC	Compensation Commissioner
CDC	Centres for Disease Control and Prevention
DoH	Department of Health
DR-TB	Drug Resistant Tuberculosis
EHS	Environmental Health and Safety
FDA	Food and Drug Administration
HAS	Health and Safety Authority
HCAIs	Health Care Associated Infections
HCWs	Health Care Workers
HIV	Human Immunodeficiency Virus
MDR-TB	Multi Drug Resistant TB
<i>M. tuberculosis</i>	<i>Mycobacterium tuberculosis</i>
NIOSH	National Institute for Occupational Safety and Health

OHSA	Occupational Health & Safety Administration
PPE	Personal Protective Equipment
RHRU	Reproductive Health & HIV Research Unit
SA	South Africa
TB	Tuberculosis
UKZN	University of KwaZulu-Natal
UVGI	Ultra Violet Germicide Irradiation
WHO	World Health Organisation
XDR-TB	Extensively Drug Resistant Tuberculosis
KZN	KwaZulu-Natal

CHAPTER ONE: INTRODUCTION AND BACKGROUND

1.1 Introduction

Airborne infection control strategies to prevent *M. tuberculosis* transmission have long been a neglected component of TB control programmes, with grave worldwide consequences (Shenoi, Escombe & Friedland, 2010:231). HCWs in South Africa (SA) work under extremely difficult conditions as a result of challenges facing the health care system, including amongst others a shortage of HCWs across the board, an increasing population, the high burden of disease, especially HIV and TB, and deteriorating infrastructure (Zungu & Malotle, 2011:1). Some of the challenges facing HCWs include that of occupational acquired TB and HIV. TB is a major public health problem in SA requiring workplace vigilance, and is even more prevalent among HCWs co-infected with HIV (Zungu & Malotle, 2011:1). The emerging infectious diseases such as blood borne viruses and HIV in recent years have created new challenges for all HCWs, including students who may be interacting with infected patients and clients during their clinical exposure (Maja & Motshudi, 2009:14). Microbes transmitted by airborne droplets or contact routes often generate fears of being infected among HCWs and students, particularly when placed in units having high risk patients/clients (Maja & Motshudi, 2009:14).

1.2 Background

The Republic of South Africa Department of Labour (1993), in the Occupational Health and Safety Act (No. 85 of 1993, section 8(1)) obliges an employer to provide, as far as is reasonably practicable, a safe working environment. Section (13) imposes a duty on every employer to, as far as is reasonably practicable, ensure that all employees are conversant with the hazards associated with their work to their health and safety, and the precautionary measures to be taken with respect to those hazards.

The objectives of the draft national infection prevention and control policy for TB, multidrug resistant tuberculosis (MDR-TB) and extensively drug resistant tuberculosis (XDR-TB) are to:

- (i) Encourage and improve effective prevention and management of nosocomial infections for both the public and private health care industry,

- (ii) Prevent and minimise environmental hazards associated with microbes for inpatients and outpatients, HCWs and visitors of health care facilities and
- (iii) Improve the measurement of the extent of hospital-acquired infections (Republic of South Africa Department of Health (DoH), 2007:6).

The protection of HCWs from contracting health care associated infections (HCAIs) in health facilities depends on the effective implementation of the infection control programme and the correct usage of personal protective equipment (PPE) (Malebati, 2010:1). Monitoring and evaluation demonstrates the impact of programme efforts and resources on achieving programme goals, and providing managers and decision-makers at all levels with relevant information for action (World Health Organisation (WHO), 2009:47). Although all HCWs are at occupational risk of acquiring airborne infectious disease, nurses have the most risk due to their prolonged contact with patients while rendering service. Therefore, it is important that policies and procedures are in place to protect them (Adeleke, 2012:198). In 2002 - 2003 a novel corona virus caused a severe acute respiratory syndrome that began in China and spread to over 29 countries, resulting in 8.450 illnesses and 812 deaths. Twenty-one per cent of these cases were among nurses and other HCWs (Cohen & Casken, 2011:1).

The transmission of HCAIs is a major concern for most health care facilities. In Britain, 8% of patients admitted to hospitals are affected in the United States, HCAIs were the leading reportable disease in 2002 and in Canada an estimated 220,000 HCAIs occur in hospitals, leading to more than 8,000 deaths annually. These present physical, social and financial costs to patients and their families, as well as financial costs to health care systems (Williams & Camahan, 2013:28). TB in SA is grave and has worsened over the past few years (WHO, 2009:1). HCWs in SA are at the forefront of the TB epidemic and have to cope with an ever-increasing number of patients in overcrowded public health facilities, where appropriate measures to prevent the airborne transmission of the disease are mostly absent (Jarand, Shean, O'Donnell et al., 2010:1179).

HCWs contracted the novel H1N1 influenza, a pandemic virus, from undiagnosed patients with respiratory symptoms and from fellow employees who came to work sick. Even when they knew they were caring for patients with novel HINI, many HCWs did not use all of the PPE recommended (Centers for Disease Control and Prevention (CDC), 2009:85). In 11 cases of HCWs who were probably infected through transmission from their patients, none

had used all of the recommended PPE. Only one HCW, a physician, reported always wearing an N95 respirator when caring for novel H1N1 patients and the infected physician had not been fit-tested (CDC, 2009:85).

Literature cites several reasons for the quick spread of SARS that included poor compliance with the use of infection control measures, absence of infection control infrastructure, lack of education, unavailability of PPE, confusing and frequently changing infection control policies and attitudes, and behaviour of individual HCWs towards infection control measures (Cohen & Casken, 2011:1). According to Baig, Knapp, Eagan and Radanovich (2010:18), HCWs are generally poorly compliant with respiratory protection policy, especially when the N95 respirator is recommended.

In the study of Baig et al. (2010), 559 survey questionnaires were distributed to establish the HCW's views about respirator use, and to obtain recommendations for features that should be included in the next generation of respirators. Only 159 questionnaires were returned. The response rate was thus 28% and these respondents indicated that HCWs seek respirators that are more comfortable, interfere less with breathing, diminish heat build-up, are disposable and permit users to have facial hair (Baig et al., 2010:18).

According to the WHO (2013:2), in 2015 it was estimated that a billion United States Dollars (USD) would be required for the diagnosis and treatment of MDR-TB. Funding available for MDR-TB has increased from 0.5 billion USD in 2009 to 0.6 billion USD in 2011, in countries with data (representing 75%) of the estimated MDR-TB cases in the world. The cost for second line drugs alone amounts to 0.3 billion USD a year.

The true impact of drug resistant TB (DR-TB) in Sub-Saharan Africa became evident with a report from a rural hospital in KwaZulu-Natal (KZN) Province of SA, which revealed that of the 1539 individuals tested for TB, 542 had at least one culture that was positive for *M. tuberculosis* mycobacterium (Jassal & Bishai, 2009: 20). Of the 542 confirmed TB cases, 53 had extreme drug resistant (XDR-TB). Concern for nosocomial infection was triggered by findings that 26 (55%) of the 53 patients with XDR-TB had never previously been treated for TB and 28 (67%) of the 47 had reported a recent stay in the hospital before their TB diagnosis. Among factors that have fuelled this are poor infection control practices (Jassal & Bishai, 2009: 20).

A study carried out in three district hospitals in KZN of special DR-TB, revealed that while occupational health and infection control policies and procedures were in place, implementation of these policies was inconsistent. TB incidence among HCWs was 1958 per 1000 000 population in 2010 (Tudor, van der Walt, Hill & Farley, 2013:141). One hospital reported a lack of PPE, namely N95 respirators, gowns and gloves, and two hospitals reported problems with the quality of the N95 respirators received, especially non-approved respirators (sold as N95). HCWs were not coming for screening for TB and HIV, due to fears of stigma and a perceived lack of confidentiality. These hospitals nevertheless reported 23 cases in 2010 due to HCWs seeking care from somewhere else when symptomatic (Tudor et al., 2013:143).

According to Moodley, Shah, Tayob, Connolly, Zetola, Gandhi, Friedland & Sturm (2011:1), in KZN 20858 patients attending one of 73 hospitals or their adjacent clinics had cultures positive for TB. Of these, 4170 (20%) were MDR-TB cases. 443 (11%) of the MDR-TB cases displayed the XDR-TB susceptibility profile. Only 1429 (34%) of the MDR-TB patients were seen in the provincial referral hospital for treatment. The highest incidence was found in eThekwin (236.6/100 000 person yrs.) (Moodley et al., 2011:1). Causing concern is the fact that more than 65% of the MDR (including XDR) cases of culture confirmed TB did not reach the referral centre and therefore remained untreated. These large groups of undiagnosed and diagnosed but not referred cases of DR-TB form a contingent of patients whose disease is managed inappropriately. They also represent a pool of potential transmitters of DR-TB in the community or in hospitals (Moodley et al., 2011:1).

The Republic of South Africa Department of Labour, in the Occupational Health and Safety Act No. 85 of 1993, requires the development, administration and periodic re-evaluation of a respiratory protection programme in TB settings when HCWs use respirators during the management of suspected or confirmed TB positive patients. For the N95 respirator mask to give the maximum desired protection, it is essential that the wearer be trained properly on fit testing and checking procedures (Republic of South Africa Department of Labour, 1993:13).

Quality improvement includes any activities or processes that are designed efficiently and have effective service delivery, leading to better health outcomes as an ongoing and continuous process. Leaders hold managers accountable for achieving a defined set of standards, with performance objectively measured and monitored, and with clear

consequences (Marshall, 2010:7). In the national core standards for health facilities, within the domain of leadership and governance, emphasis is placed on monitoring and on the evaluation of operational plans to ensure that the health establishments are compliant with the standards set under the operational management of staff welfare and employee wellness. Emphasis is also placed on infection prevention and control, under the domain of facilities and infrastructure (Klinck, 2011:3).

Among standard precautions, the use of the PPE is a fundamental measure for preventing nosocomial infection. Compliance with N95 mask use is closely related to the professional's perception about the risks they are exposed to and their susceptibility to these risks (Neves, Souza, Medeiros, Munari, Ribeiro & Tipple, 2011:357). HCWs wearing the N95 mask will only be protected meaningfully if hospital management also act on the administrative and environmental aspects as well. The focus of infection control cannot be on HCWs alone (Gibbs, O'Donnel, Padayachi & Zelnick, 2010:516).

According to Pyrek (2011:1), although use of the N95 respirator mask is one of the best lines of protection against hazardous exposures, many HCWs either shun this protective apparel or do not wear it in an appropriate manner at the appropriate times. The survey revealed that 89 per cent of safety professionals had observed workers not wearing the required safety equipment in the workplace, with 29% indicating that it had happened several times. The observed N95 respirator mask non-compliance rates were 85% in 2006, 87% in 2007 and reached 89% in 2008. The reasons for this, as pointed out earlier, were that N95 respirator masks were uncomfortable, they limited communication, they were too hot, they did not fit well and they were not available in close proximity to the work task (Pyrek, 2011:1).

In the United States, the National Institutes for Occupational Safety and Health (NIOSH) (1999:10) created 'Protect Yourself Against TB', a respiratory protection guide for health. According to the NIOSH (2010 a:10), all approved respirators should be selected, fitted, used and maintained, in accordance with the Occupational Safety and Health Administration (OSHA) and other applicable regulations. These regulations include: Never substitute or modify a respirator; and evaluate – follow the respirator programme because the respirator filters must meet stringent certification requirements. They must always demonstrate a very high level of collection efficiency for the broad range of aerosols encountered in the work place (OSHA, 2009:143). There has been a concern that respirator filters will not collect

nano-sized particles, but research has demonstrated that such particles are collected with efficiencies that meet the NIOSH standards (Brosseau & Ann, 2009:3). Respirator filters must be tested by the NIOSH at the time of application and periodically afterwards, to ensure that they continue to meet the certification test criteria. The Food and Drug Administration (FDA) does not perform an independent evaluation of surgical mask filter performance, nor does it publish manufacturer test results. In many cases it is difficult to find information about the filter test results for FDA-cleared surgical masks (Brosseau & Ann, 2009:3).

According to Malebati (2010:26) fit testing procedures should take place in a well-ventilated room. The test utilises a substance that has a distinctive odour/taste. The wearer is advised not to talk, chew gum or drink flavoured drinks such as coffee or tea for at least fifteen minutes before performing the fit testing. The South African Government has the opportunity to actively support and adequately resource the implementation of an evidence-based public health policy to turn the tide on the TB and HIV epidemics (Abdool Karim, Churchyard & Lawn, 2010:923).

According to CDC (2010:1), the wearers should conduct a fit test check each time they wear the N95 respirator mask. When the wearer inhales sharply the mask should collapse on the face, but if air can pass around the edge of the respirator mask it will not collapse, indicating that the seal is inadequate and that the mask needs to be repositioned (University of Witwatersrand Reproductive Health and HIV Research Unit, 2009:6).

There are a range of perceived barriers limiting the use of the N95 masks by HCWs, such as the fact that they are uncomfortable to wear, particularly for long periods of time in the heat. They also hinder communication with patients who may have auditory problems due to treatment they are getting for TB, and this requires the nurses to take off the mask so that patients can lip read (Gibbs et al., 2010:516).

1.3 Challenges

One of the greatest challenges facing post-Apartheid SA is the control of the concomitant HIV and TB epidemics: HIV is continuing to spread relentlessly and TB has been declared a national emergency. Until recently, the SA government's response to these diseases has been marked by denial, lack of political will and poor implementation of policies and programmes (Moodley et al., 2011:1). The situation was compounded by continuing weak central

coordination, lack of accountability of provinces to the national TB control programme, inadequate management at all levels resulting in sub-optimal implementation of directly observed treatment strategy, minimal integration of TB/HIV activities, inadequate MDR-TB management and severely limited, to absent, infection control policies, facilities and practices (Abdool Karim, Churchyard & Lawn, 2010:921).

According to WHO (2009:1), recent studies assessing TB infection control practices in South Africa found that HCWs lack appropriate knowledge and appropriate infection control measures are not adhered to consistently across all hospitals, placing HCWs at increasing risk of repeated exposure to infection.

According to Moodley et al. (2011:4), the challenges of infection control in SA are based on the following factors: Patient management and staff practice (triage and separation, coughing and education, fast tracking care and diagnosis); infrastructure including ventilation systems, negative pressure and the size of outpatient departments versus patient volumes; and participants' personal protective equipment N95 respirator adherence. Participants reported that the respirators were unpleasant for the user, unfriendly for patients, information regarding when to discard them was confusing, fit testing and consistency in donning the mask was poor and that the procurement system was lacking (Moodley et al. (2011:4).

South Africa is ranked third in the world in terms of its TB burden and is one of 22 countries with the highest burden. It contributes approximately 80% of the global burden of all TB cases. About 407 000 cases of TB were reported in 2009, with KZN and the Eastern Cape accounting for almost 50% of all cases (South Africa, 2016). In the eThekweni district where one third of the KZN population resides, 2300 new cases of TB were identified in the last quarter of 2010, adding to more than 9 000 TB cases in the district (South Africa, 2016).

National TB programmes still face many challenges, which include limited funding for work-place intervention, since TB-HIV is not highly rated as an occupational hazard and there is stigma and discrimination associated with TB-HIV. This results in poor access to services and non-completion of treatment, which further fuels MDR-TB, the latter making it so difficult to treat and reduce the mortality rate due to TB (WHO, 2011:1).

1.4 Problem Statement

HCWs in KZN have up to three times greater chance of developing DR-TB than the general population and face double the average risk of their professional colleagues elsewhere in the country, whether they work exclusively with TB patients or not. In three KZN district hospitals (with specialised MDR-TB), 8% of HCWs were diagnosed with some form of TB, and just over 1% with MDR (Dludla, 2012:2).

The KZN strain of *M. tuberculosis* is a highly virulent strain endemic to the KZN region of SA, which has recently experienced an outbreak of extensive DR-TB (Loerger, Koo & Chen, 2009:1).

According to O'Donnell & Jarand (2010:516), in the eThekweni district, the incidence of MDR-TB hospitalisation was 64.8 per 100 000 HCWs versus 11.9 per 100 000 non-HCWs. The estimated incidence of XDR-TB hospitalisations was 7.2 per 100 000 HCWs versus 1.1 per 100 000 non-HCWs. A higher percentage of HCWs than non-HCWs with MDR-TB or XDR-TB were women (78% vs. 47%: $p < 0.001$), and HCWs were less likely to report previous TB treatment (41% vs. 92%: $p < 0.001$). HIV infection statistics did not differentiate between HCWs and non-HCWs (55% vs 57%) however, among HIV infected patients, a higher percentage of HCWs were receiving antiretroviral medications (63% vs. 47%: $p < 0.001$) (O'Donnell & Jarand , 2010:516).

The National DoH introduced a policy on the use of the N95 respirator mask for HCWs when managing patients with TB or suspected TB cases, but it is not clear why HCWs do not comply with this policy (Loerger et al., 2009:1), although possible reasons have been given above.

Of concern is the fact that in the selected institution, according to the Occupational Health and Safety Administration (OHSA) report of June 2013, eight HCWs were diagnosed with TB infection. This was also reflected in the monthly report from the health and safety personnel. The health workers in the institution comprise of nurses, nursing students, doctors, radiographers, laboratory technicians and general workers. The incidence of infection occurred during service delivery. In the same institution, the TB notification report revealed that in 2012, 1734 patients were diagnosed with TB and from January to June 2013, a further 603 were diagnosed.

TB patients are admitted to the selected institution but there are no strategies to reduce exposure to infectious particles, for example by using natural ventilation. Windows are permanently locked so there is no free flow of air. There is no mechanical ventilation or upper room ultraviolet light, and this increases the risk of airborne diseases to HCWs. Sometimes the N95 masks are also not available. Such situations necessitate the evaluation of compliance with the use of N95 respirator masks by HCWs as one of the main measures to prevent transmission.

1.5 Purpose of the Study

The aim of the study was to evaluate the compliance of HCWs with the use of the N95 respirator mask.

1.6 Research Objectives

- To evaluate the level of compliance with the use of the N95 respirator mask among HCWs in the selected hospital.
- To determine the perceived barriers to compliance regarding the use of the N95 respirator mask by the HCWs of the selected hospital.
- To evaluate compliance with infection prevention and control policy, and administration and environmental control strategies related to N95 respirator masks in the selected hospital.

1.7 Research Questions

- How compliant are the HCWs in the selected hospital in their use of N95 respirator masks?
- What are the perceived barriers to compliance regarding the use of N95 respirator masks by the HCWs of the selected hospital?
- How compliant are the HCWs of the selected hospital with the infection prevention and control policy, and with the administration and environmental control strategies related to N95 respirator masks?

1.8 Operational Definitions

Compliance

This refers to the extent to which certain behaviour is carried out in accordance with medical orders or health care advice (Playle & Keeley, 1998:304).

Non-compliance

Non-compliance is defined as the extent to which certain behaviour is not in accordance with the aspects mentioned above, either partially or totally. It can be an intentional action whereby individuals deliberately choose to adopt a certain behaviour to avoid compliance, or an unintentional action whereby individuals do not follow a certain behaviour because they cannot understand its content or purpose (Hussey & Gilliland, 1989:611).

Tuberculosis

This is an infectious disease caused by the organism *M. tuberculosis*, a type of bacterium. The infection is spread by airborne droplets expelled when a person with active TB coughs or sneezes (WHO, 2009:10).

The N95 respirator mask

This is a type of mask that covers the mouth and nose and contains a special filter which filters particles of 0.3 microns or larger, including *M. tuberculosis* bacteria (Jarand et al., 2010:1179).

Healthcare workers

This refers to anyone who is an employee, including students employed and working in a health care facility. These people are involved in the direct provision of care

1.9 Significance of the Study

The community

The evaluation of compliance with the use of the N95 respirator mask is relevant to the community (the general population) that expects better control of TB. Information about

facilitators and perceived barriers to the use of the N95 respirator mask may increase insight in this area.

Nursing practices and administration

Nurses are the main health care providers involved in the care of patients. The study will assist managers in the DoH to take the corrective action to avoid non-compliance with the use of the N95 respirator mask and improve the respiratory health programme.

Nursing education

The information obtained from the study can serve as a source of reference for programmes, policy-making and in-service education and training departments.

Nursing research

This study may be relevant in providing further information regarding gaps in research covering the compliance with the use of the N95 respirator mask and it opens up pertinent questions to guide future research in nursing.

1.10 Summary of Chapter One

This chapter introduced the study and depicted the reality of TB infection among HCWs in South Africa. The challenges related to this issue are even greater as TB is linked to HIV. The study objectives, therefore, were to evaluate the level of compliance with the use of the N95 respirator mask among HCWs in a provincial hospital in KZN; to determine the perceived barriers to compliance regarding the use of the N95 respirator mask by the HCWs of this provincial hospital; and to evaluate compliance with infection prevention and control policy, and administration and environmental control strategies related to N95 respirator masks in this provincial hospital. Are the HCWs in this health care facility compliant with the use of the N95 respirator mask? The next chapter will discuss the review of the literature in detail.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter emerges from a process of reading, understanding and forming conclusions about published research and other academic texts that are related to the area under research. This review presents and critiques the existing body of literature to provide an understanding of the existing knowledge of the problem and a rationale for the research question. This literature review provides an understanding of and an insight into transmission, infection-prevention and control measures and respiratory protection in respect of pulmonary TB in health settings.

2.2 Overview of Pulmonary TB

TB is an infectious disease caused by the bacillus *M. tuberculosis*. It typically affects the lungs (WHO, 2013:14). TB is one of the major public health threats competing with HIV as the cause of death due to infectious diseases worldwide (Sulis, Roggi, Matteelli & Raviglione, 2014:1). TB is a poverty-related disease which disproportionately affects the poorest, the most vulnerable and marginalised population groups wherever it occurs (Sulis et al., 2014:1).

TB incidence in SA rose steadily in the 20th century, peaking first in the 1990s with an incidence rate of over 350 cases per 100,000 people (Kanabus, 2016). The SA health system for black people was ill-equipped and lacked any commitment to TB control. The inadequate health services were directly responsible for the under-treatment of TB patients (Kanabus, 2016). Infection with HIV increases the risk of progression of recent TB infection and reactivation of latent TB by 5-15% annually. It also increases the rate of relapse and re-infection (Republic of South Africa DoH, 2014:10).

The aims of the DoH in SA are: To reduce transmission of TB infection in the communities; to provide early diagnosis of TB and early treatment initiation in all patients diagnosed with TB; to retain patients in care until completion of treatment; and to prevent TB in people living with HIV by initiating all eligible HIV positive people on anti-retroviral therapy and isoniazid prevention therapy (Republic of South Africa DoH, 2014:3).

eThekweni has the highest TB incidence (all cases) in the province at 1126 per 100,000, which is double the national rate of 687 per 100,000 (Republic of South Africa DoH, 2013:18). The district has the highest caseload of infectious TB in the country. The new smear positive rate is declining but it is still higher than the national incidence rate (Republic of South Africa DoH, 2013:18). The new smear positive cure rate is 70.8%, below the provincial target. The TB defaulter rate is 8.2%. The success rate is 76.2 % (Republic of South Africa DoH, 2013:18). TB is preventable and curable though the treatment comprises four antibacterial drugs over a period of six months (WHO, 2016).

2.3 Risk of Transmission of *M. tuberculosis*

Health care facilities are common sites for TB transmission. Improved implementation of infection control practices, appropriate for the local setting, and in combination has been associated with reduced transmission (Shenoi et al., 2010:1).

TB is transmitted mainly by inhalation of infectious droplets produced by a person with pulmonary or laryngeal TB during coughing, laughing, shouting, singing or sneezing (Australian Government DoH, 2013:3). Transmission can occur from potentially high risk procedures such as sputum induction, treatment using a nebuliser, bronchoscopy, drainage of an open abscess or any procedure in which an aerosol containing *M. tuberculosis* is generated (Australian Government DoH, 2013:3). Droplet nuclei which are small particles, 1-5 micro gram in diameter and containing 1-5 bacilli are highly infectious. They are so small that air current normally present in any indoor space can keep them air borne for up to 4 hours. These droplets are small enough to reach the alveolar space within the lungs, where the organism replicates (Republic of South Africa DoH, 2014:8). Three factors determine the likelihood of transmission of *M. tuberculosis*: the number of organisms expelled into the air; the concentration of organisms in the air, determined by the volume of the space and its ventilation; and the length of time an exposed person breathes in the contaminated air (Republic of South Africa DoH, 2014:8).

Transmission generally occurs indoors, in dark, poorly ventilated spaces where droplets of nuclei stay airborne for a long time (Republic of South Africa DoH, 2014:8). The high incidence of TB can partly be attributed to poor TB infection control in public health care facilities in SA. Undiagnosed and untreated suspected cases and immuno-suppressed patients

who present together at health care facilities increases the likelihood of infection and re-infection with TB (Engebrecht & van Rensburg, 2013:221).

The bulk of TB transmission, both in the community and in health care facilities still occurs before an accurate diagnosis can be made. The onus is on ensuring that TB infection control measures are applied in all high-risk settings so that health care facilities become known as places of healing and safety, not death and contagion (von Delft, Dramowski & Khosa, 2015:4).

2.3.1 TB Transmission to HCWs

Transmission of TB to HCWs has been reported from virtually every country of the world regardless of local TB incidence. The risk for transmission varies by setting, occupational group and local prevalence of TB, patient population and effectiveness of TB infection control measures (Baussano, Nunn, Williams, Pivetta, Bugiami & Scano, 2011:1).

The success of TB control programmes is dependent on healthy, motivated and knowledgeable HCWs. The transmission of TB to HCWs results in a loss of skilled HCWs (McCarthy, Scott, Gous, Tellie, Venter, Stevens & van Rie, 2015:652). In 2004, 76.5% of HCWs presented with TB and 3% had MDR-TB in eight public sectors in KZN (Nicol, Mehtar, Dheda & Adams, 2014:7). In 2008, 23 HCWs were admitted to a public referral hospital with XDR-TB in KZN (Naidoo, Seevnrain & Nordstrom, 2012:1). In 2010, HCWs had a significantly higher annual TB incidence compared to the general population (Nicol et al., 2014:7).

In most of the world, respiratory infection control in health care facilities remains inadequate. A health care facility in SA was implicated as the initial site of transmission for the first documented outbreak of MDR-TB. Earlier inadequate infection control in hospitals had already led to large outbreaks of MDR-TB (Xue He, van den Hof & van der Werf, 2010:17). These outbreaks have turned attention to the need to reduce TB transmission in health care facilities (Xue He et al., 2010:17).

In SA 40% of facilities have a TB screening programme or written health policy, while only 30% of HCWs have been trained in the use of PPE (Zungu & Malotle, 2011:1) Even though the legislative framework for workers' health in SA is in progress, there is a substantial and

critical need for the enforcement of the OHSA and its regulations by the Department of Labour, as well as for the implementation of adequate infection measures by the facility managers and DoH (Zungu & Malotle, 2011:3).

The reality is that HCWs are not adequately protected, and that means that neither are those under their care. The DoH cannot afford, either economically or socially, to wait for the DR-TB situation to deteriorate further. Urgent action is required to improve the implementation of TB infection control measures and to ensure equal access to better treatment for all (von Delft et al., 2015:4).

In health care facilities, face masks, whether the N95 mask or surgical masks, are used either to protect patients from health care associated infections or to protect HCWs from occupationally acquired infections through droplet or airborne spread (Gralton, Rawlinson & Mclaws, 2010:657).

HCWs' decision not to wear the N95 masks is located in a complex array of factors that reflect on the wider contexts of the hospitals in which they work. Factors such as a lack of training regarding the use of the N95 mask, and the N95 being uncomfortable have been cited. Some HCWs expressed the view that they couldn't use it even for an hour, so they used it on and off (Zelnick, Gibbs, Loveday, Padatchi & O Donell, 2013:7). HCWs complained that the N95 masks were suffocating, made it hard to communicate and posed problems for those with a cough or asthma. Although fit testing is required to ensure the N95 mask's effectiveness, no HCWs reported having conducted the testing (Zelnick et al., 2013:13).

According to Adeleke (2012:199), despite the fear and high risk attributed, HCWs admitted they were not inclined to comply with PPE requirements due to the discomfort and suffocating nature of the respirators provided.

According to Baussano et al. (2011:488), the risk for TB among HCWs is consistently higher than among the general population worldwide. The findings confirm that TB is an occupational disease. The control measures essential to protect HCWs may decrease the annual TB incidence among HCWs by as much as 49%, 29% and 18% respectively in countries with low, intermediate and high TB incidence (Baussano et al., 2011:488).

All settings should perform risk qualification as part of risk assessment to determine the need for and frequency of the HCWs testing programme, regardless of the likelihood of encountering persons with TB disease. Baseline TB testing should be conducted for HCWs upon hiring (CDC, 2012).

When introducing better conditions for HCWs, employers will need to strengthen the infection control measures in facilities, and develop and regularly update infection control protocols based on the Draft National Infection Prevention and Control Policy for TB, MDR-TB and XDR-TB. Employers will also need to train HCWs in infection control measures, and develop and implement basic occupational health services, including the medical surveillance programme (Zungu & Malotle, 2011:3). Key players should work with the compensation commissioner (CC) in strengthening the capacity of the office of the CC and in educating the HCWs on the role of the office of the CC. Labour Unions should be involved in all workplace programmes, especially in those put in place for the control of TB (Zungu & Malotle, 2011:3).

2.3.2 TB infection control measures

TB infection control measures in South Africa are poorly implemented due to a lack of resources, a lack of faith in the efficacy of infection control measures and the focus on individual level personal protection, particularly with respect to the N95 respirators. These are some reasons for the failure to implement fully and support TB infection control measures (McCarthy et al., 2015:652).

TB infection control requires action at national and local levels to provide managerial direction and at health facility level to implement TB infection control measures (WHO, 2009:1). A recent qualitative study of HCWs' perspectives on work place safety, infection control and DR-TB in hospitals in KZN found that hospital managers and HCWs struggle to implement a TB infection prevention control policy due to resource constraints and a lack of the appropriate infrastructure (Mphahlele, Tudor, van der Walt & Farley, 2012:36).

In order to be effective, the primary emphasis of a TB infection control programme should be on achieving these three goals: Prompt detection of infectious patients, airborne precautions, and treatment of people who have suspected or confirmed TB disease (CDC, 2012:1).

TB infection control comprises three categories of measures that are hierarchical but usually implemented simultaneously to reduce the risk of health care associated TB. These are administrative controls, environmental controls and the use of personal protective equipment (Adeleke, 2012:198).

2.3.2.1 Administrative control

Administrative controls include prompt identification of clients with TB symptoms, placing them on treatment and minimising the time spent in a health facility (CDC, 2012:1). Other components of administrative control include staff training, establishing infection control committees, cough etiquette, health education and the use of paper masks by patients (Adeleke, 2012:198). The administrative controls also include reduction of diagnostic delays, use of rapid diagnostic tests, reduction of turnaround time for sputum testing and culture, and prompt initiation of treatment (WHO, 2009:7).

According to the University of Witwatersrand Reproductive Health & HIV Research Unit (RHRU) (2009:12), the following are the administrative control strategies to reduce the occurrence of infectious TB practices in health care facilities:

- Screening of clients for coughs as they enter the facility: This is best done in the reception area. A staff member should be assigned the responsibility for this task. A poster promoting client disclosure of coughing should be placed in a prominent position in the reception area.
- Education of clients in cough hygiene: The clients who are coughing are informed politely that TB is spread through coughing and they should be requested to cough into tissues or their elbow, and not their hand and into the air.
- Provision of masks/tissues to coughing clients as they enter the facility: Coughing into masks or tissues traps the droplets from a cough and prevents the generation of droplet nuclei which can spread TB (WHO, 2009:11). An experimental study in S.A found that the wearing of surgical masks by patients reduced MDR-TB transmission by more than half (56%) in health care facilities (Dharmadhikari, Mphahlele, Venter & Stolts 2012:1109). The health system also plays a crucial management role in the timely and adequate supply of respirators and paper masks (Adeleke, 2012:198)

- Separation of clients who cough from those who don't (triaging): Clients who cough should be directed to the appropriate area as they enter the facility.
- Reduction of waiting time for clients who cough. Consider establishing a separate queue and waiting areas to ensure short waiting times for clients who cough. The longer these clients are present in the facility, the more infectious particles will be generated (University of Witwatersrand RHRU, 2009:12).
- Early referral and investigation for TB of clients who are coughing: When coughing is not the primary reason for visiting the health care facility and the clients require services other than investigation for a cough, they should receive these first and then be investigated for coughing (WHO, 2009:12).
- Provision of a safe environment for collecting of sputum: All sputum collection should be done outdoors. Clients should be given access to a private open space to cough up sputum and have running water accessible for hand washing (University of Witwatersrand RHRU, 2009:12).

In practice, administrative measures are least prioritised in SA health care facilities (Heysell, Shenoi & Catherick, 2011:332). Studies revealed that HCWs still have low adherence to administrative control measures, especially early triage (Heysell et al., 2011:332). A study that assessed TB infection control in resource-limited settings in rural SA district hospitals found that despite a high level of information among HCWs, motivation and behavioural skills needed to be improved through life-long training (Kanjee, Amico, Mbolekwa, Moll & Friedland, 2012:67). The study identified several deficits in administrative measures, such as the lack of an infection control policy, poor TB screening processes, inadequate separation of TB suspects and the inconsistent use of cough hygiene (Olson, Lebovitz & Clairborne, 2011:10). According to Mphahlele et al. (2012:2), upon assessing the administrative infrastructure to deal with infection control in the Western Cape health care facilities, only 20% of these facilities were found to have facility-specific infection control plans. Cohorting of patients was not practised in any of the facilities and TB patients shared waiting rooms with other patients at all of the facilities. Triage of patients upon entry was not practiced in any of the facilities (Zelnick et al., 2013:388.). TB infection control training was only compulsory at 20% of the facilities, and N95 masks were only available at 80% of the facilities (Zelnick et al., 2013:388). Naidoo et al. (2012:4) conducted a study in the Western

Cape and in KZN, where HCWs reported using the N95 masks when collecting sputum in only two hospitals.

2.3.2.2 Environmental control

Environmental control is the second level of TB infection control in health facilities (WHO, 2009:11). This measure requires the establishment of administrative controls first, to ensure proper operation and sustainability (Republic of South Africa DoH, 2013:116-117; Adeleke, 2012:198).

Environmental control helps to reduce the number of infectious droplets in the air through controlling the direction of airflow, using natural ventilation (keeping the windows open) or mechanical ventilation (installation of vents and wind-driven air extraction or turbines), and the use of ultraviolet germicidal irradiation (UVGI) (Republic of South Africa DoH, 2013:116-117; Adeleke, 2012:198). Ventilation is the movement of air through a building so that it is replaced by air from outside. Maintenance of good air circulation by opening windows and the use of fans in waiting areas and consultation rooms are recommended (Malebati, 2010:19). Natural ventilation of the building depends on the climate, building design and human behaviour (CDC, 2009:7).

HCWs play a vital role in ensuring natural ventilation by keeping windows and doors open daily in health care facilities (WHO, 2009:12). Natural ventilation has several advantages including relatively low cost, low maintenance and applicability to a wide variety of settings (Shenoi et al., 2010:4). The behaviour of HCWs can influence consistent implementation of environmental control measures, keeping windows open, retaining the use of rooms for intended purposes, and monitoring the correct and consistent use of ventilation equipment (Mehtar, 2010:320). UVGI systems are considered to be adjunct to other TB infection control measures e.g. ventilation in settings where persons with undiagnosed TB could potentially contaminate the air e.g. waiting rooms, emergency rooms, corridors and central areas (CDC, 2009:15).

A properly designed and maintained upper-room UVGI system is effective in killing or deactivating TB bacteria in risk areas and where suspected or confirmed TB clients are isolated and where high-risk procedures are performed, e.g. bronchoscopy and sputum induction (CDC-NIOSH, 2009:15). Mechanical ventilation systems are considered reliable in

delivering the designed flow rate, regardless of the impact of variable wind and ambient temperature (WHO, 2007:9).

One of the deficits in environmental control measures identified was inconsistent natural ventilation during winter months in some health care facilities. This suggests that there is a higher risk of health care associated TB transmission during winter months in such facilities, which makes environmental TB infection control difficult (Kanjee et al., 2012:67).

The study by Naidoo et al. (2012:16) study reported on conditions in a district level hospital KZN. None of the facilities had windows opened on both sides of the TB consultation room, X-ray room and sputum collection room and there were no facilities with ultra-violet germicidal irradiation. Nurses reported that they collect sputum in the consultation rooms and the wards. There are no sputum collection rooms (Farley et al., 2012: 82).

2.3.2.3 Personal protective equipment (PPE)

This study is about the evaluation of the compliance with the use of PPE, especially the N95 respirator mask by the HCWs. If a respirator is used in a health care facility, the OSHA requires the health care facilities to have a respiratory protection programme in place (WHO, 2009:12).

There is still a dilemma concerning the best way of protecting HCWs against respiratory infections (Bessesen, Savor-Pice, Simberkoff et al., 2013:904). A well-designed and reproducible study supporting or refuting the clinical effectiveness of respirators is lacking (Bessesen et al., 2013:904). The third and last level of infection control for the protection of HCWs includes the use of the N95 respirators by all clinic staff (Adeleke, 2012:199). Respirators protect HCWs who interact closely with patients from TB infection in health care facilities (University of Witwatersrand RHRU, 2009:13). The N95 respirator contains filters that prevent wearers from inhaling the TB bacilli (WHO, 2009:12).

Ideally, the N95 respirator should be fit-tested for HCWs but this depends on the willingness of the HCWs to ensure proper fit (Mehtar, 2010:333). PPE measures require compliance of HCWs to correctly wear and consistently use respirators. Resources being out of stock or for any reason unavailable can limit HCWs performance and increase the risk of health care associated TB (Adeleke, 2012:199).

2.4 Respiratory Programme

According to the United States Department of Labour, OSHA (2009:3), respirator standard requires an employer to establish and maintain an effective respiratory protection programme when employees must wear respirators to protect against work place hazards. As part of the respiratory protection programme, appropriate instruction, information and training must be provided to all HCWs who use facemasks (Health and Safety Authority (HAS), 2011:3). Fit testing forms part of this training to ensure that wearers are able to put on masks correctly themselves. Employers must be aware that masks will not be effective unless they form a seal against the face (HAS, 2011:3).

An effective respiratory programme must cover the following: selection of an appropriate respirator approved by the NIOSH; written worksite-specific procedures; programme evaluation; training; fit testing; inspection; storage; medical evaluation; work area surveillance and maintenance of air quality standards (OSHA, 2009:5). To establish a proper respiratory protection programme, there should be a programme administrator with a background in and knowledge of implementing respiratory protection programmes (Malebati, 2010:21). If respirators are used in a health care facility, the OSHA requires the development, implementation, administration and periodic evaluation of a respiratory protection programme (CDC, 2010:1).

2.5 The N95 Respiratory Mask

The CDC (2009:54) recommends the usage of the N95 respirator mask for the safety of HCWs who may be exposed to *Mycobacterium TB* in various settings. The N95 respirator masks meet specifications required by the NIOSH which include: filter size of 1 microgram, filter efficiency =95% and tight facial seal. The letter N in N95 refers to the fact that the mask filter is not resistant to oil (CDC, 2009:21). A fit tested N95 mask should be worn by HCWs when the patient has a diagnosis or symptoms of an airborne infection such as TB, chicken pox, measles and herpes zoster, when performing aerosolising procedures with a patient with droplet infection e.g. (open suctioning or nebulised medication), or as directed by the public health officials due to a new or emerging disease (Canada Ministry of Health, 2014:3).

The N95 masks are not a substitute for administrative and environmental controls. Masks will improve personal protection when administrative and environmental controls are functioning

optimally (University of Witwatersrand RHRU, 2009:20). OSHA requires the masks to be available all the time in different sizes and models (CDC, 2010:1). The N95 masks are expensive. It is helpful to re-use them using the following guidelines: each staff member should re-use their own masks. It is helpful to write the staff members name on the mask (CDC, 2009:21). Keep the mask dry and clean, replace masks if they are damaged or get wet and never use mask inside out or reversed (University of Witwatersrand RHRU, 2009:21).

Surgical masks are very different from the N95 respirator masks. They have only 50% filter efficiency and lack a tight facial seal (CDC, 2010:18). Infectious patients should use surgical masks because these reduce the number of infectious particles in the air. Surgical masks are useful to catch larger respiratory droplets and prevent droplet nuclei from forming (CDC-NIOSH, 2010:1).

The study on personal protective equipment in S.A revealed that the N95 masks were uniformly available in all of the facilities. In 88% of the facilities, HCWs of all levels were seen entering DR-TB wards without the N95 respirators in place (Nicol et al., 2014:36). Furthermore, when visits did occur within the wards no facilities were offered to visitors to use of the N95 respirators (Nicol et al., 2014:36).

2.5.1 Storage of N95 respirators

N95 respirator masks must be stored in a clean, labelled paper bag or container between uses and not in a plastic bag. Masks should not be stored in contaminated area such as the patient's room (NYU Medical Centre, 2014:11).

2.5.2 Disposal of the N95 Masks

Used N95 respirator masks must be discarded according to infection control protocol (Minnesota DoH, 2015:1).

2.6 Training of HCWs

To reduce the risk of TB in health care facilities, HCWs should be offered updated periodic training to maintain awareness about potential TB risks (Behrman, Buchta & Budnick , 2013:986). Training should be enforced for all HCWs and professionals with regard to infectious disease associated with airborne transmission (Malebati, 2010:23). HCWs should

know the risk assessment process in relation to the respiratory protection programme (OSHA, 2009:2). HCWs must be trained on how to care for and maintain their respirators, how to store them correctly and how to dispose of them appropriately (McCarthy et al., 2015:62). HCWs need to be trained prior to using a respirator in the workplace. Supervisors must also be trained prior to supervising employees that must wear respirators (OSHA, 2009:13). The study done in two rural district hospitals in KZN health care facilities revealed that HCWs did not know that respirators required a seal in order to be effective, and 34% believed that face masks were as effective as respirators (Nicol et al., 2014:3). Training HCWs should include selection of the correct respirator, fit testing, OSHA regulations regarding respirators, knowledge regarding usage and adherence to the use of the N95 respirator masks (Malebati, 2010:23).

2.7 HCW Medical Evaluation

Medical evaluation determines the ability of HCW to use a respirator. It is required to be completed before the fit test and before the decision is made that HCWs are required to use a respirator in the work environment (CDC-NIOSH, 2010:1). Respirator use may place a physiological burden on an employee that varies with the type of respirator worn, the job, work place conditions in which the respirator is used and the medical condition of an employee (OSHA, 2009:4).

Medical evaluation is required once, prior to initial fit testing, and use of the N95 respirator mask. However, it may need to be repeated if HCW, supervisor or the respiratory programme administrator recognizes signs that may affect HCWs ability to use the respirator or physician or other licenced HCW determines that a condition exists which causes the user to need another medical evaluation (CDC-NIOSH, 2010:2).

Medical evaluation must be conducted by a physician or other licensed HCW using a mandatory medical questionnaire or an initial medical examination that obtains the same information as the medical questionnaire (OSHA, 2009:4).

2.8 Personal Protective Mask Fit Testing and Fit Checking

Fit testing is the process of determining the extent to which the facial seal of the respirator prevents inward leakage of the unfiltered air (Malebati, 2010:25). Qualitative fit tests must be

provided when workers are first fitted with a disposable respirator and repeated as necessary if the user loses or gains weight, or develops facial changes such as scars or moles around the face seal area (HAS, 2011:3). HCWs should check that their mask fits in accordance with their training each time the mask is put on (OSHA, 2009:4).

The N95 respirator will provide no protection if it is not properly fitted as air will flow through gaps between the mask and wearer's skin (CDC-NIOSH, 2009:54). Fit testing is used to determine which respirator fits the user, adequately to ensure that the user knows when the respirator fits properly. Periodic fit testing for respirators used in a TB environment can serve as an effective tool against infection (CDC, 2010:20).

Once the mask is in place, the user should inhale sharply. The mask should be drawn towards the face, indicating that a negative pressure has been generated (CDC, 2010:21). If the mask is not drawn towards the face or the user feels leakage at the edges, he should adjust the straps by pulling along the sides and or reposition respirator. This should be repeated until the mask is sealed properly (OSHA, 2009:7). This is all about fit-checking, and identifying any collapse or leakage once the mask is in place.

2.9 Summary of Chapter Two

This chapter outlined the literature review, providing an overview of TB, the risk of transmission and transmission to HCWs. TB infection control measures were discussed in terms of administrative control, environmental control and the use of N95 respirator masks. A respiratory protection programme was discussed, and included how to use, store and dispose of respirators, training of HCWs, medical evaluation and fit testing related to the N95 respiratory masks. According to Shenoi et al. (2010:1), health care facilities are common sites of TB transmission. Baussano et al., (2011:1) have revealed that TB transmission to HCWs is higher than transmission to the general population and has been magnified by outbreaks of MDR-TB and XDR-TB, resulting in the loss of skilled HCWs. In most of the world, respiratory infection control in health care facilities remains inadequate (Xue He et al., 2010). The next chapter will discuss the methodology used to evaluate the level of compliance related to the N95 respiratory mask.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter describes the research paradigm, research design, sampling and population, research setting, as well as data collection. The design and methods were selected to provide suitable information regarding compliance with the use of the N95 respirator mask by HCWs during the management of suspected or confirmed TB infected patients in a health care facility in KZN, SA. This chapter also describes data analysis, reliability and the validity of the research instrument, ethical consideration and data management.

3.2 Research Paradigm

The positivist paradigm was selected, based on the notion that only that which can be scientifically verified should be recognised as valid. This includes objective reality which is observable and about which you can ask questions rationally and objectively (Polit & Beck, 2008:16). The Positivist paradigm is rooted in 19th century thought guided by such philosophers as Comte, Mill, Newton and Locke (Polit & Hungler, 1997:12). The fundamental ontological assumption of positivists is that there is a reality out there that can be studied and known. The researcher applied positivism to evaluate compliance of HCWs in using the N95 respirator mask when managing suspected or confirmed TB patients in a TB setting.

3.3 Research Design

In line with the positivist paradigm, the study design was a quantitative non-experimental and descriptive. In the quantitative approach, the study was focused on evaluating compliance with N95 respirator mask among HCWs, together with infection prevention and control policy, administration and environmental control strategies and the perceived barriers of this compliance (Polit & Beck, 2008:274).

The purpose of descriptive design is to observe, describe and document aspects of a situation in a natural setting that can prompt hypothesis generation or theory development (Polit & Beck, 2008:274). In the study there was control over the research situation by defining a research problem, a research methodology, and variables to be studied and by controlling the effects of extraneous factors. Descriptive analysis of frequency, mean and percentages was

used. The study was conducted in different medical wards where TB patients are admitted. In the study the data was collected using structured questionnaires.

3.4 Population

Research population, according to Polit & Hungler (1997:223), is the aggregation of cases that meet a designated set of criteria. The population of this study were all categories of HCWs: doctors (registrars, interns, consultants and professors), nurses (professional nurses, enrolled nurses, enrolled nursing assistants and student nurses), physiotherapists, student physiotherapists, clerks and general workers who were employed in the hospital and had worked in TB wards for a minimum period of one month. Student nurses (DoL, 2012:7) are employed by a hospital on a contractual basis for five years from the first day of the commencement of training. The course duration is four years, and the students obtain a qualification in general nursing science, community nursing, midwifery and psychiatry. During the fifth year of the contract they are required to do community service and after that they employed in the hospital. They are retained on a persal system (they get paid), and their leave is controlled by the human resource department of the hospital. They are considered employees according to the International Labour Organization (2010:3).

3.4.1 Inclusion Criteria

All categories of nurses and HCWs that have worked in TB wards for at least a period of a month as well as the students.

3.4.2 Exclusion Criteria

Those HCWs who did not wish to participate in the study and those who have worked less than a month in an appropriate ward.

3.4.3 Sample Size

For the purpose of this study respondents were from medical wards where patients with suspected and confirmed TB are received and admitted. The number of respondents were 280 the actual population was 2200 this has been obtained from human resource information at the institution in question.

The calculation of the sample size the Raosoft sample calculator (2004) was used:

Margin of error that can be accepted: 5%.

Confidence level needed: 95%

Population size: 280.

3.4.4 Sampling Technique

Purposive sampling was employed. According to Oliver (2006:245), purposive sampling is a form of non-probability sampling in which decisions concerning the individual to be included in the sample are taken by the researcher, based upon a variety of criteria which may include specialist knowledge of the research issue or capacity and willingness to participate in the research (Oliver, 2006:245). The researcher opted for purposive sampling to select participants who could provide information related to their practice in terms of compliance with the use of the N95 respirator mask. The reasons advanced were: TB is an airborne disease; the N95 mask is worn to prevent droplet infection; the HCWs that use this protection are those working with patients that are suspected or confirmed to be infected with TB.

3.5 Setting

The research was conducted in a provincial hospital located in Durban in KZN. It is a district and regional hospital with 571 beds and 2200 staff. The hospital is an academic hospital accredited by the South African Nursing Council. The hospital has 16 clinics in its catchment areas. Services offered by the hospital include the following:

- District hospital services, namely obstetrics/maternity, gynaecology and paediatrics.
- Regional hospital services, namely general surgery, orthopaedics, ENT, general medicine, radiotherapy and oncology. There is also a coronary care unit, a chronic haemodialysis programme, and a short-term ventilation/high care unit.
- Rehabilitative services which include physiotherapy, occupational therapy and speech therapy.
- Support services such as radiology, nuclear medicine, medical physics, a pharmacy, an anaesthetic ward, a laboratory, social work, dietetics, primary health care, and training services.
- Other services include a crisis centre dealing with post-exposure prophylaxis and an anti-retro viral rollout programme.

3.6 Data Collection Method

The data were collected by a research assistant in the selected health institution in the eThekweni district of the province of KZN. Before data collection, the letter of request for approval to conduct the study was sent to the University of KwaZulu-Natal (UKZN), the DoH in Pietermaritzburg, the DoH in the eThekweni district and to the Chief Executive Officer of the selected health institution. Permission to conduct research and to collect data was obtained from all of the above. The researcher met with operational unit managers of the wards and information letters were given to respondents. Respondents signed the informed consent form. The data collection permission was granted two days prior to collection. The questionnaire was self-administered and was sent to a UKZN statistician and supervisor for verification.

The questionnaires were distributed by a research assistant to a group of respondents who were on duty, to maximise the number of completed questionnaires. The questions in the questionnaire were adopted from the Occupational Safety and Health Administration (2010), the Sixtieth World Health Assembly (2007), the Centre for Disease Control and Prevention (1991), the National Institute for Safety and Health (2013) and the Reproductive Health & HIV Research Unit of the University of Witwatersrand (2009). The researcher used questions that were relevant to the study. These questions have been used previously in studies to evaluate compliance with infection prevention and control practices and the use of the N95 respiratory mask. Some of the questions were structured and other areas of the questionnaire included open-ended questions. The structured questions comprised three sections of dichotomous questions (YES/NO), and the open-ended questions allowed respondents to specify other information. The ratings were 2 = YES, 1 = NO and 0 = DON'T KNOW (Polit & Beck, 2008:430).

- **Section A** comprised of biographic data such as professional category, years of experience in TB wards, age and gender, for the purpose of describing the research participants.
- **Section B** comprised of questions that were in accordance with those of the United States Department of Labour, OSHA (2009) the Sixtieth World Health Assembly (2007), the CDC (1999), the NIOSH (2010) and the RHRU of the University of Witwatersrand (2009). The questions here related to the respiratory protection

programme and the use of the N95 respirator mask, including medical evaluation and fit testing prior to the use of this mask.

- **Section C** contained questions regarding the HCWs practice in relation to the institutional infection control and prevention policy, to evaluate their level of compliance. Questions 11 and 13 relate to administrative and environmental control, and question 10 deals with the perceived barriers to compliance. The data generated provided indicators to evaluate the level of compliance with the use of the N95 mask.

3.7 Reliability and Validity of the Instrument

Validity is the ability of an instrument to measure that it is intended to measure (Brink, van der Walt and van Rensburg, 2012:218). Validation of the instrument was done to assess the face and content validity. Face validity: the questionnaire was given to clinical specialists, a supervisor and a statistician for correction and approval.

3.7.1 Content validity

Content validity was established by relating the instrument to the framework for evaluation

Table 3-1: Content validity

Objective	Structure	Process	Outcome	Relates to questions in the tool
To evaluate the level of compliance with use of the N95 mask among HCWs.	<p>Staff: Infection control, quality, monitoring personnel and hospital managers</p> <p>Time.</p> <p>Equipment.</p> <p>Money.</p> <p>Infrastructure and support: natural ventilation, ultraviolet light, isolation wards</p>	<p>Structure, strategize, plan and develop Policies on the Proper use of PPE and infection prevention and control in collaboration with other stakeholders.</p> <p>Confirm the budget.</p> <p>Participate in research.</p> <p>Educate staff on Policies and</p> <p>How to comply with the Organisational Policies.</p> <p>Filling in questionnaires</p> <p>Photocopying machine, toner.</p> <p>Stationary</p> <p>Buildings where Study was conducted.</p>	<p>% compliance with use of the N95 mask.</p> <p>Decrease in TB among HCWs</p>	<p>Questionnaire.</p> <p>Question 4</p> <p>Question 5</p> <p>Question 6.</p>

<p>To evaluate compliance with infection prevention and control policy, and administration and environmental control strategies related to N95 respirator masks in this provincial hospital.</p>	<p>Managers</p> <p>Time.</p> <p>Partnership: with Personnel involved in procurement procedures, various committees: cash flow, bid evaluation, specifications.</p>	<p>Policies on respiratory programme.</p> <p>Ensures financial planning and budgeting in accordance with individual Department</p> <p>Budget and mobilise management</p>	<p>Increased knowledge and understanding of respiratory protection programme.</p>	<p>Questions 7</p> <p>Question 8</p> <p>Question 9</p>
<p>To determine the perceived barriers to the use of the N95 mask.</p>	<p>Human resources.</p> <p>Time. Equipment.</p> <p>Money.</p> <p>Structure. Infrastructure and support: natural ventilation, ultraviolet light, isolation wards. Staff: Infection control, quality, monitoring personnel and hospital managers</p>	<p>Institutional policy on wearing of the N95 mask.</p> <p>Align the use of PPE with relevant policies and procedures Support</p>	<p>Increased knowledge about effects and consequences of non-compliance with use of the N95 mask. Airborne disease-free environment</p>	<p>Question 10</p> <p>Question 11.</p> <p>Question 12.</p>

3.7.2. Reliability

This refers to the accuracy and consistency of information obtained in a study (Polit & Beck, 2008:196). According to Burns & Grove (2009:713), a pilot study is a smaller version of the actual study, conducted to develop or improve the methodology such as the instrument or data collection process. A pilot study was done on a small sample of 14 nurses for the purposes of identifying the response rate and potential problems, the time taken to complete the questionnaire and to determine whether or not the data addressed the objectives of the study.

The test-retest method was used to determine the accuracy and internal consistency of the questionnaire. To this end, the same questionnaire was retested two weeks later on the same sample of 14 HCWs. The scores from initial 14 questionnaires were compared to the second set of scores obtained. The correlation reliability (r -value=0.8) was determined. The acceptable r - value is any number between 0.8 to 1.2. The number that represents the correlation can range from -1.00 to +1.00. The necessary changes were made to the questionnaire and the updated questionnaire was then handed to the respondents.

3.8 Ethical Considerations

3.8.1 Collaborative partnership

The research proposal was submitted to the UKZN of Nursing and Public Health for approval. It was then sent to the University Ethics Committee for ethical clearance. Furthermore, the application to conduct the study was sent to the KZN Health Department and to the institution head where the study was conducted.

3.8.2 Informed consent

Consent was obtained in a culturally and linguistically appropriate format. This was respected by allowing the respondents to sign an informed consent form in a language they understand which outlines and explains the study in full. Two consent forms per participant were signed. One copy was kept by the participant and the other was kept by the researcher to ensure anonymity. The consent forms contained the contact details of the researcher, supervisor and the University Ethics Committee in case respondents had questions to ask or if they required clarity.

3.8.3 Respect for respondents

The respondents were assured of anonymity and that the information that would be revealed during data collection could never be traced back to them. Only the researcher and the research supervisor will have access to the information to ensure confidentiality of data. The respondents were informed that they could withdraw from the study at any time if they did not wish to be part of the study any more. Questionnaires had no identity-distinguishing data, but were numbered by the researcher.

3.8.4 Favourable risk-benefit ratio

The study had no foreseeable risks to respondents. The respondents were informed that there were no monetary benefits involved.

3.8.5 Fair selection of study population

Fair selection was done using purposive sampling and according to the inclusion and exclusion criteria. A list of employees was obtained from the Human Resources Manager and from the Nursing Service Manager. N=2200 employees, n=280 employees on the establishment of medical wards in the hospital. The issue of vulnerability was considered, since the researcher was also an employee at the health institution. A research assistant was utilised to distribute and collect the questionnaires because the researcher was employed as a clinical facilitator in the institution. It was possible that the researcher's position might have influenced the respondents' choice to participate to the study. The research assistant was trained by the researcher in terms of where and when to distribute and collect the questionnaires, the voluntary nature of the respondents' participation, the information and consent form, as well as who to contact in case more information was required by the respondents.

3.8.6 Social values

On completion of the study a copy of the findings was disseminated to the KZN DoH and to the institution in which the study was conducted for use in practice, education, administration and future research studies.

3.9 Data Analysis

The data was analysed using Statistical Package for Social Sciences (SPSS) version 23 software package. This is software for managing data and for calculating a wide variety of statistics (Social Science Computing Cooperative, 2011:1). Descriptive analysis was done to describe the sample and the results of the study. Frequencies and percentages were computed for categorical variables. The statistics generated were all descriptive and there were no inferential statistics. This was because of the nature of the questions posed in the questionnaire. Almost all the questions in the questionnaire captured the categorical variables. The findings were presented in frequency tables, a bar graph and pie charts. Cross-tabulation of nurses according to their categories, qualifications and years of experience against compliance with use of the N95 respirator mask was done.

3.10 Data Management

All data collected was used for the purpose of the study only. The data was stored in a computer by the researcher, with the access code known only to the researcher and the supervisor. The final data was communicated to the supervisor and the Head of the School at the end of the study. The questionnaire responses were placed in a lockable cupboard in the supervisor's office at UKZN. Access to this information was restricted to the researcher and the supervisor only. The data will be kept for a period of five years and be made available for the review, should the need arise. All data will be erased from the computer program files and recycle bin after five years by the researcher. Hardcopies of the data will be shredded after five years by the supervisor and the researcher.

3.11 Summary of Chapter Three

The research design and methodology were discussed in detail in this chapter. In line with the positivist paradigm, the study design was quantitative, non-experimental and descriptive. The validity and reliability of the data collection tool was established by testing and retesting the questionnaire on a sample of 14 HCWs, and the necessary changes made to the tool. The ethical considerations of the respondents were respected throughout the study. The following chapter will disclose the findings of this study.

CHAPTER FOUR: RESULTS

4.1 Introduction

Data analysis reduces, organises and gives meaning to data and is mainly determined by the research objectives, questions or hypotheses, the research design and the level of measurement achieved by the research instrument (Burns & Grove, 2009:44). The objectives of this study were to evaluate the level of compliance with the use of the N95 respirator mask among HCWs, to evaluate compliance with the respiratory protection programme for infection prevention and control in terms of policies, administrative control, medical evaluation and to determine the perceived barriers to the use of the N95 respirator mask. Based on the study objectives the descriptive analysis of the study variables is presented in this chapter.

4.2 General Description of Study respondents

A total of 280 HCWs met the inclusion criteria for this study. There was a 100% response rate. The majority of the study respondents fell into the age groups of 21-30 and 31-40 years (see Figure 4.1).

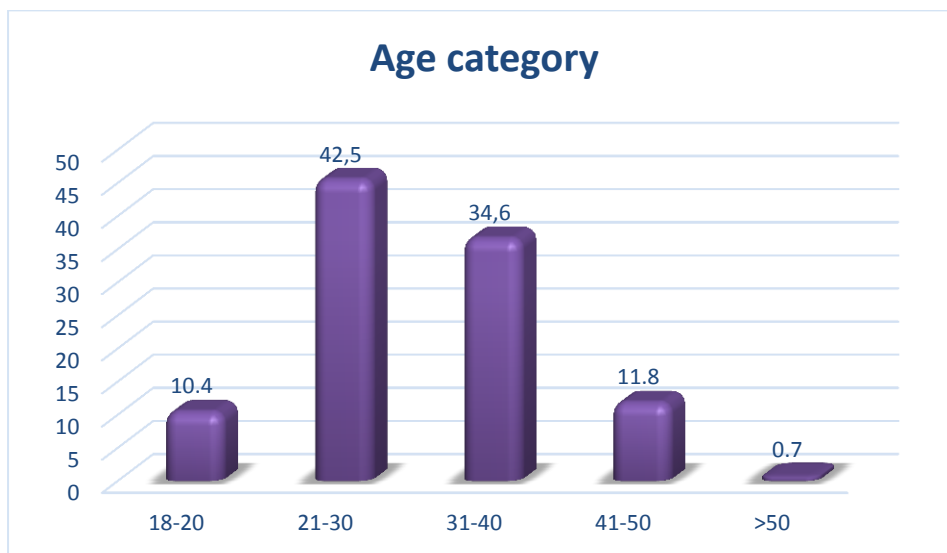


Figure 4-1: Age Category of Respondents

About 96% of the respondents were nurses (n=276). Doctors constituted the lowest category 0.7 % (n=4) (see Figure 4.2).

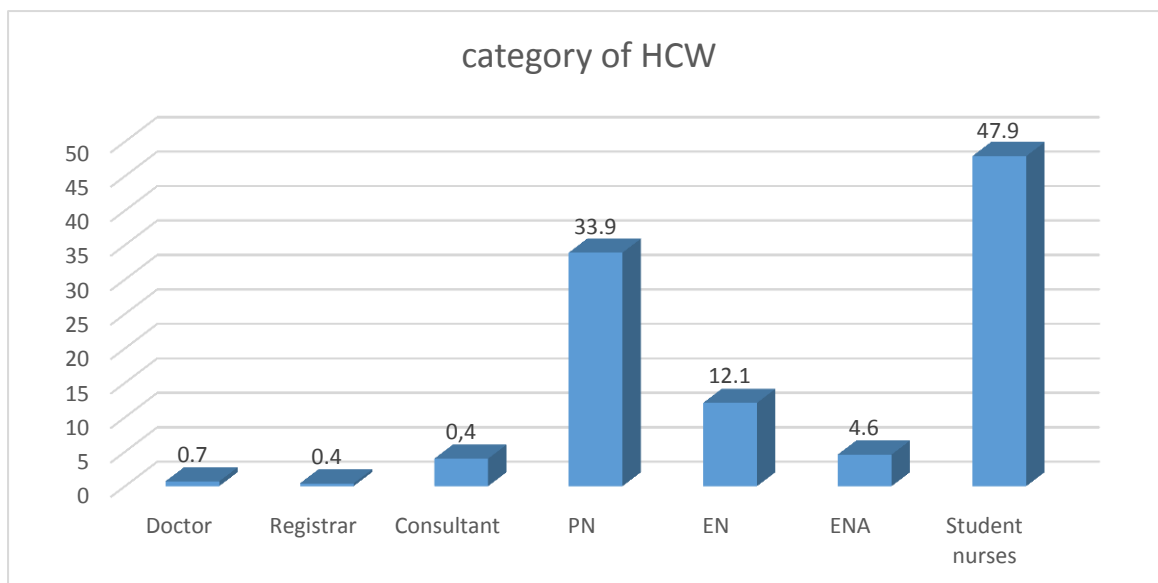


Figure 4-2: HCWs Categories

Of the respondents, 43.2 per cent (n=121) had worked in the wards for patients with suspected or confirmed TB for more than a year (see Figure 4.3).

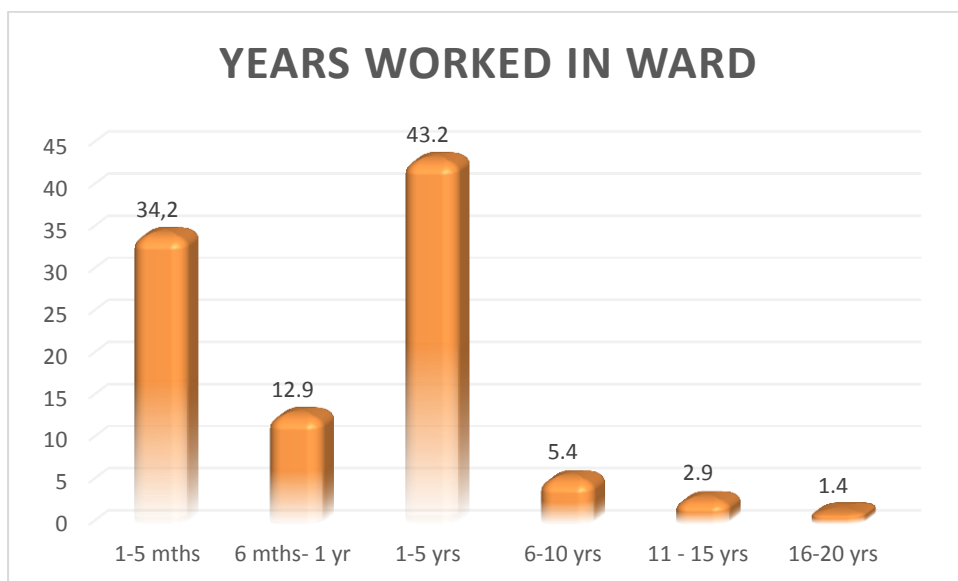


Figure 4-3: HCWs years of experience

4.3 Findings Related to the Level of Compliance with the Use of the N95 Respirator Mask among HCWs

In this section, details about the wearing of the N95 respirator mask, the medical evaluation and the fit-test as well as the maintenance, the inspection and the disposal of the respirator mask by the HCWs are presented.

4.3.1 Details about the wearing of the mask

According to the Occupational Health and Safety Act (2009:1) all reasonable measures should be taken to control or eliminate hazards in the workplace. The proper use of PPE provides an additional degree of protection against harm or injury in the workplace therefore its importance must not be underestimated (OHSA, 2009:1). Personal respiratory protection of HCWs against nosocomial transmitted TB (Jarand et al., 2010:1). Respiratory protection such as wearing respirators are not a substitute for other forms of infection control. This consists of wearing of respirators looking after one's health and lifestyle and regular screening for TB in the workplace (Jarand et al., 2010:1).

The N95 respirator mask is one of the nine types of disposable particulate respirators. Particulate respirators are also known as air purifying respirators because they protect by filtering particles out of the air the wearer breathes (Heeren, 2012:1). N95 masks are useful where strategies to limit production of infectious droplet nuclei are only partial. Officials attending to inmates who are suspected of having TB wear N95 Masks (WHO, 2013: 33).

The preferred methods of reducing exposure to TB are often not possible or practical to implement, especially during an emerging infectious disease outbreak or pandemic (CDC-NIOSH, 2013:1). During these events respirators are often the only option that can be implemented widely, quickly and seamlessly in the health care facility. Respiratory protection is often recommended for use until the transmission characteristics of the pathogens are understood and vaccines are available (CDC-NIOSH, 2013:1).

HCWs should observe droplet precautions such as wearing the N95 mask for close contact in addition to standard precautions when examining a patient with symptoms of a respiratory infection particularly if fever is present (CDC, 2012:2). Respiratory protection is needed when there is potential for a harmful agent to get into the respiratory tract. In particular the

N95 masks should be used when in close contact with patients with potentially infectious diseases, as described in the organisations' written programme (Heeren, 2012:1). In this study, 166 respondents (59.3%) reported not wearing the N95 mask in isolation rooms or when transporting TB patients, as can be seen in Table 4.1.

Table 4-1: Wearing the N95 masks in isolation rooms or when transporting TB patients

	Frequency	Percentage (%)
No	166	59.3
Yes	114	40.7

HCWs should not only wear the N95 mask, but should wear it properly by checking the seal after having put the mask on. In this study, 54.6% of the respondents reported not performing seal checks after donning the mask, as demonstrated in Table 4.2.

Table 4-2: Seal check after donning the mask

	Frequency	Percentage (%)
No	153	54.6
Yes	126	45.0

In the event that the mask is not sealed properly, the HCW should ask for help or try a different size or model. In this study, 57.9% of the respondents reported not asking for help or trying another size or model of mask when they could not achieve the proper seal. This is illustrated in Table 4.3.

Table 4-3: Ask for help or try another mask in case the seal is not properly achieved

	Frequency	Percentage (%)
No	162	57.9
Yes	118	42.1

The HCWs should not hesitate to take the N95 masks off immediately if they sense it is not working properly. Table 4.4 illustrates the finding that 49.3% of the respondents did not remove masks immediately once they sensed the mask was not working properly.

Table 4-4: Immediate removal of masks when they are not working properly

	Frequency	Percentage (%)
No	138	49.3
Yes	142	50.7

4.3.2 Details about care, maintenance and disposal of the N95 respirator mask

Not only must the N95 respirator masks be worn to protect HCWs and TB patients' families, they must be correctly maintained. First of all, a policy for the maintenance and care of the N95 masks needs to be available at the work place. In relation to this requirement, 45% (n=126) of the respondents reported that there is no policy for maintenance and care of the N95 masks available to them (see Table 4.5).

Table 4-5: Availability of maintenance and care policy for N95 masks

	Frequency	Percentage (%)
No	126	45.0
Yes	154	55.0

Secondly, there must be policy on how to dispose of the N95 respirator masks. In this study, 76 respondents (27.1%) reported that they did not have such a policy in their facility (see Table 4.16).

Table 4-6: Availability of N95 mask disposal policy

	Frequency	Percentage (%)
No	76	27.1
Yes	204	72.9

The N95 mask must be inspected for damage and contamination before use. Table 4.7 shows that 48.2% (n=135) of the respondents did not inspect their respirator masks.

Table 4-7: Inspection of the N95 mask for damage and contamination before use

	Frequency	Percentage (%)
No	135	48.2
Yes	145	51.8

Concerning the disposal of the N95 mask as health care waste, the findings revealed that only 20.9% (n=58) of the respondents reported not disposing of the N95 masks as health care waste, as evidenced in Table 4.8.

Table 4-8: Disposal of the N95 mask as health care waste

	Frequency	Percentage (%)
No	58	20.9
Yes	219	79.1

Not only that, only 22.05% (n=62) reported not disposing the N95 mask as biohazardous waste in the appropriate red lined bin or box. It can thus be seen that the majority disposed the N95 masks as medical waste (n=218), evident in Table 4.9 below.

Table 4-9: Disposal of the N95 mask in the red lined bin or box

	Frequency	Percentage (%)
No	62	22.05
Yes	218	77.95

4.3.3 Details about medical evaluation

In the study, n=260 (92.85%) of the respondents reported that they were not evaluated for potential medical difficulties when using the masks (see Figure 4.4). Medical evaluation is an element of the written respiratory protection programme that is required by the OSHA (2009:2) of the United States Department of Labour. The standard requires that if employees are required to wear a respirator due to potential hazards in the work environment, this must be medically evaluated timeously (CDC-NIOSH, 2010:1).

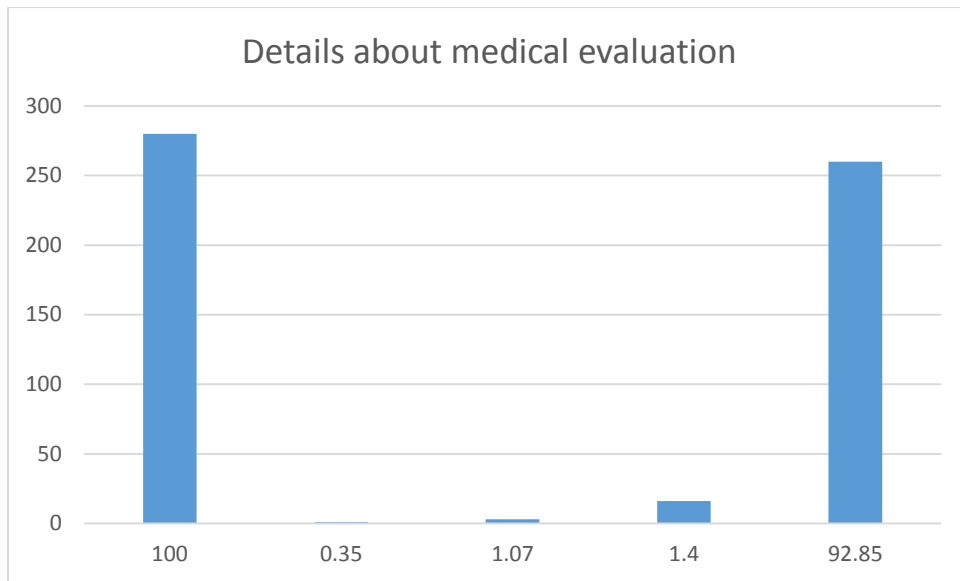


Figure 4-4: Medical evaluation of HCWs who use the N95 masks

Moreover, 72.9% of the respondents reported not promptly seeking a medical evaluation when they experienced breathing difficulties during the use of a N95 respiratory mask, as can be seen in Table 4.10 below.

Table 4-10: Prompt seeking of medical evaluation when experiencing breathing difficulty

	Frequency	Percentage (%)
No	204	72.9
Yes	76	27.1

4.3.4 Details about N95 mask fit tests

Fit testing should be done when selecting the type of mask the facility uses as variability in facial structure can mean that different types of masks fit better (University of Witwatersrand RHRU, 2013:21). The N95 respirator comes in different sizes and configurations that are variable and not standardised across models (CDC, 2014:5). As long as the N95 is the NIOSH approved respirator, it has been fit tested and is being used in accordance with the requirements of an OSHA compliant respirator programme, including it being appropriately fit tested by the user, then the wearer should receive the expected protection factors, regardless of colour, shape or style (NIOSH:2014:5). N=239 (85.4%) of the respondents reported that there are no employees in the facility that are trained to perform the fit test, as depicted in Table 4.6.

Table 4-11: Availability of trained person to perform fit tests

	Frequency	Percentage (%)
No	239	85.4
Yes	41	14.6

In the study, n = 270 (96.42%) of the respondents reported that they were not fit tested (see Figure 4.5).

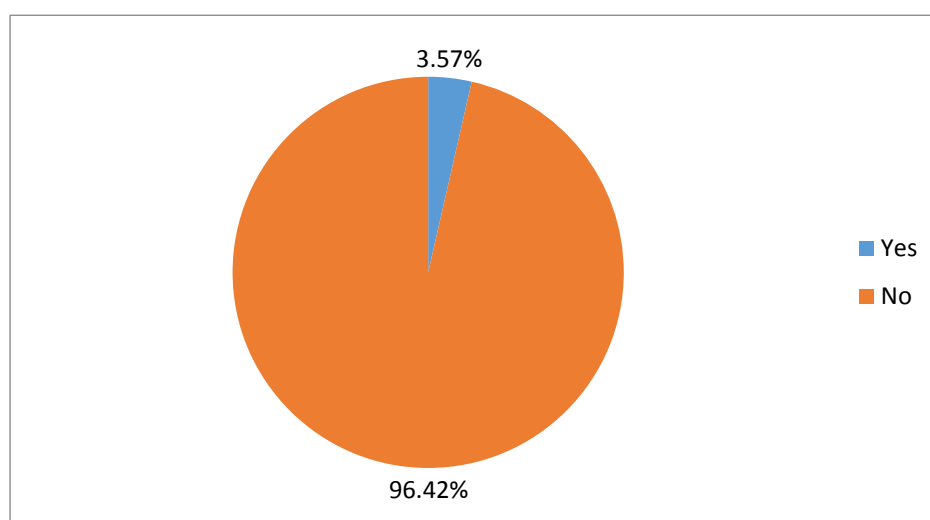


Figure 4-5: Fit testing prior to permission to wear N95 masks

Furthermore, 66.1% of the respondents believed that losing or gaining weight wouldn't affect the fit test, as can be seen in Table 4.12. This could explain why the HCWS in this health care facility would not insist on the fit test.

Table 4-12: Weight change affecting the fit-test

	Frequency	Percentage (%)
No	185	66.1
Yes	95	33.9

4.4 Findings Related to Infection Prevention and Control Policy, and Administration and Environmental Control Strategies Related to N95 Respirator Masks

In this section, the findings related to the respiratory protection policy and the administration and environmental control strategies related to the N95 mask will be disclosed.

4.4.1 Details about respiratory protection policy and administration

The respiratory standard establishes the requirement that in a place of employment where respirators are used, such as in health care facilities, a written respiratory protection programme with worksite-specific procedures must be created (Pyrek, 2011:1). In this study n=160 (57.1%) respondents reported that they do not have a written respiratory protection policy, whilst n=120 (42.9%) reported that it is available, as reflected in Table 4.13.

Table 4-13: Availability of written respiratory protection policy

	Frequency	Percentage (%)
No	160	57.1
Yes	120	42.9

Each member of staff should understand the importance of infection control and their role in following standards of care. Job descriptions should include specific infection control duties and infection control should be part of pre-service and in-service training for all staff including non-clinicians and volunteers (USAID, 2007:3). According to KZN Health Infection Prevention and Control Policy no 1 (2007:11) there should be an ongoing in-service training about infection prevention and control. All staff should be orientated to policies, guidelines and procedures before commencement of duties especially new members and when staff members are rotated from unit to unit. In this study respondents denied having received training on respiratory protection n=223 (79.6%), as can be seen in Table 4.14.

Table 4-14: Completed respiratory protection training by HCWs

	Frequency	Percentage (%)
No	223	79.6
Yes	57	20.4

All medical and nursing, as well as other HCWs must understand the nature of the infection problem, especially as it affects the infection practices necessary to their jobs. Prevention and control of health care associated infections should be emphasised routinely as infection prevention and control is a continuous process, dependent on continued awareness and the interest of all personnel within health care facility (KZN Health Policy, 2007:11). Seventy-nine point six per cent of the respondents (n=223) reported the non-availability of a respiratory policy as it is reflected in table 4.15.

Table 4-15: Availability of respiratory policy

	Frequency	Percentage (%)
No	223	79.6
Yes	57	20.4

To reduce risk of exposure, infection and disease through policy and practice, one person designated as an infection control officer and who leads the infection control team, oversees the monitoring of items within the infection control plan, organises and trains staff as needed and communicates needs to facility management (USAID, 2007:2). In this study, n=204(72.9%) reported that they do not have an administrator for respiratory protection, as seen in Table 4.16.

Table 4-16: Availability of a respiratory protection administrator/HCW

	Frequency	Percentage (%)
No	204	72.9
Yes	74	26.4
Don't know	2	0.7

Some procedures performed on TB infected patients may be more likely to generate a higher concentration of infectious respiratory aerosols such as coughing. These procedures potentially put the HCWs and others at an increased risk for TB exposure (CDC, 2015:2). Precautions for aerosol generation procedures include: only performing these procedures if they are medically necessary and cannot be postponed and limiting the number of HCWs present during the procedure to only those essential for patient care and support (CDC, 2015:2). Sputum collection should always be done in a designated area with a lot of fresh air circulating and away from other people, not in small rooms such as toilet rooms or other enclosed areas. According to this study's results, n=237 (84%) respondents responded that they do not have isolation rooms for sputum collection. These findings are reflected in Table 4.17.

Table 4-17: Availability of isolation rooms for cough and other aerosol-generating procedures

	Frequency	Percentage (%)
No	237	84.6
Yes	43	15.4

The physical design of the hospital is an essential component of a hospital infection control strategy, incorporating infection control issues to minimise the risk of infection transmission

(Rao, 2004:63). The role of infection control in the design of facilities has become increasingly visible as communicable diseases like TB and MDR-TB organisms have caught the attention of the media affecting both consumer awareness and regulatory agencies responsible for environmental health (Rao, 2004:63).

In this study 82.1 % (n=230) of the respondents indicated that they have isolation rooms in their health care facility, where patients with suspected and confirmed TB are admitted so that the spread of TB is controlled (see Figure 4.6). Components of infection prevention and control programmes include an infection control team. The team develops an annual plan for infection control and prevention, assesses infection control risks, develops written infection control policies, assesses standard of care, promotes performance improvement, reviews epidemiological data, looks for areas of improvement and intervention and assesses training and education needs for staff, patients and community (United States Agency for International Development (USAID), 2007:2).

In this study the majority of the respondents 93.9 % (n=263) have indicated that there is an infection control team in their health care facility and only 6.1% were unaware of the existence of such a team. Eighty two point five percent (n=231) agreed that they receive in-service education regarding infection control and 17.5 % (n=49) indicated that this was not the case. These findings are reflected below in Figure 4.6.



Figure 4-6: Facility details and services

In-service education was provided every three months, according to 39.6% of the respondents. Education was reported at various intervals by the majority of the respondents and only 2.1% of them reported that it was not done at all (see Figure 4.7).

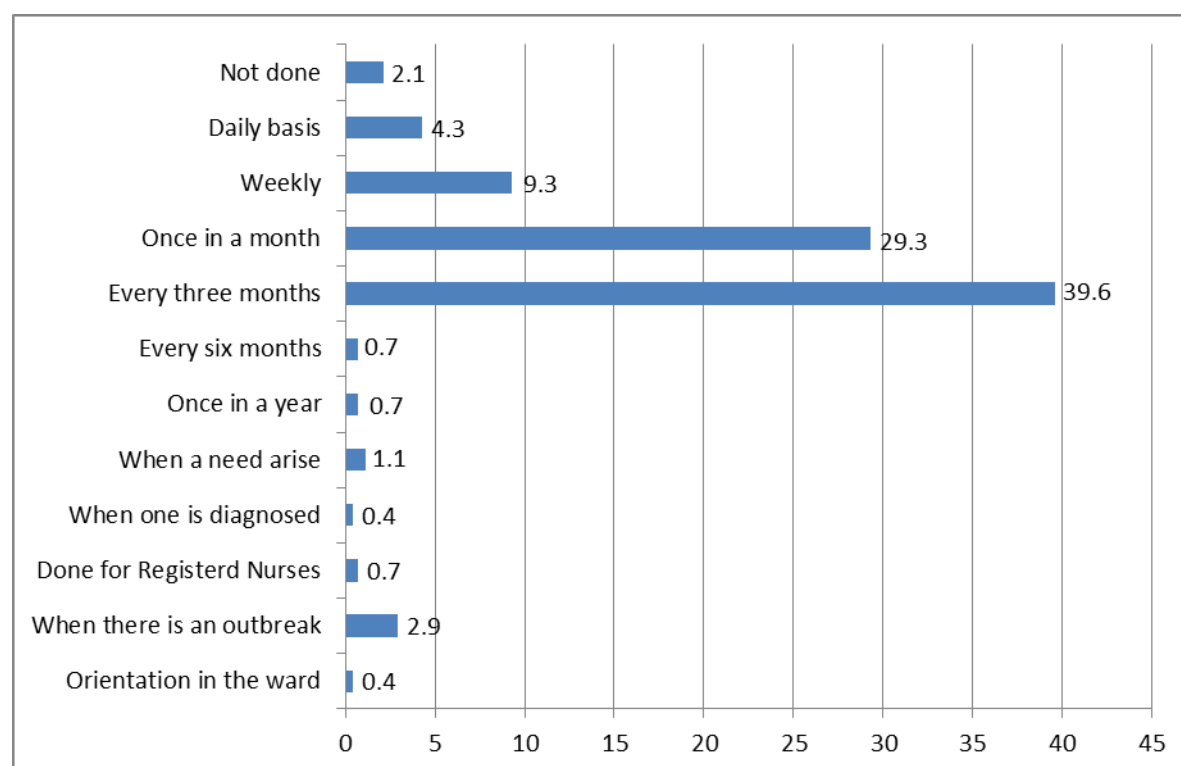


Figure 4-7: Frequency of in-service education

4.4.2 Details related to the administrative control strategies.

There are some rules in terms of administrative control strategies in order to limit the contamination of the HCWs by the patients affected by TB. Firstly, in the context of TB infection control, a system for identifying people with TB symptoms based on cough triage is used in fast-tracked TB diagnosis. In this study, 119 respondents (42.5%) reported that they did not screen patients as they entered the facility, in order to identify people with TB symptoms. This can be seen in Table 4.18.

Table 4-18: Screening of the patients who cough as they enter the facility

	Frequency	Percentage (%)
No	119	42.5
Yes	161	57.5

Furthermore, further separation of suspected cases should be done when necessary (WHO, 2009:37). Unfortunately, 64.3% of the respondents reported that they did not separate TB suspects from those who were not suspected of being infected with TB, as depicted in Table 4.19.

Table 4-19: Separation of TB suspects from those who are not infected

	Frequency	Percentage (%)
No	180	64.3
Yes	100	35.7

Another administrative strategy is to educate patients. Educating patients on cough hygiene will help to stop the spread of TB and other germs to people (University of Witwatersrand RHRU, 2012:41). In this study, the findings revealed that 54.6% of the respondents said they did not educate patients in cough hygiene as they entered the facility, as seen in Table 4.20.

Table 4-20: Education of patients in cough hygiene

	Frequency	Percentage (%)
No	153	54.6
Yes	127	45.4

Posters informing clients that the facility is implementing TB infection control policies and that if they cough, waiting times may be shorter and will need to wear a mask should be displayed in facility reception and waiting areas (University of Witwatersrand RHRU, 2012:39). In this study, 27.9% of the respondents reported having posters indicating the need for wearing N95 masks, as seen in Table 4.21.

Table 4-21: Availability of posters indicating the need of wearing N95 mask

	Frequency	Percentage (%)
No	202	72.1
Yes	78	27.9

Posters of how to prevent TB and encouraging early diagnosis should also be displayed. Early case detection remains one of the most important interventions for reducing the risk of TB transmission in the household (WHO, 2014:19). Only 22.9% of the respondents reported having been reminded of the need for early diagnosis that month, as can be seen in Table 4.22.

Table 4-22: Reminder of the need for early diagnosis

	Frequency	Percentage (%)
No	216	77.1
Yes	64	22.9

Material promoting infection control amongst HCWs such as posters of the N95 mask, surgical masks, airflow direction in the consultation rooms and summary of infection control measures should be displayed in the reception area, tearooms and consultation rooms (University of Witwatersrand RHRU, 2012:39). Acid Fast Bacillus (AFB) smears are reported within 24 hours of receipt and AFB cultures are reported on at six weeks, once bacterial colony growth or the lack thereof has been determined (CDC, 2015:2). In this study, respondents appeared unaware of the actual turnaround times. For example, 22.5% of the respondents said that sputum AFB smears were reported on after more than 72 hours, as per Table 4.23 below.

Table 4-23: Laboratory turnaround time for sputum AFB smears

	Frequency	Percentage (%)
< 48 Hours	39	13.9
48 Hours	4	1.4
48 - 72 Hours	174	62.1
> 72 Hours	63	22.5

4.4.3 Details related to the environmental control strategies to remove infectious aerosols.

Mechanical ventilation is created by using an air supply or an exhaust fan to force air exchange and to drive airflow. Such ventilation works by generating negative or positive pressure in the room to drive air changes (WHO, 2009:35). In this study, 14.3% of the respondents reported using fans to increase air circulation in their work area (Table 4.24).

Table 4-24: Use of fans to increase the circulation of air in the work area

	Frequency	Percentage (%)
No	240	85.7
Yes	40	14.3

Natural ventilation created by the use of external natural forces such as wind and temperature control of air flow direction cannot be achieved by simple natural ventilation; it depends on sufficient wind speed, direction or temperature differentiation (WHO, 2014:19). Therefore, the HCWs should know the direction of airflow in each consultation room as an environmental strategy to reduce or remove infection aerosols. In this study, respondents (94.6%) reported not knowing the direction of the airflow in each room (see Table 4.25).

Table 4-25: Knowledge of the direction of airflow in the consultation room

	Frequency	Percentage (%)
No	265	94.6
Yes	15	5.4

Not only that, the HCWs should sit with their back towards the direction of the airflow. The majority of the respondents (91.8%) reported not sitting with their back towards the direction of the airflow in order to allow airborne pathogens to be blown away from them. This is demonstrated in Table 4.26.

Table 4-26: Sitting with the back towards the direction of airflow

	Frequency	Percentage (%)
No	257	91.8
Yes	23	8.2

As another environmental strategy, the windows of the rooms should be able to open. The majority of the respondents (70.7%) answered “no” to the question: Are windows in your facility able to open? (Refer to Table 4.27).

Table 4-27: Windows able to open

	Frequency	Percentage (%)
No	198	70.7
Yes	82	29.3

The windows should be able to open and should be opened during working hours. If they are not able to open, it is obvious they will not be open during working hours. In this study, the findings revealed that 67.1% of the respondents reported that they did not keep the windows opened during working hours, as depicted in Table 4.28.

Table 4-28: Windows opened during working hours

	Frequency	Percentage (%)
No	188	67.1
Yes	92	32.9

Personal risk reduction strategies fall into the environmental strategies to reduce infection aerosols. Precautions that apply to patients or suspects with airborne infections and are used in addition to standard precautions include use of respirators by HCWs, patient placement in a separated, well-ventilated area and the use of medical masks on patients for transportation out of the isolation area (WHO, 2009:35). In this study, 57.9% of the respondents reported that they did not wear an N95 mask in high risk areas that month, as can be seen in Table 4.29.

Table 4-29: Use of the N95 mask in high risk areas

	Frequency	Percentage (%)
No	162	57.9
Yes	118	42.1

4.5 Barriers to the Use of N95 Respirator Masks

Combined with the low percentage of available N95 respirator masks in the facility, the findings revealed there are barriers to the use of N95 respirator masks by the respondents. Hairstyle was considered a barrier by 46.4% of the respondents, who asserted that this prevented them from wearing N95 respirator masks, as evidenced in Table 4.30.

Table 4-30: Hairstyle as a barrier

	Frequency	Percentage (%)
No	150	53.6
Yes	130	46.4

Another barrier identified by the respondents was the high environmental temperature. A total of 60, 7% mentioned it as a reason why they could not wear an N95 respirator mask, indicated in Table 4.31.

Table 4-31: High environmental temperature as a barrier

	Frequency	Percentage (%)
No	110	39.3
Yes	170	60.7

Less than half, 42.9% of the respondents, regarded make up as a further barrier to the use of N95 masks (see Table 4.32).

Table 4-32: Make up as a barrier

	Frequency	Percentage (%)
No	160	57.1
Yes	120	42.9

Finally, the findings revealed that 65.7% of the respondents considered interference with communication as a barrier to the use of N95 masks (see Table 4.33).

Table 4-33: Interference with communication as a barrier

	Frequency	Percentage (%)
No	96	34.3
Yes	184	65.7

4.6 Summary of Chapter Four

In this chapter, a general description of the study showed that nurses comprised the majority of the respondents. Facility services such as isolation rooms and an infection control team were available, although not all of the respondents were aware of them. Respiratory policies and administration were not always available in the facility. Not all the respondents always wore the N95 respirator nor disposed of or maintained them adequately. Neither environmental control strategies, nor administrative ones were always followed by the respondents. Finally, barriers to the use of the N95 respirator like high temperatures, hindrance to communication, hairstyle and make up were identified.

CHAPTER FIVE: DISCUSSION AND RECOMMENDATIONS

5.1 Introduction

In the previous chapter the results of the study were presented according to sections of the questionnaire. In this chapter the main findings of the study, recommendations, limitations and conclusion will be discussed. The results are discussed in relation to objectives of the study so that appropriate conclusion and recommendation can be made. Recommendations are made with reference to the study findings. The recommendations made focus on the improvement of infection control measures and on the respiratory programme in relation to compliance with the use of the N95 mask during the management of a patient with suspected or confirmed TB infection in health care facilities in the eThekweni district.

5.2 Discussion of the Findings

The study objectives were to evaluate the level of compliance with the use of the N95 respirator mask among HCWs in this provincial hospital; to evaluate compliance with infection prevention and control policy, and with administration and environmental control strategies related to N95 respirator masks in this provincial hospital; and to determine the perceived barriers to compliance regarding the use of the N95 respirator mask by the HCWs of this provincial hospital. The purpose of the study was to evaluate the compliance of the HCWs with the use of the N95 mask in one of the health care facilities in the eThekweni district when managing patients with suspected or confirmed TB infection. A self-administered questionnaire was used to collect data in relation to the following:

5.2.1 Demographic and work profile

It was important to present the summary of demographic and work profile, as it shows the numbers and categories of respondents, age categories and work experience. It made it easy for the researcher to understand and to assess which staff category among HCWs were exposed to suspected or confirmed TB infections in the one of the health care facilities in the eThekweni district. The study showed that out of 280 HCWs who responded in the study the majority (98.5%) of the respondents were nurses, whilst doctors were (1.5%). Nursing staff are the majority of personnel in health care facilities (Malebati, 2010:53). The nursing team is the largest category of health professionals and, due to the nature of their tasks, they have the

closest physical contact with patients, through functions like bathing, cleaning fluids and secretions, collecting biological samples etc. Hence, the nursing team is the professional group most exposed to occupational risk, including the risk of catching nosocomial TB (Duarte, Miola, Cavalcante & Bammann, 2010:1010).

Most of the respondents fell within the age group 21-30 n=119 (42.5) and 31-40 n=97 (34.6%). 66% n=184 HCWs had 6 months to five years of work experience in wards with suspected or confirmed TB infection in this institution.

5.2.2 Objective 1: To evaluate the level of compliance with the use of the N95 respirator mask among HCWs

In this section, we will be discussing the wearing of the N95 respirator mask, the medical evaluation and the fit test as well as the maintenance, the inspection and the disposal of the respirator mask by the HCWs.

5.2.2.1 Details about wearing of the N95 respirator mask

To ensure compliance with the use of N95 respirator mask, the institution must have a respiratory protection program. A respiratory protection program is a cohesive collection of written, worksite-specific procedures and policies that, taken together, address all of the respiratory protection elements required by the standard. The program must contain specific procedures describing how a respirator will be selected, fitted, used, maintained and inspected in a particular work place (United States Department of Labour, OHSA, 2010:9) The researcher used a structured questionnaire to evaluate the compliance with the use of the N95 respirator as a TB control measure.

It can be asked how the OHSA complies with the South African Department of Labour and the Occupational Health and Safety Act of 1993. The SA Department of Labour (2001:13) states that employers should ensure the provision of N95 respirator masks to all employees and patients in areas of collective gathering of people, and consistently implement the policies correctly. This is in line with the Occupational Health and Safety Act, which is concerned about the health of an employee in the work place. Acquiring of TB by HCWs is an occupational hazard which can be avoided by adherence to the abovementioned Acts.

In the study compliance with the use of N95 respirator mask was not revealed in the study objective. CDC (2006:54) recommends the usage of the N95 respirator mask for the safety of HCWs who may be exposed to *M. tuberculosis* in various settings. The N95 respirator masks meet specifications required by the NIOSH which include: filter size of 1 microgram, filter efficiency =95% and tight facial seal. The majority of the respondents in the study (77.9%) agreed that they have responsibility for compliance with the use of N95 respirator and that masks protect them against infection but are not always available. In this study n=166 (59%) respondents reported that they do not wear N95 mask all the time when entering an isolation facility and when transporting a suspected or confirmed TB infected patient. PPE measures require compliance of HCWs to correct wear and consistent use of respirators stock out and non- availability of such resources can limit HCWs performance and increase the risk of health care associated TB (Adeleke, 2012:199). The majority of respondents n=153 (54.6%) reported that they do not check the seal in a mask after putting on a mask and n=162 (57.9%). respondents do not try different sizes or models if they cannot achieve seal due to leakage nor do they ask for help. According to United States Department of Labour, OHSA (2010:33) if a good face piece-to face seal is not achieved the respirator will provide a lower level of protection than it was designed to provide. Without a good seal the respirator can allow contaminants to leak into the users breathing air. According to CDC (2009:85), HCWs contracted the novel H1N1 influenza a pandemic virus from undiagnosed patients with respiratory symptoms and from fellow employees who came to work sick but even when they knew they were caring for patients with novel H1N1, many HCWs did not use all the PPE that were recommended including N95 respirator mask.

5.2.2.2. Medical evaluation

In this study n=249 (88.9%) respondents reported that they were not evaluated for potential medical difficulties before being permitted to wear the N95 masks. Employees who are required to wear respirators at work must pass a medical exam before being permitted to wear respirator mask (United States Department of Labour, OHSA, 2010:13). The employer must obtain a written recommendation from the local physician or licensed health-care professional for each employee's ability to wear a respirator (United States Department of Labour, OHSA, 2010:14). Employees are not permitted to wear respirators until a physician has determined that they are medically able to do so (CDC, 2012:3). Medical evaluation determines the ability of the HCW to use a respirator mask. It is required to be completed

before fit-test and before the decisions are made that HCWs are going to use a respirator in the work environment (CDC-NIOSH, 2014:1). Medical evaluation is necessary because using a respirator may place burden in an employee's health. The burden varies according to number of factors such as weight and breathing resistance of respirator and the work place conditions (United States Department of Labour, OHSA, 2010:29). HWCs with chronic bronchitis and those with asthma may have problem with the use other respiratory mask. The majority of respondents n=185 (66.1%) reported that gaining or losing weight cannot affect fit testing. About 61.8% (n=173) respondents reported that family of TB patients are not given masks to wear before being in contact with their relatives. 54.3 % (n=54.3) reported that patients are given masks to wear when going out of the isolation ward.

5.2.2.3 Fit test

The findings of this study have indicated that n=239 (85.4%) of the respondents do not have a person trained to perform fit testing. The majority of the respondents n=263 (93.9%) were not fit tested before they were permitted to wear the N95 respirator mask. All respirators that rely on a mask-to-face seal need to be annually checked with either qualitative or quantitative methods to determine whether or not the mask provides an acceptable fit to a wearer (Heeren, 2012:4). Qualitative fit testing uses the wearer's sense of taste or smell or reaction to irritant in order to detect leakage into the respirator face-piece and a quantitative instrument is used to measure face seal leakage (United States Department of Labour, OHSA, 2010:1). For best effect, the N95 masks need to be fitted properly for each user this includes correct size and that the mask covers the nose and mouth without leakage (Singapore Ministry of Health, 2014). When the respondents were asked if gaining or losing weight can affect fit test 66.1 % responded yes which is contrary to United States Department of Labour, OHSA, 2010:37 who says physical changes in an employee that might affect face piece-face seal include obvious change in body weight, facial scarring or cosmetic surgery. With regard to achieving proper seal 57.9% of the respondents indicated that they do not ask for help in order to try different models and sizes and 60.4% indicated that it does not matter what model respirator you use as long as you were fitted with. The United States Department of Labour, OHSA (2010:1) states that whenever an employee switches to different size, make or model of respirator mask fit test must be conducted.

5.2.2.4. Details about care, maintenance and disposal of the N95 respirator mask

As part of facility's comprehensive respiratory protection program, policies and procedures guiding disposable N95 respirator inspection, usage, storage and replacement should be documented in writing and presented to workers as part of their training, at least annually (CDC, 2010:6).

The wearer of the N95 respirator mask should know how to use respirator effectively, including in situations in which the respirator malfunctions. The wearer must know how to inspect, put on and remove, use and check the seal of the respirator (University of Florida, Environmental Health and Safety (EHS), 2010:3). About n=204 (72.9%) reported that there is a policy for the maintenance and care of the N95 mask in the work place. According to the (2010:3), the supervisory personnel shall ensure respirators are used and worn correctly. If problems are observed corrective measures shall be taken immediately. About inspection of the N95 mask for damage and contamination before using it, n=145 (51.8%) responded yes. the University of Florida, EHS respiratory protection policy specifies that each person issued a respirator shall inspect the respirator prior to each use to ensure that it is in a good condition. This inspection shall include the tightness of the connection and the conditions of the face piece. A replacement of the same model and size shall be provided if any defects are noted. About disposing of the N95 mask the majority of respondents n=218 (77.9%) treat the disposal of N95 mask as health care waste and discard it in a redlined box. Used N95 respirator mask must be discarded according to infection control protocol (Minnesota DoH, 2015:1). The majority of respondents n=155 (55%) were not sure of how long they used the N95 mask before discarding it whilst 45 % (n=125) reported that was used for 8 hours. According to CDC (2010:5) Re -use of disposal N95 respirators, where the respirator is removed and re-donned between patient encounters, can result in a risk of contact transmission by touching contaminated surface of the mask and subsequently touching the mucous membrane of the face. If re- use is chosen as a strategy to increase availability of respiratory protection the following should be considered to minimize the risk of transmission:

- Discard disposable N95 respirators following aerosol- generating procedures.
- Discard disposable N95 respirators when contaminated with blood, secretions from patient and other bodily fluids from the patient.

- Disposable respirators must only be used and re used by the single wearer.
- Do not re- use the disposable respirator that is obviously contaminated, damaged or hard to breathe through.
- Store the respirator in a clean, breathable container such as a paper bag between uses.
- Avoid touching the inside of the respirator.

According to the study done by Duarte et al. (2010:1007) in Brazil on the maintenance status of N95 respirator masks after use in a health care facility which included 167 nurses, dirt, stains and folds were observed in 80% of the devices. Internal stains and folds were more frequent among workers of the 12 hours shift than 6 hours shift. It is not currently possible to specify a longest safe duration of disposable N95 respirator use since this may be affected by number of variables that impact on respirator function and acquisition of contamination over time. Examples include frequency of use, practice used to prevent contamination, intensity of potential contaminating exposures and the range of materials and methods used to manufacture different models of disposable N95 respirators (CDC, 2010:5).

5.2.3 Objective 2: To determine the perceived barriers to compliance regarding the use of the N95 respirator mask.

Here the barriers to the use of N95 respirator masks will be discussed. The findings revealed that the high environmental temperature, the loss of effective communication with patients and the hairstyle and make up were some of the perceived barriers identified to the use of the mask.

5.2.3.1. High environmental temperature

Ideally, respirators used in the health care workplace should permit HCWs to perform their duties without interference. However, many studies of N95 respirator masks in the United State market place have shown them to be associated with overall discomfort, diminished visual, vocal or auditory acuity, excessive humidity or heat, headache, facial pressure, skin irritation or itchiness, excessive fatigue or exertion, malodorousness, anxiety or claustrophobia and other interferences with occupational duties (Baig et al, 2010:2). In this study the respondents were asked if high environmental temperature prevents them from

wearing N95 respirator mask 60.7 % responded yes. Baig et al. (2010:18) distributed 159 surveys on the HCWs view about respirator use and features that should be included in the next generation of respirators 28% of respondents responded that they seek respirators that are more comfortable, less interfere with breathing, diminishing heat building, disposable and permit user to have facial hair. They then commented that HCWs are in general poorly compliant with respiratory protection policy especially when N95 is recommended.

5.2.3.2 Communication

According to Gibbs et al., (2010:516), there are range of material barriers limiting the use of N95 respirator masks by HCWs, such as the hindering of communication with patients who has auditory problems as a result of the treatment they are getting for TB and this requires the HCWs to take off the mask so that the patients can lip read. In this study the respondents were asked if wearing N95 respirator mask interferes with communication. Sixty-five point seven percent responded yes. According to Pyrek (2011:1) the study on the use of N95 respirator mask, the observed N95 respirator mask noncompliance rates were 85% in 2006, 87% in 2007 and reached 89% in 2008. Reasons being given were respirators are uncomfortable, limit communication, too hot, not fitting and not available in close proximity to the work task.

5.2.3.3 Hairstyle

Infection prevention continues to be an issue across the health care spectrum, and N95 respirator mask use also remains an important component of HCW safety and infection prevention (Beam, Gibbs, Hewlett, Iwen, Nuss & Smith, 2014:1). Hairstyle refers to the styling of the hair on the human scalp and is considered an aspect of personal grooming. In this study, respondents also mentioned hairstyle as a barrier to the use of the N95 respirator mask. When asked if hairstyle prevents them from wearing N95 respirator masks, 46.4% responded 'yes'. The study done on methods for investigating nursing behaviour related to isolation care by Bean et al. (2014) revealed that nurses were observed using only one strap to secure the N95 respirator mask. When asked about the second one, they commented on the hairstyle factor.

5.2.3.4. Make-up

Staff protective infection control behaviours are cognitively driven by a perception that infection control measures hinder task performance. However individual factors require further consideration (Gralton et al, 2013:2). Make-up is the application of cosmetic to the face such as lipstick, powder, eyeliners to enhance appearance as aspect of personal grooming. In this study when the respondents were asked if make-up prevents them from wearing N95 respirator mask 42.9% responded yes.

5. 2. 4. Objective3: *To evaluate compliance with the respiratory protection programme for TB infection prevention and control in terms of policy and administration and environmental strategies related to N95 respirator masks related to N95 mask.*

Here the policies and administration program related to the N95 mask will be discussed, as well as the environmental strategies to decrease the spread of infection in the work place.

5. 2. 4.1 Respiratory protection programme

Infection prevention and control refers to measures, policies, protocols and procedures aimed at preventing and controlling infections and transmission of infection in a health care facility. Such infections may be pre-existing on admission or may be acquired in a health care facility (Atkinson, Chartier & Pessoa-Silva, 2007:6). The OSHA (2010:3) requires the employer to establish and maintain an effective respiratory protection programme when employees must wear respirators to protect against work place hazards. According to the United States Department of Labour, OSHA (2010:11) the respiratory protection standard in the work place is intended to:

- Enhance the protection of employee health.
- Promote effective use of respirators.
- Make it easier to understand the policy and procedures to be followed when implementing a respirator protection programme.
- Supersede most respiratory provisions in existing standard.

There is no written respiratory protection policy in the institution. The HCWs were not trained on respiratory protection and there are no respiratory protection policy. 72.9% of the respondents reported that there is no administrator for respiratory protection in the facility.

The results of the study done by Malebati in 2010 on adherence of use with N95 respirator mask in Tshwane District 48% of respondents did not know that there was respiratory protection programme in their work place. The implementation of a respiratory protection programme is mostly focused on protecting employees against exposure to TB infection in health care facilities during the management of suspected or confirmed TB patients. The results of the study done by Tudor (2013:143) investigating TB infection prevention control measures in various health care facilities and among HCWs in Limpopo, the Eastern Cape, KZN, Mpumalanga and North-West provinces revealed that few facilities had written infection control plans for TB. Less than 20% of all facilities reported a written respiratory protection plan.

5.2. 4.2 Respiratory protection policy and administration

OHS policy and administrative data are an indicator of the effectiveness of control measures in place to ensure that HCWs are not overexposed during management or curing of TB patients in the TB health settings. HCWs managing patients suspected or confirmed as having pulmonary TB infection are required to wear the N95 respirator mask in the TB settings (WHO, 2009:11). The South African Occupational Health Safety Act 85 of 1993 (OHSA) requires that the entire TB health settings implement respiratory protection programme for the safety of HCWs. The administrative programme is all about preventing HCWs from being exposed to TB infection and reducing the spread of TB infection by:

- Developing and implementing policies in health care facilities
- Monitoring and evaluating the implemented standard.
- Developing staff training programmes.
- Developing respiratory protection template (guidelines) for training.

Training includes compliance with the use of N95 respirator mask in terms of correct usage care and maintenance as well as fit testing and medical evaluation. Appropriate TB infection prevention and control policies need to be implemented in all health care facilities (Nicol et al., 2014:2). In this study, n=160 (57%) responded 'no' to being aware of a written respiratory protection policy. The results of this study show that there is no availability of a written respiratory protection policy in the institution. Effective TB infection control is essential in all health care facilities. In more than half of the studies assessing TB infection

prevention and control in South African health care facilities, less than 50% of the facilities had a written TB infection prevention and control policy, with a person in charge of TB infection prevention and control in the facility (Khazaei, Roshanaei, Saatchi, Rezaeian, Zahiri & Bathaei, 2014:50). A study done by Naidoo et al. (2012) in 51 primary health clinics in KZN assessing adherence to infection control policies showed that only eleven (22%) of the clinics had infection control policies.

In the study n=204 (72.9%) reported that the institution does not have an administrator for respiratory protection. An administrator is needed in the health care facility to train HCWs in infection control measures, monitor the HCWs compliance with infection control measures and report occupational TB cases to the infection control programme through the statutory reporting system (Zungu & Malotle, 2011:17). An administrator increases awareness of the occupational and infection control hazards in the health care sector, focusses on the biological hazards and strengthens occupational health and safety committees increasing knowledge of international guidelines related to occupational health and safety for HCWs (Lavoie, Yassi, Bryce and Fujii et al., 2010:398). The administrator enables health professionals to share knowledge, expand understanding and enhance occupational health services for HCWs and fosters international, inter-sectoral and inter-institutional collaboration of occupational health in the health care sector (Zungu & Malotle, 2011:17). In this study, 93.9% of respondents there is an infection control team in the hospital. Some of the responsibilities of infection prevention and control committee are to ensure ongoing staff training in TB infection control and to ensure that finances and budgets allow for implementation of infection control interventions. 82% reported that they receive in-service education regarding infection control. When the respondents were asked how often the in-service is conducted, 39.6% of them reported that it is done every three months, 29.3% reported that it is done every month. Other respondents reported that it is done weekly, others reported that it is done when there is a patient with infectious condition. According to the infection prevention and control policy of the hospital where this study was conducted, in-service training or education on infection prevention and control was done every three months. The supervisors initially received the three monthly training and were then required to train the HCWs in their units. Farley et al. (2012:82) evaluated infection control in all 24 MDR-TB and XDR-TB facilities in South Africa. The results showed that annual infection control training was available in 38% of the facilities.

Infection control is effective only if each person working in a facility understands the importance of infection control policies and his or her role in implementing them (WHO, 2009:24). As part of training each HCW should receive instruction appropriately for his/her job category ideally training should be conducted before initial assignment and continuing education should be provided to all employees (WHO, 2009:24).

5.2.4.3. Policy for respiratory protection

In this study n=223 (79.6%) respondents reported that there is no policy for respiratory protection in the institution. WHO (2009) proposed guidelines for infection prevention and control measures that are effective, affordable and can be implemented in resource-limited settings (Bhebhe, van Rooyen, Steinberg, 2014:4). In the study, 72.1% reported that N95 respirator mask is not always available in the wards and 78.6% reported that they do ask the supervisor for provision. WHO and CDC proposed the implementation infection and control at three levels: administrative, environmental and personal respiratory protection (Bhebhe et al., 2014:4). Appropriate management protocols need to be implemented to ensure that administrative, environmental and personal protective activities are functional and implemented appropriately in all health care facilities (Khazaei et al., 2014:50). Study on evaluation of infection control in MDR-TB and XDR-TB facilities in South Africa by Farley et al. (2012:82) indicated that in 88% of facilities HCWs of all levels were seen to enter drug-resistant TB wards without N95 respirators in place. According to Naidoo et al. (2012:4) the results of the study on adherence to infection control policies revealed that although eleven clinics (22%) had N95 respirator masks available for use but on risk assessment days none of the HCWs were seen to wear them.

5.2.4.4 Details about administrative control strategies.

Strategies to reduce the production of infectious TB particles rely on the identification of clients who cough. This can be done by asking clients for their history of coughing, or by observing clients. The sooner coughing clients are identified, the better. Client confidentiality should be maintained and a gentle approach is advised (University of Witwatersrand RHRU, 2009:12). Although such an approach might interfere with patients' rights to autonomy and will undoubtedly have human rights implications, the SA XDR-TB policy states that these measures are reasonable and justifiable, and must be seen from a utilitarian perspective (Singh, Upshur & Padayatchi, 2007:0024). The respondents n=161 (57.5%) reported that they

do not screen patients for coughing as they enter the facility. About 54.6 % (n=153) reported that they do not educate patients in cough hygiene as they enter the facility. The majority of the respondents n=206 (73.6%) reported that those who are coughing are not provided with masks to reduce infectious aerosols. About separating TB suspects from those who are not, n=180 (64.3%) reported that patients are not separated. The majority of the respondents n=216 (77.1 %) were not reminded of the need for early diagnosis of TB during the month of data collection. Regarding the fast queue for collection of sputum smear results n=222 (80.4 %) responded that it is not done. The results of the study done by Mphahlele et al. (2012:2) on the assessment of infection control practices in 10 primary health care facilities in the Western Cape revealed that in terms of administrative infrastructure, only 20% of the facilities had facility-specific infection control plans, cohorting of patients was not practiced in any of the facilities and TB patients shared waiting rooms with other patients at all of the facilities. Triage of patients upon entry was not practiced in any of the facilities.

With regard to isolation n=230 (82.1%) of the respondents reported that they had isolation facilities in the institution. Transmission-based precautions are applied to patients suspected or confirmed to be infected with microorganisms transmitted by contact, droplets or air or airborne routes (Canterbury District Health Board, 2012:1). To protect patients, visitors and personnel from spread of infection, a system of isolation precautions and procedures must be implemented and those precautions must be adopted from the most current recommendations of the CDCs (The University of Mississippi, 2015:2). n=263 (93.9%) confirmed that an infection control team is available at this institution. Such a team identifies risk areas and assesses the training needs of the HCWs (WHO, 2009:29).

5.2.4.5. Environmental control strategies

Adequate ventilation in the health facilities is essential for preventing transmission of airborne infections and is strongly recommended for controlling of spread of TB. The use of N95 respirator mask is third strategy to prevent transmission of TB from suspected or confirmed TB patients and it is effective when administrative and environmental strategies are in place (WHO, 2009:12). Higher ventilation rate is able to provide a higher dilution of airborne pathogens and consequently reduces the risk of airborne infections (WHO, 2009:13).

In this study, when the respondents were asked if they open windows during working hours 67.1% reported no and when asked if windows are able to open n =198 (70.7%) respondents

reported that windows are not able to open in the institution. A well designed, maintained and operated fan can help to obtain adequate dilution when natural ventilation alone cannot provide sufficient ventilation (WHO, 2009:14). Regarding the use of fans to increase circulation of air in the area of work, in this study majority of the respondents n=240 (85.7%) responded that it is not done. In this study about 94.6% (n=265) do not know the direction of airflow in each consultation room. Majority of the respondents in this study n=265 (94.6%) reported that the institution does not use ultraviolet germicidal irradiation in the facility high risk areas. The results of the study done by Malangu and Mngomezulu (2015:4) on evaluation of TB control measures in 52 health facilities KZN Ugu and Uthungulu districts revealed that 80% of facilities had an unrestricted airflow in the restricted areas, 20% had ultraviolet irradiation only in high risk areas and staff members failed to comply with the requirement to sit with their backs towards the direction of airflow, only 23, 6% of facilities complied with this requirement.

In this study n=237 (84.6%) reported that this is not available in the institution. Sputum collection always should be done outside (open environment) and away from other people (WHO, 1999:26). Environmental controls also include the provision of the sputum collection booths outside out-patient waiting rooms and consulting areas (WHO, 2009:8). A study by Farley et al. (2012:8) on infection control and prevention practice revealed that 59% of HCWs reported collecting sputum specimens in the wards.

5.4 Limitations of the study

There was scanty information in most literature articles studied in relation to compliance with the use of the N95 respirator mask and respiratory protection programme. Limited information in the literature studied made it difficult for the researcher to gather more information and to discuss the study results in this context.

5.5 Recommendations

The study results showed that there were several problems regarding the compliance with the use of the N95 respirator mask in the health care facility. The recommendations will improve compliance with the use of the N95 mask in this particular health care facility in the eThekweni district. Recommendations made below are based on the findings from this study.

5.5.1 General recommendations

It is recommended that the DoH compile a specific policy and standard operational procedures for the usage of the N95 respirator mask as a TB control measure, and that such a policy be made compulsory in all health care facilities. Fit testing checks should be performed each and every time when the N95 respirator mask is worn. Personnel should not be allowed to enter or to manage suspected or confirmed TB patients until a satisfactory fit testing check is achieved.

Visitors entering the isolation room or areas used by patients who have suspected or confirmed TB infection should be provided with the N95 respirator mask and should be instructed by a trained HCW in the TB ward. Patients who have suspected or confirmed TB infection with an active cough and sneeze should also be provided with a surgical face mask as soon as identified and be moved to an isolation room with good ventilation.

5.5.2 Recommendation for management

HCWs working with suspected or confirmed TB patients should be provided with the N95 respirator mask. There is a need for the health care facility managers to introduce the policy compelling HCWs to undergo medical evaluation for potential medical difficulties before they are permitted to use the N95 respirator mask in the TB facilities. Staff must be trained on the use of the N95 respirator mask and medical evaluation. HCWs using the N95 respirator should be included in respiratory protection programmes. For the HCWs to comply with the use of the N95 respirator mask the following must be in place:

- There should be a designated person with sufficient knowledge who must be given the responsibility to manage or oversee the usage of the N95 respirator masks in the facility.
- There must be standard operational procedures for the usage of the N95 respirator mask by HCWs in TB settings.
- Continuous induction and in -service training of HCWs according to the usage of respirator mask.
- OHS should train personnel to perform fit testing of the N95 respirator mask.
- Inspection and maintenance of the N95 respirator mask should be according to the manufacturer's instructions.

- Periodic evaluation of the respiratory protection programme must take place within the health care facility.

5.5.3 Recommendations for practice

- The DoH should monitor and evaluate the implementation of the written respiratory protection programme policies by all the health care facilities in the eThekwin district.
- Newly appointed HCWs should undergo an induction programme for the respiratory protection programme and for the usage of the N95 respirator mask.
- HCWs who have undergone the respiratory protection induction course on the usage of the N95 respirator mask should be provided with a signed acknowledgement of their course.
- The DoH in KZN should provide a standardised type of N95 respirator mask that must be used by all health care facilities in the province.
- Health care facilities must develop and implement written worksite-specific procedures for proper N95 respirator use, care and maintenance.
- Respiratory protection programme for use of the N95 respirator mask must regularly be re-evaluated to ensure that it is up to date and effective while considering the following:
 - The type of N95 respirator used or alternatives. The health care facility must select a comfortable N95 respirator mask to be used by HCWs.

5.5.4 Recommendation for future study

It is recommended that a study on the evaluation of compliance with the respiratory protection programme in the health care facilities of the province of KZN be researched in future.

5.5 5. Conclusion

Occupational risks assumed by many HCWs included exposure to a variety of airborne respiratory infectious diseases, such as TB, measles, or emerging diseases such as acute respiratory syndrome and H1N1 influenza. Respiratory protective equipment is recommended as one method to diminish risk of exposure. However numerous studies have demonstrated

that HCWs are, in general, poorly compliant with respiratory protection policy, especially when N95 respirator mask use is recommended.

This chapter discussed demographic and workplace profile and in this study the majority of the respondents were nurses due to the nature of their tasks. The first objective of the study was discussed which is the N95 respirator mask compliance in terms of availability of respiratory protection programme, correct use of N95 respirator masks, care, maintenance, inspection, disposal, facial seal, medical evaluation and fit test. In the study compliance with the use of N95 respirator mask compliance was not revealed. Majority of the respondents reported that they do not wear N95 respirator mask all the time when treating suspected or confirmed TB patients, they do not undergo medical evaluation and fit test, they do not check facial seal, respiratory protection programme is not available in the institution. Objective two discussed N95 respirator mask compliance barriers. Two barriers were identified; high environmental temperature causes discomfort when wearing N95 respirator mask and they hinder communication. The third objective of the study was discussed in terms of policies and administration as well as other administrative strategies to reduce infection. The majority of the respondents reported they do not have written respiratory protection policy in their institution. Other administrative strategies to reduce infection are not practiced. Coughing patients share waiting rooms with those that are not coughing. N95 respirator masks are sometimes not available. The study limitations were discussed and in the study there was scanty information on previous studies related to the topic. Recommendations in general, to the management, for practice and for future study were discussed.

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SECTION A: DEMOGRAPHIC AND WORK PLACE DATA

QUESTIONNAIRES

INSTRUCTIONS

Answer all the questions.

Tick where appropriate.

Filling questionnaires is voluntary not compulsory.

Do not identify yourself.

1. INDICATE YOUR CATEGORY √ WHERE APPROPRIATE	
Doctor	
Intern	
Registrar	
Consultant	
Professor	
Physiotherapist	
Student physiotherapist	
General worker	
Clerk	
Nurse	
Professional nurse	
Enrolled nurse	
Enrolled nursing assistant	
Student nurse	
2. INDICATE YOUR AGE CATEGORY √ WHERE APPROPRIATE	
18-20	
21-30	
31-40	
41-50	
>50	
3. HOW MANY YEARS HAVE YOU BEEN WORKING IN THIS WARD? √ WHERE APPROPRIATE.	
1-5 Months	
6 Months-< 1Year	
1-5 Years	
6-10 Years	
11-15 Years	
16-20 Years	
21-25 Years	
>25 years	

4. COMPLETE YOUR FACILITY DETAILS BELOW ✓ YES/ NO

4.1. Do you have dedicated isolation room for management of TB patients in your facility?	YES	NO
4.2. Do you have infection prevention and control team in your facility?	YES	NO
4.3. Do you receive in-service education regarding infection prevention and control?	YES	NO
4.4. If yes, how often is the in-service conducted? ----- ----- ----- -----		

SECTION B: OHS POLICY AND ADMINISTRATION

5. PROVIDE DETAILS ABOUT RESPIRATORY PROTECTION POLICY AND ADMINISTRATION. ✓ YES, NO OR DON'T KNOW

5.1. Do you have a written respiratory protection policy in your facility?	YES	NO	DON'T KNOW
5.2. Have you undergone training in respiratory protection?	YES	NO	
5.3. If yes, were the respiratory policy provided during your training?	YES	NO	
5.4. If yes do you follow the policy for respiratory protection?	YES	NO	
5.5. Do you have an administrator for a respiratory-protection programme in your work facility?	YES	NO	DON'T KNOW
5.6. Was the respiratory protection programme in place prior to your training session?	YES	NO	
5.7. Was the respiratory protection programme designated after the training session?	YES	NO	
5.8. Do you have isolation rooms where cough-inducing or aerosol- generating procedures are performed in your facility?	YES	NO	
6. PROVIDE DETAILS ABOUT MEDICAL EVALUATION			
6.1. Have you been evaluated for potential medical difficulties with respiration before you were permitted to wear the N95 respirator mask?	YES	NO	
6.2. If yes, when did you undergo medical evaluation for potential medical difficulties with respirator use? ----- ----- ----- -----			

✓2 YES 1= NO 0 = DON'T KNOW

7. PROVIDE DETAILS ABOUT FIT TEST

7.1 Do you currently have an employee at your facility that is trained to perform a fit test?	0	1	2
7.2. If yes, was this person trained by OHS hygienist?	0	1	2
7.3. Have you been provided with fit-testing before you were permitted to wear an N95 mask?	0	1	2
7.4. If yes when was fit –testing commenced? ----- ----- ----- ----- -----	0	1	2
SECTION C: PRACTICES WHEN USING N95 RESPIRATORY MASK			
8. PROVIDE DETAILS ABOUT WEARING OF N 95 RESPIRATOR MASK √ 2=YES 1=NO 0=DONTKNOW			
8. 1.Do you wear the N95 respirator mask all the time within the shift when entering an isolation room and when transporting a suspected or confirmed TB patient?	0	1	2
8.2 Do you allow family of a TB patient to wear N95 respirator masks?	0	1	2
8.3 Is there a designated person in your facility that assists family members with fit-testing?	0	1	2
8.4 Do you let active TB patients in your facility wear N 95 respirator mask when going out?	0	1	2
8.5. After putting on the N95 respirator mask do you check your seal?	0	1	2
8.6. If you cannot achieve a proper seal due to air leakage do you ask for help or try a different size or model?	0	1	2
8.7. Do air purifying respirators such as the N95 supply air to breathe?	0	1	2
8.9. If you sense the respirator is not working properly, do you take it off immediately?	0	1	2
8.10. Do you perform a seal check each time you use the N95 respirator mask?	0	1	2
8.11. Does it matter what model respirator you use as long as you wear the same size you were fitted with?	0	1	2
8.12. If you experience breathing difficulty during an N95 use, do you promptly seek medical re- evaluation?	0	1	2
8.13. As long as you always wear an N95 respirator, you are not at risk of infection?	0	1	2
8.14. Can losing or gaining weight affect fit test	0	1	2

9. PROVIDE DETAILS ABOUT CARE AND MAINTANANCE AND DISPOSAL OF N95 RESPIRATOR √ YES/ NO		
9.1 Do you have a guideline for maintenance and care of the N95 respirator mask in your work place?	YES	NO
9.2. Do you have policy on how you should dispose of the N95 respirator mask in your facility?	YES	NO
9.3. Do you inspect the N95 Mask for damage and contamination before you wear it?	YES	NO
9.3. Do you treat the disposal of N95 mask as health care risk waste?	YES	NO

9.4. If yes, how do you dispose your mask?-----

9.5.How long do you use the N95 mask before you discard it?-----

9.6. What is the proper time to store the N95 mask?-----

10. UNDERSTANDING ISSUES WITH THE N95 MASK AND EMPLOYEES' RESPONSIBILITY AND COMPLIANCE WITH THE USE OF THE N95 MASK √ YES/NO

10.1. Do you feel you have a responsibility for compliance with the use of the N95 mask?	YES	NO
10.2. If yes why----- ----- ----- -----		
10.3. Is the N95 mask always available in your facility?	YES	NO
10.4. If no, do you ask your supervisor for provision?	YES	NO
10.5. Have you ever observed anyone in your facility failing to wear N95 mask in a situation when He/she should have been wearing it?	YES	NO
10.6. If yes was it investigated by management at any time as to why the use of the N95 mask was not observed?	YES	NO
10.7. Do you personally believe that wearing the N95 mask can help to protect you from work -elated infection?	YES	NO
10.8. Do you wear the N95 mask by habitual inclination?	YES	NO
10.9. Does your hairstyle prevent you from wearing the N95 mask?	YES	NO

10.10 .Does the high environmental temperature prevent you from wearing the mask?	YES	NO
10.11. Does the N95 mask interfere with communication?	YES	NO
10.12. Does your make up prevent you from wearing the N95 mask?	YES	NO

11. ENVIRONMENTAL CONTROLS: STRATEGIES TO REMOVE INFECTIOUS AEROSOLS AFTER GENERATION: N0=0, 1=OCCASSIONALLY AND YES =2.√ WHERE APPROPRIATE.			
11.1. Are windows in your facility able to open?	0	1	2
11.2. Do you keep windows in your facility open during working hours?	0	1	2
11.3. Do you use fans to increase circulation of air in your area of work?	0	1	2
11.4. Do you know the direction of airflow in each consultation room in your facility	0	Only for some	2
11.5. Does the staff in consultation rooms sit with their back towards the direction of airflow?	0	1	2
11.6. Do you use ultraviolet germicidal irradiation in your facility's high risk areas?	0	Uncertain	2

12. PERSONAL RISK REDUCTION STRATEGIES TO REDUCE INHALATION OF INFECTIOUS AEROSOLS. 0=NO ,1=SOME STAFF AND 2=YES .√ WHERE APPROPRIATE			
12.1. Were you screened for TB infection symptoms this month?	0	1	2
12.2. Were you encouraged to know your HIV status this month?	0	1	2
12.3. Were you reminded of the risks of TB for people who are living with HIV this month?	0	1	2
12.4. Were you trained to recognize and diagnose TB this month?	0	1	2
12.5. Do you haveN95 masks in your work area this month?	0	Sometimes	2
12.6. Did you use the N95 masks in high risk services this month?	0	Sometimes	2
12.7. Do you have posters indicating the need to wear the N95 mask in your facility?	0	Sometimes	2
12.8. Do you display the N95 masks in prominent position in the waiting area?	0	Sometimes	2
12.9. Is the N95 mask a substitute for administrative and environmental control?	0	Uncertain	2
12.10. Is the N95 mask worn to improve personal protection when administrative and environmental controls are functioning optimally?	0	Uncertain	2

13. ADMINISTRATIVE CONTROLS: STRATEGIES TO REDUCE GENERATION OF INFECTIOUS AEROSOL. N0=0, OCCASIONALLY=1 AND YES=2. √ WHERE APPROPRIATE.			
13.1. Do you screen the patients for coughs as they enter your facility?	0	1	2
13.2. Do you educate patients in cough hygiene as they enter your facility?	0	1	2
13.3. Do you provide patients who are coughing with masks to reduce infectious aerosols?	0	1	2
13.4. Do you separate TB suspects from those who are not?	0	1	2
13.5. Were you reminded of the need for early diagnosis during this month?	0	1	2
13.6. Do you have separate and well-ventilated facilities for sputum collection from suspects?	0	Not ventilated	2
13.7. Do you have a fast queue for collection of sputum smear samples?	0	1	2
13.8 What is the laboratory turnaround time for sputum AFB?	>72 hours	48-72hours	<48 Hours

Annexure 1: Application letter to conduct the study to the district



health

Department:
Health
PROVINCE OF KWAZULU-NATAL

Postal Address: Private Bag X54318 Durban 4000
ss: 83 Jan Smuts Highway, Mayville, Durban 4001
Tel.031 2405308: Fax. 031 2405500
Email. penny.dladla@kznhealth.gov.za
www.kznhealth.gov.za

Enquiries: Ms Ntombifuthi Mthethwa
Tel: 031 240 5342
Date: 11 March 2015

Attention: Zandile Mbele
E-mail : zandile.mbele@kznhealth.gov.za

REQUEST TO CONDUCT RESEARCH:

Evaluation of compliance with use of personal protective equipment in a health institution in eThekweni district KwaZulu natal.

Support is hereby granted to conduct base line assessment on the above topic.

Please note the following:

1. Please ensure that you adhere to all the policies, procedures, protocols and guidelines of the Department of Health with regard to this research.
2. This research will only commence once this office has received confirmation from the Provincial Health Research Committee in the KZN Department of Health.
3. Please ensure that this office is informed before you commence your research.
4. The District Office will not provide any resources for this research.
5. You will be expected to provide feedback on your findings to the District Office.

Ms. N.B. Mthethwa

For The District Manager
EThekweni Health District
Telephone: 031 2405342
Fax: 031 2405501
Email: ntombifuthi.mthethwa@kznhealth.gov.za

Annexure 2: Permission to conduct the study from Department of Health



health

Department:
Health
PROVINCE OF KWAZULU-NATAL

Health Research & Knowledge Management sub-component
10 – 103 Natalia Building, 330 Langalibalele Street
Private Bag x9051
Pietermaritzburg
3200
Tel: 033 – 3953189
Fax: 033 – 394 3782
Email: hrkm@kznhealth.gov.za
www.kznhealth.gov.za

Reference : HRKM 038/15
Enquiries : Mr X Xaba
Tel : 033 – 395 2805

Dear Ms Z. Mbele
(Email: Zandile.Mbele@kznhealth.gov.za)

Subject: Approval of a Research Proposal

1. The research proposal titled 'Evaluation of compliance with the use of personal protective equipment' was reviewed by the KwaZulu-Natal Department of Health.

The proposal is hereby **approved** for research to be undertaken at Addington Hospital.

2. You are requested to take note of the following:
 - a. Make the necessary arrangement with the identified facility before commencing with your research project.
 - b. Provide an interim progress report and final report (electronic and hard copies) when your research is complete.
3. Your final report must be posted to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200** and e-mail an electronic copy to hrkm@kznhealth.gov.za

For any additional information please contact Mr X. Xaba on 033-395 2805.

Yours Sincerely

Dr E Lutge

Chairperson, Health Research Committee

Date: 24/02/15

uMnyango Wezempilo . Departement van Gesondheid

Fighting Disease, Fighting Poverty, Giving Hope

Annexure 3: UKZN HSSREC full approval



16 March 2015

Ms Zandile Bendictor Mbele (210545658)
School of Nursing & Public Health
Howard College Campus

Dear Ms Mbele,

Protocol reference number: HSS/0019/015M

Project title: An evaluation of compliance of the use of personal protective equipment

Full Approval – Expedited Application

In response to your application received on 23 December 2014, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

Dr Shenika Singh (Chair)
Humanities & Social Sciences Research Ethics Committee

/pm

Cc Supervisor: Dr Jane Kerr
Cc Academic Leader Research: Professor M Mars
Cc School Administrator: Ms Caroline Dhanraj

Humanities & Social Sciences Research Ethics Committee

Dr Shenika Singh (Chair)

Westville Campus, Govan Mbeki Building

Postal Address: Private Bag X24001, Durban 4000

Telephone: +27 (0) 31 260 3587/8050/4557 Facsimile: +27 (0) 31 260 4609 Email: ethics@ukzn.ac.za / scythems@ukzn.ac.za / mohung@ukzn.ac.za

Website: www.ukzn.ac.za



100 YEARS OF ACADEMIC EXCELLENCE

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Annexure 4: Amendment of the UKZN HSSREC full approval



20 April 2016

Ms ZB Mbele 210545658
School of Nursing and Public Health
Howard Campus

Dear Ms Mbele

Protocol reference number: HSS/0019/015M

New project title: Evaluation of N95 Compliance Respirator Masks in a selected Hospital in KwaZulu-Natal

Approval notification – Amendment Application

This letter serves to notify you that your application for an amendment dated 20 April 2016 has now been granted **Full Approval**.

- Change in Title
- Change in Objectives
- Change in Research Questionnaire

Any alterations to the approved research protocol i.e. Questionnaire/interview Schedule, Informed Consent Form, Title of the Project, Location of the Study must be reviewed and approved through an amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years

The ethical clearance certificate is only valid for a period of **3** years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

Best wishes for the successful completion of your research protocol.

Yours faithfully


Dr Shenuka Singh (Chair)
Humanities/Social Sciences Research Ethics

/pm

Supervisor: Dr Jane Kerr
Academic Leader Research: Professor M Mars
School Administrator: Ms Caroline Dhanraj

Humanities & Social Sciences Research Ethics Committee

Dr Shenuka Singh (Chair)

Westville Campus, Govan Mbeki Building

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Website: www.ukzn.ac.za



Founding Campuses:  Edgewood  Howard College  Medical School  Pietermaritzburg  Westville

Annexure 5: Permission letter from the institution



HEALTH
KwaZulu-Natal



Enquiries

Ext: 2443

11 February 2015

Mrs. Z.B. Mbele
Tutor
College
Addington Hospital

Dear Mrs. Mbele,

Re: PERMISSION TO CONDUCT RESEARCH ON PERSONAL PROTECTIVE CLOTHING.

Permission to conduct research on personal protective clothing in the hospital has been granted.

Yours faithfully,

ACTING NURSE MANAGER
HPNZ/ln

uMnyango Wezempilo . Departement van Gesondheid

Fighting Disease, Fighting Poverty, Giving Hope

Annexure 6: Information sheet

18 Rock hill Grove
Hill grove New lands west
Durban
403

Student no 210545658
Contact no 0315785526
Supervisor Kerr. Jane
kerrj@ukzn.ac.za
Contact no 0312601432
Academic leader research Professor M. Mars
E mail address Mars@ukzn.co.za
Chair of ethics committee Dr. Sigh
Contact number 0312603587

University name University of KwaZulu-Natal

School of nursing and public health

Dear Participant

I am completing a research project as part of the requirements for a master of nursing degree (nursing management).

Title of the research: Evaluation of N95 mask compliance in a selected hospital in KwaZulu-Natal.

Purpose of the research: The aim of the study is to evaluate the compliance of health care workers with the use of the N95 respirator mask.

Procedure: Data will be collected by the research assistant. Your views are sought as you have been exposed to the use of the N95 mask and your input is deemed valuable. You are being asked to complete this questionnaire which asks about your compliance with use of the N95 mask regarding your clinical practice experience thus far. It should take approximately 15 minutes to complete the questionnaire. By completing the questionnaire it is taken that you agree to participate in the research. Please do not write personal particulars or particulars about the institution that may link you or the institution to the study. This is to protect your privacy and the name of the institution. The computer used to store and analyse data has an access code known only to the researcher.

Ethical aspects: Please note that all the information given will be kept confidential and only for the research purpose. Your identity will not appear in any report of the research. Please know that you can withdraw from the study at any time if you do not wish to continue. Participation is voluntary no one is forced to participate. There are no risks attached to your participation. If you have any question or concerns do not hesitate to call Zandile or Jane at the above mentioned numbers.

Annexure 7: Informed consent

Researcher Miss Z.B Mbele

Student no 210545658

Contact no 0833728685

Supervisor Mrs. J. Kerr.

Contact no 0312601432

Email kerrj@ukzn.co.za

Academic leader research Professor M. Mars

E mail address Mars@ukzn.co.za

Human Social Science ethics committee Ms. P. Ximba

ximbap@ukzn.ac.za

Contact number 0312603587

Declaration

I..... (Full names of the participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I am free to withdraw from the project at any time should I wish to do so.

Signature of participant..... Date.....

Signature of witness..... Date.....

Annexure 8: Email from the statistician

Dear Zandile,

I read the report of the markers as well as the report that we sent you.

The report we sent you presents the descriptive statistics. This analysis was based on your research questions and the nature of your data. No inferential statistic were performed because of the nature of your data. There is no proper scale per se, that can cater for validity and reliability.

**Paul. I Research Consultant, OSMOZ CONSULTING SPSS, AMOS and NVivo expert
+27 (0) 745 642 967 Johannesburg**

From: Osmoz Saker [mailto:osmozconsulting@gmail.com]

Sent: 06 May 2016 09:32 AM

To: Mbele Zandile

Subject: Re: Re markers comments